



<div>OS-299 (5-21)</div> <div><div><b>pennsylvania</b> DEPARTMENT OF TRANSPORTATION www.penndot.gov</div></div>	TRANSMITTAL LETTER	PUBLICATION:  Publication 218M
		DATE:  7/10/2025
<div>SUBJECT:</div> <div>Standards for Bridge Design April 2016 Edition Change 8</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div><b>Incorporate the attached revisions into the April 2016 Edition of Publication 218M.</b></div> <div><b>These revisions update PennDOT’s Sign Structures to meet AASHTO LRFD design requirements.</b></div> <div><b>These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules and in conjunction with the current Publication 408 Specifications. Projects with T.S.&amp;L. submissions after October 31, 2025 and projects let after February 28, 2026 must incorporate these new standards.</b></div> <div><b>A description of the changes made to the 2016 Edition since Change 7 of October 7, 2024 are listed in the attached multi-sheet table. On the standards, light blue highlighting indicates Change 8 revisions to details and notes.</b></div> <div><b>Comments or questions concerning this Publication may be directed to the Bureau of Bridge.</b></div>		
<div>CANCEL AND DESTROY THE FOLLOWING:</div> <div>Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.</div>	<div>ADDITIONAL COPIES ARE AVAILABLE FROM:</div> <div><input checked="" type="checkbox"/> PennDOT website - <a href="http://www.penndot.gov">www.penndot.gov</a> <i>Click on Forms, Publications &amp; Maps</i></div>	
	<div>APPROVED FOR ISSUANCE BY:</div> <div>MICHAEL B. CARROLL Secretary of Transportation</div> <div>BY:  Jonathan A. Eboli, P.E. Chief Executive Highway Administration</div>	

**PUBLICATION #218M**  
**APRIL 2016 EDITION**  
**CHANGE NO. 8**

The major revisions for each Standard Drawing are presented below. Since minor changes are not indicated, it is strongly advised that all recipients thoroughly examine the changes and revisions incorporated in this release.

Standard	Sheet	Description of Changes
General		Updated the Sign Structure design standards (BD-641M, BD-644M, BD-645M, BD-647M, BD-649 and BD-650M) to meet AASHTO Sign LRFD criteria. (Note: design standard BD-643M for 2 Post Planar Truss Sign Structure has been discontinued.)
BD-641M	1 of 7 (formerly 1 of 8)	Added note to clarify the design criteria that was used to develop the LRFD design tables throughout this standard.
		Revised General Note 13 to state bolt bearing has been incorporated in this standard.
		Revised General Note 15 to state anchor bolt design has been incorporated in this standard.
		Revised General Note 17 to state Charpy V-notch testing is required for all members with thicknesses greater than 1/2". Also updated 'Load Path Redundant' terminology.
		Updated all references of "Dynamic Message Signs (DMS)" to "Changeable Message Signs (CMS)"
		Updated all wind loads to meet AASHTO Sign LRFD criteria.
		Added live load of 500 lbs to walkway design criteria.
		Updated all references for ACI to be ACI 318-14.
		Updated all references for AASHTO Sign to be AASHTO LRFD Sign
		Updated all references for AASHTO Bridge to be AASHTO LRFD Bridge
		Added soil friction factor of 0.58 to Design Criteria.
		Added DM-4 reference under Spread Footing Design Criteria for Pressures for Eccentrically Loaded Footings.
		Revised Seismic Design Criteria to state seismic loads were not considered.
		Added reference to AISC Design Guide 1, Base Plate and Anchor Rod Design, 2nd Edition.
		Revised connection bolts to be ASTM F3125 Grade A325
	2 of 7 (formerly 2 of 8)	Added Note to Designer clarifying the shop drawing review requirements.
		Added Note to Designer clarifying detailing scale requirements for contract plans.
	3 of 7 (formerly 3 of 8)	Revised the procedure for determining the design sign area.
		Revised the design example to include more accurate pedestal elevation details.
	4 of 7 (formerly 4 of 8)	No changes
		Revised the fill height allowed to be 8 ft maximum, rather than 10 ft.
		Revised the pedestal stick-up allowed to be 6" Minimum to 1'-6" Maximum.
		Revised note to state "Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.", instead of "Designer must check adequacy for fill heights less than 10 ft".
		Revised the note indicating the controlling design sign area condition.
	5 of 7 (formerly 5 of 8)	Revised the location plan to show a cantilever structure, instead of a full span structure.
		Revised maximum pedestal height allowed to be 9'-6", rather than 11'-0".
		Revised note indicating the controlling cambers for this standard are based on the worst-case deflections for all possible sign combinations for a given structure geometry.
	6 of 7 (formerly 6 of 8 & 7 of 8)	Moved Note A for short struts on Type B structures.
		Combined two sheets for cantilever sign structure design tables onto one sheet.
		Revised design tables for LRFD Specifications.
		Removed Pedestal table and added note clarifying that pedestal type designates all pedestal details in BC-741M.

Standard	Sheet	Description of Changes
BD-641M (cont.)	6 of 7 (cont.)	Revised note for description of footing type.
		Revised note to state "Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.", instead of "Designer must check adequacy for fill heights less than 10 ft".
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
	7 of 7 (formerly 8 of 8)	Revised design tables for LRFD Specifications.
		Revised note for description of footing type.
		Added note clarifying that pedestal type designates all pedestal details in BC-741M.
		Revised note to state "Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.", instead of "Designer must check adequacy for fill heights less than 10 ft".
BD-643M	All Shts.	Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Revised maximum pedestal height allowed to be 9'-6", rather than 11'-0".
BD-644M	General	Discontinued standard for 2 Post Planar Truss Sign Structures.
	General	Reduced maximum span covered by this standard from 240 ft. to 200 ft. and revised the title of all sheets to reflect this reduced applicability.
		Removed Note stating "member sizes indicated do not include the fatigue requirements indicated in the design criteria."
		Added note to clarify the design criteria that was used to develop the LRFD design tables throughout this standard.
		Revised General Note 13 to state bolt bearing has been incorporated in this standard.
		Revised General Note 15 to state anchor bolt design has been incorporated in this standard.
		Revised General Note 17 to state Charpy V-notch testing is required for all members with thicknesses greater than 1/2". Also updated 'Load Path Redundant' terminology.
		Updated all references of "Dynamic Message Signs (DMS)" to "Changeable Message Signs (CMS)"
		Removed Catwalk Dead Load from design criteria.
		Updated all wind loads to meet AASHTO Sign LRFD criteria.
		Added live load of 500 lbs to walkway design criteria.
		Updated all references for ACI to be ACI 318-14.
		Updated all references for AASHTO Sign to be AASHTO LRFD Sign
		Updated all references for AASHTO Bridge to be AASHTO LRFD Bridge
		Added soil friction factor of 0.58 to Design Criteria.
		Added DM-4 reference under Spread Footing Design Criteria for Pressures for Eccentrically Loaded Footings.
		Revised Seismic Design Criteria to state seismic loads were not considered.
		Added reference to AISC Design Guide 1, Base Plate and Anchor Rod Design, 2nd Edition.
		Revised connection bolts to be ASTM F3125 Grade A325
		Added Note to Designer clarifying the shop drawing review requirements.
		Added Note to Designer clarifying detailing scale requirements for contract plans.
	2 of 10 (formerly 2 of 13)	Added Note 4 to determine sign area for multiple sign panels.
		Removed note defining 'Type 1' and 'Type 2' Loading Conditions for center of gravity of sign panels located at varying locations along the span. The revised design tables combine the worst case from both Loading Type 1 and Loading Type 2.
		Revised the design example to include more accurate pedestal elevation details.



Standard	Sheet	Description of Changes
BD-644M (cont.)	3 of 10 (formerly 3 of 13)	No changes.
	4 of 10 (formerly 4 of 13)	Replaced all labels for “ST” sections to be round pipe sections.
		Moved all chord splices to be shown at mid-panel.
		Revised the fill height allowed to be 8 ft maximum, rather than 10 ft.
		Revised the pedestal stick-up allowed to be 6" Minimum to 1'-6" Maximum.
		Revised note to state “Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.”, instead of “Designer must check adequacy for fill heights less than 10 ft”.
		Removed “Loading Type” from the Design Criteria Table.
	5 of 10 (formerly 5 of 13)	Merged portions of table on former sheet 7 into design table due to elimination of Loading Type 1 and Type 2.
		Revised design table for LRFD Specifications.
		Revised Camber Table for LRFD Specifications.
		Revised note to state “Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.”, instead of “Designer must check adequacy for fill heights less than 10 ft”.
		Revised the Truss Depth to be a minimum of 4'-0”.
		Revised the locations of the first truss vertical to be 12”, rather than 11”.
		Revised maximum pedestal height allowed to be 9'-6", rather than 11'-0".
		Revised note for description of footing type.
		Added note clarifying that pedestal type designates all pedestal details in BC-744M.
		Removed note related to ‘ST’ sections.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Moved all chord splices to be shown at mid-panel.
		Removed reference to 'Loading Type' in title block.
	6 of 10 (formerly 6 of 13)	Merged portions of table on former sheet 7 into design table due to elimination of Loading Type 1 and Type 2.
		Revised design tables for LRFD Specifications.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Removed reference to 'Loading Type' in title block.
		Removed Pedestal Size table.
		Removed note related to ‘ST’ sections.
	former 7 of 13	Deleted sheet and merged design table into table on sheets 5 & 6 due to elimination of Loading Type 1 and Type 2.
	7 of 10 (formerly 8 of 13)	Replaced all labels for “ST” sections to be round pipe sections.
		Corrected the diagonals shown in View B-B.
		Moved all chord splices to be shown at mid-panel.
		Revised the fill height allowed to be 8 ft maximum, rather than 10 ft.
		Revised the pedestal stick-up allowed to be 6" Minimum to 1'-6" Maximum.
		Revised note to state “Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.”, instead of “Designer must check adequacy for fill heights less than 10 ft”.
		Removed "Loading Type" from the Design Criteria Table.



Standard	Sheet	Description of Changes
BD-644M (cont.)	8 of 10 (formerly 9 of 13)	Merged portions of table on former sheet 12 into design table due to elimination of Loading Type 1 and Type 2.
		Revised design tables for LRFD Specifications.
		Revised Camber Table for LRFD Specifications.
		Revised the Truss Depth to be a minimum of 4'-0”.
		Revised the locations of the first truss vertical to be 12”, rather than 11”.
		Revised maximum pedestal height allowed to be 9'-6", rather than 11'-0".
		Revised note for description of footing type.
		Added note clarifying that pedestal type designates all pedestal details in BC-744M.
		Removed note related to ‘ST’ sections.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Removed reference to 'Loading Type' in title block.
	9 of 10 (formerly 10 of 13)	Merged portions of tables on former sheets 12 & 13 into design table due to elimination of Loading Type 1 and Type 2.
		Revised design tables for LRFD Specifications.
		Revised Design Table sheet reference.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Removed spans 240’ to 200’ from the Chord Splice Table
		Removed reference to 'Loading Type' in title block.
	10 of 10 (formerly 11 of 13)	Merged portions of table on former sheet 13 into design table due to elimination of Loading Type 1 and Type 2.
		Revised design tables for LRFD Specifications.
		Revised Design Table sheet reference.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Removed spans Over 200’ to 240’ from the Design Table
		Removed reference to 'Loading Type' in title block.
	former 12 of 13	Deleted sheet and merged design table into tables on sheets 8 & 9 (formerly sheets 9 & 10)
	former 13 of 13	Deleted sheet and merged design table into tables on sheets 9 & 10 (formerly sheets 10 & 11)
BD-645M	1 of 6 (formerly 1 of 7)	Added a note clarifying requirements for the use of this standard for CMS loadings.
		Added note to clarify the design criteria that was used to develop the LRFD design tables throughout this standard.
		Revised General Note 13 to state bolt bearing has been incorporated in this standard.
		Revised General Note 15 to state anchor bolt design has been incorporated in this standard.
		Revised General Note 17 to state Charpy V-notch testing is required for all members with thicknesses greater than 1/2". Also updated 'Load Path Redundant' terminology.
		Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Removed Catwalk Dead Load from design criteria.
		Updated all wind loads to meet AASHTO Sign LRFD criteria.
		Added live load of 500 lbs to walkway design criteria.
		Updated all references for ACI to be ACI 318-14.
		Updated all references for AASHTO Sign to be AASHTO LRFD Sign
		Updated all references for AASHTO Bridge to be AASHTO LRFD Bridge

Standard	Sheet	Description of Changes
BD-645M (cont.)	1 of 6 (cont.)	Added DM-4 reference under Spread Footing Design Criteria for Pressures for Eccentrically Loaded Footings.
		Added soil friction factor of 0.58 to Design Criteria.
		Revised Seismic Design Criteria to state seismic loads were not considered.
		Added reference to AISC Design Guide 1, Base Plate and Anchor Rod Design, 2nd Edition.
		Revised connection bolts to be ASTM F3125 Grade A325
		Revised the Note to Designer clarifying how the CMS standards from BD-650M are to be used in coordination with BD-645M.
		Added Note to Designer clarifying the shop drawing review requirements.
		Added Note to Designer clarifying detailing scale requirements for contract plans.
	2 of 6 (formerly 2 of 7)	Added Note 4 to determine sign area for multiple sign panels.
		Removed note defining ‘Type 1’ and ‘Type 2’ Loading Conditions for center of gravity of sign panels located at varying locations along the span. The revised design tables combine the worst case from both Loading Type 1 and Loading Type 2.
		Revised the design example to include more accurate pedestal elevation details.
	3 of 6 (formerly 3 of 7)	Added missing table for ‘Y <sub>1,2</sub> ’ back to the sheet.
	4 of 6 (formerly 4 of 7)	Revised the fill height allowed to be 8 ft maximum, rather than 10 ft.
		Revised the pedestal stick-up allowed to be 6" Minimum to 1'-6" Maximum.
		Revised note to state “Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.”, instead of “Designer must check adequacy for fill heights less than 10 ft”.
		Removed “Loading Type” from the Design Criteria Table.
		Changed “Truss Depth” to be a variable dimension, instead of constant 4 ft.
		Changed Top and Bottom tower brace members to match the section size used for the remaining tower brace members.
	5 of 6 (formerly 5 of 7)	Revised design tables for LRFD Specifications.
		Revised Camber Table for LRFD Specifications.
		Revised the Truss Depth to be variable based on span length
		Revised maximum pedestal height allowed to be 9'-6", rather than 11'-0".
		Revised note for description of footing type.
		Added note clarifying that pedestal type designates all pedestal details in BC-745M.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Removed reference to ‘Loading Type’ in title block.
		Removed note for CVN requirements
	6 fo 6 (formerly 6 of 7)	Merged table on former sheet 7 into design table due to elimination of Loading Type 1 and Type 2.
		Revised design tables for LRFD Specifications.
		Revised note stating that the design tables show all commercially available sections, rather than only showing standard wall thicknesses and indicating when a non-standard wall thickness may be substituted.
		Removed reference to ‘Loading Type’ in title block.
	former 7 of 7	Deleted sheet and merged design table into table on sheet 6.
BD-647M	1 of 7 (formerly 1 of 5)	Added ‘Informational Notes’ and ‘Information contained in the Design Tables’ to be consistent with the design data provided for the other sign standards.
		Reformatted all notes to be consistent with the other sign standards.

Standard	Sheet	Description of Changes
BD-647M (cont.)	2 of 7 (NEW)	New Sheet Added to match the design data provided for the ofther sign standards
	3 of 7 (formerly 2 of 7)	Removed General Note regarding reinforcement requirements for caissons.
		Added General Note stating “Contractor has the option to add or eliminate connections”.
		Revised splice detail to remove stiffener plates.
	4 of 7 (formerly 3 of 5)	Removed General Note regarding reinforcement requirements for caissons.
		Added General Note stating “Contractor has the option to add or eliminate connections”.
		Revised splice detail to remove stiffener plates.
	5 fo 7 (formerly 4 of 5)	Revised design tables for LRFD Specifications.
		Revised Camber Table for LRFD Specifications.
	6 of 7 (formerly 5 of 5)	Removed note regarding the elimination of splices.
		Added Camber Table and Diagram.
		Revised design tables for LRFD Specifications.
	7 of 7 (NEW)	New Sheet added for alternative caisson details.
BD-649M	1 of 6	Revised Informational Notes, regarding the use of details from BC-741M for CMS structures.
		Reformatted all notes to be consistent with the other sign standards.
		Revised Dead Loads Design Criteria to reference PennDOT Standard Drawings.
		Revised General Note 13 to state bolt bearing has been incorporated in this standard.
		Revised General Note 15 to state anchor bolt design has been incorporated in this standard.
		Revised General Note 17 to state Charpy V-notch testing is required for all members with thicknesses greater than 1/2". Also updated ‘Load Path Redundant’ terminology.
		Added Note 20, to clarify the requirements for Alternative Foundation Designs.
		Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Updated all wind loads to meet AASHTO Sign LRFD criteria.
		Added live load of 500 lbs to walkway design criteria.
		Updated all references for ACI to be ACI 318-14.
		Updated all references for AASHTO Sign to be AASHTO LRFD Sign
		Updated all references for AASHTO Bridge to be AASHTO LRFD Bridge
		Added DM-4 reference under Spread Footing Design Criteria for Pressures for Eccentrically Loaded Footings.
		Added soil friction factor of 0.58 to Design Criteria.
		Revised Seismic Design Criteria to state seismic loads were not considered.
		Added reference to AISC Design Guide 1, Base Plate and Anchor Rod Design, 2nd Edition.
		Revised Construction General Notes to be consistent with the other sign standards.
		Revised the Note to Designer clarifying how the CMS standards from BD-650M are to be used in coordination with BD-645M.
		Added “Information Contained in the Design Tables” notes to highlight the design assumptions used to generate the designs for this standard.
		Revised Reference Drawings to refer to ITS-62, which replaced the old ITS-1201
	2 of 6	Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Revised Note to Designer No. 10 to clarify criteria requiring a submission approval by the Chief Bridge Engineer.
		Added Note to Designer No. 14 to clarify the responsibilities of the Designer.
		Added Note to Designer No. 16 to state the standard note for weld standards.
		Added Note to Designer No. 17 clarifying the shop drawing review requirements.
		Added Note to Designer No. 18 clarifying detailing scale requirements for contract plans.

Standard	Sheet	Description of Changes
BD-649M (cont.)	2 of 6 (cont.)	Added Note to Fabricator No. 8 to clarify the design computations requirements from the fabricator.
		Added Note to Fabricator No. 9 and 10 to state the certification requirements for all materials.
		Added Note to Fabricator No. 11 to clarify the repair procedure.
		Added Note to Fabricator No. 12 to state the requirements for anchorage orientation and installation.
	3 of 6	Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Revised the pedestal height to be 2’-6” Minimum, and 9’-6” Maximum.
		Revised the pedestal stick-up allowed to be 6" Minimum
		Revised note to state “Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.”, instead of “Designer must check adequacy for fill heights less than 10 ft”.
		Added ‘Note to Designer’ clarifying top of access platform elevation requirements.
	4 of 6	Revised design tables for LRFD Specifications.
		Added Note 1 refering to sheet one for General Notes.
		Added Note 2 clarifying the area for each CMS.
		Added Note 3 clarifying the Double CMS configuration.
		Added Note 4 clarfying that all CMS are to be centered on the column.
		Added Note 5 referencing Pedestal and Footing Types Sheet.
		Revised note to state “Designer must check adequacy of footings with an average fill height less than 8 ft. Designer must check the adequacy of pedestals with an average fill height greater than 8 ft.”, instead of “Designer must check adequacy for fill heights less than 10 ft”.
		Added note clarifying Charpy V-notch testing requiriements.
		Added note stating that the design tables show all commercially available sections, and indicating when a standard wall thickness may be substituted.
		Removed pedestal and footing details from this sheet.
	5 of 6	Added pedestal and footing details to this sheet.
		Revised design tables for LRFD Specifications.
		Added note for Additional Foundation and Reinforcement Details.
	6 of 6	Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Removed “Maximum Length (Dx)” limit from Note 3.
		Reduced “Maximum Height (DY)” limit from 10 ft to 8 ft.
		Revised Note 7 to specify “AASHTO LRFD Sign Specifications”
		Revised all references for “ASTM A325 bolts” to be “ASTM F3125 Grade A325 bolts”
BD-650	1 of 4	Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Revised Informational Notes, regarding the use of details from BD-650m and BC-745M for CMS structures.
		Removed Note 1 regarding all dimenions in U.S. Customary Units.
		Added General Note 5 regarding verifying existing conditions in the field.
		Revised General Note 13 to state bolt bearing has been incorporated in this standard.
		Revised General Note 15 to state anchor bolt design has been incorporated in this standard.
		Added General Note 16 to require double nuts and washers for each anchor bolt.
		Revised General Note 17 to state Charpy V-notch testing is required for all members with thicknesses greater than 1/2". Also updated ‘Load Path Redundant’ terminology.
		Added General Note 18, stating “Walkways to be provided only when required by District Bridge Engineer”.
		Added General Note 21, to clarify the requirements for Alternative Foundation Designs.
		Revised Dead Loads Design Criteria to reference PennDOT Standard Drawings.
		Updated all wind loads to meet AASHTO Sign LRFD criteria.

Standard	Sheet	Description of Changes
BD-650M (cont.)	1 of 4 (cont.)	Added live load of 500 lbs to walkway design criteria.
		Updated all references for ACI to be ACI 318-14.
		Updated all references for AASHTO Sign to be AASHTO LRFD Sign
		Updated all references for AASHTO Bridge to be AASHTO LRFD Bridge
		Added DM-4 reference under Spread Footing Design Criteria for Pressures for Eccentrically Loaded Footings.
		Added soil friction factor of 0.58 to Design Criteria.
		Revised Seismic Design Criteria to state seismic loads were not considered.
		Added reference to AISC Design Guide 1, Base Plate and Anchor Rod Design, 2nd Edition.
		Revised Construction General Notes to be consistent with the other sign standards.
		Revised Reference Drawings to refer to ITS-62, which replaced the old ITS-1201
		Revised connection bolts to be ASTM F3125 Grade A325
	2 of 4	Added Notes To Designer No. 12, to clarify designers responsibility for applying the BD-645M and BC-745M details for the use in this standard.
		Added Notes To Designer No. 13, to state that the designer is responsible to ensure the pipe size used in the design is commercially available.
		Added Notes To Designer No. 14 to require the note for welding specifications be place on the plans.
		Added Notes To Designer No. 15 to state “The Four-Post Four-Chord structure types as presented on these standards are recommended to carry CMS.”
		Added Notes To Designer No. 16 clarifying the shop drawing review requirements.
		Added Notes To Designer No. 17 clarifying detailing scale requirements for contract plans.
		Added Notes to Fabricator No. 7 clarifying the design calculations required from the fabricator.
		Added Notes to Fabricator No. 8 and 9 clarifying the certifications required for materials and inspection reports.
		Added Notes to Fabricator No. 10 to clarify the repair procedure.
		Added Notes to Fabricator No. 11 to state the requirements for anchorage orientation and installation.
		Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
	3 of 4	Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Added “Min” to 6” dimension from top of pedestal to ground line.
		Changed “Truss Depth” to be a variable dimension, instead of constant 4 ft.
	4 of 4	Updated all references of “Dynamic Message Signs (DMS)” to “Changeable Message Signs (CMS)”
		Revised connection bolts to be ASTM F3125 Grade A325
		Removed Note to Designer related to “Maximum Length (Dx) of 30’-0”

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<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div><b>Incorporate the attached revisions into the April 2016 Edition of Publication 218M.</b></div> <div><b>These revisions provide details for the connection of W-Beam Guide Rail (Type 31-S) to bridge barriers on the trailing end of bridges on divided highways and one-way roadways.</b></div> <div><b>These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules and in conjunction with the current Publication 408 Specifications. Projects with T.S.&amp;L. submissions after December 15, 2024 and projects let after April 11, 2025 must incorporate these new standards.</b></div> <div><b>A description of the changes made to the 2016 Edition since Change 6 of February 14, 2023 are listed in the attached multi-sheet Table. On the standards, light red highlighting indicates Change 7 revisions to details and notes.</b></div> <div><b>Comments or questions concerning this Publication may be directed to the Bureau of Bridge.</b></div>		
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	<div>APPROVED FOR ISSUANCE BY:</div> <div>MICHAEL B. CARROLL Secretary of Transportation</div> <div>BY:  Gavin E. Gray, P.E. Chief Engineer Highway Administration</div>	

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**CHANGE NO. 7**

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STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-609M	General	Inserted new sheet 3; updated total number of sheets.
	1 of 3 (formerly 1 of 2)	<p>PLAN:</p> <ul style="list-style-type: none"> <li>Added callouts for “SEE NOTE 18” (2 places).</li> </ul> <p>ELEVATION:</p> <ul style="list-style-type: none"> <li>Added “(SEE NOTES 18 AND 19)” to callouts (2 places).</li> </ul> <p>NOTES:</p> <ul style="list-style-type: none"> <li>Added Notes 16, 17, 18 and 19.</li> </ul> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"> <li>Added RC-51M – TYPE 31 STRONG POST GUIDE RAIL.</li> </ul>
	2 of 3 (formerly 2 of 2)	<p>PA 3-RAIL BRIDGE BARRIER END TRANSITION:</p> <ul style="list-style-type: none"> <li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li> </ul> <p>CLEAR ROADWAY WIDTH DETAIL:</p> <ul style="list-style-type: none"> <li>Added 1’-6” dimension</li> <li>Added “(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)” below detail name.</li> <li>Revised note from “CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 4 3/4" ON BOTH SIDES AT THE BARRIER FOR THRIE-BEAM TERMINAL CONNECTOR WIDTH” to “CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 4 3/4" MINIMUM TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH”.</li> </ul>
	3 of 3 (NEW)	<p>New Sheet – PA 3-RAIL BRIDGE BARRIER BARRIER DETAILS – 3</p> <p>Added ELEVATION and SECTION C-C to show details for the W-Beam Terminal Connection.</p>
BD-610M	General	Inserted new sheet 5 and renumbered subsequent sheets.
	1 of 11 (formerly 1 of 10)	<p>Rearranged layout of sheet.</p> <p>ELEVATION:</p> <ul style="list-style-type: none"> <li>Added callouts for “(SEE NOTE 16)” (2 places).</li> <li>Added “OR W-BEAM” to Transition Connection callout.</li> </ul> <p>NOTES:</p> <ul style="list-style-type: none"> <li>Added Notes 14, 15, and 16.</li> </ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	2 of 11 (formerly 2 of 10)	CLEAR ROADWAY WIDTH DETAIL: <ul style="list-style-type: none"> <li>Added 1'-6" dimension</li> <li>Added "(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)" beneath detail name.</li> <li>Revised note from "CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" ON BOTH SIDES AT BARRIER FOR THRIE-BEAM TERMINAL CONNECTOR WIDTH" to "CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" (MINIMUM) TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH".</li> </ul>
	3 of 11 (formerly 3 of 10)	TITLE BLOCK: <ul style="list-style-type: none"> <li>Added "WITH THRIE-BEAM CONNECTION" to sheet title.</li> </ul> PA BRIDGE BARRIER END TRANSITION: <ul style="list-style-type: none"> <li>Added "WITH THRIE-BEAM CONNECTION" to detail name.</li> </ul>
	4 of 11 (formerly 4 of 10)	TITLE BLOCK: <ul style="list-style-type: none"> <li>Added "WITH THRIE-BEAM CONNECTION" to sheet title.</li> </ul>
	5 of 11 (NEW)	New Sheet – END OF BARRIER DETAILS WITH W-BEAM CONNECTION  Added ELEVATION, SECTION G-G, SECTION H-H AND HORIZONTAL REINFORCEMENT, LEGEND and NOTES to show details for the W-Beam Terminal Connection.
	7 of 11 (formerly 6 of 10)	36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK: <ul style="list-style-type: none"> <li>Added callout "#4 FOR SPACING, SEE SHEET 1" for the vertical bar in the barrier.</li> </ul>
	11 of 11 (formerly 10 of 10)	PLAN: <ul style="list-style-type: none"> <li>Renamed section cuts from "G-G" to "X-X".</li> </ul> Renamed SECTION G-G to SECTION X-X.  NOTES: <ul style="list-style-type: none"> <li>Note 4: Revised "TO 1101.4 PUB. 408" to "AS SPECIFIED IN PUBLICATION 408, SECTION 1101.04".</li> </ul>
BD-617M	General	Inserted new sheet 4 and renumbered subsequent sheets.
	1 of 10 (formerly 1 of 9)	ELEVATION: <ul style="list-style-type: none"> <li>Added callouts for "(SEE NOTE 20)" (2 places).</li> </ul> NOTES: <ul style="list-style-type: none"> <li>Added Notes 18, 19, and 20.</li> </ul>
	2 of 10 (formerly 2 of 9)	TITLE BLOCK: <ul style="list-style-type: none"> <li>Added "WITH THRIE-BEAM CONNECTION" to the sheet title.</li> </ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M	2 of 10 (formerly 2 of 9) (cont.)	PA TYPE 10M BRIDGE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to the detail name.</li></ul> CLEAR ROADWAY WIDTH DETAIL: <ul style="list-style-type: none"><li>Added 1’-6” dimension</li><li>Added “(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)” beneath detail name.</li><li>Revised note from “CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" ON BOTH SIDES AT THE BARRIER FOR THE THRIE-BEAM TERMINAL CONNECTOR WIDTH” to “CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" MINIMUM TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH”.</li></ul>
	3 of 10 (formerly 3 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul>
	4 of 10 (NEW)	New Sheet – END OF BARRIER DETAILS WITH W-BEAM CONNECTION  Added ELEVATION, SECTION G-G, SECTION H-H AND HORIZONTAL REINFORCEMENT, LEGEND and NOTES to show details for the W-Beam Terminal Connection.
	6 of 10 (formerly 5 of 9)	36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK: <ul style="list-style-type: none"><li>Added callout “#4 FOR SPACING, SEE SHEET 1” for the vertical bar in the barrier.</li></ul>
	10 of 10 formerly 9 of 9)	PLAN: <ul style="list-style-type: none"><li>Renamed section cuts from “G-G” to “X-X”.</li></ul> Renamed SECTION G-G to SECTION X-X.  NOTES: <ul style="list-style-type: none"><li>Note 4: Revised note from “CONFORM ANCHOR MATERIALS TO 1101.4 PUB. 408” to “CONFORM ANCHOR MATERIALS AS SPECIFIED IN PUBLICATION 408, SECTION 1101.04. ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.”.</li></ul>
BD-618M	General	Inserted new sheets 7, 8 and 8 and renumbered subsequent sheets; updated all sheet references.
	1 of 12 (formerly 1 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “MISCELLANEOUS DETAILS” to sheet title.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>Added RC-51M – TYPE 31 STRONG POST GUIDE RAIL.</li></ul> NOTES: <ul style="list-style-type: none"><li>Added Notes 6, 7 and 8.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BC-618M (cont.)	1 of 12 (formerly 1 of 9) (cont.)	CLEAR ROADWAY WIDTH DETAIL: <ul style="list-style-type: none"><li>Added “(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)” beneath detail name.</li><li>Revised note from “CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" ON BOTH SIDES AT BARRIER FOR THRIE-BEAM TERMINAL CONNECTOR WIDTH” to “CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" MINIMUM TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH”.</li></ul>
	2 of 12 (formerly 2 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> 32” VERTICAL WALL CONCRETE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li></ul> 42” VERTICAL WALL CONCRETE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li></ul> ELEVATION VIEWS: <ul style="list-style-type: none"><li>Added callout for “CL THRIE-BEAM GUIDE RAIL”.</li></ul>
	3 of 12 (formerly 3 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> 42” VERTICAL WALL CONCRETE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li></ul> ELEVATION: <ul style="list-style-type: none"><li>Removed section cuts C-C and E-E and renamed three section cuts.</li></ul> Renamed SECTION G-G to SECTION E-E.
	4 of 12 (formerly 4 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> 32” VERTICAL WALL CONCRETE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li></ul> ELEVATION: <ul style="list-style-type: none"><li>Removed section cuts C-C and E-E and renamed three section cuts.</li><li>Renamed SECTION H-H to SECTION F-F.</li></ul>
	5 of 12 (formerly 5 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> Removed SECTIONS C-C and E-E.  Renamed “SECTION D-D” to “SECTION C-C”.  Renamed ‘SECTION F-F” to “SECTION D-D”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	6 of 12 (formerly 6 of 9)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul>
	7 of 12 (NEW)	New Sheet – BARRIER END TRANSITION WITH W-BEAM CONNECTION – 1  Added PLANS, ELEVATIONS and SECTION G-G to show details for the W-Beam Terminal Connection.
	8 of 12 (NEW)	New Sheet – BARRIER END TRANSITION WITH W-BEAM CONNECTION – 2  Added PLAN, ELEVATION, SECTION H-H, LEGEND and NOTES to show details for the W-Beam Terminal Connection for the 42” Vertical Wall Concrete Barrier.
	9 of 12 (NEW)	New Sheet – BARRIER END TRANSITION WITH W-BEAM CONNECTION – 3  Added PLAN, ELEVATION, LEGEND and NOTES to show details for the W-Beam Terminal Connection for the 32” Vertical Wall Concrete Barrier.
	12 of 12 (formerly 9 of 9)	NOTES: <ul style="list-style-type: none"><li>Note 4: Revised “TO 1101.4 PUB. 408” to “AS SPECIFIED IN PUBLICATION 408, SECTION 1104.04”.</li></ul>
BD-622M	General	Inserted new sheets 9, 10 and 11 and renumbered subsequent sheets; updated total number of sheets and all sheet references.
	1 of 13 (formerly 1 of 10)	GENERAL NOTES: <ul style="list-style-type: none"><li>Added Notes 4, 5 and 6.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>Added RC-51M – TYPE 31 STRONG POST GUIDE RAIL.</li></ul>
	2 of 13 (formerly 2 of 10)	SECTION C-C and ALTERNATE SECTION C-C: <ul style="list-style-type: none"><li>Added “3” next to the bar callouts located in the last 4’ of the section.</li><li>Added callout “END CHAMFERS (SEE SHEET 1, GENERAL NOTE 6)”.</li><li>Revised “OPTIONAL CONSTR. JT. AT BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB” to “OPTIONAL CONSTR JT AT BOTTOM OF PAVEMENT STRUCTURE OR 1” MIN BELOW APPROACH SLAB”</li></ul> SECTIONS D-D, E-E and F-F: <ul style="list-style-type: none"><li>Revised “BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1” MIN BELOW APPROACH SLAB”</li></ul> LEGEND: <ul style="list-style-type: none"><li>Added Legend Note “3”.</li></ul>
	3 of 13 (formerly 3 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul>



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	3 of 13 (formerly 3 of 10) (cont.)	45” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li></ul> PLAN, ELEVATION and LEGEND: <ul style="list-style-type: none"><li>Revised Legend Note “3” to “4”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 1: Removed “J-J” and “L-L”.</li></ul>
	4 of 13 (formerly 4 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> 42” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to detail name.</li></ul> PLAN, ELEVATION and LEGEND: <ul style="list-style-type: none"><li>Revised Legend Note “3” to “4”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 1: Removed “J-J” and “L-L”.</li></ul>
	5 of 13 (formerly 5 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> 32” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION: Added “WITH THRIE-BEAM CONNECTION” to detail name.  PLAN, ELEVATION, and LEGEND: <ul style="list-style-type: none"><li>Revised Legend Note “3” to “4”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 1: Removed “J-J” and “L-L”.</li></ul>
	6 of 13 (formerly 6 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Added “WITH THRIE-BEAM CONNECTION” to sheet title.</li></ul> SECTIONS G-G, H-H, K-K and M-M and LEGEND: <ul style="list-style-type: none"><li>Revised Legend Notes “4” to “5”, “5” to “6”, “6” to “7” and “7” to “8”.</li></ul>
	7 of 13 (formerly 7 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “BRIDGE BARRIER TRANSITION REINFORCEMENT – 5” to “BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAILS – 1”.</li></ul> TABLE 4: <ul style="list-style-type: none"><li>Added “(412)”.</li></ul> TABLE 5: <ul style="list-style-type: none"><li>Added “(411)”.</li></ul> TABLE 6: <ul style="list-style-type: none"><li>Added “(406, 408 &amp; 409)”.</li></ul>



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	8 of 13 (formerly 8 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “BRIDGE BARRIER TRANSITION REINFORCEMENT – 6” to “BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAILS – 2”.</li></ul> PLAN 403, PLAN 404 and LEGEND: <ul style="list-style-type: none"><li>Revised Legend Note “8” to “9”.</li></ul>
	9 of 13 (NEW)	New Sheet – BRIDGE BARRIER TRANSITION REINFORCEMENT WITH W-BEAM CONNECTION – 1  Added PLAN, ELEVATION and W-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL to show details for the W-Beam Terminal Connection for the 45” F-Shape Concrete Bridge Barrier.
	10 of 13 (NEW)	New Sheet – BRIDGE BARRIER TRANSITION REINFORCEMENT WITH W-BEAM CONNECTION – 2  Added PLAN, ELEVATION and SECTION W-W to show details for the W-Beam Terminal Connection for the 42” F-Shape Concrete Bridge Barrier.
	11 of 13 (NEW)	New Sheet – BRIDGE BARRIER TRANSITION REINFORCEMENT WITH W-BEAM CONNECTION – 3  Added PLAN and ELEVATION to show details for the W-Beam Terminal Connection for the 32” F-Shape Concrete Bridge Barrier.
	12 of 13 (formerly 9 of 10)	TITLE BLOCK: <ul style="list-style-type: none"><li>Removed “FOR SPREAD BEAMS” from sheet title.</li></ul> TYPICAL ELEVATION: <ul style="list-style-type: none"><li>Revised “TOP OF CHEEKWALL 1” MIN. BELOW BOTTOM OF DECK” to “TOP OF CHEEKWALL 1” BELOW BOTTOM OF DECK”.</li></ul>
	13 of 13 (formerly 10 of 10)	TYPICAL ELEVATION: <ul style="list-style-type: none"><li>Revised “TOP OF CHEEKWALL 1” MIN. BELOW BOTTOM OF DECK” to “TOP OF CHEEKWALL 1” BELOW BOTTOM OF DECK”.</li></ul>
BD-624M	1 of 4	GENERAL NOTES: <ul style="list-style-type: none"><li>Added Notes 4, 5 and 6.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>Added RC-51M – TYPE 31 STRONG POST GUIDE RAIL.</li></ul>
	2 of 4	SECTION C-C and ALTERNATE SECTION C-C: <ul style="list-style-type: none"><li>Added “3” next to the bar callouts located in the last 4’ of the section.</li><li>Added callout “END CHAMFERS (SEE SHEET 1, GENERAL NOTE 6)”.</li><li>Revised “OPTIONAL CONSTR. JT. AT BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB” to “OPTIONAL CONSTR JT AT BOTTOM OF PAVEMENT STRUCTURE OR 1” MIN BELOW APPROACH SLAB”</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	2 of 4 (cont.)	SECTIONS D-D, E-E and F-F: <ul style="list-style-type: none"><li>Revised “BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1” MIN BELOW APPROACH SLAB”</li></ul> LEGEND: <ul style="list-style-type: none"><li>Legend Note “3”: Added new note.</li></ul>
	3 of 4	TYPICAL ELEVATION: <ul style="list-style-type: none"><li>Revised “TOP OF CHEEKWALL 1” MIN. BELOW BOTTOM OF DECK” to “TOP OF CHEEKWALL 1” BELOW BOTTOM OF DECK”.</li></ul>
	4 of 4	TYPICAL ELEVATION: <ul style="list-style-type: none"><li>Revised “TOP OF CHEEKWALL 1” MIN. BELOW BOTTOM OF DECK” to “TOP OF CHEEKWALL 1” BELOW BOTTOM OF DECK”.</li></ul>
BD-632M	1 of 16	All Details: <ul style="list-style-type: none"><li>Removed “NO SCALE”.</li></ul> ABBREVIATIONS: <ul style="list-style-type: none"><li>Added “RC = DENOTES REINFORCED CONCRETE”</li></ul>
	2 of 16	PLAN: <ul style="list-style-type: none"><li>Added callouts for “SEE GUIDE RAIL CONNECTION NOTE 3” (2 places).</li></ul> ELEVATION: <ul style="list-style-type: none"><li>Added callouts for “(SEE GUIDE RAIL CONNECTION NOTES 3 AND 4)” (2 places).</li></ul> Added GUIDE RAIL CONNECTION NOTES.
	3 of 16	TYPICAL HEADWALL ELEVATION: <ul style="list-style-type: none"><li>Removed “NO SCALE”.</li></ul>
	4 of 16	BARRIER TRANSITION SUPPORT WALL: <ul style="list-style-type: none"><li>Added “6” next to the bar callouts located in the last 4’ of the section.</li><li>Added callout “END CHAMFERS (SEE GUIDE RAIL CONNECTION NOTE 3 ON SHEET 2)”.</li><li>Added callout for “CONSTR JT AT BOTTOM OF PAVEMENT STRUCTURE OR 1” MIN BELOW APPROACH SLAB”.</li><li>Removed callouts #5 @ 6” (2 places).</li></ul> SECTIONS B-B: <ul style="list-style-type: none"><li>Revised “BOTTOM OF PAVEMENT STRUCTURE, OR APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1” MIN BELOW APPROACH SLAB”</li></ul> LEGEND: <ul style="list-style-type: none"><li>Added Legend Note “6”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-632M (cont.)	6 of 16	PRECAST CULVERT WITH PRECAST END SECTION – PROFILE: <ul style="list-style-type: none"><li>Removed callouts “31-SC GUIDE RAIL – 3’-0” MIN.” and “31-SCC GUIDE RAIL – 2’-0” MIN.” for the offset distance between the collar and rear face of guide rail.</li></ul>
	7 of 16	PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS – PROFILE: <ul style="list-style-type: none"><li>Revised LEGEND Note “4” to “7”.</li><li>Removed callouts “31-SC GUIDE RAIL – 3’-0” MIN.” and “31-SCC GUIDE RAIL – 2’-0” MIN.” for the offset distance between the collar and rear face of guide rail.</li></ul> LEGEND: <ul style="list-style-type: none"><li>Revised LEGEND Note “4” to “7”.</li></ul>
	9 of 16	PLAN: <ul style="list-style-type: none"><li>Added callouts for “SEE GUIDE RAIL CONNECTION NOTE 3 ON SHEET 2” (2 places).</li></ul> ELEVATION: <ul style="list-style-type: none"><li>Added “(SEE GUIDE RAIL CONNECTION NOTES 3 AND 4 ON SHEET 2)” to callouts (2 places).</li></ul> NOTES: <ul style="list-style-type: none"><li>Added Note 2.</li></ul>
	16 of 16	All Details: <ul style="list-style-type: none"><li>Removed “NO SCALE”.</li></ul>

<div>OS-299 (5-21)</div> <div><div><b>pennsylvania</b> DEPARTMENT OF TRANSPORTATION <a href="http://www.penndot.gov">www.penndot.gov</a></div></div>	TRANSMITTAL LETTER	PUBLICATION:  Publication 218M
		DATE:  2/14/2023
<div>SUBJECT:</div> <div>Standards for Bridge Design April 2016 Edition Change 6</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div><b>Incorporate the attached revisions into the April 2016 Edition of Publication 218M.</b></div> <div><b>These revisions introduce the PA 3-Rail Bridge Barrier which replaces the Structure Mounted Guide Rail.</b></div> <div><b>These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules and in conjunction with the current Publication 408 Specifications. Projects with T.S.&amp;L. submissions after March 31, 2023 and projects let after October 6, 2023 must incorporate these new standards.</b></div> <div><b>A description of the changes made to the 2016 Edition since Change 5 of November 23, 2022 are listed in the attached multi-sheet Table. On the standards, pink highlighting indicates Change 6 revisions to details and notes.</b></div> <div><b>Comments or questions concerning this Publication may be directed to the Bridge Office.</b></div>		
<div>CANCEL AND DESTROY THE FOLLOWING:</div> <div>Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.</div>	<div>ADDITIONAL COPIES ARE AVAILABLE FROM:</div> <div><input checked="" type="checkbox"/> PennDOT website - <a href="http://www.penndot.gov">www.penndot.gov</a> <i>Click on Forms, Publications &amp; Maps</i></div>	
	<div>APPROVED FOR ISSUANCE BY:</div> <div>MICHAEL B. CARROLL Acting Secretary of Transportation</div> <div>BY: </div> <div>Jonathan R. Fleming Chief Executive Highway Administration</div>	

**PUBLICATION #218M**  
**SEPTEMBER 2016 EDITION**  
**CHANGE NO. 6**

The major revisions for each Standard Drawing are presented below. Since minor changes are not indicated, it is strongly advised that all recipients thoroughly examine the changes and revisions incorporated in this release.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M	1 of 12	REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>Added BD-609M – PA 3-RAIL BRIDGE BARRIER</li><li>Added BC-706M – PA 3-RAIL BRIDGE BARRIER</li></ul>
BD-601M	2 of 12	No Changes.
BD-601M	3 of 12	No Changes.
BD-601M	4 of 12	No Changes.
BD-601M	5 of 12	Added details for the new PA 3-Rail Bridge Barrier.
BD-601M	6 of 12	No Changes.
BD-601M	7 of 12	No Changes.
BD-601M	8 of 12	No Changes.
BD-601M	9 of 12	No Changes.
BD-601M	10 of 12	No Changes.
BD-601M	11 of 12	No Changes.
BD-601M	12 of 12	No Changes.
BD-609M	All Sheets	New Standard for the PA 3-Rail Bridge Barrier.
BD-631M	All Sheets	TITLE BLOCK: Revised “BUREAU OF PROJECT DELIVERY” to “BRIDGE OFFICE”  SIGNATURE BLOCKS: <ul style="list-style-type: none"><li>Revised “ACT. DIR. , BUR. OF PROJECT DELIVERY” to “ACTING CHIEF ENGINEER, HIGHWAY ADMIN.”</li></ul>
BD-631M	1 of 2	NOTES: <ul style="list-style-type: none"><li>Note 3: Revised “WORK QUALITY” to “PERFORM WORK”.</li><li>Note 10: Revised “STRUCTURE MOUNTED GUIDE RAIL” to “PA 3-RAIL BRIDGE BARRIER”.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>BD-632M: Removed “STANDARD”</li></ul>

**PUBLICATION #218M**  
**SEPTEMBER 2016 EDITION**  
**CHANGE NO. 6**

BD-631M	2 OF 2	SECTION B-B THRU CULVERT: <ul style="list-style-type: none"><li>Revised the 3’-6” dimension to “3’-6” MIN. UNLESS NON-ERODIBLE ROCK IS ENCOUNTERED”</li></ul>
BD-632M	1 of 16	DETAIL B: <ul style="list-style-type: none"><li>Revised “FOR BARRIER DETAILS, SEE BD-601M, BD-610M, BD-617M OR BD-618M BASED ON BARRIER TYPES.” to “FOR BARRIER DETAILS, SEE BD-601M, BD-610M, BD-617M OR BD-618M BASED ON BARRIER TYPE. FOR PA 3-RAIL BRIDGE BARRIER DETAILS, SEE SHEET 2.”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Added Note 21: “THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.”.</li></ul> REFERENCES DRAWINGS: <ul style="list-style-type: none"><li>Added BD-609M – PA 3-RAIL BRIDGE BARRIER</li><li>Added BC-706M – PA 3-RAIL BRIDGE BARRIER</li></ul>
BD-632M	2 of 16	Added details for the new PA 3-Rail Bridge Barrier.
BD-632M	3 of 16	TYPICAL CULVERT HEADWALL DETAILS: <ul style="list-style-type: none"><li>Remove “NOTE: FOR TYPICAL WING DETAILS SEE SHEET 6”.</li></ul> NOTE: <ul style="list-style-type: none"><li>Remove Note 1: “1. FOR ADDITIONAL END BARRIER TRANSITION, SEE BD-601M AND BD-624M.</li></ul>
BD-632M	4 of 16	No Changes.
BD-632M	5 of 16	No Changes.
BD-632M	6 of 16	No Changes.
BD-632M	7 of 16	No Changes.
BD-632M	8 of 16	No Changes.
BD-632M	9 of 16	Added details for the new PA 3-Rail Bridge Barrier.
BD-632M	10 of 16	No Changes.
BD-632M	11 of 16	No Changes.
BD-632M	12 of 16	No Changes.

**PUBLICATION #218M**  
**SEPTEMBER 2016 EDITION**  
**CHANGE NO. 6**

BD-632M	13 of 16	No Changes.
BD-632M	14 of 16	No Changes.
BD-632M	15 of 16	No Changes.
BD-632M	16 of 16	No Changes.
BD-637M	All Sheets	TITLE BLOCK: Revised “BUREAU OF PROJECT DELIVERY” to “BRIDGE OFFICE”  SIGNATURE BLOCKS: <ul style="list-style-type: none"><li>Revised “ACT. DIR. , BUR. OF PROJECT DELIVERY” to “ACTING CHIEF ENGINEER, HIGHWAY ADMIN.”</li></ul>
BD-637M	1 of 6	DESIGN NOTES: <ul style="list-style-type: none"><li>Note 10: Revise “SHEET 4” to “SHEET 5”.</li><li>Note 16: Revised to “THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3 AND MAY BE USED ON STRUCTURES ON NON-NHS ROADWAYS ONLY. WHERE BRIDGE BARRIERS WITH DESIGNATIONS GREATER THAN TL-3 ARE PROVIDED, A SEPARATE DESIGN IS REQUIRED.”.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>RC-50M: Revised title to “GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li><li>RC-52M: Revised to “RC-52M” to “RC-51M” and “TYPE 2” to “TYPE 31”.</li><li>BD-609M: Revised to “PA 3-RAIL BRIDGE BARRIER”.</li><li>BC-706M: Revised to “PA 3-RAIL BRIDGE BARRIER”.</li></ul>
BD-637M	2 of 6	No Changes.
BD-637M	3 of 6	No Changes.
BD-637M	4 of 6	No Changes.
BD-637M	5 of 6	No Changes.
BD-637M	6 of 6	No Changes.



TRANSMITTAL LETTER

PUBLICATION:  
Publication 218M

DATE:  
11/23/2022

SUBJECT:

Standards for Bridge Design  
April 2016 Edition  
Change 5

INFORMATION AND SPECIAL INSTRUCTIONS:

**Incorporate the attached revisions into the April 2016 Edition of Publication 218M.**

**These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules and in conjunction with the current Publication 408 Specifications. All projects with T.S.&L. submissions after February 28, 2023 must incorporate these new standards.**

**A description of the changes made to the 2016 Edition since Change 4 of June 1, 2021 are listed in the attached multi-sheet Table. On the standards, light orange highlighting indicates Change 5 revisions to details and notes.**

**Comments or questions concerning this Publication may be directed to the Bridge Office.**

CANCEL AND DESTROY THE FOLLOWING:

Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.

ADDITIONAL COPIES ARE AVAILABLE FROM:

☒ PennDOT website - [www.penndot.gov](http://www.penndot.gov)  
*Click on Forms, Publications & Maps*

APPROVED FOR ISSUANCE BY:

YASSMIN GRAMIAN, P.E.  
Secretary of Transportation

BY:



Jonathan R. Fleming  
Chief Executive  
Highway Administration

Standard	Sheet	Description of Changes
BD-601M	1 of 12	LEGEND: revised all deck slab lap splice lengths given in legend ⑪. <i>[e-Notification No. 79, dated 6/21/2021]</i>
		REFERENCE DRAWINGS: Removed BD-609M and BC-706M.
	2 of 12	NOTE 2: Added barrier lap splice lengths for lightweight concrete.
	3 of 12	NOTE 2: Added barrier lap splice lengths for lightweight concrete.
	4 of 12	TYPICAL SIDEWALK DETAIL: Updated barrier name from “Typical” to “42” F-Shape” in call-out.
		ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER DETAIL: Removed dimension of top longitudinal bar spacing for consistency with other barrier details.
		NOTE 2: Added barrier lap splice lengths for lightweight concrete.
	5 of 12	TITLE BLOCK: Replaced PA STRUCTURE MOUNTED GUIDE RAIL with PA 3-RAIL BRIDGE BARRIER in sheet title.
		Removed all details and notes from sheet.
		Added large note clarifying that sheet has been intentionally left blank because the PA Structure Mounted Guide Rail is being discontinued and replacement PA 3-Rail Bridge Barrier still pending.
BD-610M	2 of 10	SECTION A-A: Updated rail tube designation from TS to HSS in call-out.
BD-613M	1 of 7	SOLE AND MASONRY PLATE OREINTATION OPTIONS: Added asterisk (✱) note with consideration to facilitate future replacement of masonry plate.
	5 of 7	▲ NOTE: Added text to note concerning locations of tapped screws to avoid interference with stainless steel sheet.
	6 of 7	▲ NOTE: Added text to note concerning locations of tapped screws to avoid interference with stainless steel sheet.
	7 of 7	▲ NOTE: Added text to note concerning locations of tapped screws to avoid interference with stainless steel sheet.
BD-616M	1 of 2	GENERAL NOTE 1: Removed year of AASHTO LRFD spec. and spelled out DM-4.
		GENERAL NOTE 8: Replaced note with reference to applicable AASHTO and DM-4 articles for the design of the splices
		GENERAL NOTE 9: Replaced the equations and variable definitions with reference to applicable AASHTO article.
		FLANGE SPLICE DETAIL – TYPE 1, VIEW A-A: Added bolt pattern which was inadvertently deleted in previous change.
		WEB SPLICE DETAIL: Added bolt pattern which was inadvertently deleted in previous change.
	2 of 2	WEB SPLICE DETAIL: Added bolt pattern which was inadvertently deleted in previous change.
BD-617M	1 of 9	TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION: Extended rails to 4” from end of barrier and dded dimension to and call-out of post CL (both ends).
		VERTICAL V-NOTCH DETAIL: Corrected depiction of bolt and v-notch locations.
		SECTION A-A: Updated rail tube designation from TS to HSS in call-out.
BD-620M	2 of 9	HORIZONTAL REINFORCEMENT: Revised incompatible 1'-4” dimension to 1'-2”
	1 of 6	LATERAL STABILITY BRACING DESIGN CRITERIA, NOTE 7: Replaced second sentence to indicate design loading of interior girders.
	4 of 6	TOP FLANGE LATERAL BRACING CONNECTIONS: Revised note to change the preferred arrangement from attaching the lateral bracing. <i>[e-Notification No. 74, dated 9/19/2019]</i>
	1 of 10	Added GENERAL NOTE 3 and TABLE 1 to clarify when safety wings are required.
BD-622M	1 of 10	TYPICAL PLAN (SKEWS < 75°): Added reference to new Table 1 in safety wing call-out.
		Renumbered TABLE 1 to TABLE 2 and updated all references to table.
	2 of 10	All Details: Made construction joint at bottom of pavement structure or approach slab OPTIONAL.

Standard	Sheet	Description of Changes
BD-622M (cont.)	3 of 10	ELEVATION: Removed section cuts J-J and L-L.
	4 of 10	ELEVATION: Removed section cuts J-J and L-L.
	5 of 10	ELEVATION: Removed section cuts J-J and L-L.
	6 of 10	Deleted SECTION J-J and SECTION L-L.
		All Sections: Made construction joint at bottom of pavement structure or approach slab OPTIONAL.
		SECTION H-H: Corrected bar mark from 404 to 403.
		SECTION K-K: Corrected location of the 404 longitudinal bars to be inside the 407 vertical rebar.
		SECTION M-M: Corrected depicted vertical location of top pair of 404 longitudinal bars.
		Renumbered TABLE 2 to TABLE 3.
	7 of 10	Renumbered TABLE 3 to TABLE 4, TBALE 4 to TABLE 5 and TABLE 5 to TABLE 6 and updated all references to the tables.
	9 of 10	SECTION R-R: Revised detail to add optional construction joint at bottom of pavement structure or approach slab, to terminate rear face batter at this new construction joint, and to provide reinforcement of the concrete between construction joints.
		SECTION R-R: Repurposed the 2” dimension to indicate the location of the upper V-notch instead of the rebar cover to the construction joint.
		TYPICAL ELEVATION and SECTION Q-Q: Relocated the lower V-notch on the wingwall to coincide with the new optional construction joint at the bottom of pavement structure or approach slab.
BD-624M	1 of 4	Added GENERAL NOTE 3 and TABLE 1 to clarify when safety wings are required.
		TYPICAL PLAN (SKEWS < 75°): Added reference to new Table 1 in safety wing call-out.
	2 of 4	Renumbered TABLE 1 to TABLE 2 and updated all references to table.
		All Details: Made construction joint at bottom of pavement structure or approach slab OPTIONAL.
	3 of 4	SECTION R-R: Revised detail to add optional construction joint at bottom of pavement structure or approach slab, to terminate rear face batter at this new construction joint, and to provide reinforcement of the concrete between construction joints.
		SECTION R-R: Repurposed the 2” dimension to indicate the location of the upper V-notch instead of the rebar cover to the construction joint.
BD-627M	8 of 8	TYPICAL ELEVATION and SECTION Q-Q: Relocated the lower V-notch on the wingwall to coincide with the new optional construction joint at the bottom of pavement structure or approach slab.
		PAVEMENT RELIEF JOINT, PLAN and SECTION E-E: Increased pavement relief joint and open joint in barrier from 1'-0” to 2'-0” for consistency with revisions to BD-628M.
BD-628M	General	Removed contraction joints as an option for the approach slab longitudinal joints.
		Removed paving notch joint seal details (Detail H on Sheet 10 and Detail J on Sheet 11), notes, and callouts and now reference BC-766M which has updated details.
		Updated terminology from “2-ply bit. paper” to “2-ply asphalt-saturated paper”.
		Increased width of pavement relief joints from 1'-0” to 2'-0”.
		Removed drain pipes through sleeper slabs beneath neoprene strip seal dams.
	2 of 35	INSTRUCTIONS TO DESIGNER, NOTE 9: Moved “Compression Seals or Inverted V Joint Seals” from the fourth bullet (incidental costs) to the third bullet (separate pay items & quantities)
		INSTRUCTIONS TO DESIGNER, NOTE 21 (new): Added note regarding use of a Geosynthetic Stabilized Bridge Approach as shown on new RC-15M and new Pub. 408, Section 224.
		APPROACH SLAB SELECTION CRITERIA TABLE, NOTE 2: Updated “Bridge Design and Technology Division” to “Bridge Office”.
	3 of 35	PAVING NOTCH FORMING DETAILS: Separated Type 1 and Type 3 approach slabs into two details.



Standard	Sheet	Description of Changes
BD-628M (cont.)	3 of 35 (cont.)	PAVING NOTCH FORMING DETAILS, TYPE 1 APPROACH SLABS: Removed anything specific to Type 3 approach slabs. Replaced “Seal Height Plus 1” callout with “Sawed Seal Groove as shown in BC-766M”. Added MIN. to 1/4” offset of face of formed opening. Added “Formed Basic Joint” callout.
		PAVING NOTCH FORMING DETAILS, TYPE 2 APPROACH SLABS: Replaced “Seal Height Plus 1” callout with “Sawed Seal Groove as shown in BC-766M”. Added MIN. to 1/4” offset of face of formed opening. Added “Formed Basic Joint” callout.
		Added PAVING NOTCH FORMING DETAILS, TYPE 3 APPROACH SLABS
		Deleted JOINT PREPARATION NOTES.
	5 of 35	PLAN 2, TYPE 1 AND TYPE 2: In longitudinal joint callouts, removed “optional” and condensed call-out (2 instances). Removed reference to sheet 9 in sleeper slab callout. Revised sleeper slab width from 6'-0" to 7'-0" when adjacent to pavement relief joint.
		Renamed DETAIL B to DETAIL A and renamed DETAIL C to DETAIL B.
		DETAIL A – CONSTRUCTION JOINT: Removed details of joint seal and revised callout to reference BC-752M, Detail A.
		DETAIL B – CONTRACTION JOINT: Revised depiction and call-out of joint groove.
		Replaced JOINT SEALING DETAIL with new DETAIL C depicting shallow tooled/sawcut groove.
		NOTE 6: Removed reference to Section 501.2 and subsection (d) of 705.4.
	6 of 35	PLAN 3, TYPE 1 AND TYPE 2: In longitudinal joint callouts, removed “optional” and added contraction joint option (2 instances). Revised sleeper slab width from 6'-0" to 7'-0" when adjacent to pavement relief joint.
	7 of 35	PLAN 4, TYPE 1 AND TYPE 2: In longitudinal joint callouts, removed “optional” and added contraction joint option (2 instances). Revised sleeper slab width from 6'-0" to 7'-0" when adjacent to pavement relief joint.
		NOTE 4: Revised opening from 1'-0" to 2'-0" adjacent to pavement relief joint.
	8 of 35	SECTION E-E: In longitudinal joint callouts, removed “optional” and condensed call-out (4 instances).
	9 of 35	TYPE 1 AND TYPE 4 APPROACH SLAB – DETAIL 3: Increased width of pavement relief joint from 1'-0" to 2'-0" and increased width of sleeper slab by 1'-0".
	10 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 4: Revised joint seal callout to reference BC-766M instead of Detail H. Removed dimensions locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 4: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimensions locating paving notch joint along roadway surface.
		OPTIONAL BACKWALL: Moved horizontal dimension of paving notch to below notch.
		Deleted DETAIL H (both for Neoprene Compression Seal and for Inverted V Joint Seal) and DETAIL H NOTES which are now covered on BC-766M.
		Deleted NOTE 3 regarding joint seals which is now covered by BC-766M.
	11 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 5: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimensions locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 5: Revised joint seal callout to reference BC-766M instead of Detail J. Removed dimensions locating paving notch joint along the roadway surface.
		Deleted DETAIL J (both for Neoprene Compression Seal and for Inverted V Joint Seal) and DETAIL J NOTE which are now covered on BC-766M.
		Deleted NOTE 2 regarding joint seals which is now covered by BC-766M.
	12 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 6: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.

Standard	Sheet	Description of Changes
BD-628M (cont.)	12 of 35 (cont.)	TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 6: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	13 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 7: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 7: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	14 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 8: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 8: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	15 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 9: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface.
		TYPE 2 APPROACH SLAB (WITH OVERLAY) – DETAIL 7: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface.
	16 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 10: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
		TYPE 2 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 10: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
	17 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
		TYPE 2 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
	18 of 35	TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 12: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
		TYPE 2 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 12: Revised joint seal callout to reference BC-766M instead of Detail J on Sheet 11. Removed dimension locating paving notch joint along roadway surface. Added horizontal paving notch dimension to neoprene sponge.
	19 of 35	PLAN 1, TYPE 3: Revised sleeper slab width from 8'-6" to 9'-6" when adjacent to pavement relief joint. Corrected depiction of joints and rebar in the area of the barriers.
	20 of 35	PLAN 2, TYPE 3: Revised sleeper slab width from 8'-6" to 9'-6" when adjacent to pavement relief joint. Corrected depiction of joints and rebar in the area of the barriers.
		NOTE 4: Revised opening from 1'-0" to 2'-0" adjacent to pavement relief joint.
	21 of 35	PLAN 3, TYPE 3: Revised sleeper slab width from 8'-6" to 9'-6" when adjacent to pavement relief joint. Corrected depiction of joints and rebar in the area of the barriers.
	22 of 35	TYPE 3 AND 5 APPROACH SLAB – DETAIL 13: Removed drain pipe through sleeper slab.
		TYPE 3 AND 5 APPROACH SLAB – DETAIL 14: Removed drain pipe through sleeper slab.
		TYPE 3 AND 5 APPROACH SLAB – DETAIL 15: Increased width of pavement relief joint from 1'-0" to 2'-0" and increased width of sleeper slab by 1'-0". Removed drain pipe through sleeper slab.

Standard	Sheet	Description of Changes
BD-628M (cont.)	23 of 35	TYPE 5 APPROACH SLAB – DETAIL 18: Increased width of pavement relief joint from 1'-0" to 2'-0" and increased width of sleeper slab by 1'-0".
	24 of 35	TYPE 3 APPROACH SLAB – DETAIL 19 and TYPE 3 APPROACH SLAB – DETAIL 20 and ALTERNATE REBAR DETAIL: Revised joint depiction. Revised joint callout to reference Detail S on Sheet 35 instead of Detail H on Sheet 10. Added horizontal paving notch dimension to neoprene sponge and added dimension of neoprene sponge height.
		Deleted NOTE 5.
	25 of 35	TYPE 3 APPROACH SLAB – DETAIL 21 and TYPE 3 APPROACH SLAB – DETAIL 22: Revised joint depiction. Revised joint seal callout to reference Detail S on Sheet 35 instead of Detail H on Sheet 10. Added horizontal paving notch dimension to neoprene sponge and added dimension of neoprene sponge height.
		Deleted NOTE 5.
	26 of 35	PLAN 1, TYPE 4: Revised sleeper slab width from 6'-0" to 7'-0" when adjacent to pavement relief joint. Corrected depiction of joint to bend at gutterline.
	27 of 35	PLAN 2, TYPE 4: Revised sleeper slab width from 6'-0" to 7'-0" when adjacent to pavement relief joint. Corrected depiction of joint to bend at gutterline.
	27 of 35	PLAN 3, TYPE 4: Corrected depiction of joint to bend at gutterline.
	30 of 35	TYPE 4 APPROACH SLAB – DETAIL 24: Revised joint depiction. Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10.
		Deleted NOTE 5.
	32 of 35	TYPE 4 APPROACH SLAB – DETAIL 26: Revised joint seal callout to reference BC-766M instead of Detail H on Sheet 10. Added horizontal paving notch dimension to neoprene sponge and added dimensions of neoprene sponge thickness and height.
		Deleted NOTE 4.
	33 of 35	TOOTH DAM SUPPORT PLAN: Corrected depiction of joint to bend at gutterline.
	34 of 35	Renamed SECTION A-A to SECTION Z-Z and updated references.
	35 of 35	PLAN, TYPE 5: Revised sleeper slab width from 6'-0" to 7'-0" when adjacent to pavement relief joint and from 8'-6" to 9'-6" at strip seals adjacent to concrete pavement.
Renamed DETAIL A to DETAIL Q and updated references.		
Renamed DETAIL O to DETAIL S and updated references.		
BD-629M	10 of 15	COLUMNS: Revised class of splice from Class C to Class B (2 instances)
	12 of 15	DRILLED SHAFTS: Revised class of splice from Class C to Class B (4 instances)
BD-632M	General	Removed details, depictions and references to the PA Structure Mounted Guide Rail which is being discontinued. Sheets 2 and 9 (formerly 8) are retained but intentionally left blank until the replacement PA 3-Rail Bridge Barrier is released.
		Re-assigned letters to cut sections throughout the standard so they appear in alphabetical order without any duplications. Updated all references to these sections.
		With added sheet 4, renumbered subsequent sheets and updated the total number of sheets in all Title Blocks. Updated all references to the renumbered sheets.
	1 of 16	NOTE 3: Revised language of note requiring conformity with Publication 408.
		NOTE 9: Revised "allowable design foundation pressure" to "factored bearing resistance".
		NOTE 11: Updated reference from "Sheet 5" to "Sheet 6".
		NOTE 17: Revised SAFETY WINGS to BARRIER TRANSITION.
		Deleted NOTE 18 regarding Test Level designation of PA Structure Mounted Guide Rail which is being discontinued. Renumbered subsequent notes.
		DESIGN DATA FOR C-I-P BOX CULVERT: Revised Note 4 to clarify that the yield strength is for <b>plain</b> welded wire fabric and to increase the required strength.
	DESIGN DATA FOR C-I-P BOX CULVERT: Added Note 5 to provide the required yield strength for <b>deformed</b> welded wire fabric.	

Standard	Sheet	Description of Changes
BD-632M (cont.)	1 of 16 (cont.)	DESIGN DATA FOR C-I-P BOX CULVERT - INSTRUCTIONS: Added item K to indicate that additional welded wire fabric information is on sheet 5.
		SECTION ALONG CL CULVERT: Removed depiction of structure mounted guiderail and revised barrier curb dimension/callout to a general barrier callout.
		DETAIL B: Removed depiction of structure mounted guide rail, including curb reinforcement, to make detail applicable to multiple barrier types. Removed mention of railings, guide rail, and BD-609M from callout. Removed curb height callout.
		DETAIL B: Removed NOTE referencing sheet 2 for PA Structure Mounted Guide Rail details.
		DETAIL B: Added (VARIES) to wearing course callout and added asterisk (✱) note providing maximum and minimum wearing course thickness at gutterline.
		DETAIL B: Revised headwall reinforcement callout from "#6" to "Headwall reinforcement #6 min. or as required by design".
		DETAIL B: Removed S7 bars.
		APRON SECTION: Revised "Center of Apron" to "Mid-Height of Slab" in wire fabric call-out. Replaced depth call-out with reference to Legend Note 2. Added "Cutoff Wall" to cutoff wall call-out and added reference to Legend Note 3.
		Renamed existing LEGEND to ABBREVIATIONS.
		Added new LEGEND with three notes.
		REFERENCE DRAWINGS: Removed BD-609M, BC-706M, and BC-739M. Added RC-50M, BD-622M and BD-624M.
	2 of 16	TITLE BLOCK: Removed HEADWALL DETAILS from sheet title.
		Moved TYPICAL HEAD WALL SECTIONS to sheet 3.
		Moved PAVEMENT NOTCH DETAILS to sheet 3.
		Removed PA STRUCTURE MOUNTED GUIDE RAIL ELEVATION ALONG TOP OF SLAB OF CULVERT and SECTION A-A.
		Added large note clarifying that sheet has been intentionally left blank because the PA Structure Mounted Guide Rail is being discontinued and replacement PA 3-Rail Bridge Barrier still pending.
	3 of 16	TITLE BLOCK: Added HEADWALL DETAILS to sheet title.
		Moved TYPICAL HEADWALL ELEVATION – FLARED SAFETY WING, SECTION B-B, and SECTION C-C to new sheet 4.
		Moved TYPICAL HEADWALL SECTIONS here from sheet 3. Replaced E#4 @ 12" bar callout with barrier callout referencing BD-601M.
		Moved PAVEMENT NOTCH DETAIL here from sheet 3.
	4 of 16 (NEW)	Moved TYPICAL HEADWALL ELEVATION – BARRIER TRANSITION, SECTIONS B-B and SECTION C-C here from sheet 3. Revised elevation title to BARRIER TRANSITION SUPPORT WALL. Revised elevation and Section C-C for new MASH-compliant F-shape barrier end transition. Revised Section B-B to be applicable for multiple barrier types.
		LEGEND: Added legend to supplement the elevation view and Section B-B. Note 4 provides a list of applicable standards for the reinforcement details of different barrier types. Note 5 allows a buried barrier moment slab to be used in lieu of the barrier transition support wall.
	5 of 16 (formerly 4 of 15)	NOTE 2: Updated ASTM references.
		NOTE 5: Revised language of note requiring conformity with Publication 408.
		NOTE 13: Revised note to require waterproofing membrane over entire top of the box culvert.
		NOTES: Added Notes 30, 31 and 32 concerning mud slabs.
		BOX DETAILS – WELDED WIRE FABRIC: Added reference to new Notes 30 - 32 in bedding depth call-out.
		DESIGN DATA: Added required compressive strength of baffles/weirs and mud slabs, revised the yield strength of plain WWF, and added the required yield strength of deformed WWF.

Standard	Sheet	Description of Changes
BD-632M (cont.)	6 of 16 (formerly 5 of 15)	Rearranged details on sheet.
		PRECAST CULVERT WITH PRECAST END SECTION: Replaced cutoff wall depth dimension text with reference to Legend Note 2. Added callout of cutoff wall.
		PRECAST CULVERT WITH PRECAST END SECTION: Added third galvanized connection strap with reference to note on sheet 8. Added reference to BC-798M in connection strap callout.
		PRECAST CULVERT WITH PRECAST END SECTION: Added reference to Note 30 on Sheet 5 to bedding callout.
		PRECAST CULVERT WITH PRECAST END SECTION, NOTES: In second bullet, revised “Rock Protection” to “Scour Protection” and added “Precast” to referenced detail title.
		PRECAST CULVERT WITH PRECAST END SECTION, NOTES: Deleted third bullet (now part of callout in detail) and added new bullet referencing Note 10 on Sheet 8 when slab thicknesses are less than 13”.
		Added LEGEND with Note 2 for depth of cutoff wall and Note 3 regarding alternate cutoff wall.
		KEYED JOINT and SHIP LAP JOINT: Added callouts for “Precast Box” and the “Joint”.
	7 of 16 (formerly 6 of 15)	PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS - PROFILE: Added scour protection dimension/call-out. Added reference to Legend Note 4 at depression call-out. Shortened cutoff wall call-outs by referencing Legend Notes 2 and 3.
		Added LEGEND with NOTES 2 for depth of cutoff wall, NOTE 3 to reference alternate cutoff wall, and NOTE 4 for streambed material depth on top of rock lining.
		ALTERNATE CUTOFF WALL WITH GROUTED ROCK - DETAIL D (WITHOUT APRON) and DETAIL E (WITHOUT APRON): Revised depiction and call-outs while conceptually remaining the same.
	8 of 16 (formerly 7 of 15)	POST-TENSIONING NOTE 3: In second bullet, added reference to new Note 10 when slab thicknesses are less than 13”.
		POST-TENSIONING NOTES: Added Note 10 concerning the use of a third galvanized tie strap.
		POST-TENSION END SECTION – SPAN > 12 FEET and POST-TENSION END SECTION – SPAN ≤ 12 FEET: Added third galvanized tie strap with reference to new Note 10. Added reference to BC-798M in connection strap callout.
		SECTION H-H and SECTION J-J: Revised chamfer callout to provide minimum and maximum dimensions.
	9 of 16 (formerly 8 of 15)	TITLE BLOCK: Removed HEADWALL DETAILS from sheet title.
		Removed all details, notes, and legend from sheet.
	11 of 16 (formerly 10 of 15)	Added large note clarifying that sheet has been intentionally left blank because the PA Structure Mounted Guide Rail is being discontinued and replacement PA 3-Rail Bridge Barrier still pending.
		TITLE BLOCK: In sheet title revised 4% to 2%.
	12 of 16 (formerly 11 of 15)	DESIGN NOTES: Added Note 12 regarding the PA Fish & Boat Commission’s Alternate Double Weir Baffle design.
		DESIGN NOTES: Added Note 12 referencing Note 12 on Sheet 11 regarding the PA Fish & Boat Commission’s Alternate Double Weir Baffle design.
	14 of 16 (formerly 13 of 15)	TITLE BLOCK: In sheet title revised 4% to 2%.
	15 of 16 (formerly 14 of 15)	DESIGN NOTES: Added Note 12 regarding the PA Fish & Boat Commission’s Alternate Double Weir Baffle design.
		General: Re-designated the squared segment joints as “Standard” and the skewed segment joints as “Alternate” with new Design Note 1 clarifying squared joints as the preference. Reorganized and reworked entire sheet.
		Removed the DESIGN INSTRUCTIONS table.
		Renamed SKEW ANGLE ≥ 75 DEGREES to ALTERNATE SKEWED SEGMENT JOINTS, PLAN VIEW – SKEW ANGLE ≥ 75 DEGREES. Added minimum segment length callout, end section callout, and line for edge of end section.

Standard	Sheet	Description of Changes
BD-632M (cont.)	15 of 16 (formerly 14 of 15) (cont.)	Renamed SKEW ANGLE < 75 DEGREES – OPTION 1 to ALTERNATE SKEWED SEGMENT JOINTS, PARTIAL PLAN VIEW – SKEW ANGLE < 75 DEGREES. Revised to only show one intermediate and one end joint. Added callout for squared wall faces at joints, end section callout, and line for edge of end section.
		Renamed SKEW ANGLE < 75 DEGREES – OPTION 2 to STANDARD SQUARED SEGMENT JOINTS, PLAN VIEW. Added minimum intermediate segment length callout, end section callout, and line for edge of end section.
		ALTERNATE END SEGMENTS DETAIL: Added detail showing layout when two or more segments are used to transition from squared segment joints to a skewed culvert end.
		STAGED CONSTRUCTION JOINT DETAIL: Added detail showing layout when there is a staged construction joint in the culvert.
		ALTERNATE STAGED CONSTRUCTION JOINT DETAIL: Added detail showing layout when two or more segments are used to transition from squared segment joints to a skewed construction joint.
		Renamed DESIGN EXAMPLE – BOX CULVERT (STEEL FORM) – MINIMUM SKEW ANGLE to FABRICATION LIMITATIONS. Split the design example into a notation list and an Example Calculation. Made improvement for clarity and to cover the case of a segment with two skewed faces. Added a simple plan of a segment with two skewed faces.
		DESIGN NOTES: Added four notes to cover segment joint preferences and parameters.
		Added note to allow fabricator to pursue any option shown on standard (not just that shown on contract plans) at the shop drawing stage.
	16 of 16 (formerly 15 of 15)	TYPICAL PLAN, SECTION W-W, and SECTION V-V: Added tie bars to connect the concrete wedges to the end section slab. Added welded wire fabric to the exposed faces of the wedges.
		SECTION W-W: Corrected depiction to be consistent with the Typical Section and Section V-V. Corrected the vertical location of the tie bars. Added dimensioning for tie bar vertical placement. Moved streambed to top of slab dimension to Section V-V.
		SECTION V-V: Removed tie bar callout. Moved dimensioning for tie bar vertical placement to Section W-W. Corrected the vertical location of the tie bars. Added streambed to top of slab dimension.
BD-651M	2 of 2	TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – SPANS UP TO 75’: Revised intermediate diaphragm to be oriented with skew instead of perpendicular to beam
		TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – SPANS GREATER THAN 75’: Revised intermediate diaphragms to be oriented with skew instead of perpendicular to beam; added (TYP.) to maximum void length.
		TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – NOTES: Shortened Note 1 to removed mention of the orientation of diaphragms.
		TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAMS BRIDGES – NOTES: Added Note 4 to indicate that no intermediate diaphragm is required for spans ≤ 40 ft.
BD-653M	1 of 2	Added new CLIPPED FLANGE DETAIL
		NOTE 4: Added note 4 to reference BD-662M for additional clipped flange details
		DETAIL A – WITH PAVING NOTCH AND WITHOUT BACKWALL: Added callout to see newly Added Clipped Flange Detail
		DETAIL C – WITH BACKWALL: Added callout to see newly added Clipped Flange Detail
	2 of 2	ELASTOMERIC BEARING PAD ARRANGEMENTS (I-BEAM AND PA BULB TEE BEAMS): Added callout to see newly added Clipped Flange Detail on sheet 1.
		ALTERNATE BEARING PAD ARRANGEMENTS (I-BEAM AND PA BULB TEE BEAMS): Added callout to see newly added Clipped Flange Detail on sheet 1.
BD-660M	1 of 2	NOTE 5: Added sentence to prohibit the shortening of S7 bars in the acute corner of skewed deck slabs.
BD-661M	1 of 8	ADJACENT BOX BEAMS PLAN-TYPICAL BEAM: Revised intermediate diaphragm to show geometry at skews above and below 75° and to be consistent with BC-775M.

Standard	Sheet	Description of Changes
BD-661M (cont.)	1 of 8 (cont.)	ELEVATION A-A: Tendon pocket and splice chuck pocket added at tendon holes.
	3 of 8	STRAND CONFINEMENT NOTES: Updated referenced DM-4 article.
		STRAND PATTERN NOTES: Added Note 3 and 4 to clarify tendon pocket's and splice chuck pocket's impact on available prestressing strand locations.
BD-666M	1 of 1	General: Updated this standard to better reflect current strengthening practices and to be consistent with current ACI guide and upcoming AASHTO specification changes.
		DESIGN NOTE 5: Updated reference of ACI 440-2R document to the latest 2017 version.
		DESIGN NOTE 8: Removed this note, not necessary. Renumbered subsequent notes.
		GENERAL NOTE 1: Revised A SURFACE MOUNTED to AN EXTERNALLY BONDED.
		Deleted ELEVATION - FLEXURE STRENGTHENING OF ADJACENT BOX BEAM (SPREAD BOX BEAM SIMILAR) and ELEVATION - FLEXURE STRENGTHENING OF I-BEAM.
		Added ELEVATION - TYPICAL FLEXURE STRENGTHENING OF CONCRETE BEAM to replace the two deleted elevations with a new detail that is consistent with current ACI guide and upcoming AASHTO specification changes.
		SECTION - FLEXURE STRENGTHENING OF I-BEAM: Revised to only place CRFP on the underside of the beam, reflecting current strengthening practices. Added callout concerning CRFP orientation, strip width and number of plies.
		SECTION - FLEXURE STRENGTHENING OF BOX BEAM: Revised the CFRP sheet maximum width, indicated that the FRP cut-off dimension to beam edge as per design and added callout concerning CRFP orientation, strips width and number of plies.
		ELEVATION - SHEAR STRENGTHENING OF SPREAD BOX BEAM: Revised U-wrap strip maximum width and updated callout concerning strip spacing, width and number of plies.
BD-667M	General	Throughout the standard, replaced specific lap splice lengths and development lengths with generic callouts so that standard cannot become out-of-date/inconsistent with latest BC-736M.
		With added sheet 4, renumbered subsequent sheets and updated the total number of sheets in all Title Blocks. Updated all references to the renumbered sheets.
	1 OF 10	GENERAL NOTE 8: Updated development and lap lengths to match current requirements by replacing table with reference to BC-736M. Carried this change through numerous details by replacing specific lap length with generic dimension.
		GENERAL NOTES 19 and 24: Revised notes to remove prohibition on adjacent box beams for integral abutments.
		GENERAL NOTE 30: Revised note to instruct designer to place redecking note on integral abutment bridge plans.
	2 of 10	Removed specific lap splice lengths (2 instances) and revised ✱ note to remove specific girder spacing threshold that corresponds to a specific lap splice length.
		PARTIAL SECTION THRU ABUTMENT, CONCRETE GIRDER: In pile cap, added missing reinforcement bars below box beam and removed bars that do not exist at pile location.
		Renamed SECTION G-G to SECTION F-F.
	3 of 10	SHEET TITLE: Added SPREAD BEAMS to sheet title to differentiate from new sheet 4 for adjacent beams.
		Removed specific lap splice lengths and specific dimensions based on lap splice lengths (7 instances)
		SECTION A-A - GIRDER WITH PILE: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7); removed bar size and spacing from callout.
		SECTION B-B - NO GIRDER, NO PILE: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7).
		SECTION C-C - GIRDER WITHOUT PILE: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7).
		SECTION D-D – PILE WITHOUT GIRDER: Revised approach slab tie bar to match how the bar is shown in the details on sheet 8 (formerly 7).

Standard	Sheet	Description of Changes
BD-667M (cont.)	4 of 10 (NEW)	Added new sheet to provide details like those on sheet 3 but specific to adjacent box beams.
	5 of 10 (formerly 4 of 9)	SECTION E-E: Revised shape of the #8 bar at front corner to show the required 90° hook for development instead of a 9" min. lap splice with the #5 bar.
	6 of 10 (formerly 5 of 9)	Removed specific lap splice lengths (5 instances)
	8 of 10 (formerly 7 of 9)	Removed specific development lengths (once in each section) and lap splice lengths (Legend note ⑦).
		SECTION THRU END DIAPHRAGM BETWEEN BEAMS – GIRDER DEPTH ≥ 2'-0": Added waterstop to match BD-628M. Added dimension to locate placement of approach slab tie bars. Removed girder to clarify that this detail is applicable between beams.
	8 of 10 (cont.)	SECTION THRU END DIAPHRAGM AT BEAMS – GIRDER DEPTH ≥ 2'-0": Added waterstop to match BD-628M. Added haunch depth to height of slab. Changed callout to indicate that the additional #8 bar runs entire “width of approach slab”, not “length of end diaphragm” which is discontinuous at beams.
		SECTION THRU END DIAPHRAGM BETWEEN BEAMS – GIRDER DEPTH < 2'-0": Added waterstop to match BD-628M. Generalized dimension that locates approach slab tie bar placement to allow for greater flexibility of deck thickness and avoidance of waterstop. Changed bend angle of approach slab tie bar and reversed direction of its hook for better placement geometry. Removed girder to clarify this detail is applicable between beams.
		SECTION THRU END DIAPHRAGM AT BEAMS – GIRDER DEPTH < 2'-0": Added waterstop to match BD-628M. Added haunch depth to height of slab.
		DETAIL A: Added waterstop to match BD-628M. Increased minimum clearance from 1" to 2" from rear face of integral abutment to approach slab tie bar for consistency with BD-628M.
BD-668M	1 of 3	TYPICAL PRECAST CHANNEL SECTIONS: Revised shape of reinforcement bar projecting out of the beam into the barrier to match revised Bar Detail this sheet. Added 2" CLR. cover call-out on bottom of channel.
		BAR DETAIL: Added 90° hook to end of leg and revised horizontal length of leg prior to bend.
	3 of 3	TYPICAL PRECAST CHANNEL SECTION WITH 42" VERTICAL WALL CONCRETE BARRIER: Revised shape of reinforcement bar projecting out of the beam into the barrier to match revised Vertical Barrier Bar Detail this sheet. Added 1½" clearance callout to top and bottom faces of the beam top flange. Added 2" CLR. cover call-out on bottom of channel.
		TYPICAL PRECAST CHANNEL SECTION WITH PA TYPE 10M BRIDGE BARRIER: Revised shape of reinforcement bar projecting out of the beam into the barrier to match revised PA Type 10M Barrier Bar Detail this sheet. Added 1½" clearance callout to top and bottom faces of the beam top flange. Added 2" CLR. cover call-out on bottom of channel.
		VERTICAL BARRIER BAR DETAIL: Added 90° hook to end of leg and revised horizontal length of leg prior to bend.
BD-697M	5 of 5 (NEW)	PA TYPE 10M BARRIER BAR DETAIL: Added 90° hook to end of leg and revised horizontal length of leg prior to bend.
		Added sheet 5 for GRS-IBS Caution Tape Placement. <i>[e-Notification No. 77, dated 12/21/2020]</i> NOTE 3: Modified and provided additional caution tape requirements. Removed image of caution tape.



TRANSMITTAL LETTER

PUBLICATION:  
Publication 218M

DATE:  
6/1/2021

SUBJECT:  
Standards for Bridge Design  
April 2016 Edition  
Change 4

INFORMATION AND SPECIAL INSTRUCTIONS:

**Incorporate the attached new standard BD-663M into the April 2016 Edition of Publication 218M.**

**BD-663M "Concrete Deck Slab Design & Details for Flex Beam Bridges" is being issued to provide a low-cost system for rapid replacement of deficient short span highway bridges.**

**This new standard may be used immediately.**

**Comments or questions concerning this Publication may be directed to the Bureau of Project Delivery, Bridge Design and Technology Division.**

CANCEL AND DESTROY THE FOLLOWING:

n/a



ADDITIONAL COPIES ARE AVAILABLE FROM:

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*Click on Forms, Publications & Maps*

APPROVED FOR ISSUANCE BY:

YASSMIN GRAMIAN, P.E.  
Secretary of Transportation

BY:  
  
Brian G. Thompson, P.E.  
Director, Bureau of Project Delivery,  
Highway Administration

<div>OS-299 (7-08)</div> <div></div>	TRANSMITTAL LETTER	<div>PUBLICATION:  Publication 218M April 2016 Edition Change No. 3</div> <div>DATE:  February 19, 2021</div>
<div>SUBJECT:  Revisions to Standards for Bridge Design April 2016 Edition</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div>Incorporate the attached revisions into the April 2016 Edition of Publication 218M. These standards are being issued to address bridge barriers and transitions to bridge barriers that are compliant with the AASHTO Manual for Assessing Safety Hardware (MASH 2016). These standards may be used immediately and can be adopted as soon as practical on new and existing designs without affecting letting schedules. However, projects with T.S.&amp;L. submissions after July 1, 2021 and projects let after April 1, 2022 shall incorporate these standards. A description of the changes made to the 2016 Edition since Change 2 dated August 30, 2019 are listed in the attached multi-sheet Table. On the standards, light blue highlighting indicates Change 3 revisions. Highlighting of Change 1 and Change 2 revisions has been omitted for clarity. Comments or questions concerning this Publication may be directed to the Bureau of Project Delivery, Bridge Design and Technology Division.</div>		
<div>CANCEL AND DESTROY THE FOLLOWING:</div> <div>Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.</div>	<div>ADDITIONAL COPIES ARE AVAILABLE FROM:</div> <div><div><input type="checkbox"/> PennDOT SALES STORE (717) 787-6746 phone (717) 787-8779 fax ra-penndotsalesstore.state.pa.us</div><div><input checked="" type="checkbox"/> PennDOT website - <a href="http://www.dot.state.pa.us">www.dot.state.pa.us</a> Click on Forms, Publications &amp; Maps</div><div><input type="checkbox"/> DGS warehouse (PennDOT employees ONLY)</div></div>	
	<div>APPROVED FOR ISSUANCE BY:</div> <div>YASSMIN GRAMIAN, P.E. Secretary of Transportation</div> <div>BY:  Brian G. Thompson, P.E. Director, Bureau of Project Delivery, Highway Administration</div>	

**PUBLICATION #218M**  
**SEPTEMBER 2016 EDITION**  
**CHANGE NO. 3**

The major revisions for each Standard Drawing are presented below. Since minor changes are not indicated, it is strongly advised that all recipients thoroughly examine the changes and revisions incorporated in this release.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M	OLD 1 of 11 NEW 1 of 12	<p>Revised number of sheets from 11 to 12.</p> <p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 1 OF 11” to “SHEET 1 OF 12”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Added “GENERAL” to “NOTES”.</li><li>Note 2: Revised “INTEGRAL SIDEWALKS” to “TYPICAL SIDEWALKS”.</li><li>Note 2: Revised “RAISED OR ALTERNATE SIDEWALK” to “RAISED SIDEWALK OR ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER”.</li><li>Note 4 – Added CONCRETE COVERS as follows: BARRIER 2½” to 2” and SIDEWALK TOP COVER 2” to 2½”.</li><li>Note 4 – BAR SIZE: Revised ③ to ⑱.</li><li>Note 4 – Revised BAR SPACINGS: MINIMUM TRANSVERSE REINFORCEMENT SPACING 5” to 5½”.</li><li>Note 5: Removed “SEE DESIGN MANUAL PART 4, SECTION D 5.4.3.1.”.</li><li>Note 6: Added “SEE DESIGN MANUAL PART 4, SECTION D5.4.3.1”.</li><li>Note 7: Revised “SHEETS 9 AND 10” to “SHEETS 10 AND 11”.</li><li>Note 10: Revised “SHEET 8” to “SHEET 9”.</li><li>Note 16: Revised to “THE 42” AND 45” F-SHAPE CONCRETE BARRIERS AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNATED AS MASH TL-5. THE 42” F-SHAPE CONCRETE BARRIER IS DESIGNATED AS TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42”. THE ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-2. THE 50” SPLIT CONCRETE MEDIAN BARRIER AND 50” CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-4. THE 32” SPLIT CONCRETE MEDIAN BARRIER, 32” F-SHAPE CONCRETE BARRIER AND 32” CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-3.”.</li><li>Note 20: Revised “SHEETS 9 AND 10” to “SHEETS 10 AND 11”.</li><li>Removed Note 22.</li><li>Note 23: Revised note “23” to “22”. Revised “SHEETS 6 AND 7” to “SHEETS 7 AND 8”.</li><li>Note 24: Revised note “24” to “23”.</li><li>Note 25: Revised note “25” to “24”. Revised to “THE SLAB REINFORCEMENT SHOWN ON SHEETS 10 AND 11 IS APPLICABLE FOR THE BARRIERS SHOWN ON SHEET 2, 3, 4, AND 5, PA TYPE 10M, PA BRIDGE BARRIER AND CONCRETE VERTICAL WALL BRIDGE BARRIERS AND BARRIERS WITH FENCES AND HANDRAILS. REDESIGN OF THE DECK IS REQUIRED WHEN OTHER ATTACHMENTS SUCH AS LIGHT POLES AND SIGN STRUCTURES ARE USED. SEE NOTE 25 FOR MODIFICATIONS REQUIRED WHEN</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 1 of 11 NEW 1 of 12 (cont.)	<p>SOUND BARRIERS ARE USED.”</p> <ul style="list-style-type: none"><li>Note 26: Revised note “26” to “25”. Revised “SHEET 4” to “SHEET 2”. Revised “WEIGHT OF SOUND BARRIER PLUS THE WEIGHT OF BARRIER AND DECK SLAB IN EXCESS OF THE TYPICAL BARRIER OF ≤ 600LB. PER FOOT OF LENGTH.” to “WEIGHT OF SOUND BARRIER PLUS THE WEIGHT OF BARRIER AND DECK SLAB MINUS 650 LB. MAY NOT BE IN EXCESS 600LB. PER FOOT OF LENGTH.”. Revised “SHEETS 9 AND 10” to “SHEETS 10 AND 11”.</li><li>Note 27: Revised note “27” to “26”. Revised note to:<ul style="list-style-type: none"><li>45” F-SHAPE CONCRETE BARRIER 700 LB./FT,</li><li>42” F-SHAPE CONCRETE BARRIER 650 LB./FT,</li><li>32” F-SHAPE CONCRETE BARRIER 520 LB./FT,</li><li>50” SPLIT CONCRETE MEDIAN BARRIER 750 LB./FT,</li><li>32” SPLIT CONCRETE MEDIAN BARRIER 520 LB./FT,</li><li>50” CONCRETE MEDIAN BARRIER 960 LB./FT,</li><li>32” CONCRETE MEDIAN BARRIER 700 LB./FT,</li><li>CONCRETE MOUNTABLE DIVISOR TYPE A 260 LB./FT, TYPE B 280LB.FT,</li><li>SPLIT CONCRETE MOUNTABLE DIVISOR TYPE A 130 LB./FT, TYPE B 140 LB./FT,</li><li>42” VERTICAL WALL CONCRETE BARRIER ON ALTERNATE SIDEWALK (WITHOUT RAILING) 530 LB./FT</li></ul></li><li>Note 28: Revised note “28” to “27”. Revised “SHEET 9” to “SHEET 10”. Revised “SHEET 10” to “SHEET 11”.</li><li>Note 29: Revised note “29” to “28”.</li><li>Note 30: Revised note “30” to “29”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Revised ① to ⑱.</li><li>Revised ② to ⑰. Revised “SHEET 8” to “SHEET 9”.</li><li>Revised ③ to ⑱.</li><li>Revised ④ to ⑰. Removed “STANDARD DRAWING”.</li><li>Revised ⑤ to ⑪.</li><li>Revised ⑥ to ④.</li><li>Revised ⑦ to ⑳.</li><li>Added legend note ①. Moved from sheet 2.</li><li>Added legend note ②. Moved from sheet 2.</li><li>Added legend note ③. Moved from sheet 2.</li><li>Added legend note ⑤. Moved from sheet 2.</li><li>Added legend note ⑥. Moved from sheet 2.</li><li>Added legend note ⑦. Moved from sheet 4.</li><li>Added new legend note: “⑧ FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP. (SEE NOTE 24)”.</li><li>Added new legend note: “⑨ FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 2.”.</li><li>Added legend note ⑩. Moved from sheet 3.</li><li>Added legend note ⑫. Moved from sheet 4.</li></ul>



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 1 of 11 NEW 1 of 12 (cont.)	<ul style="list-style-type: none"><li>Added new legend note: “<b>⑬</b> WHEN A TRAFFIC BARRIER IS MOUNTED ON THE DECK BETWEEN TWO GIRDERS, PROVIDE TOP AND BOTTOM REINFORCEMENT AREA IN THE DECK IN THE BAY WHERE THE BARRIER EXISTS, AT LEAST EQUAL TO THE OVERHANG TOP REINFORCEMENT AREA AS SHOWN ON SHEETS 10 OR 11. IF S7 BARS ARE REQUIRED THEY SHOULD MATCH THE SPACING OF THE S2 BARS ON THE TOP MAT AND S1 BARS ON THE BOTTOM MAT.”.</li><li>Added new legend note: “<b>⑭</b> TO BE USED WHEN MATCHING DETAIL IS SPECIFIED IN APPROACH ROADWAY.”.</li><li>Added new legend note: “<b>⑮</b> TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.”.</li><li>The following notes were transferred to sheet 1 and re-numbered: 8, (also changed reference to see note 24), 9 (changed reference to sheet 2), 10, 11, 12, 14, 15, 16, 17 (also changed reference to sheet 9), 13, 18, 19, 20.</li></ul> <p>TYPICAL SLAB PANEL 1:</p> <ul style="list-style-type: none"><li>Moved detail to sheet 2.</li><li>Revised reference note “29” to “28” (2 locations).</li><li>Revised reference note “30” to “29” (3 locations).</li><li>Revised “SHEET NO. 8” to “SHEET NO. 9”.</li><li>Revised <b>①</b> to <b>⑯</b> (2 locations).</li><li>Revised <b>②</b> to <b>⑰</b>.</li><li>Revised <b>④</b> to <b>⑲</b>.</li><li>Revised <b>⑤</b> to <b>⑪</b>.</li><li>Revised <b>⑥</b> to <b>④</b> (2 locations).</li><li>Revised “(SEE SHEETS 9 AND 10)” to (SEE SHEETS 10 AND 11)”.</li><li>Added <b>⑧</b> to “TYPICAL SLAB PANEL 1”.</li><li>Added “SEE NOTE 27” to “SIMPLE AND CONTINUOUS COMPOSITE POSITIVE MOMENT REGIONS”.</li><li>Removed “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP (SEE NOTE 28)”.</li></ul> <p>TYPICAL SLAB PANEL 2:</p> <ul style="list-style-type: none"><li>Moved detail to sheet 2.</li><li>Revised reference note “29” to “28” (2 locations).</li><li>Revised reference note “30” to “29” (3 locations).</li><li>Revised “SHEET NO. 8” to “SHEET NO. 9”.</li><li>Revised <b>①</b> to <b>⑯</b> (3 locations).</li><li>Revised <b>②</b> to <b>⑰</b>.</li><li>Revised <b>③</b> to <b>⑱</b> (2 locations).</li><li>Revised <b>④</b> to <b>⑲</b>.</li><li>Revised <b>⑤</b> to <b>⑪</b>.</li><li>Revised <b>⑥</b> to <b>④</b> (2 locations).</li><li>Revised <b>⑦</b> to <b>⑳</b> (2 locations).</li><li>Revised “(SEE SHEET 10)” to “(SEE SHEET 11)”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 1 of 11 NEW 1 of 12 (cont.)	Added: <ul style="list-style-type: none"><li>“CONTRACT DRAWING NOTE: “1. THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42” F-SHAPE CONCRETE BARRIER IS USED: THE 42” F-SHAPE CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42”.”</li></ul> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>Removed “BC-718M ALTERNATE RAILING DETAILS”.</li><li>Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”.</li><li>Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li><li>Added “BD-622M R.C. ABUTMENTS WITH BACKWALL”.</li><li>Added “BD-624M R.C. ABUTMENTS WITHOUT BACKWALL”.</li></ul>
	OLD 2 of 11 NEW 2 of 12	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 2 OF 11” to “SHEET 2 OF 12”.</li></ul> <p>Added “45” F-SHAPE CONCRETE BARRIER DETAIL <b>⑧⑨</b>”.</p> <p>TYPICAL CONCRETE BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Revised “TYPICAL CONCRETE BARRIER DETAIL” to “42” F-SHAPE CONCRETE BARRIER DETAIL <b>⑧⑨</b>”</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <b>⑧</b>.</li><li>Added R=1”.</li><li>Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”.</li><li>Removed 5½” dimension between top bars.</li><li>Revised * to <b>⑦</b>.</li><li>Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”.</li></ul> <p>ALTERNATE CONCRETE BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Revised “ALTERNATE CONCRETE BARRIER DETAIL” to “32” F-SHAPE CONCRETE BARRIER DETAIL”.</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <b>⑧</b>.</li><li>Added R=1”.</li><li>Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”.</li><li>Removed 5½” dimension between top bars.</li><li>Revised * to <b>⑦</b>.</li><li>Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”.</li></ul> <p>TYPICAL SLAB PANEL 1:</p> <ul style="list-style-type: none"><li>Moved from sheet 1.</li></ul> <p>TYPICAL SLAB PANEL 2:</p> <ul style="list-style-type: none"><li>Moved from sheet 1.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 2 of 11 NEW 2 of 12 (cont.)	<p>45” F-SHAPE CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Moved from sheet 4.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Added “AND LEGEND”.</li></ul> <p>SPLIT CONCRETE GLARE SCREEN MEDIAN BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Moved to sheet 3.</li><li>Revised “SPLIT CONCRETE GLARE SCREEN MEDIAN BARRIER DETAIL” to “50” SPLIT CONCRETE MEDIAN BARRIER DETAIL <del>⑧</del><del>⑨</del><del>⑭</del>”.</li><li>Removed “TO BE USED WHEN CONCRETE GLARE SCREEN IS SPECIFIED IN APPROACH ROADWAY.”.</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Added R=1”.</li><li>Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”.</li><li>Removed 4<sup>5</sup>/<sub>8</sub>” dimension between top bars.</li><li>Revised * to <del>⑦</del> (2 locations).</li><li>Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”.</li></ul> <p>ALTERNATE SPLIT CONCRETE MEDIAN BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Moved to sheet 3.</li><li>Revised “ALTERNATE SPLIT CONCRETE MEDIAN BARRIER DETAIL” to “32” SPLIT CONCRETE MEDIAN BARRIER DETAIL <del>⑧</del><del>⑨</del><del>⑭</del>”.</li><li>Removed “TO BE USED WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.”.</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Added R=1”.</li><li>Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”.</li><li>Removed 6½” dimension between top bars.</li><li>Revised * to <del>⑦</del> (2 locations).</li><li>Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”.</li></ul> <p>TYPICAL OVERHANG REINFORCEMENT:</p> <ul style="list-style-type: none"><li>Moved to sheet 3.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Legend <del>①</del>: Moved to sheet 1. Added “FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.”.</li><li>Legend <del>②</del>: Moved to sheet 1.</li><li>Legend <del>③</del>: Moved to sheet 1.</li><li>Removed “<del>④</del> BEGIN S3 AND S3’ BARS AT LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT. (SEE SHEET 8 FOR LOCATIONS).”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 2 of 11 NEW 2 of 12 (cont.)	<ul style="list-style-type: none"><li>Legend <del>⑤</del>: Moved to sheet 1. Revised “SHEET 6” to “SHEET 7”.</li><li>Legend <del>⑥</del>: Moved to sheet 1.</li></ul>
	OLD 3 of 11 NEW 3 of 12	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 3 OF 11” to “SHEET 3 OF 12”.</li></ul> <p>50” SPLIT CONCRETE MEDIAN BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Moved from sheet 2.</li></ul> <p>32” SPLIT CONCRETE MEDIAN BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Moved from sheet 2.</li></ul> <p>CONCRETE MEDIAN BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Revised “CONCRETE MEDIAN BARRIER DETAIL” to “32” CONCRETE MEDIAN BARRIER DETAIL <del>⑧</del><del>⑨</del><del>⑭</del><del>⑮</del>”.</li><li>Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHT 1.” to LEGEND Sheet 1. Legend number <del>⑨</del>. Revised “SHT 1” to “SHEET 2”.</li><li>Removed “TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS AND WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.”</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Removed 9½” dimension between top bars.</li><li>Revised <del>⑥</del><del>⑦</del> to <del>⑩</del><del>⑪</del> (2 locations).</li><li>Revised “S7 SEE NOTE 22 ON SHT. 1” to “S7 <del>③</del><del>⑬</del>”.</li></ul> <p>CONCRETE GLARE SCREEN BARRIER DETAIL:</p> <ul style="list-style-type: none"><li>Revised “CONCRETE GLARE SCREEN BARRIER DETAIL” to “50” CONCRETE MEDIAN BARRIER DETAIL <del>⑧</del><del>⑨</del><del>⑭</del><del>⑮</del>”.</li><li>Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHT 1.” to LEGEND Sheet 1. Legend number <del>⑨</del>. Revised “SHT 1” to “SHEET 2”.</li><li>Removed “TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS AND WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.”</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Revised <del>⑥</del><del>⑦</del> to <del>⑩</del><del>⑪</del> (2 locations).</li><li>Revised “S7 SEE NOTE 22 ON SHT. 1” to “S7 <del>③</del><del>⑬</del>”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Added “AND LEGEND”.</li><li>Note 2: Removed.</li><li>Note 3: Revised note “3” to “2”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 3 of 11 NEW 3 of 12 (cont.)	<p>SPLIT CONCRETE DIVISOR DETAIL:</p> <ul style="list-style-type: none"><li>Moved to sheet 4.</li><li>Revised “SPLIT CONCRETE DIVISOR DETAIL” to “SPLIT CONCRETE MOUNTABLE DIVISOR DETAIL<del>⑧</del><del>⑨</del><del>⑭</del><del>⑮</del>”.</li><li>Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 1.” to LEGEND Sheet 1. Legend number <del>⑨</del>. Revised “SHEET 1” to “SHEET 2”.</li><li>Replaced “MEDIAN” to “TRAFFIC”</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Revised * to <del>⑦</del> (2 locations).</li><li>Revised “SEE NOTE 2” to <del>⑥</del>.</li><li>Revised “(SEE SHEET 9)” to “(SEE SHEETS 10 AND 11)”.</li></ul> <p>CONCRETE DIVISOR DETAIL:</p> <ul style="list-style-type: none"><li>Moved to sheet 4.</li><li>Revised “CONCRETE DIVISOR DETAIL” to “CONCRETE MOUNTABLE DIVISOR DETAIL <del>⑧</del><del>⑨</del><del>⑭</del><del>⑮</del>”.</li><li>Moved “FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 1.” to LEGEND sheet 1. Legend number <del>⑨</del>. Revised “SHEET 1” to “SHEET 2”.</li><li>Moved “TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.” To LEGEND sheet 1. Legend number <del>⑮</del>.</li><li>Replaced “MEDIAN” to “TRAFFIC”</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Added S1 and S2.</li><li>Moved “UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.” to LEGEND sheet 1. Legend number <del>⑦</del>.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Revised <del>⑥</del> to <del>⑩</del>. Moved to sheet 1.</li><li>Removed <del>①</del><del>②</del><del>③</del><del>④</del><del>⑤</del><del>⑦</del>.</li></ul>
	OLD 4 of 11 NEW 4 of 12	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 4 OF 11” to “SHEET 4 OF 12”.</li></ul> <p>CONCRETE MOUNTABLE DIVISOR DETAIL:</p> <ul style="list-style-type: none"><li>Moved from sheet 3.</li></ul> <p>SPLIT CONCRETE MOUNTABLE DIVISOR DETAIL</p> <ul style="list-style-type: none"><li>Moved from sheet 3.</li></ul> <p>INTEGRAL SIDEWALK DETAIL:</p> <ul style="list-style-type: none"><li>Revised “INTEGRAL SIDEWALK DETAIL” to “TYPICAL SIDEWALK DETAIL”.</li><li>Added “(45” F-SHAPE CONCRETE BARRIER SIMILAR)”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 4 of 11 NEW 4 of 12 (cont.)	<ul style="list-style-type: none"><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised <del>⑦</del> to <del>⑫</del>.</li><li>Revised <del>⑥</del> to <del>⑦</del>.</li><li>Added <del>⑥</del>.</li></ul> <p>RAISED SIDEWALK DETAIL:</p> <ul style="list-style-type: none"><li>Added <del>⑧</del><del>⑨</del>.</li><li>Removed “TYPICAL OR ALTERNATE” from “SEE SHEET 2 TYPICAL OR ALTERNATE BARRIER REINFORCEMENT)”.</li><li>Removed “NOTE: ALTERNATE BARRIER REQUIRES ALTERNATE RAILING, BC-718M”.</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Added “42” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 45” F-SHAPE CONCRETE BARRIER SIMILAR)”.</li><li>Revised <del>⑦</del> to <del>⑫</del>.</li><li>Revised <del>⑧</del> to <del>⑩</del> (2 locations).</li><li>Revised <del>⑤</del> to <del>⑪</del> (3 locations).</li><li>Revised <del>⑥</del> to <del>⑦</del>.</li><li>Added <del>⑥</del> to “DRIP NOTCH”.</li><li>Added <del>⑩</del> to “L”.</li></ul> <p>ALTERNATE SIDEWALK DETAIL:</p> <ul style="list-style-type: none"><li>Revised “ALTERNATE SIDEWALK DETAIL” to “ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER DETAIL <del>⑧</del><del>⑨</del><del>⑭</del>”.</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number <del>⑧</del>.</li><li>Revised “¾” x ¾” CHAMFER (TYP.)” to R=1” at front face of barrier.</li><li>Added “¾” x ¾” CHAMFER” to rear face of barrier.</li><li>Removed “WITH OR WITHOUT RAILING” from 3’-6”.</li><li>Revised <del>⑤</del> to <del>⑪</del> (2 locations).</li><li>Revised <del>⑥</del> to <del>⑦</del>.</li><li>Added <del>⑥</del> to “DRIP NOTCH”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Added “AND LEGEND”.</li><li>Note 2: Removed.</li><li>Note 3: Revised note “3” to “2”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Moved to sheet 1.</li><li>Removed <del>①</del><del>②</del><del>③</del><del>④</del><del>⑤</del><del>⑧</del>.</li><li>Revised <del>⑥</del> to <del>⑦</del>. Moved to sheet 1.</li><li>Revised <del>⑦</del> to <del>⑫</del>.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 4 of 11 NEW 4 of 12 (cont.)	CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL: <ul style="list-style-type: none"><li>Moved to sheet 2.</li><li>Revised “CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL” to “45” F-SHAPE CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL ⑧⑨”.</li><li>Revised “PROTECTIVE FENCE” to “ALUMINUM” and removed “AND RAILINGS”.</li><li>Moved “FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.” to LEGEND Sheet 1. Legend number ⑧.</li><li>Added “(42” F-SHAPE CONCRETE BARRIER SIMILAR)”.</li><li>Added R=1”.</li><li>Removed “(TYP.)” from ¾” x ¾” CHAMFER and R=1”.</li><li>Revised 2’-8” to 2’-11”.</li><li>Revised 3’-6” to 3’-9”.</li><li>Added ⑤ to ①.</li><li>Revised ⑥ to ⑦.</li><li>Added ⑥ to “DRIP NOTCH”.</li><li>Revised “(SEE SHEET 9)” to “(SEE SHEETS 9 AND 10)”.</li></ul>
	OLD 5 of 11 NEW 5 of 12	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 5 OF 11” to “SHEET 5 OF 12”.</li></ul> REINFORCEMENT BAR DETAILS: <ul style="list-style-type: none"><li>Added “CURB” to REINFORCEMENT BAR DETAILS.</li><li>Added “#4” (2 locations).</li></ul> ANCHOR BOLT BAR DETAIL: <ul style="list-style-type: none"><li>Added “#6”.</li></ul> SECTION A-A: <ul style="list-style-type: none"><li>Added ⑦.</li></ul>
	NEW 6 of 12	New Sheet. F-SHAPE CONCRETE BARRIER TRANSITIONS.  Added “F-SHAPE TO F-SHAPE CONCRETE BARRIER TRANSITION”.
	OLD 6 of 11 NEW 7 of 12	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 6 OF 11” to “SHEET 7 OF 12”.</li></ul> BARRIERS, SPLIT GLARE SCREEN AND SPLIT MEDIAN BARRIERS (2 locations): <ul style="list-style-type: none"><li>Revised “BARRIERS, SPLIT GLARE SCREEN AND SPLIT MEDIAN BARRIERS” to “F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS” (2 locations).</li><li>Revised “CURB” to “GUTTERLINE”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 6 of 11 NEW 7 of 12 (cont.)	BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER: <ul style="list-style-type: none"><li>Revised “BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER” to “F-SHAPE BARRIERS WITH SOUND BARRIERS AND ALUMINUM PROTECTIVE BARRIER”.</li><li>Revised “CURB” to “GUTTERLINE”.</li></ul> ALTERNATE SIDEWALK: <ul style="list-style-type: none"><li>Revised “ALTERNATE SIDEWALK” to “ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER”.</li><li>Revised “*DETAIL FOR SIDEWALK WIDTHS OF 8’-0” AND LESS” to “*DETAILED FOR SIDEWALK DEPTH OF 8””.</li></ul> TABLE 1: <ul style="list-style-type: none"><li>Revised “BARRIERS, SPLIT MEDIAN AND SPLIT GLARE SCREEN MEDIAN BARRIERS” to “F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS”.</li></ul> TABLE 2: <ul style="list-style-type: none"><li>Added “45” F-SHAPE CONCRETE BARRIER” with corresponding dimensions.</li><li>Revised “TYPICAL BARRIER” to “42” F-SHAPE CONCRETE BARRIER”.</li><li>Revised “ALTERNATE BARRIER AND SPLIT MEDIAN BARRIER” to “32” F-SHAPE CONCRETE BARRIER AND 32” SPLIT MEDIAN BARRIER”.</li><li>Revised “SPLIT GLARE SCREEN MEDIAN BARRIER” to “50” SPLIT CONCRETE MEDIAN BARRIER”.</li></ul>
	OLD 7 of 11 NEW 8 of 12	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 7 OF 11” to “SHEET 8 OF 12”.</li></ul> SPLIT CONCRETE DIVISOR: <ul style="list-style-type: none"><li>Revised “SPLIT CONCRETE DIVISOR” to “SPLIT CONCRETE MOUNTABLE DIVISOR”.</li></ul> CONCRETE DIVISOR: <ul style="list-style-type: none"><li>Revised “CONCRETE DIVISOR” to “CONCRETE MOUNTABLE DIVISOR”.</li></ul> MEDIAN BARRIER: <ul style="list-style-type: none"><li>Revised “MEDIAN BARRIER” to “32” CONCRETE MEDIAN BARRIER”.</li><li>Revised “CURB” to “GUTTERLINE”.</li></ul> GLARE SCREEN MEDIAN BARRIER: <ul style="list-style-type: none"><li>Revised “GLARE SCREEN MEDIAN BARRIER” to “50” CONCRETE MEDIAN BARRIER”.</li><li>Revised “CURB” to “GUTTERLINE”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 8 of 11 NEW 9 of 12	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 8 OF 11” to “SHEET 9 OF 12”.</li></ul> TABLE 1: MINIMUM HAUNCH THICKNESS: <ul style="list-style-type: none"><li>Removed sheet “1”.</li></ul>
	OLD 9 of 11 NEW 10 of 12	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 9 OF 11” to “SHEET 10 OF 12”.</li></ul> DESIGN NOTES: <ul style="list-style-type: none"><li>Note 3: Revised “25, 26, AND 27” to “24, 25 AND 26”.</li><li>Note 4: Removed sheet “1”.</li><li>Added note: “5. THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE TRANSVERSE BARS AS THE TOP BAR IN THE MAT.”.</li><li>Note 5: Revised note “5” to “6”.</li></ul>
	OLD 10 of 11 NEW 11 of 12	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 10 OF 11” to “SHEET 11 OF 12”.</li></ul> DESIGN NOTES: <ul style="list-style-type: none"><li>Note 3: Revised “25, 26, AND 27” to “24, 25, AND 26”.</li><li>Note 4: Revised to “FOR LOCATION OF REINFORCEMENT BARS IN THE BOTTOM MAT, SEE SHEETS 2, 3 AND 4. FOR LOCATION OF DIMENSION “L”, SEE SHEETS 2, 3, AND 4.”.</li><li>Added note: “5. THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE LONGITUDINAL BARS AS THE TOP BAR IN THE MAT. THIS CONFIGURATION IS NOT GRAPHICALLY DEPICTED IN THIS STANDARD EXCEPT IT IS SHOWN IN THE DETAIL TITLED “TYPICAL SLAB PANEL 2” ON SHEET 2.”.</li><li>Note 5: Revised note “5” to “6”.</li></ul> TABLE 1: <ul style="list-style-type: none"><li>Revised S2 @ S=4’-7” from #5 @9½” to #5 @7½”.</li></ul> TABLE 2: <ul style="list-style-type: none"><li>Revised S2 @ S=10’-9” from #6 @6” to #6 @5½”.</li></ul> TABLE 3: <ul style="list-style-type: none"><li>Revised S2 @ S=4’-3” from #5 @11” to #5 @10½”.</li><li>Revised S2 @ S=9’-6” from #6 @6” to #6 @5½”.</li><li>Revised S2 @ S=9’-10” from #6 @6” to #6 @5½”.</li><li>Revised S2 @ S=10’-2” from #6 @6” to #6 @5½”.</li><li>Revised S2 @ S=10’-5” from #6 @6” to #6 @5½”.</li></ul> TABLE 4: <ul style="list-style-type: none"><li>Revised S2 @ S=6’-6” from #5 @9” to #5 @8½”.</li><li>Revised S2 @ S=6’-10” from #5 @9” to #5 @7½”.</li><li>Revised S<sub>o</sub> @ S=8’-10” from 4’-8” to 4’-11”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-601M (cont.)	OLD 11 of 11 NEW 12 of 12	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 11 OF 11” to “SHEET 12 OF 12”.</li></ul> <p>PLAN:</p> <ul style="list-style-type: none"><li>Revised section callout “A-A” to “B-B”.</li></ul> <p>REINFORCEMENT TABLE:</p> <ul style="list-style-type: none"><li>Added “LENGTH 45” F-SHAPE” with corresponding dimensions.</li><li>Added “X 45” F-SHAPE” with corresponding dimensions.</li><li>Revised “TYPICAL” to “42” F-SHAPE” (2 locations).</li><li>Revised “ALTERNATE” to “32” F-SHAPE” (2 locations).</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “WORK QUALITY” to “PERFORM WORK”.</li></ul> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Revised “SECTION A-A” to “SECTION B-B”.</li><li>Revised “TYP.” to “F-SHAPE”.</li></ul> <p>BARRIER TYPE TABLE:</p> <ul style="list-style-type: none"><li>Added “45” F-SHAPE CONCRETE BARRIER” with corresponding dimensions.</li><li>Revised “TYPICAL” to “42” F-SHAPE CONCRETE BARRIER”.</li><li>Revised “ALTERNATE” to “32” F-SHAPE CONCRETE BARRIER”.</li></ul>
BD-610M	OLD 1 of 17 NEW 1 of 10	<p>Total number of sheets revised from 17 to 10.</p> <p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “BARRIER DETAILS” to “BARRIER DETAILS – 1”.</li><li>Revised “SHT 1 OF 17” to “SHT 1 OF 10”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised to “THE PA BRIDGE BARRIER IS DESIGNATED AS MASH TL-5.”</li><li>Note 2: Revised “WORK QUALITY” to “PERFORM WORK”.</li><li>Note 5: Removed “SHEET 2”.</li><li>Note 8: Removed.</li><li>Note 9: Revised note “9” to “8”.</li><li>Note 10: Revised note “10” to “9”. Added “MASH” to TL-5 BARRIER RATING.</li><li>Added note – “10. PROVIDE POST SPACINGS ON THE CONTRACT PLANS.”.</li><li>Added note – “11. FOR DETAILS OF THE PA BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEETS 3 AND 4.”.</li><li>Added new note – “12. FOR SECTION A-A, SEE SHEET 2.”.</li><li>Added new note – “13. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL SHEET 2.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 1 of 17 NEW 1 of 10 (cont.)	<p>TYPICAL PA BRIDGE BARRIER ELEVATION:</p> <ul style="list-style-type: none"><li>Revised elevation for new MASH Barrier and New MASH End Transition.</li><li>Removed “(WITHOUT INLET PLACEMENT SHOWN; WITH INLET PLACEMENT SIMILAR, SEE SHEET 11)”.</li><li>Removed “RAILING” in LEGEND ① (2 locations).</li><li>Added “③ PLACE 1-#4 VERTICAL BAR AT CL POST.”.</li><li>Added “④ WITHIN 10’-0” ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER WALL, REDUCE SPACING OF REINFORCEMENT TO #4 @ 12” MAX. PLACE REINFORCEMENT 3” FROM ANY JOINT.”.</li></ul> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Moved to sheet 2.</li><li>Added “BARRIER WALL” to 1’-6”.</li><li>Revised “RAILING POST W 8 x 31” to “POST W 8 x 31”.</li><li>Added 1” horizontal front face dimension.</li><li>Revised “ANCHOR PLATE ¼”x11½”x1’-3”” to “10¼”x1’-3”x¼” ANCHOR PLATE”.</li><li>Revised “③” to “④”.</li><li>Added “WALL” to note ④.</li><li>Moved ④ to LEGEND.</li><li>Added “TRANSVERSE REINFORCEMENT SHOWN ON TOP. LONGITUDINAL REINFORCEMENT SIMILAR.”.</li><li>Removed “SHEET 3” from BC-713M Notes (3 locations).</li><li>Added “CLR” To 2½”.</li><li>Added “CLR” to 3”.</li></ul> <p>DETAIL A:</p> <ul style="list-style-type: none"><li>Moved to sheet 2.</li><li>Added “OR ¾” x ¾” CHAMFER” to 1”R.</li><li>Added 1’-6” dimension.</li></ul> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>Removed “BC-712M THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>Added “BD-667M INTEGRAL ABUTMENT”.</li><li>Revised “GUIDE RAIL TRANSITION AT END OF STRUCTURE” to “GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li></ul>
	OLD 2 of 17	Removed sheet.
	NEW 2 of 10	<p>New sheet. BARRIER DETAILS – 2.</p> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Moved from sheet 1.</li></ul> <p>DETAIL A:</p> <ul style="list-style-type: none"><li>Moved from sheet 1.</li></ul> <p>Added “CLEAR ROADWAY WIDTH DETAIL”.</p>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	NEW 2 of 10 (cont.)	<p>Added “VERTICAL V-NOTCH DETAIL”.</p> <p>Added “LEGEND”.</p> <p>Added “NOTES”.</p>
	OLD 3 of 17	Removed sheet.
	NEW 3 of 10	<p>New sheet. END OF BARRIER DETAILS – 1.</p> <p>Added “PA BRIDGE BARRIER END TRANSITION ELEVATION”.</p> <p>Added “SECTION B-B”</p> <p>Added “HORIZONTAL REINFORCEMENT”.</p> <p>Added “SECTION C-C”</p> <p>Added “HORIZONTAL REINFORCEMENT”.</p> <p>Added “LEGEND”.</p> <p>Added “NOTES”.</p>
	OLD 4 of 17	Removed sheet.
	NEW 4 of 11	<p>New Sheet. END OF BARRIER DETAILS – 2.</p> <p>Added “SECTION D-D”</p> <p>Added “VERTICAL REINFORCEMENT”.</p> <p>Added “SECTION E-E”</p> <p>Added “SECTION F-F”.</p> <p>Added “LEGEND”.</p> <p>Added “NOTES”.</p>
	OLD 5 of 17	Removed sheet.
	OLD 6 of 17	Removed sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 7 of 17	Removed sheet.
	OLD 8 of 17	Removed sheet.
	OLD 9 of 17	Removed sheet.
	OLD 10 of 17	Removed sheet.
	OLD 11 of 17	Removed sheet.
	OLD 12 of 17 NEW 5 of 10	<p><b>TITLE BLOCK:</b></p> <ul style="list-style-type: none"><li>Revised “MISCELLANEOUS DETAILS” to “SIDEWALK DETAILS”.</li><li>Revised “SHT 12 OF 17” to “SHT 5 OF 10”.</li></ul> <p><b>TYPICAL SIDEWALK DETAIL:</b></p> <ul style="list-style-type: none"><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Added “1.5% SLOPED TOWARD BARRIER (BRIDGE OVER ROADWAY) ⑩”.</li><li>Added “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”.</li><li>Removed “3’-6” MIN.”.</li><li>Added “PEDESTRIAN RAILING, SIDEWALK PROTECTIVE FENCE OR BARRIER. FOR ADDITIONAL DETAILS, SEE BC-701M, BC-711M, AND BC-716M.”.</li><li>Added ⑨.</li></ul> <p><b>RAISED SIDEWALK DETAIL:</b></p> <ul style="list-style-type: none"><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Added “1”Ø SIDEWALK RAIL ROD (TYP.), FOR DETAILS, SEE BC-713M”.</li><li>Added “1.5% SLOPED TOWARD BARRIER (BRIDGE OVER ROADWAY) ⑩”.</li><li>Added “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”.</li><li>Removed “3’-6” MIN.”.</li><li>Added “PEDESTRIAN RAILING, SIDEWALK PROTECTIVE FENCE OR BARRIER. FOR ADDITIONAL DETAILS, SEE BC-701M, BC-711M, AND BC-716M.”.</li><li>Added ⑨.</li></ul> <p><b>ALTERNATE SIDEWALK DETAIL:</b></p> <ul style="list-style-type: none"><li>Added “BARRIER WALL” to 1’-6”.</li><li>Added “ROADWAY”.</li><li>Added “1”Ø SIDEWALK RAIL ROD (TYP.) FOR DETAILS, SEE BC-713M”.</li><li>Added “TRANSVERSE REINFORCEMENT SHOWN ON TOP. LONGITUDINAL REINFORCEMENT ON TOP SIMILAR.”.</li><li>Added “1” RAD.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 12 of 17 NEW 5 of 10 (cont.)	<ul style="list-style-type: none"><li>Added 1” horizontal dimension at front face sidewalk.</li><li>Added 0”.</li><li>Added ⑨.</li></ul> <p>TABLE 1:</p> <ul style="list-style-type: none"><li>Added title, “VERTICAL REINFORCEMENT DIMENSION TABLE”.</li></ul> <p>REINFORCEMENT BAR NOTES:</p> <ul style="list-style-type: none"><li>Note 4: Removed.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “SHEET 1” to “SHEET 2”.</li></ul> <p>Added “LEGEND”.</p>
	OLD 13 of 17 NEW 6 of 10	<p><b>TITLE BLOCK:</b></p> <ul style="list-style-type: none"><li>Revised “MISCELLANEOUS DETAILS” to “ADJACENT BOX BEAM DETAILS – 1”.</li><li>Revised “SHT 13 OF 17” to “SHT 6 OF 10”.</li></ul> <p><b>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER:</b></p> <ul style="list-style-type: none"><li>Added “BARRIER WALL” to 1’-6”.</li><li>Revised ③ to ⑬.</li><li>Revised ② to ⑫.</li></ul> <p><b>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK:</b></p> <ul style="list-style-type: none"><li>Added “TYPICAL” to title.</li><li>Revised ① to ⑪.</li><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Revised ③ to ⑬.</li><li>Revised “*” to ⑩.</li><li>Removed 3’-6” dimension.</li><li>Removed “** DRAIN RUNOFF THROUGH CONCRETE CURB WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.”.</li></ul> <p><b>LEGEND:</b></p> <ul style="list-style-type: none"><li>Revised ① to ⑪.</li><li>Revised ② to ⑫.</li><li>Revised ③ to ⑬.</li><li>Added “⑩ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATIONS. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “SHEET 1” to “SHEET 2”.</li></ul>



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 14 of 17 NEW 7 of 10	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “MISCELLANEOUS DETAILS” to “ADJACENT BOX BEAM DETAILS – 2”.</li><li>Revised “SHT 14 OF 17” to “SHT 7 OF 10”.</li></ul> <p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK:</p> <ul style="list-style-type: none"><li>Added “BARRIER WALL” to 1’-6”.</li><li>Removed “W8x31”.</li><li>Revised ① to ⑬.</li><li>Revised ② to ⑭ (2 locations).</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Revised ① to ⑬.</li><li>Revised ② to ⑭.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “SHEET 1” to “SHEET 2”.</li><li>Note 2: Revised note “2” to “4”.</li><li>Note 3: Revised note “3” to “2”.</li><li>Note 4: Revised note “4” to “3”</li></ul>
	OLD 15 of 17 NEW 8 of 10	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “MISCELLANEOUS DETAILS” to “BOX CULVERT DETAILS”.</li><li>Revised “SHT 15 OF 17” to “SHT 8 OF 10”.</li></ul> <p>AT GRADE SECTION AT C.I.P. R.C. CULVERT:</p> <ul style="list-style-type: none"><li>Added “BARRIER WALL” to 1’-6”.</li><li>Revised “#5 @ 9” ② to “#5 @ 9” ”.</li></ul> <p>AT GRADE SECTION AT PRECAST R.C. CULVERT:</p> <ul style="list-style-type: none"><li>Removed linework of wing cutoff wall and bedding.</li><li>Added “BARRIER WALL” to 1’-6”.</li><li>Removed ③.</li><li>Revised ② to ⑯.</li><li>Revised ① to ⑮.</li><li>Revised vertical reinforcement details.</li><li>Added “MECHANICAL SPLICE AS PER PUBLICATION 35 BULLETIN 15 SECTION 1002.2(c). (TYP.)”.</li></ul> <p>VERTICAL REINFORCEMENT:</p> <ul style="list-style-type: none"><li>Moved “CAST IN PLACE CULVERT” to title.</li><li>Removed “(FOR DIMENSIONS “B” &amp; “C”, SEE TABLE 1)”.</li><li>Revised 7¾” to 6¾”.</li><li>Revise 4” to 5”.</li><li>Revised “RAD. 2” to “RAD. 2½” ”.</li><li>Revised “C” to “1’-1¾” + T”.</li><li>Revised “B” to “1’- 4<sup>7</sup>/<sub>8</sub>” + T”.</li><li>Added #5.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 15 of 17 NEW 8 of 10 (cont.)	<p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “SHEET 1” to “SHEET 2”.</li></ul> <p>Removed “VERTICAL REINFORCEMENT – PRECAST CULVERT”.</p> <p>Removed “TABLE 1”.</p> <p>Added “PRECAST CULVERT VERTICAL REINFORCEMENT”.</p> <p>Added “LEGEND”:</p> <ul style="list-style-type: none"><li>Revised ① to ⑮. Revised 2’-0” MAX. to 11” MAX.</li><li>Revised ② to ⑯.</li><li>Removed ③.</li></ul>
	OLD 16 of 17 NEW 9 of 10	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 16 OF 17” to “SHT 9 OF 10”.</li></ul> <p>SECTION J-J:</p> <ul style="list-style-type: none"><li>Revised to show new MASH barrier end transition.</li><li>Revised “#6 @ 8” MAX.” to “#8 @ 6” MAX.”.</li><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”.</li></ul> <p>SECTION L-L:</p> <ul style="list-style-type: none"><li>Revised to show new MASH barrier end transition.</li><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”.</li></ul> <p>TYPICAL PLAN</p> <ul style="list-style-type: none"><li>Revised to show new MASH barrier end transition.</li><li>Revised 3’-8” to 3’-3¾”.</li><li>Revised “FOR RAILING POST SPACING SEE BC-713M” to “FOR POST SPACING SEE SHEET 1”.</li><li>Added “WINGWALL” to 1’-8¼”.</li><li>Added “1’-6" BARRIER WALL”.</li><li>Revised ③ to ⑳.</li><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”.</li></ul> <p>DETACHED WINGWALL PLAN:</p> <ul style="list-style-type: none"><li>Revised 3’-8” to 3’-3¾”.</li><li>Revised “FOR RAILING POST SPACING SEE BC-713M” to “FOR POST SPACING SEE SHEET 1” (2 locations).</li><li>Added “WINGWALL” to 1’-8¼”.</li><li>Added “1’-6" BARRIER WALL”.</li><li>Revised ③ to ⑳.</li><li>Revised ④ to ⑲.</li><li>Revised ①② to ⑰⑱.</li><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEET 3 AND 4)”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 16 of 17 NEW 9 of 10 (cont.)	<p>LEGEND:</p> <ul style="list-style-type: none"><li>Revised ① to ⑰.</li><li>Revised ② to ⑱.</li><li>Removed “③ SECTION SHOWN WITHOUT INLET PLACEMENT. WHEN AN INLET IS PLACED AT THE END OF A BARRIER WALL, PROVIDE A TRANSITION TO MATCH THE CONCERT INLET CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR BARRIER WALL AND BEVEL DETAILS.”.</li><li>Revised ④ to ⑲.</li><li>Added “⑳ SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEET 3 AND 4.”.</li></ul> <p>SECTION K-K:</p> <ul style="list-style-type: none"><li>Revised section to show approach slab and corresponding notes.</li><li>Added Barrier Wall outline.</li><li>Added “BARRIER WALL” to 1’-6” dimension.</li><li>Added “MIN.” to 2’-2”.</li><li>Added “OPTIONAL CONSTR. JOINT”.</li><li>Added “SEE BD-628M SHEET 35, SECTION B-B FOR ADDITIONAL DETAILS.”.</li><li>Added “1” CLOSED CELL NEOPRENE SPONGE”.</li><li>Added “APPROACH SLAB”.</li><li>Revised “#4 BARRIER WALL REINFORCEMENT SEE SHEET 1 FOR SPACING” to “#4 BARRIER WALL REINFORCEMENT SEE SHEET 3 AND 4 FOR SPACING AND DETAILING”.</li></ul> <p>SECTION N-N:</p> <ul style="list-style-type: none"><li>Revised section to show approach slab and corresponding notes.</li><li>Added Barrier Wall outline.</li><li>Added “BARRIER WALL” to 1’-6” dimension.</li><li>Added “MIN.” to 2’-2”.</li><li>Added “OPTIONAL CONSTR. JOINT”.</li><li>Added “SEE BD-628M SHEET 35, SECTION B-B FOR ADDITIONAL DETAILS.”.</li><li>Added “1” CLOSED CELL NEOPRENE SPONGE”.</li><li>Added “APPROACH SLAB”.</li><li>Revised “#4 BARRIER WALL REINFORCEMENT SEE SHEET 1 FOR SPACING” to “#4 BARRIER WALL REINFORCEMENT SEE SHEET 3 AND 4 FOR SPACING AND DETAILING”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Added note – “2. FOR ADDITIONAL NOTES, SEE SHEET 1.”.</li></ul> <p>Removed “LONGITUDINAL REINFORCEMENT”.</p> <p>Removed “VERTICAL CURB REINFORCEMENT”.</p> <p>Removed “REINFORCEMENT BAR NOTES”.</p>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-610M (cont.)	OLD 17 of 17 NEW 10 of 10	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 17 OF 17” to “SHT 10 OF 10”.</li></ul> <p>PLAN:</p> <ul style="list-style-type: none"><li>Revised section marks “R-R” to “G-G”.</li></ul> <p>ELEVATION:</p> <ul style="list-style-type: none"><li>Added “PUB. 408”.</li></ul> <p>SECTION R-R:</p> <ul style="list-style-type: none"><li>Revised SECTION R-R to “SECTION G-G”.</li><li>Revised “1½” MIN.” to “2” MIN.”.</li><li>Added ½” horizontal dimension.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “WORK QUALITY” to “PERFORM WORK”.</li><li>Added Note 10 – “FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.”.</li></ul>
BD-615M	ALL	Standard Discontinued
BD-617M	OLD 1 of 16 NEW 1 OF 9	<p>Total number of sheets revised from 16 to 9.</p> <p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 1 OF 16” to “SHT 1 OF 9”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised to “THE PA TYPE 10M BARRIER IS DESIGNATED AS MASH TL-4.”</li><li>Note 2: Revised “WORK QUALITY” to “PERFORM WORK”.</li><li>Note 5: Removed.</li><li>Added note – “5. USE f’c = 3.5 KSI CLASS AA CONCRETE FOR BARRIER WALL.”.</li><li>Note 8: Revised “MEETING THE REQUIREMENTS OF SECTION 705, PUBLICATION 408” to “AS SPECIFIED IN PUBLICATION 408, SECTION 705.8(b)”.</li><li>Note 14: Added “SEE BC-709M, SHEET 1, FOR RAIL JOINT DETAILS.”.</li><li>Note 15: Revised “FOUR” to “THREE”. Removed “RAISED SIDEWALK 10M” barrier weight. Revised the following barrier weights: TYPICAL 10M 375 LB./FT. SIDEWALK 10M 385 LB./FT. ALT. SIDEWALK 10M 385 LB./FT.</li><li>Added new note – “16. FOR DETAILS OF THE PA TYPE 10M BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEET 2 &amp; 3.”.</li><li>Added new note – “17. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 1 of 16 NEW 1 OF 9 (cont.)	<p>TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION:</p> <ul style="list-style-type: none"><li>Revised elevation for new MASH Barrier and New MASH End Transition.</li><li>Removed “(WITHOUT INLET PLACEMENT SHOWN; WITH INLET PLACEMENT SIMILAR, SEE SHEET 10)”.</li><li>Removed “RAILING” in ① (2 locations). Moved note to LEGEND.</li><li>Moved note ② to LEGEND.</li></ul> <p>REINFORCEMENT BAR NOTES:</p> <ul style="list-style-type: none"><li>Note 4: Revised note to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.</li></ul> <p>DETAIL A:</p> <ul style="list-style-type: none"><li>Added 1’-6” horizontal dimension.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li></ul> <p>VERTICAL REINFORCEMENT:</p> <ul style="list-style-type: none"><li>Revised 7 ¾” to 11 ½”.</li><li>Revised 5” to 9”.</li><li>Revised 11” to 1’-3”.</li><li>Removed ¼” slope in top of bar. Make horizontal.</li></ul> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Revised 2’-11” to 3’-3” barrier height.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Added “BARRIER WALL” to 1’-6”.</li><li>Added 6<sup>5</sup>/<sub>8</sub>” horizontal dimension.</li><li>Added 4” horizontal dimension.</li><li>Removed “RAILING” from W 8 x 18 POST.</li><li>Added “CLIPPED” to HARDENED WASHERS.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li><li>Revised “ANCHOR BAR 2”X<sup>3</sup>/<sub>8</sub>”X6” (GALVANIZED) SECURED WITH DOUBLE NUTS” to “6”X6”X ¼” ANCHOR PLATE (GALVANIZED) SECURED WITH DOUBLE NUTS, (SEE BC-709M)”</li><li>Added 2 ½” CLR. (in 2 locations).</li></ul> <p>Added “LEGEND”.</p> <p>Added “VERTICAL V-NOTCH DETAIL”.</p> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>Removed “BC-708M THRIE-BEAM TO PA TYPE 10M BARRIER TRANSITION CONNECTION”.</li><li>Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li><li>Added “RC-51 TYPE 31 STRONG POST GUIDE RAIL”.</li></ul>
	OLD 2 of 16	Removed Sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 3 of 16	Removed Sheet.
	NEW 2 of 9	<p>New sheet added. END OF BARRIER DETAILS – 1.</p> <p>Added “PA TYPE 10M BARRIER END TRANSITION ELEVATION”.</p> <p>Added “SECTION B-B”.</p> <p>Added “SECTION C-C”.</p> <p>Added “HORIZONTAL REINFORCEMENT”.</p> <p>Added “CLEAR ROADWAY WIDTH DETAIL”.</p> <p>Added “THRIE-BEAM GUIDE RAIL RECESS AND BOLT HOLE DETAIL”.</p> <p>Added “NOTES”.</p> <p>Added “LEGEND”.</p>
	OLD 4 of 16	Removed Sheet.
	NEW 3 of 9	<p>New sheet added. END BARRIER DETAILS – 2.</p> <p>Added “SECTION D-D”.</p> <p>Added “VERTICAL REINFORCEMENT”.</p> <p>Added “SECTION E-E”.</p> <p>Added “SECTION F-F”.</p> <p>Added “NOTES”.</p> <p>Added “LEGEND”.</p>
	OLD 5 of 16	Removed Sheet.
	OLD 6 of 16	Removed Sheet.
	OLD 7 of 16	Removed Sheet.
	OLD 8 of 16	Removed Sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 9 of 16	Removed Sheet.
	OLD 10 of 16	Removed Sheet.
	OLD 11 of 16 NEW 4 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 11 OF 16” to “SHT 4 OF 9”.</li></ul> <p>INTEGRAL SIDEWALK DETAIL:</p> <ul style="list-style-type: none"><li>Revised “INTEGRAL SIDEWALK DETAIL” to “TYPICAL SIDEWALK DETAIL”.</li><li>Revised “3’-6” MIN.” to “3’-10” MIN.”.</li><li>Added 3’-3” vertical dimension.</li><li>Added “1’-5” BARRIER WALL”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Added ⑧.</li><li>Added “1.5% SLOPED TOWARD CONC. BARRIER (BRIDGE OVER ROADWAY) ⑦”.</li><li>Added “1.5% SLOPED AWAY FROM CONC. BARRIER (OTHER CONDITIONS)”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li></ul> <p>ALTERNATE SIDEWALK DETAIL:</p> <ul style="list-style-type: none"><li>Revised 3’-6” to 3’-10”.</li><li>Revised 2’-11” to 3’-3”.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li><li>Added ⑧.</li></ul> <p>Added “NOTES”.</p> <p>Added “LEGEND”.</p> <p>Removed “RAISED SIDEWALK DETAIL”.</p>
	OLD 12 of 16 NEW 5 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 12 OF 16” to “SHT 5 OF 9”.</li></ul> <p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER:</p> <ul style="list-style-type: none"><li>Revised 2’-11” to 3’-3”.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 12 of 16 NEW 5 of 9 (cont.)	<ul style="list-style-type: none"><li>Added “2 ½” CLR.”.</li><li>Revised ② to ⑩.</li><li>Revised ③ to ⑪.</li></ul> <p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK:</p> <ul style="list-style-type: none"><li>Added “TYPICAL” to title.</li><li>Revised “3’-6” to “3’-10”.</li><li>Added 3’-3” vertical dimension.</li><li>Added “1’-5” BARRIER WALL”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Revised ** to ⑦.</li><li>Removed “*** DRAIN RUNOFF THROUGH CONCRETE CURB WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li><li>Added “2 ½” CLR.”.</li><li>Removed 2’-11” vertical dimension.</li><li>Revised ③ to ⑪.</li><li>Revised ① to ⑨.</li><li>Removed “(RAISED SIDEWALK DETAIL SIMILAR)”.</li></ul> <p>VERTICAL REINFORCEMENT (left):</p> <ul style="list-style-type: none"><li>Removed ¼” slope in top of bar. Made top of bar horizontal.</li><li>Revised 11¼” to 1’-3”.</li><li>Revised 4¼” to 8”.</li><li>Revised 8” to 12”.</li><li>Revised 11” to 1’-3”.</li></ul> <p>VERTICAL REINFORCEMENT (right):</p> <ul style="list-style-type: none"><li>Removed ¼” slope in top of bar. Made top of bar horizontal.</li><li>Revised 11” to 1’-3”.</li><li>Revised 8” to 12”.</li><li>Revised 8¼” to 12”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Revised ① to ⑨.</li><li>Revised ② to ⑩.</li><li>Revised ③ to ⑪.</li><li>Added “⑦ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN THE SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.”.</li></ul> <p>Added “NOTES”.</p>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 13 of 16 NEW 6 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 13 OF 16” to “SHT 6 OF 9”.</li></ul> <p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK:</p> <ul style="list-style-type: none"><li>Revised “3’-6” to “3’-10”.</li><li>Added 3’-3” vertical dimension.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “BARRIER” to “1’-6” BARRIER WALL”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li><li>Added “2 ½” CLR.”.</li><li>Removed “W8x18”.</li><li>Revised ① to ⑪.</li><li>Added ⑫ (2 locations).</li></ul> <p>VERTICAL REINFORCEMENT:</p> <ul style="list-style-type: none"><li>Removed ¼” slope in top of bar. Made top of bar horizontal.</li><li>Revised 11” to 1’-3”.</li><li>Revised 10¼” to 1’-1½”.</li><li>Revised 10½” to 1’-1½”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Revised ① to ⑪.</li><li>Added “⑫ FOR DIMENSIONS, SEE BD-601M, SHEET 4.”.</li></ul> <p>Added “NOTES”.</p>
	OLD 14 of 16 NEW 7 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 14 OF 16” to “SHT 7 OF 9”.</li></ul> <p>SECTION – C.I.P.:</p> <ul style="list-style-type: none"><li>Added “BARRIER WALL” to 1’-6”.</li><li>Revised 2’-11” to 3’-3”.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li></ul> <p>SECTION – PRECAST:</p> <ul style="list-style-type: none"><li>Added “BARRIER WALL” to 1’-6”.</li><li>Revised 2’-11” to 3’-3”.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li><li>Removed “1’-0” BEDDING MINIMUM”.</li></ul> <p>OPTIONAL ANCHOR BOLT DETAIL:</p> <ul style="list-style-type: none"><li>Revised 1’-4” to 1’-8”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 14 of 16 NEW 7 of 9 (cont.)	<p>C.I.P. CULVERT:</p> <ul style="list-style-type: none"><li>Removed ¼” slope in top of bar. Made top of bar horizontal.</li><li>Revised 11” to 1’-3”.</li><li>Revised 9” to 1’-1”.</li><li>Revised 9¼” to 1’-1”.</li></ul> <p>PRECAST CULVERT VERTICAL REINFORCEMENT:</p> <ul style="list-style-type: none"><li>Revised 11” to 1’-3” (2 locations).</li><li>Revised 2½” to 3” (2 locations).</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Added note – “3. FOR ADDITIONAL NOTES, SEE SHEET 1.”.</li></ul>
	OLD 15 of 16 NEW 8 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 15 OF 16” to “SHT 8 OF 9”.</li></ul> <p>TYPICAL ELEVATION:</p> <ul style="list-style-type: none"><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li></ul> <p>SECTION J-J:</p> <ul style="list-style-type: none"><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”.</li><li>Revised “#6 @ 8” MAX.” to “#8 @ 6” MAX.”.</li></ul> <p>SECTION L-L:</p> <ul style="list-style-type: none"><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”.</li></ul> <p>TYPICAL PLAN:</p> <ul style="list-style-type: none"><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”.</li><li>Revised barrier end for new MASH barrier end transition.</li><li>Revised ③ to ⑯.</li><li>Removed “1’-5 ¾” WITHOUT INLET PLACEMENT 2’-8” WITH INLET PLACEMENT” to 3’-3”.</li><li>Added “STEEL I-GIRDERS SHOWN; P/S CONCRETE GIRDERS SIMILAR. PIPE PILES SHOWN; H PILES SIMILAR.”.</li></ul> <p>DETACHED WINGWALL PLAN:</p> <ul style="list-style-type: none"><li>Added “9’-0” MIN. BARRIER END TRANSITION (SEE SHEETS 2 AND 3)”.</li><li>Revised barrier end for new MASH barrier end transition.</li><li>Revised ③ to ⑯.</li><li>Removed “1’-5 ¾” WITHOUT INLET PLACEMENT 2’-8” WITH INLET PLACEMENT” to 3’-3”.</li><li>Revised ④ to ⑮.</li><li>Revised ①② to ⑬⑭.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-617M (cont.)	OLD 15 of 16 NEW 8 of 9 (cont.)	<p>SECTION K-K:</p> <ul style="list-style-type: none"><li>Revised “VARIES” to “1’-6” BARRIER WALL”.</li><li>Revised “#4 CURB REINFORCEMENT SEE SHEET 1 FOR SPACING” to “#4 BARRIER REINFORCEMENT SEE SHEET 2 AND 3 FOR SPACING AND DETAILING”.</li></ul> <p>SECTION N-N:</p> <ul style="list-style-type: none"><li>Revised “VARIES” to “1’-6” BARRIER WALL”.</li><li>Revised “#4 CURB REINFORCEMENT SEE SHEET 1 FOR SPACING” to “#4 BARRIER REINFORCEMENT SEE SHEET 2 AND 3 FOR SPACING AND DETAILING”.</li></ul> <p>Removed “VERTICAL CURB REINFORCEMENT”.</p> <p>Added “LEGEND”:</p> <ul style="list-style-type: none"><li>Revised ① to ⑬. Revised “SHEET 4” to “SHEETS 5 AND 6”.</li><li>Revised ② to ⑭.</li><li>Removed note ③.</li><li>Revised ④ to ⑮.</li><li>Added “⑩ SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEET 2 AND 3.”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Added note – “2. FOR ADDITIONAL NOTES, SEE SHEET 1.”.</li></ul>
	OLD 16 of 16 NEW 9 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHT 16 OF 16” to “SHT 9 OF 9”.</li></ul> <p>PLAN:</p> <ul style="list-style-type: none"><li>Revised section mark “Q-Q” to “G-G”.</li><li>Added “BARRIER WALL” to 1’-6”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “WORKMANSHIP” to “PERFORM WORK”.</li></ul> <p>ELEVATION:</p> <ul style="list-style-type: none"><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li><li>Added “PUB. 408, SECTION”.</li></ul> <p>SECTION Q-Q:</p> <ul style="list-style-type: none"><li>Revised “SECTION Q-Q” to “SECTION G-G”.</li><li>Added a second row of anchor bolts and replaced anchor bar with an anchor plate.</li><li>Revised 1’-1” to “1’-5” BARRIER WALL”.</li></ul> <p>REINFORCEMENT BAR NOTES:</p> <ul style="list-style-type: none"><li>Note 2: Revised “ALL REINFORCEMENT BARS SHALL BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M	OLD 1 of 12 NEW 1 of 9	<p>Total number of sheets revised from 12 to 9.</p> <p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER” to “VERTICAL WALL CONCRETE BARRIER”.</li><li>Revised “SHT 1 OF 12” to “SHT 1 OF 9”.</li></ul> <p>TYPICAL VERTICAL WALL BARRIER DETAIL – TL5:</p> <ul style="list-style-type: none"><li>Revised “TYPICAL VERTICAL WALL BARRIER DETAIL – TL5” to “42” VERTICAL WALL CONCRETE BARRIER DETAIL”.</li><li>Removed 6<sup>3</sup>/<sub>8</sub>” dimension.</li><li>Relocated “2” CLR.” and added “(TYP.)”.</li><li>Removed “(TYP.)” from ¾”x¾” CHAMFER.</li><li>Added “R=1””.</li></ul> <p>ALTERNATE VERTICAL WALL BARRIER DETAIL – TL4:</p> <ul style="list-style-type: none"><li>Revised “ALTERNATE VERTICAL WALL BARRIER DETAIL – TL4” to “32” VERTICAL WALL CONCRETE BARRIER DETAIL”.</li><li>Removed 5<sup>3</sup>/<sub>8</sub>” dimension.</li><li>Removed “(TYP.)” from ¾”x¾” CHAMFER.</li><li>Added “R=1””.</li></ul> <p>TABLE 1:</p> <ul style="list-style-type: none"><li>Revised “TYP. VERTICAL WALL” to “42” VERTICAL WALL CONCRETE”.</li><li>Revised “ALT. VERTICAL WALL” to “32” VERTICAL WALL CONCRETE”.</li><li>Dimension C: Revised for 42” VERTICAL WALL from 4” to 3”.</li><li>Dimension D: Revised for 42” VERTICAL WALL from 6½” to 5½”.</li></ul> <p>REINFORCEMENT BAR NOTES:</p> <ul style="list-style-type: none"><li>Note 4: Revised “PROVIDE REINFORCEMENT BARS, EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(C).” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1 (c).”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Note ①: Added “FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “WORK QUALITY” to “PERFORM WORK”.</li><li>Note 2: Removed.</li><li>Note 3: Removed.</li><li>Note 4: Revised as the following:<ul style="list-style-type: none"><li>“TYP. VERTICAL WALL” to “42” VERTICAL CONCRETE WALL”.</li><li>“ALT. VERTICAL WALL” to “32” VERTICAL CONCRETE WALL”.</li><li>“SIDEWALK VERTICAL WALL” to “SIDEWALK VERTICAL CONCRETE WALL”.</li><li>“RAISED SIDEWALK VERTICAL WALL” to “RAISED SIDEWALK VERTICAL CONCRETE WALL”.</li></ul></li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 1 of 12 NEW 1 of 9 (cont.)	<ul style="list-style-type: none"><li>• Note 5: Removed.</li><li>• Note 6: Removed.</li><li>• Note 7: Removed.</li><li>• Added Note 2: “THE 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-5. THE 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42”.”.</li><li>• Added Note 3: “THE 32” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-3.”</li><li>• Added Note 5: “FOR DETAILS OF THE 42” AND 32” VERTICAL WALL CONCRETE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS IN BD-622M AND BD-624M.”.</li></ul> <p>Added:</p> <ul style="list-style-type: none"><li>• “CONTRACT DRAWING NOTE: THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42” VERTICAL WALL CONCRETE BARRIER IS USED: THE 42” VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42”.”.</li></ul> <p>Added “CLEAR ROADWAY WIDTH DETAIL”.</p> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>• Removed “BC-703M THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>• Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li></ul> <p>Removed “PLAN VIEW FOR TYP. VERTICAL WALL TO TYP. BRIDGE BARRIER TRANSITION”.</p> <p>Removed “ELEVATION VIEW FOR TYP. VERTICAL WALL TO TYP. BRIDGE BARRIER TRANSITION”.</p> <p>Removed “ELEVATION VIEW FOR ALTERNATE VERTICAL WALL TO ALTERNATE BRIDGE BARRIER TRANSITION”.</p>
	OLD 2 of 12	Removed sheet.
	OLD 3 of 12	Removed sheet.
	OLD 4 of 12	Removed sheet.
	OLD 5 of 12	Removed sheet.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 6 of 12	Removed sheet.
	OLD 7 of 12	Removed sheet.
	OLD 8 of 12	Removed sheet.
	OLD 9 of 12	Removed sheet.
	NEW 2 of 9	New sheet added. BARRIER END TRANSITION – 1.  Added “32” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. <ul style="list-style-type: none"><li>• “PLAN” and “ELEVATION” views.</li></ul> Added “42” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. <ul style="list-style-type: none"><li>• “PLAN” and “ELEVATION” views.</li></ul> Added “SECTION A-A”.  Added “LEGEND”.
	NEW 3 of 9	New sheet added. BARRIER END TRANSITION – 2.  Added “42” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. <ul style="list-style-type: none"><li>• “PLAN” and “ELEVATION” views.</li></ul> Added “SECTION G-G”.  Added “LEGEND”.  Added “NOTES”.
	NEW 4 of 9	New sheet added. BARRIER END TRANSITION – 3.  Added “32” VERTICAL WALL CONCRETE BARRIER END TRANSITION”. <ul style="list-style-type: none"><li>• “PLAN” and “ELEVATION” views.</li></ul> Added “SECTION H-H”.  Added “LEGEND”.  Added “NOTES”.
	NEW 5 of 9	New sheet added. END TRANSITION REINFORCEMENT – 1.  Added “SECTION B-B”.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	NEW 5 of 9 (cont.)	Added “SECTION C-C”.  Added “SECTION D-D”.  Added “SECTION E-E”.  Added “SECTION F-F”.  Added “415” bar diagram.  Added “416” bar diagram.  Added “417” bar diagram.  Added “418” bar diagram.  Added “419” bar diagram.  Added “LEGEND”.
	NEW 6 of 9	New sheet added. END TRANSITION REINFORCEMENT – 2.  Added “413” bar diagram.  Added “414” bar diagram.  Added “LEGEND”.
	OLD 10 of 12 NEW 7 of 9	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER SIDEWALK DETAILS” to “VERTICAL WALL CONCRETE BARRIER SIDEWALK DETAILS”.</li><li>Revised “SHT 10 OF 12” to “SHT 7 OF 9”.</li></ul> INTEGRAL SIDEWALK DETAIL: <ul style="list-style-type: none"><li>Revised “INTEGRAL” to “TYPICAL”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li></ul> <ul style="list-style-type: none"><li>Added “1.5%, SLOPED TOWARD BARRIER ⑬ (BRIDGE OVER ROADWAY)” and “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”.</li><li>Revised ① to ⑫.</li><li>Added “②”.</li></ul> RAISED SIDEWALK DETAIL: <ul style="list-style-type: none"><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Added “1.5%, SLOPED TOWARD BARRIER ⑬ (BRIDGE OVER ROADWAY)” and “1.5% SLOPED AWAY FROM BARRIER (OTHER CONDITIONS)”.</li><li>Revised ① to ⑫.</li><li>Added “②”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 10 of 12 NEW 7 of 9 (cont.)	Added “LEGEND”. <ul style="list-style-type: none"><li>Revised ① to “⑫ 42” VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32” VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3’-6” MINIMUM ON SIDEWALK SIDE OF RAILING.”.</li><li>Added “② UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.”.</li><li>Added “⑬ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.”.</li></ul>
	OLD 11 of 12 NEW 8 of 9	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER ADJACENT BOX BEAM DETAILS” to “VERTICAL WALL CONCRETE BARRIER ADJACENT BOX BEAM DETAILS”.</li><li>Revised “SHT 11 OF 12” to “SHT 8 OF 9”.</li></ul> 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: <ul style="list-style-type: none"><li>Removed detail “AT BARRIER TERMINATION SECTION”.</li><li>Removed title “AT TYPICAL BARRIER SECTION”.</li><li>Revised ③⑤ to ⑮⑰.</li><li>Revised ④ to ⑯.</li><li>Removed ⑥ at OVERHANG LIMITED TO 4” MAX.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “#5” to “#6”.</li><li>Revised longitudinal reinforcement callout from #6 to #5.</li><li>Revised “1½” CLR. ⑤” to “2” CLR. (TYP.)”.</li><li>Revised “TYP. VERTICAL WALL BARRIER SHOWN, ALT. VERTICAL WALL BARRIER SIMILAR)” to “(42” VERTICAL WALL CONCRETE BARRIER SHOWN, 32” VERTICAL WALL CONCRETE BARRIER SIMILAR)”.</li></ul> 36” & 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK: <ul style="list-style-type: none"><li>Added “TYPICAL” to “36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING SIDEWALK”.</li><li>Revised “VEHICULAR WIDTH” to “ROADWAY”.</li><li>Revised “#5” to “#6”.</li><li>Revised longitudinal reinforcement callout from #6 to #5</li><li>Removed ⑥.</li><li>Revised “1½” CLR. (TYP.) ⑤” to “2” CLR. (TYP.)”.</li><li>Revised ③⑤ to ⑮⑰.</li><li>Revised ④ to ⑯.</li><li>Revised ② to ⑭.</li><li>Revised ** to ⑬.</li><li>Removed “** DRAIN RUNOFF THROUGH CONCRETE CURB WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT</li></ul>



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 11 of 12 NEW 8 of 9 (cont.)	<p>IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.”.</p> <p>VERTICAL REINFORCEMENT: (2 locations)</p> <ul style="list-style-type: none"><li>Revised “4” FOR TYP. VERTICAL WALL BARRIER 3” FOR ALT. VERTICAL WALL BARRIER” to 3”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Note ① added “FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-6.”.</li><li>Revised ② to ⑭.</li><li>Revised ③ to ⑮.</li><li>Revised ④ to ⑯.</li><li>Revised ⑤ to “⑰ FOR 32” VERTICAL WALL CONCRETE BARRIER USE #4 @ 12”.”</li><li>Removed ⑥.</li><li>Revised ⑦ to ⑫. Revised “IF ALTERNATE VERTICAL WALL BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3’-6” MIN. ON SIDEWALK SIDE OF RAILING. ALTERNATE RAILING DETAILS ON BC-718M MAY BE USED IN PLACE OF BC-720M TO OBTAIN MINIMUM HEIGHT.” to “42” VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32” VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3’-6” MIN. ON SIDEWALK SIDE OF RAILING.”.</li><li>Added “⑬ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1” ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Added “CONCRETE”.</li></ul>
	OLD 12 of 12 NEW 9 of 9	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER LIGHTING POLE ANCHORAGE DETAILS” to “VERTICAL WALL CONCRETE BARRIER LIGHTING POLE ANCHORAGE DETAILS”.</li><li>Revised “SHT 12 OF 12” to “SHT 9 OF 9”.</li></ul> <p>REINFORCEMENT BAR NOTES:</p> <ul style="list-style-type: none"><li>Note 2: Revised “ALL REINFORCEMENT BARS SHALL BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.</li></ul> <p>PLAN:</p> <ul style="list-style-type: none"><li>Revised section marks “Q-Q” to “J-J”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-618M (cont.)	OLD 12 of 12 NEW 9 of 9 (cont.)	<p>REINFORCEMENT BAR TABLE:</p> <ul style="list-style-type: none"><li>Revised “AT TYP. VERT. WALL BARRIER” to “42” VERTICAL WALL CONCRETE BARRIER” (2 locations).</li><li>Revised “AT ALT. VERT. WALL BARRIER” to “32” VERTICAL WALL CONCRETE BARRIER” (2 locations).</li></ul> <p>ELEVATION:</p> <ul style="list-style-type: none"><li>Revised leaders for “405” and “406”.</li></ul> <p>SECTION Q-Q:</p> <ul style="list-style-type: none"><li>Revised “Q-Q” to “J-J”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “WORK QUALITY” to “PERFORM WORK”.</li><li>Note 10: Added “CONCRETE”.</li></ul>
	BD-622M  OLD 1 of 5 NEW 1 of 10	<p>Revised number of sheets from 5 to 10.</p> <p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 1 of 5” to “SHEET 1 of 10”.</li></ul> <p>GENERAL NOTES:</p> <ul style="list-style-type: none"><li>Note 2: Revised “BARRIER TRANSITION” to “SAFETY WING”.</li></ul> <p>ABUTMENT WITH FLARED WINGS:</p> <ul style="list-style-type: none"><li>Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.</li></ul> <p>TYPICAL PLAN (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li><li>Corrected linework to show barrier turning at gutterline.</li><li>Added “SAFETY WING” callout.</li><li>Revised “FOR BARRIER AND BRIDGE TERMINAL CONNECTION DETAILS, SEE BD-601M AND BC-739M.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M. (TYP.)”.</li></ul> <p>DETAIL A:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition.</li></ul> <p>DETAIL B:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition.</li></ul> <p>NOTE:</p> <ul style="list-style-type: none"><li>Added “BELOW GUTTERLINE”.</li></ul> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 1 of 5 NEW 1 of 10 (cont.)	<p>SECTION B-B:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li></ul> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”.</li><li>Added “BD-610M PA BRIDGE BARRIER”.</li><li>Added “BD-617M PA TYPE 10M BRIDGE BARRIER”.</li><li>Added “BC-618M VERTICAL WALL CONCRETE BARRIER”.</li><li>Added “BC-734M ANCHOR SYSTEMS”.</li><li>Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li></ul>
	OLD 2 of 5 NEW 2 of 10	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “FLARED WINGS LAYOUT AND DETAILS” to “SAFETY WING DETAILS”.</li><li>Revised “SHEET 2 of 5” to “SHEET 2 of 10”.</li></ul> <p>SECTION C-C:</p> <ul style="list-style-type: none"><li>Revised section to remove 10° flare and updated for new MASH barrier end transition.</li></ul> <p>ALTERNATE SECTION C-C:</p> <ul style="list-style-type: none"><li>Revised section to remove 10° flare and updated for new MASH barrier end transition.</li></ul> <p>SECTION D-D:</p> <ul style="list-style-type: none"><li>Removed barrier details. This makes the section generic for all barriers.</li><li>Added ①.</li><li>Revised “CONSTR. JT” to “V-NOTCH &amp; OPTIONAL CONSTR. JOINT (RAKED FINISH)”.</li><li>Revised “OPTIONAL CONSTR. JT.” to “CONSTR. JOINT &amp; V-NOTCH”.</li><li>Added 1’-8 ¼” dimension.</li><li>Revised “#6” to “#6 @ 12 E.F.”.</li><li>Revised “BOTTOM OF PAVEMENT STRUCTURE OR APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”.</li><li>Removed “OPTIONAL” from CONSTR. JOINT at BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB location.</li><li>Added "MIN. LAP" to 2'-2".</li><li>Added “F.F” and “R.F.”.</li></ul> <p>SECTION E-E:</p> <ul style="list-style-type: none"><li>Revised SECTION E-E” to “SECTION F-F”.</li><li>Removed barrier details. This makes the section generic for all barriers.</li><li>Added ①.</li><li>Revised “CONSTR. JT” to “V-NOTCH &amp; OPTIONAL CONSTR. JOINT (RAKED FINISH)”.</li><li>Revised “#6” to “#6 @ 12 E.F.”.</li><li>Revised “BOTTOM OF PAVEMENT STRUCTURE OR APPROACH SLAB” to “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 2 of 5 NEW 2 of 10 (cont.)	<ul style="list-style-type: none"><li>Revised “OPTIONAL CONSTR. JT.” to “CONSTR. JOINT &amp; V-NOTCH”.</li><li>Added "MIN. LAP" to 2'-2".</li><li>Added bend bar below BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB with 1'-2" MIN. lap.</li><li>Added “F.F” and “R.F.”.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 5: Removed.</li><li>Note 6: Revised note “6” to “5”.</li></ul> <p>Added “LEGEND”.</p> <p>Added “SECTION E-E”.</p> <p>Added “TABLE 1”.</p> <p>Removed “ALTERNATE BARRIER REINFORCEMENT SECTION”.</p>
	OLD 3 of 5	Removed sheet.
	NEW 3 of 10	<p>New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 1.</p> <p>Added “45” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAIL”:</p> <ul style="list-style-type: none"><li>“PLAN” and “ELEVATION” views.</li></ul> <p>Added “THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL”.</p> <p>Added “LEGEND”.</p> <p>Added “NOTES”.</p>
	NEW 4 of 10	<p>New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 2.</p> <p>Added “42” F-SHAPE CONCRETE BRIDGE BARRIER TRANSITION REINFORCEMENT DETAIL”:</p> <ul style="list-style-type: none"><li>“PLAN” and “ELEVATION” views.</li></ul> <p>Added “LEGEND”.</p> <p>Added “NOTES”.</p>
	NEW 5 of 10	<p>New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 3.</p> <p>Added “32” F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION REINFORCEMENT DETAIL”:</p> <ul style="list-style-type: none"><li>“PLAN” and “ELEVATION” views.</li></ul> <p>Added “LEGEND”.</p> <p>Added “NOTES”.</p>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	NEW 6 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 4.  Added “SECTION H-H”.  Added “SECTION J-J”.  Added “SECTION K-K”.  Added “SECTION L-L”.  Added “SECTION M-M”.  Added “SECTION G-G”.  Added “TABLE 2”.  Added “LEGEND”.  Added “NOTES”.
	NEW 7 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 5.  Added bar diagram “412”.  Added “TABLE 3”.  Added bar diagram “411”.  Added “TABLE 4”.  Added bar diagram “406”.  Added bar diagram “407”.  Added bar diagram “408”.  Added bar diagram “409”.  Added “TABLE 5”.
	NEW 8 of 10	New Sheet. BRIDGE BARRIER TRANSITION REINFORCEMENT – 6.  Added bar diagram “403”.  Added bar diagram “404”.  Added “LEGEND”.
	OLD 4 of 5 NEW 9 of 10	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 4 of 5” to “SHEET 9 of 10”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 4 of 5 NEW 9 of 10 (cont.)	<p>TYPICAL PLAN (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li><li>Revised “FOR 10° END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”.</li><li>Revised section cut “J-J” to “Q-Q”.</li><li>Revised section cut “K-K” to “R-R”.</li></ul> <p>SECTION K-K:</p> <ul style="list-style-type: none"><li>Revised “SECTION K-K” to “SECTION R-R”.</li><li>Added “45” F-SHAPE CONCRETE BARRIER SHOWN. 32” AND 42” F-SHAPE CONCRETE BARRIER SIMILAR.”</li><li>Revised “CONSTR. JT.” to “V-NOTCH &amp; OPTIONAL CONSTR. JOINT (RAKED FINISH)”.</li><li>Revised “#4 @ 6” ” to “#4 @ 12” (SEE NOTE 3)”.</li><li>Added “MIN.” to 2’ -2”.</li><li>Added “OR APPROACH SLAB” to V-NOTCH @ BOTT. OF DECK.</li></ul> <p>SECTION J-J:</p> <ul style="list-style-type: none"><li>Revised “SECTION J-J” to “SECTION Q-Q”.</li><li>Revised barrier for new barrier end transition.</li><li>Revised “V-NOTCH AND OPTIONAL CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND OPTIONAL CONSTR. JT.”.</li><li>Revised “V-NOTCH AND CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND CONSTR. JT.”.</li><li>Revised “V-NOTCH @ BOTTOM OF DECK” to “V-NOTCH @ BOTTOM OF DECK OR APPROACH SLAB”.</li><li>Added break line.</li></ul> <p>TYPICAL ELEVATION:</p> <ul style="list-style-type: none"><li>Revised section cut “H-H” to “P-P”.</li><li>Revised section cut “G-G” to “N-N”.</li></ul> <p>TYPICAL CORNER DETAIL FOR EXPANSION DAM (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Revised “TYPICAL” to “45” F-SHAPE”.</li><li>Revised “ALTERNATE” to “32” AND 42” F-SHAPE CONCRETE”.</li><li>Removed 3<sup>3</sup>/<sub>8</sub>” and 1’ -0” dimensions.</li></ul> <p>ABUTMENT WITH U-WINGS:</p> <ul style="list-style-type: none"><li>Revised “SECTION G-G” to “SECTION N-N”.</li><li>Revised “SECTION H-H” to “SECTION P-P”.</li><li>Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.</li><li>Modified SECTION H-H to correct corner details (2 locations).</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 3: Revised “SPACING OF BARRIER REINFORCEMENT SHOWN IS FOR U-WING LENGTHS OF 20’ -0” OR LESS. FOR U-WING LENGTHS GREATER THAN 20’ -0”, SPACING OF REINFORCEMENT SHOWN IS</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-622M (cont.)	OLD 4 of 5 NEW 9 of 10 (cont.)	FOR A DISTANCE OF 10’-0” FROM EACH END OF AN EXPANSION JOINT. FOR U-WING SECTIONS BETWEEN THE 10’-0” SECTION, THE VERTICAL REINFORCEMENT SPACING MAY BE INCREASED TO 12” to “WITHIN 10’-0” ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON SHEETS 3-8.”.
	OLD 5 of 5 NEW 10 of 10	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 5 of 5” to “SHEET 10 of 10”.</li></ul> <p>TYPICAL PLAN (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Revised section cut “J-J” to “Q-Q”.</li><li>Revised section cut “K-K” to “R-R”.</li><li>Removed 10° flare and updated with new MASH barrier end transition.</li><li>Revised “FOR 10° END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”.</li></ul> <p>TYPICAL ELEVATION:</p> <ul style="list-style-type: none"><li>Revised section cut “M-M” to “T-T”.</li><li>Revised section cut “L-L” to “S-S”.</li></ul> <p>ABUTMENT WITH U-WINGS:</p> <ul style="list-style-type: none"><li>Revised “SECTION L-L” to “SECTION S-S”.</li><li>Revised “SECTION M-M” to “SECTION T-T”.</li><li>Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.</li><li>Modified SECTION S-S to correct corner details (2 locations).</li></ul> <p>ABUTMENT PLAN – WITH BACKWALL (SKEWS &lt; 75°) U- WINGS FOR ADJACENT BEAMS:</p> <ul style="list-style-type: none"><li>Revised “STYROFOAM” to “PLACE PREFORMED CELLULAR POLYSTYRENE (P.C.P)”.</li><li>Corrected line work to show barrier turning at gutterline.</li><li>Added break line.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “FOR SECTIONS J-J AND K-K, SEE SHEET 4.” to “FOR SECTIONS Q-Q AND R-R, SEE SHEET 9.”.</li></ul>
BD-624M	OLD 1 of 5 NEW 1 of 4	<p>Revised number of sheets from 5 to 4.</p> <p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 1 OF 5” to “SHEET 1 OF 4”.</li></ul> <p>GENERAL NOTES:</p> <ul style="list-style-type: none"><li>Note 2: Revised “HOOKS ON BARS EXTENDING FROM BARRIER TRANSITION INTO THE BACKWALL MAY BE TURNED IN ANY</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 1 of 5 NEW 1 of 4 (cont.)	<p>DIRECTION.” to “HOOKS ON BARS EXTENDING FROM SAFETY WING INTO THE STEM MAY BE TURNED IN ANY DIRECTION.”.</p> <p>ABUTMENT WITH FLARED WINGS:</p> <ul style="list-style-type: none"><li>Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.</li></ul> <p>TYPICAL PLAN (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li><li>Revised “FOR BARRIER AND BRIDGE TERMINAL CONNECTION DETAILS, SEE BD-601M AND BC-739M.” to “F-SHAPE CONCRETE BARRIER SHOWN. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”.</li></ul> <p>DETAIL A:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition.</li></ul> <p>DETAIL B:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition.</li></ul> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li></ul> <p>SECTION B-B:</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition (2 locations).</li></ul> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”.</li><li>Added “BD-610M PA BRIDGE BARRIER”.</li><li>Added “BD-617M PA TYPE 10M BRIDGE BARRIER”.</li><li>Added “BC-618M VERTICAL WALL CONCRETE BARRIER”.</li><li>Added “BC-622M REINFORCED CONCRETE ABUTMENTS WITH BACKWALL”.</li><li>Added “BC-734M ANCHOR SYSTEMS”.</li><li>Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li></ul> <p>Added “NOTE”.</p>
	OLD 2 of 5 NEW 2 of 4	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “FLARED WINGS LAYOUT AND DETAILS” to “SAFETY WING DETAILS”.</li><li>Revised “SHEET 2 OF 5” to “SHEET 2 OF 4”.</li></ul> <p>SECTION C-C:</p> <ul style="list-style-type: none"><li>Revised section to remove 10° flare and update for new MASH barrier end transition.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 2 of 5 NEW 2 of 4 (cont.)	<p>ALTERNATE SECTION C-C:</p> <ul style="list-style-type: none"><li>Revised section to remove 10° flare and update for new MASH barrier end transition.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 5: Removed.</li><li>Note 5: Revised note “5” to “4”.</li><li>Note 6: Revised note “6” to “5”.</li></ul> <p>SECTION D-D:</p> <ul style="list-style-type: none"><li>Removed barrier details. This makes the section generic for all barriers.</li><li>Added ①.</li><li>Added “(TOP OF PAVEMENT)” to GUTTERLINE.</li><li>Revised “CONSTR. JT” to “V-NOTCH &amp; OPTIONAL CONSTR. JOINT (RAKED FINISH)”.</li><li>Added “CONSTR. JOINT &amp; V-NOTCH”.</li><li>Added “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”.</li><li>Added “#6 @ 12” E.F.” bars between GUTTERLINE (TOP OF PAVEMENT) and BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB.</li><li>Added "MIN. LAP" to 2'-2".</li><li>Added “F.F.” and “R.F.”.</li><li>Added 1’-8 ¼”.</li></ul> <p>Added “SECTION E-E”.</p> <p>SECTION E-E:</p> <ul style="list-style-type: none"><li>Revised “SECTION E-E” to “SECTION F-F”.</li><li>Removed barrier details. This makes the section generic for all barriers.</li><li>Added ①.</li><li>Revised “CONSTR. JT” to “V-NOTCH &amp; OPTIONAL CONSTR. JOINT (RAKED FINISH)”.</li><li>Added “CONSTR. JOINT &amp; V-NOTCH”.</li><li>Added “BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB”.</li><li>Added “#6 @ 12” E.F.” bars between GUTTERLINE (TOP OF PAVEMENT) and BOTTOM OF PAVEMENT STRUCTURE OR 1” BELOW APPROACH SLAB.</li><li>Added "MIN. LAP" to 2'-2".</li><li>Added bend bar below BOTTOM OF PAVEMENT STRUCTURE OR 1" BELOW APPROACH SLAB with 1'-2" lap.</li><li>Added “F.F.” and “R.F.”.</li></ul> <p>Added “TABLE 1”.</p> <p>Added “LEGEND”.</p> <p>Removed “ALTERNATE BARRIER REINFORCEMENT SECTION”.</p>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 3 of 5	Removed sheet.
	OLD 4 of 5 NEW 3 OF 4	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 4 OF 5” to “SHEET 3 OF 4”.</li></ul> <p>TYPICAL PLAN (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition.</li><li>Revised “FOR 10° END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN, FOR ADDITIONAL DETAILS, SEE BD-622M. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”.</li><li>Revised section marks “J-J” to “Q-Q”.</li><li>Revised section marks “K-K” to “R-R”.</li></ul> <p>TYPCIAL ELEVATION:</p> <ul style="list-style-type: none"><li>Revised “V-NOTCH AT BOTTOM OF DECK” to “V-NOTCH AT BOTTOM OF DECK OR APPROACH SLAB”.</li><li>Removed “SPECIFY CONSTR. JT. IF EXP. JOINT BETWEEN WING AND ABUTMENT IS OMITTED”.</li><li>Revised section marks “H-H” to “P-P”.</li><li>Revised section marks “G-G” to “N-N”.</li></ul> <p>SECTION K-K:</p> <ul style="list-style-type: none"><li>Revised “SECTION K-K” to “SECTION R-R”.</li><li>Added “45” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 42” F-SHAPE CONCRETE BARRIER SIMILAR.”.</li><li>Revised “CONSTR. JT” to “V-NOTCH AND OPTIONAL CONSTR. JT. (RAKED FINISH)”.</li><li>Added “OR APPROACH SLAB” to V-NOTCH @ BOTT. OF DECK.</li><li>Revised “#4 @ 6” ” to “#4 @ 12” (SEE NOTE 2)”.</li><li>Added “R.F.” and “F.F.”.</li></ul> <p>SECTION J-J:</p> <ul style="list-style-type: none"><li>Revised “SECTION J-J” to “SECTION Q-Q”.</li><li>Revised barrier for new MASH barrier end transition (2 locations).</li><li>Revised “V-NOTCH AND OPTINAL CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND OPTIONAL CONSTR. JT.”.</li><li>Revised “V-NOTCH AND CONSTR. JT. @ GUTTERLINE” to “V-NOTCH AND CONSTR. JT.”.</li><li>Revised “V-NOTCH @ BOTTOM OF DECK” to “V-NOTCH @ BOTTOM OF DECK OR APPROACH SLAB”.</li><li>Added break line.</li></ul> <p>ABUTMENT WITH U-WINGS:</p> <ul style="list-style-type: none"><li>Revised “SECTION G-G” to “SECTION N-N”.</li><li>Revised “SECTION H-H” to “SECTION P-P”.</li><li>Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-624M (cont.)	OLD 4 of 5 NEW 3 OF 4 (cont.)	NOTES: <ul style="list-style-type: none"><li>Note 2: Revised to “WITHIN 10’ OF BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF A BRIDGE BARRIER, REDUCE THE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAIL SHOWN ON BD-622M, SHEETS 3-8.”.</li></ul>
	OLD 5 of 5 NEW 4 of 4	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 5 OF 5” to “SHEET 4 OF 4”.</li></ul> <p>TYPICAL PLAN (SKEWS &lt; 75°):</p> <ul style="list-style-type: none"><li>Removed 10° flare and updated with new MASH barrier end transition.</li><li>Revised “FOR 10° END FLARE DETAILS, SEE SHEETS 1, 2 AND 3.” to “F-SHAPE CONCRETE BARRIER SHOWN FOR ADDITIONAL DETAILS, SEE BD-622M. FOR OTHER BARRIER TYPES, SEE BD-610M, BD-617M AND BD-618M. FOR GUIDE RAIL CONNECTION DETAILS, SEE RC-50M.”.</li><li>Revised section marks “J-J” to “Q-Q”.</li><li>Revised section marks “K-K” to “R-R”.</li></ul> <p>TYPICAL ELEVATION:</p> <ul style="list-style-type: none"><li>Revised “V-NOTCH AT BOTTOM OF DECK” to “V-NOTCH AT BOTTOM OF DECK OR APPROACH SLAB”.</li><li>Removed “SPECIFY CONSTR. JT. IF EXP. JOINT BETWEEN WING AND ABUTMENT IS OMITTED”.</li><li>Revised section marks “M-M” to “T-T”.</li><li>Revised section marks “L-L” to “S-S”.</li></ul> <p>ABUTMENT WITH U-WINGS:</p> <ul style="list-style-type: none"><li>Revised “SECTION L-L” to “SECTION S-S”.</li><li>Revised “SECTION M-M” to “SECTION T-T”.</li><li>Revised “COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.” to “COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS.”.</li></ul> <p>ABUTMENT PLAN – WITHOUT BACKWALL (SKEWS &lt; 75°) U- WINGS FOR ADJACENT BEAMS:</p> <ul style="list-style-type: none"><li>Revised “STYROFOAM” to “PLACE PREFORMED CELLULAR POLYSTYRENE (P.C.P)”.</li><li>Added break line.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised “FOR SECTIONS J-J AND K-K, SEE SHEET 4.” to “FOR SECTION Q-Q AND R-R, SEE SHEET 3.”.</li></ul>
BD-627M	1 of 8	<p>GENERAL NOTES:</p> <ul style="list-style-type: none"><li>Note 2: Revised “WORK QUALITY” to “PERFORM WORK”.</li></ul> <p>INSTRUCTIONS TO DESIGNERS:</p> <ul style="list-style-type: none"><li>Note 4: Fixed locations of bullets</li><li>Note 5: Fixed locations of bullets.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-627M (cont.)	1 of 8 (cont.)	<ul style="list-style-type: none"><li>Note 7: Fixed locations of bullet.</li><li>New Note: “9. THE 42” F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-4. THE 32” F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-3. THE ALTERNATE SIDEWALK WITH 42” VERTICAL WALL CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNED AS MASH TL-2.”.</li><li>New Note: “10. THE 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”</li></ul> <p>INDEX OF SHEETS:</p> <ul style="list-style-type: none"><li>Revised Sheet 7 title from “FLARED END TREATMENT” to “END TREATMENT”.</li></ul> <p>REFERENCE DRAWINGS:</p> <ul style="list-style-type: none"><li>Deleted “BC-703M THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>Deleted “BC-709M THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>Deleted “BC-712M THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>Deleted “BC-739M BRIDGE BARRIER TO GUIDERAIL TRANSITION”.</li><li>Deleted “BD-615M PA HT BRIDGE BARRIER”.</li><li>Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li><li>Added “BD-622M R.C. ABUTMENTS WITH BACKWALL”.</li><li>Added “BD-624M R.C. ABUTMENTS WITHOUT BACKWALL”.</li></ul>
	2 of 8	<p>MOMENT SLAB (BURIED) WITH TYPICAL C.I.P. BARRIER:</p> <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB (BURIED) WITH C.I.P. 42” F-SHAPE CONCRETE BARRIER”.</li><li>Added “ * ”.</li><li>Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.</li></ul> <p>MOMENT SLAB (AT-GRADE) WITH TYPICAL C.I.P. BARRIER:</p> <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB (AT-GRADE) WITH C.I.P. 42” F-SHAPE CONCRETE BARRIER”.</li><li>Added “ * ”.</li><li>Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.</li></ul>
	3 of 8	<p>MOMENT SLAB (AT-GRADE) WITH TYPICAL PRECAST CONCRETE BARRIER:</p> <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB (AT-GRADE) WITH PRECAST 42” F-SHAPE CONCRETE BARRIER”.</li></ul> <p>MOMENT SLAB (BURIED) WITH TYPICAL PRECAST CONCRETE BARRIER:</p> <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB (BURIED) WITH PRECAST 42” F-SHAPE CONCRETE BARRIER”.</li></ul> <p>TYPICAL PRECAST CONCRETE BARRIER DETAILS:</p> <ul style="list-style-type: none"><li>Revised title to “PRECAST 42” F-SHAPE CONCRETE BARRIER DETAILS”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-627M (cont.)	3 of 8 (cont.)	NOTES: <ul style="list-style-type: none"><li>Note 1: Revised “PER PUB.” to “CONFORMING TO PUBLICATION”.</li><li>Note 3: Revised “IN ACCORDANCE WITH” to “CONFORMING TO”.</li></ul>
	4 of 8	MOMENT SLAB WITH ALTERNATE SIDEWALK AND VERTICAL WALL BARRIER (C.I.P.): <ul style="list-style-type: none"><li>Revised to “MOMENT SLAB WITH ALTERNATE SIDEWALK AND 42” VERTICAL WALL CONCRETE BARRIER (C.I.P.)”.</li></ul> MOMENT SLAB WITH ASPHALT OVERLAY ADJACENT TO TYPE 2 APPROACH SLAB WITH TYPICAL C.I.P. BARRIER: <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB WITH ASPHALT OVERLAY ADJACENT TO TYPE 2 APPROACH SLAB WITH C.I.P. 42” F-SHAPE CONCRETE BARRIER”.</li><li>Added “ * ”.</li><li>Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.</li><li>Revised “#4 @ 12” MAX.” to “#6 @ 12” MAX.” in barrier.</li><li>Revised “#5 @ 9½” MAX.” to “#5 @ 12” MAX.” in slab.</li></ul> ALTERNATE TRAFFIC BARRIER: <ul style="list-style-type: none"><li>Revised title to “32” F-SHAPE CONCRETE BARRIER”</li><li>Replaced “TYPICAL” to “F-SHAPE CONCRETE”.</li></ul>
	5 of 8	MOMENT SLAB (BURIED) WITH TOE WALL AND TYPICAL C.I.P. BARRIER: <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB (BURIED) WITH TOE WALL AND C.I.P. 42” F-SHAPE CONCRETE BARRIER”.</li><li>Added “ * ”.</li><li>Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.</li></ul> MOMENT SLAB (AT-GRADE) WITH TOE WALL AND TYPICAL C.I.P. BARRIER: <ul style="list-style-type: none"><li>Revised title to “MOMENT SLAB (AT-GRADE) WITH TOE WALL AND C.I.P. 42” F-SHAPE CONCRETE BARRIER”.</li><li>Added “ * ”.</li><li>Deleted “(TYP.)” from “¾” X ¾” CHAMFER”.</li></ul>
	6 of 8	JOINT NOTES: <ul style="list-style-type: none"><li>Note 1: Revised “PER” to “AS SPECIFIED IN”.</li></ul>
	7 of 8	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised title to “END TRANSITION”.</li></ul> BARRIER TO GUIDE RAIL TRANSITION: <ul style="list-style-type: none"><li>Deleted 10° flare from “PLAN” and “ELEVATION” views and showed new MASH barrier end transition.</li><li>Revised “BC-739M” to “RC-50M”.</li><li>Revised “TABLE” to “TABES (2 locations).</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-627M (cont.)	7 of 8 (cont.)	MOMENT SLAB ADJACENT TO BRIDGE: <ul style="list-style-type: none"><li>Deleted 10° flare and showed new MASH barrier end transition.</li><li>Revised “BC-739M” to “RC-50M”.</li><li>Revised “TABLE” to “TABES (2 locations).</li></ul> SECTION B-B: <ul style="list-style-type: none"><li>Revised “BC-739M” to “RC-50M”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Added new note: “2. REFER TO BD-622M OR BD-624M FOR BARRIER END TRANSITION DETAILS.”.</li></ul> Added: “MINIMUM MOMENT SLAB DIMENSIONS FOR NEW PROJECTS” table.
	8 of 8	SECTION D-D: <ul style="list-style-type: none"><li>Revised “ALTERNATE” to “32” F-SHAPE CONCRETE”.</li></ul> DETAIL A: <ul style="list-style-type: none"><li>Revised “PG 46-40” to “PG 64S-22”.</li><li>Revised “SECTION 470.2(a)” to “SECTION 471.2(a)”.</li></ul>
BD-628M	OLD 1 of 36 NEW 1 of 35	Total number of sheets revised from 36 to 35.  TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 1 OF 36” to “SHEET 1 of 35”</li></ul> GENERAL NOTES: <ul style="list-style-type: none"><li>Note 2: Revised “WORKMANSHIP” to “PERFORM WORK”.</li></ul> MATERIAL NOTES: <ul style="list-style-type: none"><li>Note 3: Added “OR GRADE 50” (2 locations).</li></ul> INDEX OF SHEETS: <ul style="list-style-type: none"><li>Removed “36 TYPE 5 – DETAILS”.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>Removed “BD-703M THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION.”</li><li>Removed “BC-708M THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>Removed “BC-712M THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION”.</li><li>Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”.</li><li>Removed “BD-615M PA HT BRIDGE BARRIER”.</li><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER” TO “VERTICAL WALL CONCRETE BRIDGE BARRIER”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 2 of 36 NEW 2 of 35	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 2 OF 36” to “SHEET 2 of 35”</li></ul> <p>INSTRUCTIONS TO DESIGNERS:</p> <ul style="list-style-type: none"><li>Note 2: Added “FOR CONCRETE PAVEMENT THE MINIMUM APPROACH SLAB SKEW IS 60 DEGREES.”.</li><li>Note 14: Revised “TYPICAL” to “45” F-SHAPE”.</li><li>Added note – “20. ROADWAY INLETS ARE TO BE LOCATED AT A MINIMUM OF 10’-0” FROM THE END OF MOMENT SLABS OR SLEEPER SLABS, MEASURED PERPENDICULAR TO SLABS.”.</li></ul> <p>APPROACH SLAB GUIDELINES NOTES:</p> <ul style="list-style-type: none"><li>Note 4: Revised note “4” to “5”.</li></ul> <p>APPROACH SLAB SELECTION CRITERIA TABLE:</p> <ul style="list-style-type: none"><li>Revised minimum skew angle (degrees) for concrete roadway pavement types from “45” to “60”.</li></ul>
	OLD 3 of 36 NEW 3 of 35	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 3 OF 36” to “SHEET 3 of 35”</li></ul>
	OLD 4 of 36 NEW 4 of 35	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 4 OF 36” to “SHEET 4 of 35”</li></ul> <p>PLAN 1 TYPE 1 AND 2:</p> <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Revised “(LENGTH AS REQUIRED)” to “SEE NOTE 6 &amp; 7” (2 locations).</li><li>Removed “10’-0” MIN.” dimension and “BEND LINE” callouts (2 locations).</li><li>Removed “8” CURB” and 8¾” dimension.</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> <p>TYPE 2 APPROACH SLAB ADJACENT TO MOMENT SLAB:</p> <ul style="list-style-type: none"><li>Revised “SEAL WITH ASPHALT JOINT SEALANT (AC-20)” to “SEAL WITH ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)].”</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 6: Removed.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 4 of 36 NEW 4 of 35 (cont.)	<ul style="list-style-type: none"><li>Note 7: Removed.</li><li>Added new note – “6. 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”.</li><li>Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16’-0” MINIMUM PER BD-627M.”.</li><li>Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 5 of 36 NEW 5 of 35	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 5 OF 36” to “SHEET 5 of 35”</li></ul> <p>PLAN 2 TYPE 1 AND 2:</p> <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Revised curb callouts.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb. Moved outside edge of approach slab and sleeper slab to end at front face of barrier.</li><li>Revised “SHEET 7” to “SHEET 5” (4 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> <p>TYPE 2 – CONCRETE APPROACH SLAB WITH SUPERPAVE ASPHALT OVERLAY:</p> <ul style="list-style-type: none"><li>Revised 1” to ½”.</li><li>Revised 8” to 4”.</li><li>Revised detail for 4” curb.</li><li>Revised “SEAL WITH ASPHALT JOINT SEALANT (AC-20)” to “SEAL WITH ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]”.</li></ul> <p>TYPE 1, 3, OR 5 – CONCRETE APPROACH SLAB:</p> <ul style="list-style-type: none"><li>Revised 7” to 7½”.</li><li>Revised 1” to ½”.</li><li>Revised 8” to 4”.</li><li>Revised detail for 4” curb.</li><li>Revised “SEE NOTE 6” to “SEE NOTE 4”.</li></ul> <p>JOINT SEALING DETAIL:</p> <ul style="list-style-type: none"><li>Revised “SEE NOTE 8” to “SEE NOTE 6”.</li></ul>



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 5 of 36 NEW 5 of 35 (cont.)	NOTES: <ul style="list-style-type: none"><li>Note 4: Removed.</li><li>Note 5: Removed.</li><li>Note 6: Revised note “6” to “4”.</li><li>Note 7: Revised note “7” to “5”.</li><li>Note 8: Revised note “8” to “6”.</li><li>Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li><li>Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul> <p>Removed “DETAIL C”.</p>
	OLD 6 of 36 NEW 6 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 6 OF 36” to “SHEET 6 of 35”</li></ul> PLAN 3 TYPE 1 AND 2: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Added “AND NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> SECTION F-F: <ul style="list-style-type: none"><li>Removed “BEND LINE” and revised for MASH barrier end transition.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 4: Removed.</li><li>Added new note – “4. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li><li>Added new note – “5. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 7 of 36 NEW 7 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 7 OF 36” to “SHEET 7 of 35”</li></ul> PLAN 4 TYPE 1 AND 2: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 7 of 36 NEW 7 of 35 (cont.)	<ul style="list-style-type: none"><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Added “AND NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> SECTION G-G: <ul style="list-style-type: none"><li>Removed “BEND LINE” and revised for MASH barrier end transition.</li></ul> MOMENT SLAB ADJACENT TO TYPE 2 APPROACH SLAB: <ul style="list-style-type: none"><li>Revised “SEAL WITH ASPHALT JOINT SEALANT (AC-20)” to “SEAL WITH ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 6: Removed.</li><li>Note 7: Removed.</li><li>Added new note – “6. 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”.</li><li>Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16-0” MINIMUM PER BD-627M.”.</li><li>Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 8 of 36 NEW 8 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 8 OF 36” to “SHEET 8 of 35”</li></ul> SECTION E-E: <ul style="list-style-type: none"><li>Revised “NOTE 7” to “NOTE 5” (8 locations).</li></ul>
	OLD 9 of 36 NEW 9 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 9 OF 36” to “SHEET 9 of 35”</li></ul>
	OLD 10 of 36 NEW 10 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 10 OF 36” to “SHEET 10 of 35”</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 11 of 36 NEW 11 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 11 OF 36” to “SHEET 11 of 35”</li></ul>
	OLD 12 of 36 NEW 12 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 12 OF 36” to “SHEET 12 of 35”</li></ul>
	OLD 13 of 36 NEW 13 of 35 OLD 13 of 36 NEW 13 of 35 (cont.)	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 13 OF 36” to “SHEET 13 of 35”</li></ul> TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 7: <ul style="list-style-type: none"><li>Revised “1’-3” to 1’-6”.</li></ul> TYPE APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 7: <ul style="list-style-type: none"><li>Revised “1’-3” to 1’-6”.</li></ul>
	OLD 14 of 36 NEW 14 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 14 OF 36” to “SHEET 14 of 35”</li></ul>
	OLD 15 of 36 NEW 15 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 15 OF 36” to “SHEET 15 of 35”</li></ul>
	OLD 16 of 36 NEW 16 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 16 OF 36” to “SHEET 16 of 35”</li></ul>
	OLD 17 of 36 NEW 17 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 17 OF 36” to “SHEET 17 of 35”</li></ul> TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: <ul style="list-style-type: none"><li>Revised “1’-3” to 1’-6”.</li></ul> TYPE APPROACH SLAB (WITHOUT OVERLAY) – DETAIL 11: <ul style="list-style-type: none"><li>Revised “1’-3” to 1’-6”.</li></ul>
	OLD 18 of 36 NEW 18 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 18 OF 36” to “SHEET 18 of 35”</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 19 of 36 NEW 19 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 19 OF 36” to “SHEET 19 of 35”</li></ul> PLAN 1 TYPE 3: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Added “&amp; NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> SECTION K-K: <ul style="list-style-type: none"><li>Removed “BEND LINE” and revised for MASH barrier end transition.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 3: Removed.</li><li>Added new note – “3. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16’-0” MINIMUM PER BD-627M.”.</li><li>Added new note – “4. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M, AND RC-50M.”.</li></ul>
	OLD 20 of 36 NEW 20 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 20 OF 36” to “SHEET 20 of 35”</li></ul> PLAN 2 TYPE 3: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Added “&amp; NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 20 of 36 NEW 20 of 35 (cont.)	SECTION L-L: <ul style="list-style-type: none"><li>Removed “BEND LINE” and revised for MASH barrier end transition.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 6: Removed.</li><li>Note 7: Removed.</li><li>Added new note – “6. 45” F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.”.</li><li>Added new note – “7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16’-0” MINIMUM PER BD-627M.”.</li><li>Added new note – “8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 21 of 36 NEW 21 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 21 OF 36” to “SHEET 21 of 35”</li></ul> PLAN 3 TYPE 3: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb.</li><li>Added “&amp; NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER” (2 locations).</li><li>Revised curb callouts.</li></ul> DETAIL R: <ul style="list-style-type: none"><li>Revised 2 ½” to 3”.</li><li>Revised 6 ½” to 5” (3 locations).</li><li>Revised 2’-1” to 1’-9”.</li></ul> SECTION Z-Z: <ul style="list-style-type: none"><li>Revised “8”x8” CURB” to “4” HEIGHT x 8” WIDE CURB”.</li><li>Revised detail for 4” curb.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 5: Removed.</li><li>Note 6: Removed.</li><li>Added new note – “5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 21 of 36 NEW 21 of 35 (cont.)	<ul style="list-style-type: none"><li>Added new note – “6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 22 of 36 NEW 22 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 22 OF 36” to “SHEET 22 of 35”</li></ul>
	OLD 23 of 36 NEW 23 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 23 OF 36” to “SHEET 23 of 35”</li></ul>
	OLD 24 of 36 NEW 24 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 24 OF 36” to “SHEET 24 of 35”</li></ul> TYPE 3 APPROACH SLAB – DETAIL 19: <ul style="list-style-type: none"><li>Placed #6 bar inside hook.</li></ul>
	OLD 25 of 36 NEW 25 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 25 OF 36” to “SHEET 25 of 35”</li></ul>
	OLD 26 of 36 NEW 26 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 26 OF 36” to “SHEET 26 of 35”</li></ul> PLAN 1 TYPE 4: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Added “&amp; NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> SECTION P-P: <ul style="list-style-type: none"><li>Removed “BEND LINE” and revised for MASH barrier end transition.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 26 of 36 NEW 26 of 35 (cont.)	NOTES: <ul style="list-style-type: none"><li>Note 6: Removed.</li><li>Added new note – “6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li><li>Added new note – “7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 27 of 36 NEW 27 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 27 OF 36” to “SHEET 27 of 35”</li></ul> PLAN 2 TYPE 4: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb. Moved outside edge of approach slab and sleeper slab to end at rear face of curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Revised curb callouts.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb. Moved outside edge of approach slab and sleeper slab to end at front face of barrier.</li><li>Added “&amp; NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> SECTION S-S: <ul style="list-style-type: none"><li>Revised for MASH barrier end transition.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 6: Removed.</li><li>Note 7: Removed.</li><li>Added new note – “6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li><li>Added new note – “7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 28 of 36 NEW 28 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 27 OF 36” to “SHEET 27 of 35”.</li></ul> PLAN 3 TYPE 4: <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 28 of 36 NEW 28 of 35 (cont.)	<ul style="list-style-type: none"><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li></ul> SECTION T-T: <ul style="list-style-type: none"><li>Removed “BEND LINE” and revised for MASH barrier end transition.</li></ul> TOOTH EXPANSION DAM ANCHORAGE DETAIL: <ul style="list-style-type: none"><li>Added “SLIDING SURFACE ***”.</li><li>Added “*** 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING.”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Note 5: Removed.</li><li>Note 6: Removed.</li><li>Added new note – “5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li><li>Added new note – “6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.”.</li></ul>
	OLD 29 of 36 NEW 29 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 29 OF 36” to “SHEET 29 of 35”</li></ul>
	OLD 30 of 36 NEW 30 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 30 OF 36” to “SHEET 30 of 35”</li></ul>
	OLD 31 of 36 NEW 31 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 31 OF 36” to “SHEET 31 of 35”</li></ul>
	OLD 32 of 36 NEW 32 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 32 OF 36” to “SHEET 32 of 35”</li></ul>
	OLD 33 of 36 NEW 33 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 33 OF 36” to “SHEET 33 of 35”</li></ul>
	OLD 34 of 36 NEW 34 of 35	TITLE BLOCK: <ul style="list-style-type: none"><li>Revised “SHEET 34 OF 36” to “SHEET 34 of 35”</li></ul> SAFETY WING PLAN: <ul style="list-style-type: none"><li>Removed 10° flare and revised for MASH barrier end transition.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 34 of 36 NEW 34 of 35 (cont.)	<p>SECTION Q-Q:</p> <ul style="list-style-type: none"><li>Removed 10° flare and revised for MASH barrier end transition.</li><li>Removed callout of reinforcement in barrier.</li></ul> <p>SECTION A-A:</p> <ul style="list-style-type: none"><li>Removed callout of reinforcement in barrier.</li></ul> <p>JOINT INSTALLATION NOTES:</p> <ul style="list-style-type: none"><li>Note 9: Revised to “AFTER THE CONCRETE OF THE BLOCKOUT ACHIEVES THE MINIMUM COMPRESSIVE STRENGTH SPECIFIED IN PUBLICATION 408 SECTION 1001.3(q)1, REMOVE THE TEMPORARY SUPPORT ASSEMBLY AND GRIND OFF THE TACK WELDS UNTIL SMOOTH.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Added new note: “2. REFER TO BD-622M AND BD-624M FOR REINFORCEMENT DETAILS.”.</li></ul>
	OLD 35 of 36 NEW 35 of 35	<p>TITLE BLOCK:</p> <ul style="list-style-type: none"><li>Revised “SHEET 35 OF 36” to “SHEET 35 of 35”</li></ul> <p>PLAN TYPE 5:</p> <ul style="list-style-type: none"><li>Left barrier: Removed 10° flare and revised for MASH barrier end transition with curb.</li><li>Revised “1” FLUSH EXPANSION JOINT” to “¾” THICK PREMOLDED EXPANSION JOINT FILLER”.</li><li>Right barrier: Removed 10° flare and revised for MASH barrier end transition without curb.</li><li>Added “&amp; NOTE 5” to OPTIONAL KEYED CONSTRUCTION JOINT (2 locations).</li><li>Revised “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW” to “APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW. FOR APPROACH SLAB ADJACENT TO CONCRETE PAVEMENTS THE MINIMUM SKEW ANGLE IS 60 DEGREES. THE DESIGNER SHALL DETAIL THE APPROACH SLAB GEOMETRY ACCOUNTING FOR A DIFFERENCE BETWEEN THE SKEW ANGLE AT THE BRIDGE (PAVING NOTCH) AND AT THE APPROACH CONCRETE PAVEMENT.”.</li></ul> <p>DETAIL A:</p> <ul style="list-style-type: none"><li>Removed 10° flare and revised for MASH barrier end transition.</li></ul> <p>NOTES:</p> <ul style="list-style-type: none"><li>Note 5: Removed.</li><li>Note 6: Removed.</li><li>Note 7: Revised note “7” to “5”.</li><li>Added new note – “6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12’-0” MINIMUM FOR F-SHAPE CONCRETE BARRIERS.”.</li><li>Added new note – “7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M, BD-667M AND RC-50M.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	OLD 36 of 36	Removed sheet.
BD-660M	1 of 2	<p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Revised to “PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.”.</li><li>Note 2: Revised to “DESIGN TOP LONGITUDINAL STEEL OVER THE PIERS, IN ACCORDANCE WITH LRFD SPECIFICATIONS AND DESIGN SECTION 5.12.3.3.”.</li></ul>
BD-661M	4 of 8	<p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER:</p> <ul style="list-style-type: none"><li>Added “F-SHAPE” to detail title.</li><li>Revised note “TYPICAL BARRIER SHOWN. ALTERNATE BARRIER AND PLANK BEAM IS SIMILAR.” to “45” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 42” F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.”.</li><li>Added 3’-9” dimension.</li></ul> <p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK:</p> <ul style="list-style-type: none"><li>Revised note “TYPICAL BARRIER SHOWN. ALTERNATE BARRIER IS SIMILAR.” to “45” F-SHAPE CONCRETE BARRIER SHOWN, 32” AND 42” F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.⑭.</li><li>Revised 3’-6” to 3’-9”.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Legend ⑨: Added “FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.”.</li><li>Legend ⑬ revised 1’-2” to 1’-4”.</li><li>Added “⑭ IF THE 32” F-SHAPE CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF THE BARRIER AND RAILING MUST BE 3’-6” MINIMUM.”.</li></ul> <p>REINFORCEMENT BAR NOTES:</p> <ul style="list-style-type: none"><li>Note 3: Revised “ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.</li></ul>
	5 of 8	<p>36” &amp; 48” COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK:</p> <ul style="list-style-type: none"><li>Added “WITH 42” VERTICAL WALL CONCRETE BARRIER” to detail title.</li><li>Revised ⑭ to ⑮.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Legend ⑨: Added “FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.”.</li><li>Revised ⑭ to ⑮.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-661M (cont.)	5 of 8 (cont.)	REINFORCEMENT BAR NOTES: <ul style="list-style-type: none"><li>Note 3: Revised “ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.</li></ul>
BD-667M	1 of 9	GENERAL NOTES: <ul style="list-style-type: none"><li>Note 3: Revised “WORKMANSHIP” to “PERFORM WORK”.</li></ul> REFERENCE DRAWINGS: <ul style="list-style-type: none"><li>Added “RC-50M GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS”.</li><li>Added “BD-622M R.C. ABUTMENTS WITH BACKWALL”.</li><li>Added “BD-624M R.C. ABUTMENTS WITHOUT BACKWALL”.</li><li>Removed “BC-739M BRIDGE BARRIER TO GUIDE RAIL TRANSITION”.</li></ul>
	5 of 9	ATTACHED RECTANGULAR WINGWALL ELEVATION: <ul style="list-style-type: none"><li>Revised #6 @ 8” to #8 @ 6”.</li><li>Revised “L ≤ 8’-8” MAX.” to “L*”.</li></ul> ATTACHED TAPERED WINGWALL ELEVATION: <ul style="list-style-type: none"><li>Revised “L ≤ 16’-7” MAX.” to “L ⑰ SEE TABLE 1 FOR MAX. LENGTH AND TABLE 2 FOR MIN. LENGTH”.</li></ul> DETACHED WINGWALL ELEVATION <ul style="list-style-type: none"><li>Added “⑨”.</li></ul> SECTION J-J: <ul style="list-style-type: none"><li>Revised for new MASH barrier end transition.</li><li>Revised “#6 @ 8” MAX.” to “#8 @ 6” MAX.”.</li><li>Revised “L” to “L*”.</li></ul> SECTION L-L: <ul style="list-style-type: none"><li>Revised for new MASH barrier end transition.</li><li>Revised “L” to “L ⑰ SEE TABLE 1 FOR MAX. LENGTH AND TABLE 2 FOR MIN. LENGTH”.</li></ul> SECTION K-K: <ul style="list-style-type: none"><li>Added “MIN.” to 2’-2”.</li><li>Revised “BD-601M” to “BD-622M AND BD-624M”.</li></ul> SECTION N-N: <ul style="list-style-type: none"><li>Added “MIN.” to 2’-2”.</li><li>Revised “BD-601M” to “BD-622M AND BD-624M”.</li></ul> Removed bar detail.  TABLE 1: <ul style="list-style-type: none"><li>Revised lengths in “WINGWALL LENGTH BEYOND THE REAR FACE OF THE ABUTMENT (L)” column.</li><li>Revised reinforcement in “REINFORCEMENT” column.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-667M (cont.)	5 of 9 (cont.)	TABLE 2: <ul style="list-style-type: none"><li>Revised 8’-8” to 9’-0”.</li><li>Added “AND THE MINIMUM BARRIER END TRANSITION LENGTH IN TABLE 3.” to note ***.</li></ul> LEGEND: <ul style="list-style-type: none"><li>Added: “⑰ FOR MINIMUM BARRIER END TRANSITION LENGTH (L) REFER TO TABLE 3.”.</li></ul> Added “NOTE TO DESIGNER: THE BEAM DEPTH AND MAXIMUM WINGWALL LENGTHS ARE BASED ON STRUCTURAL CAPACITY OF THE WING WALL ATTACHMENT TO THE CAP. THEREFORE THE BARRIER END TRANSITION LENGTH INDICATED IN TABLE 3 MAY CONTROL THE MINIMUM BEAM DEPTH.”.  Added “*THE WING LENGTH MUST BE LONG ENOUGH TO INCLUDE THE APPROPRIATE BARRIER END TRANSITION LENGTH FOR THE BRIDGE BARRIER TYPE ON THE STRUCTURE, SEE NOTE ON SHEET 6. SEE TABLE 3.”.  Added “TABLE 3: RECTANGULAR WINGWALL”.
	6 of 9	PARTIAL SECTION THRU DETACHED WINGWALL EXPANSION JOINT: <ul style="list-style-type: none"><li>Added “NOTE: IF THE ATTACHED RECTANGULAR WINGWALL CANNOT ACCOMMODATE THE REQUIRED TRANSITION LENGTH, USE THE ATTACHED TAPERED WINGWALL OR DETACHED WINGWALL.”.</li></ul>
	7 of 9	MINIMUM APPROACH SLAB LENGTH TABLE: <ul style="list-style-type: none"><li>Revised Table title “MINIMUM APPROACH SLAB LENGTH ALONG CL”.</li></ul>
	9 of 9	CONNECTION DETAIL – ADDITIONAL BAY: <ul style="list-style-type: none"><li>Added “▲ MAY BE EXCEEDED UP TO DECK PAN DEPTH PLUS 1”.”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Added Note 5: “FOR “TYPICAL CONNECTION DETAIL” SEE BC-754M.”.</li></ul>
BD-668M	1 of 3	NOTES: <ul style="list-style-type: none"><li>Note 1: Revised “ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.” to “EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).”.</li><li>Note 2: Revised “MATERIAL AND WORK QUALITY” to “PROVIDE MATERIALS AND PERFORM WORK”. Deleted “SUPPLEMENTS THERETO, AND THE CONTRACT SPECIAL PROVISIONS”.</li><li>Note 6: Revise “TYPICAL” to “42” F-SHAPE”.</li><li>Note 13: Deleted.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-668M (cont.)	1 of 3 (cont.)	<p>LEGEND:</p> <ul style="list-style-type: none"><li>Added “**** FOR SHEAR KEY DETAILS, SEE BC-775M.”.</li><li>Added “① WITHIN 10’ ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.”.</li></ul> <p>TYPICAL PRECAST CHANNEL SECTIONS:</p> <ul style="list-style-type: none"><li>Added *** at shear key locations.</li><li>Added ① to barrier bar callout #4 @ 12” MAX. SPA.</li><li>Removed “SHEET 6”.</li><li>Added 2’-11¼” dimension.</li><li>Revised note to “PRECAST CHANNEL BEAM SHOWN SUPPORTING 42” F-SHAPE CONCRETE BARRIER. OTHER F-SHAPE BARRIERS SIMILAR. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE 32’, 42” AND 45” F-SHAPE CONCRETE BARRIERS NOT SHOWN, SEE BD-601M. SEE SHEET 3 FOR PA TYPE 10M BRIDGE BARRIER DETAILS AND VERTICAL WALL CONCRETE BARRIER DETAILS.</li></ul> <p>REFERENCE DRAWING:</p> <ul style="list-style-type: none"><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER” to “VERTICAL WALL CONCRETE BARRIER”.</li><li>Added “BD-622M R.C. ABUTMENTS WITH BACKWALL”.</li><li>Added “BD-624M R.C. ABUTMENTS WITHOUT BACKWALL”.</li></ul>
	2 of 3	<p>NOTES:</p> <ul style="list-style-type: none"><li>Note 1: Deleted “STANDARD DRAWING”.</li></ul> <p>PARTIAL PLAN:</p> <ul style="list-style-type: none"><li>Added “SEAL JOINT BETWEEN THE BOTTOM OF THE BEAMS WITH BACKER ROD OR CCNS WITH DOUBLE SIDED ADHESIVE STRIP PRIOR TO FILLING SHEAR KEYS WITH NON-SHRINK EPOXY GROUT. (SEE BD-775M) to ½” joint.</li><li>Revised void detailing.</li></ul>
	3 of 3	<p>TYPICAL PRECAST CHANNEL SECTION WITH CONCRETE VERTICAL WALL BRIDGE BARRIER:</p> <ul style="list-style-type: none"><li>Revised title to “TYPICAL PRECAST CHANNEL SECTION WITH 42” VERTICAL WALL CONCRETE BARRIER”.</li><li>Revised note to “PRECAST CHANNEL BEAM SHOWN SUPPORTING VERTICAL WALL CONCRETE BARRIER. FOR GEOMETRC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-618M.”.</li><li>Added note “(42” VERTICAL WALL CONCRETE BARRIER SHOWN, 32” VERTICAL WALL CONCRETE BARRIER SIMILAR)”.</li><li>Added note “**** FOR SHEAR KEY DETAILS, SEE BC-775M)”.</li><li>Added note “① WITHIN 10’ ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-668M (cont.)	3 of 3 (cont.)	<ul style="list-style-type: none"><li>Revised 1 ½” CLR. to 2” CLR.</li><li>Added *** at shear key location.</li><li>Added ① to #4 @ 8” MAX.</li><li>Added 0” dimension.</li></ul> <p>TYPICAL PRECAST CHANNEL SECTION WITH PA TYPE 10M BRIDGE BARRIER:</p> <ul style="list-style-type: none"><li>Revised “CURB” to “BARRIER WALL”.</li><li>Revised 11½” to 1’-3½”.</li><li>Revised rear face barrier to be vertical. Deleted ½”.</li><li>Added a second set of anchor bolts and anchor plate.</li><li>Added 4” dimension between anchor bolts.</li><li>Revised “1’-1” CONCRETE CURB” to “1’-5” BARRIER WALL”.</li><li>Added *** at shear key location.</li><li>Added note “* VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.”.</li><li>Added note “**** FOR SHEAR KEY DETAILS, SEE BC-775M)”.</li></ul> <p>VERTICAL BARRIER BAR DETAIL:</p> <ul style="list-style-type: none"><li>Revised top of bar to be level.</li><li>Revised 2’-7” to 2’-5”.</li><li>Revise 4” to 3”.</li><li>Revised 1’-8½” to 1’-4”.</li></ul> <p>PA TYPE 10M BARRIER BAR DETAIL:</p> <ul style="list-style-type: none"><li>Revised top of bar to be level.</li><li>Revised 2’-0” to 2’-4”.</li><li>Revised 11” to 1’-3”.</li></ul> <p>Deleted REFERENCE DRAWINGS</p>
	1 of 11	<p>MOMENT SLAB:</p> <ul style="list-style-type: none"><li>Removed “MIN”.</li></ul> <p>REFERENCE DRAWING:</p> <ul style="list-style-type: none"><li>Revised “CONCRETE VERTICAL WALL BRIDGE BARRIER” to “VERTICAL WALL CONCRETE BARRIER”.</li></ul>
	2 of 11	<p>NOTES TO DESIGNER:</p> <ul style="list-style-type: none"><li>Note 11: Revised “PROVIDED” to “SPECIFIED”.</li></ul> <p>DESIGN PARAMETERS:</p> <ul style="list-style-type: none"><li>Note 1: Revised “NOTE 28” to “NOTE 25”.</li></ul>
BD-679M	4 of 11	<p>TYPICAL C.I.P. MOMENT SLAB AND BARRIER SECTION:</p> <ul style="list-style-type: none"><li>Added ▲ to 3’-6” barrier height dimension.</li></ul> <p>LEGEND:</p> <ul style="list-style-type: none"><li>Added: “▲ 45” F-SHAPE CONCRETE BARRIER NOT PERMITTED ON MOMENT SLAB.”.</li></ul>

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-679M (cont.)	4 of 11 (cont.)	MOMENT SLAB NOTES: <ul style="list-style-type: none"><li>Note 3: Added “BD-627M AND”.</li></ul>
	5 of 11	DETAIL D (WITHOUT CABLE CONNECTION): <ul style="list-style-type: none"><li>Removed symbol from WELDED WIRE FABRIC (WWF).</li></ul>
	7 of 11	SECTION: <ul style="list-style-type: none"><li>Removed 3’-7” dimension.</li><li>Revised NOTE to “45” F-SHAPE CONCRETE BARRIER SHOWN, 42” F-SHAPE CONCRETE BARRIER AND 42” VERTICAL WALL CONCRETE BARRIER SIMILAR.”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Added new note – “3. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.”.</li></ul> Added “VERTICAL V-NOTCH DETAIL”.
	8 of 11	SECTION: <ul style="list-style-type: none"><li>Removed 3’-7” dimension.</li><li>Revised NOTE to “45” F-SHAPE CONCRETE BARRIER SHOWN, 42” F-SHAPE CONCRETE BARRIER AND 42” VERTICAL WALL CONCRETE BARRIER SIMILAR. 45” F-SHAPE CONCRETE BARRIER NOT PERMITTED FOR SOUND BARRIERS ON MOMENT SLAB.”.</li></ul> NOTES: <ul style="list-style-type: none"><li>Added new note – “3. PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS, SEE DETAIL SHEET 7.”.</li></ul>
	10 of 11	PLAN – STRUCTURE MOUNTED SOUND BARRIER TO GROUND MOUNTED SOUND BARRIER: <ul style="list-style-type: none"><li>Revised detail to remove flare from end of barrier.</li><li>Revised “BEND POINT OR END OF WALL” to “END OF WALL OR BEGINNING OF BARRIER TRANSITION”.</li><li>Revised note to “(BARRIER/RETAINING WALL WITH BARRIER TRANSITION)”.</li></ul>



OS-299 (7-08)



TRANSMITTAL LETTER

**PUBLICATION:**  
  
Publication 218M  
September 2016 Edition  
Change No. 2

**DATE:**  
  
August 30, 2019

**SUBJECT:**  
  
**Revisions to  
Standards for Bridge Design  
September 2016 Edition**

**INFORMATION AND SPECIAL INSTRUCTIONS:**

Incorporate the attached revisions into the September 2016 Edition of Publication 218M.

These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules. All projects with T.S.&L. submissions after November 1, 2019 shall incorporate these new standards.

A description of the changes made to the 2016 Edition since Change 1 of August 4, 2017 are listed in the attached multi-sheet Table. On the standards, light green highlighting indicates Change 2 revisions to details and notes; light yellow highlighting indicates Change 1 revisions.


**CANCEL AND DESTROY THE FOLLOWING:**

Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.

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**APPROVED FOR ISSUANCE BY:**

LESLIE S. RICHARDS  
Secretary of Transportation

BY:   
Melissa J. Batula, P.E.  
Acting Director, Bureau of Project Delivery,  
Highway Administration

Standard	Sheet	Description of Changes
General		Revised terminology for gender-neutrality throughout the standards (e.g. replaced WORKMANSHIP with WORK QUALITY).
BD-601M	1 of 11	NOTES, Note 4, Clear Distance: revised min. clear distance between reinforcement mats to be two lines that specify a 2" min. vertical clear distance between longitudinal bars in top and bottom mats and between transverse bars in top and bottom mats.
		NOTES, Note 4, Bar Spacing: consolidated maximum bar spacing for slabs and for barriers into one line.
		NOTES, Note 4, Bar Spacing: added TRANSVERSE REINFORCEMENT to MINIMUM SPACING.
		NOTES, Note 13: updated to 8th Edition AASHTO Article Number from 5.14.1.4 to 5.12.3.3 and DM-4 Section D5.14.1.1.4 to D5.12.3.3.
		NOTES, Note 16: in second line removed 32" from before ALTERNATE SIDEWALK. Added ALTERNATE BARRIER IS DESIGNED TO RESIST VEHICULAR COLLISION AT TEST LEVEL 3 to end of note.
		NOTES: deleted Note 23 and re-numbered subsequent notes; updated references to the re-numbered notes throughout the standard.
		NOTES: added Note 29 to require mechanical grinding of bridge decks without overlays on interstate, limited access and NHS routes; this requires an extra 1/4" of initial deck slab thickness and top cover; added references to this note in the typical slab panel details.
		NOTES: added Note 30 regarding eliminating the 1/2 " integral wearing surface from concrete deck slab when an epoxy, latex modified concrete (LMC) or polyester polymer concrete (PPC) overlay is used; added references to this note in the typical slab panel details.
		LEGEND, Item 3: updated referenced DM-4 article from D5.14.1.14 to D5.12.3.3.
		LEGEND, Item 5: updated lap splice lengths from 2'-7" to 2'-10" and from 3'-1" to 3'-10" for #5 and #6 bars in normal weight concrete, and from 4'-1" to 4'-6" for #6 bars in lightweight concrete.
	3 of 11	LEGEND, Item 7: updated lap splice lengths from 2'-7" to 2'-10" and from 3'-1" to 3'-10" for #5 and #6 bars in normal weight concrete, and from 4'-1" to 4'-6" for #6 bars in lightweight concrete.
	4 of 11	LEGEND, Item 5: updated lap splice lengths from 2'-7" to 2'-10" and from 3'-1" to 3'-10" for #5 and #6 bars in normal weight concrete, and from 4'-1" to 4'-6" for #6 bars in lightweight concrete.
	6 of 11	In three reinforcement bar details, revised length of horizontal leg (development length) from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
	7 of 11	In four reinforcement bar details, revised length of horizontal leg (development length) from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
	8 of 11	HAUNCH REINFORCEMENT DETAILS: removed LAP from 1'-0" rebar leg dimension (2 places).
BD-604M	1 of 4	Deleted ALTERNATE CONTINUITY REINFORCEMENT DETAIL.
		TABLE 4: for S = 8'-6"; revised T from 8 1/2" to 8", S2 size to #5 and So to 4'-10", for S = 12'-9"; revised S1 to be #5 @5 1/2 and S3 to be #5 @6, and for S = 13'-9"; revised S1 to be #5 @5 1/2 and S3 to be #5 @6. <i>[e-Notification No. 68]</i>
		NOTES: added Note 17 to state that barriers as shown are not MASH compliant and should not be used and re-numbered subsequent notes; updated references to the re-numbered notes.
		NOTES: added Note 18 stating that Sheet 4 shall be used for preliminary design only and re-numbered subsequent notes; updated references to the re-numbered notes.
	2 of 4	BARRIER NOTES, Note 24 (formerly 22): revised reference from BC-739M to RC-50M.
		REFERENCE DRAWINGS: Added BD-601M, BC-751M, BC-767M, BC-788M and RC-50M to list.
		DETAIL A: added SEE EXTRUSION NOTE call-out and Extrusion Note beneath Detail A. <i>[e-Notification No. 60]</i>
	3 of 4	BARRIER REINFORCEMENT: revised horizontal leg length from 1'-2" to 1'-10" for NORMAL WEIGHT CONCRETE and from 1'-5" to 2'-2" for LIGHTWEIGHT CONCRETE.
	4 of 4	TABLE 1: removed table entry for 3" Bearing Bar. <i>[e-Notification No. 60]</i>
		NOTES, DECK OVERLAYS, Note 3: revised terminology from BITUMINOUS OVERLAYS to ASPHALT PAVEMENT OVERLAYS.
BD-605M	1 of 6	DRAWING NOTES, Note 3: added CONTRACTOR MUST PERFORM FINAL DESIGN OF POST-TENSIONING SYSTEM. POST-TENSIONING CALCULATION MUST ACCOUNT FOR PROPOSED HARDWARE AND ARE TO to beginning of note.

Standard	Sheet	Description of Changes
BD-605M (cont.)	1 of 6 (cont.)	DRAWING NOTES, Note 4: added CONTRACTOR TO DESIGN LIFTING DEVICES AND CALCULATIONS MUST to the beginning of the note.
		DRAWING NOTES, Note 5: added BLAST CLEAN INSIDE FACE OF SHEAR BLOCKOUTS AND SHEAR KEYS TO CREATE to the beginning of the note.
		DRAWING NOTES: added Note 6: BLAST CLEAN TRANSVERSE AND LONGITUDINAL JOINTS OF PRECAST PANELS TO CREATE AN EXPOSED AGGREGATE FINISH.
		DRAWING NOTES: added Note 7: ASSESS THE STABILITY OF EXTERNAL PRECAST DECK PANELS DUE TO ASYMMETRICAL AND/OR ECCENTRIC LOADING. MAINTAIN STABILITY OF PRECAST DECK PANELS DURING LIFTING, TRANSPORTATION AND ERECTION OF THE PANELS UNTIL CLOSURE POURS AND POST-TENSIONING OPERATIONS ARE COMPLETE.
		SEQUENCE OF CONSTRUCTION Notes: added PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION. to second line of Note 6 and to first line of Note 12.
	2 of 6	SECTION A-A: added TINE FINISH OF PRECAST DECK PANELS call-out to top of deck.
	4 of 6	SHEAR CONNECTOR BLOCKOUT DETAIL: added call-out to sides of block-out to reference Drawing Note 5 on Sheet 1.
	5 of 6	SECTION B-B, SECTION D-D and LONGIT. CLOSURE POUR BETWEEN BEAMS/GIRDERS: added call-out to sides of joint/closure pour to reference Drawing Note 6 on Sheet 1.
	6 of 6	VERTICAL ADJUSTMENT DEVICE: modified FORMED POCKET object lines and revised call-out from 2 1/2" MIN. FORMED POCKET to SEE FORMED POCKET DETAIL.
		Added FORMED POCKET DETAIL.
BD-610M	1 of 17	VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHTWEIGHT CONCRETE.
		SECTION A-A: revised two anchor bars to an ANCHOR PLATE and revised size call-out to be 1/4" x 11 1/2" x 1'-3"
		NOTES: removed Note 9 and renumbered subsequent notes.
	3 of 17	SECTIONS C-C, D-D, G-G and Legend No. 2: revised rebar vertical lap splice from 2'-1" MIN. to 2'-2" MIN.
	6 of 17	SECTION F-F: revised anchor bars to be an anchor plate.
		SECTIONS E-E & F-F and Legend No. 3: revised rebar lap length from 2'-1" MIN. to 2'-2" MIN.
	10 of 17	SECTION K-K: revised anchor bars to be an anchor plate.
		SECTIONS J-J & K-K and Legend No. 2: revised rebar lap length from 2'-1" MIN. to 2'-2" MIN.
	11 of 17	PLAN & ELEVATION VIEWS (4 views): revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
		SECTIONS N-N & P-P: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
	12 of 17	SIDEWALK DETAILS (3 details): revised anchor bars to be an anchor plate.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHTWEIGHT CONCRETE.
	13 of 17	In two box beam details: revised anchor bars to be an anchor plate.
		ADJACENT BOX BEAMS SUPPORTING BARRIER detail: rebar vertical embedment in box beam revised from 1'-0" MIN. to 1'- 4" MIN. **.
		VERTICAL REINFORCEMENT (2 details): revised vertical rebar leg embedment length from 1'-0" to 1'-4" MIN. **, revised horizontal leg length from 1'-0" to 1'-4" (2 places), and added the following note: ** OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
	14 of 17	ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: revised anchor bars to be an anchor plate.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHTWEIGHT CONCRETE.
	15 of 17	In two R.C. Culvert details: revised anchor bars to be an anchor plate.
		VERTICAL REINFORCEMENTS: revised horizontal leg length from 1'-0" to 1'-10" NORMAL WEIGHT CONCRETE / 2'-2" LIGHTWEIGHT CONCRETE.
	16 of 17	SECTIONS J-J & L-L: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
		LONGITUDINAL REINF.: revised rebar leg lengths from 2'-1" to 2'-8" and 3'-10 1/4" to 4'-5 1/4".

Standard	Sheet	Description of Changes
BD-610M (cont.)	16 of 17 (cont.)	SECTIONS K-K & N-N: revised rebar splice length from 2'-1" to 2'-2" and moved leader line from gutter line to start of lap. VERTICAL CURB REINFORCEMENT: revised rebar leg lengths from 3'-8 3/4" to 3'-11 1/2" and 2'-2" to 2'-4".
	17 of 17	SECTION R-R: revived anchor bars to a single anchor plate for anchorage of post in barrier wall.
BD-611M	2 of 3	DIAPHRAGM AT ABUTMENT WITH BACKWALL: revised rebar lap splice from 1'-3" to 1'-11" due to adoption of 8th Edition AASHTO Spec.
BD-612M	1 of 3	WATER OR GAS LINE SUPPORT DETAIL: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	2 of 3	PIPELINE UTILITY - FULL DEPTH DIAPHRAGM: added GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED to Threaded Insert call-out.
	3 of 3	END & PIER DIAPHRAGM details: added GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED to Threaded Insert call-out.
BD-615M	2 of 3	VERTICAL REINFORCEMENT: revised horizontal rebar leg length from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
BD-617M	1 of 16	SECTION A-A: removed erroneous 19 before 3/4" in threaded anchor studs call-out. VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete; moved horizontal leg's dimension line to start of straight segment.
	3 of 16	SECTIONS C-C, D-D & F-F: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
	6 of 16	SECTIONS E-E and H-H: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
	7 of 16	NOTES, Note 1: added IF SAFETY WINGS ARE NOT PRESENT, to beginning of line 1.
	10 of 16	SECTIONS N-N & P-P: added bar in top of barrier parapet <i>[e-Notification No. 64]</i> . PLAN VIEW, ELEVATION VIEW, SECTIONS N-N & P-P: revised rebar lap splice from 2'-1" to 2'-2".
	12 of 16	VERTICAL REINFORCEMENT (2 details): revised rebar leg embedment length from 12" MIN. to 1'-4" MIN. **, and revised horizontal leg length from 12" to 1'-4" (2 places), and added the following note: ** OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
	13 of 16	VERTICAL REINFORCEMENT: moved horizontal leg's dimension line to start of straight segment. VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
	14 of 16	VERTICAL REINFORCEMENT - C.I.P. CULVERT: revised horizontal leg length from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete; moved horizontal leg's dimension line to start of straight segment.
	15 of 16	SECTIONS K-K and N-N: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN. Removed OF 35 from two references to BD-628M.
	1 of 12	NOTES: removed Note 8.
		VERTICAL REINFORCEMENT: revised horizontal leg length from 1'-0" to 1'-6" for normal weight concrete and from 1'-3" to 1'-9" for light weight concrete.
	2 of 12	SECTIONS A-A & B-B: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.
BD-618M	5 of 12	SECTION F-F: added 1'-8 1/4" dimension for thickness at top of wall stem. SECTION F-F: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN. SECTION E-E: added Construction Joint lines in stem at 6' barrier termination and a horizontal joint 3' below barrier.
	6 of 12	TITLE BLOCK: removed WITHOUT BACKWALL from second line of title. TYPICAL PLAN: added following note below title: (FLARED SAFETY WING IS NOT REQUIRED. VERTICAL WALL BRIDGE BARRIER MUST TERMINATE ON BRIDGE DECK.)
	9 of 12	LEGEND, Item 2: revised lap splice lengths from 2'-7" to 3'-7" and from 3'-1" to 4'-4" for #5 and #6 bars in normal weight concrete, and from 3'-5" to 4'-9" and from 4'-1" to 5'-9" for #5 and #6 bars in light weight concrete. VERTICAL WALL BRIDGE BARRIER ON U-WING: revised rebar splice length from 2'-1" MIN. to 2'-2" MIN.

Standard	Sheet	Description of Changes
BD-618M (cont.)	11 of 12	AT TYPICAL BARRIER: decreased deck overhang limit from 8" to 4". VERTICAL REINFORCEMENT (2 details): revised vertical rebar leg embedment length from 12" MIN. to 1'-4" MIN. **, and revised horizontal leg length from 12" to 1'-4" (2 places), and added the following note: ** OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
	1 of 5	NOTE 2. REFERENCES: updated references. NOTE 3. DETAILING REQUIREMENTS: added CURVED in heading of table. Recommended fit conditions for Horizontal Curve I-Girder Bridges: changes (L/R)max from > 0.1 to ≥ 0.2. NOTE 3. DETAILING REQUIREMENTS, item 1 under tables: rewrote the discussion of the applicability of the SDLF condition. NOTE 4. USAGE AND ORIENTATION OF DIAPHRAGMS, item b): added SKEW before ANGLES in the last sentence for clarity (2 instances). NOTE 4. USAGE AND ORIENTATION OF DIAPHRAGMS, item k): added BEND before RADII in last line for clarity.
BD-619M	2 of 5	NOTE 6. SELECTION OF DIAPHRAGM MEMBERS, first paragraph: added AND SIZES to DIFFERENT TYPES OF MEMBERS USED for clarity. NOTE 6. SELECTION OF DIAPHRAGM MEMBERS, fifth bullet: added REFER TO PUB. 408 SECTION 1105.03(t) FOR MINIMUM BEND RADII. NOTE 9. DETERMINATION OF DESIGN LOADS, item a), sixth bullet: modified WS Load factor to 1.00 (3 instances). NOTE 9. DETERMINATION OF DESIGN LOADS, item a), sixth through tenth bullet: added LOAD COMBINATIONS for clarity (7 instances). NOTE 9. DETERMINATION OF DESIGN LOADS: added following bullet item: • IN THE ABOVE-LISTED LOAD COMBINATIONS, USE THE APPROPRIATE WIND VELOCITY FOR THE GIVEN LOAD COMBINATION.
	3 of 5	NOTE 10, item a), second bullet: revised fatigue category from E to E'. NOTE 10, item a), second bullet and item d), third bullet: added LOAD COMBINATION for clarity. NOTE 10, item d), first bullet: corrected spelling of CENTROID. NOTE 10, item d), fourth bullet: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325. (4 instances). NOTE 10, item d), fifth bullet: added USE CLASS C SLIP RESISTANCE FOR GALVANIZED BOLTS . . . Note 11c and 11d: revised WIND FORCE EFFECTS to GLOBAL (SYSTEM) DEAD, LIVE, AND WIND LOAD. NOTE 14, item d): updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	5 of 5	NOTE: added REFER TO AASHTO LRFD SECTION C6.7.4.2 FOR ADDITIONAL DISCUSSION REGARDING EFFICIENT FRAMING ARRANGEMENTS. to end of note. CONTIGUOUS CROSS-FRAME . . . , and SEVERELY SKEWED SUPPORTS . . . : replaced 1.5 D with 4 bf in the limits of O and added definition of bf.
	1 of 6	MINIMUM DESIGN WIND PRESSURE (PSF) FOR LATERAL BRACING DURING CONSTRUCTION: added CW and AND PRESSURE DISTRIBUTION TO GIRDERS to the title; added the wind pressure distribution to each girder in the schematic.
	3 of 6	NOTES, Note 3: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	5 of 6	NOTES, Note 3: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	1 of 3	PILE ANCHORAGE DETAILS: added note below detail title listing three conditions for which the shown anchorage is required. <i>[e-Notification No. 67]</i> NOTES, Note 9: corrected referenced sheet number for weep hole details. REFERENCE DRAWINGS: removed BD-625M R.C. ABUT. MISCELLANEOUS DETAILS from list.
	2 of 3	TYPICAL SECTION WITHOUT BACKWALL . . . – STEM HEIGHT LESS THAN 12'-0": Added SEE NOTE 13 call-out that was inadvertently deleted in initial 2016 edition.
	1 of 5	ABUTMENT SECTION, Bearing Seat Slope: replaced 1V :10H with 1" / FT.
	2 of 5	SECTION D-D, SECTION E-E & ALT. BARRIER REINFORCEMENT SECTION: revised #4 rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from the optional construction joint to the end of the lap.
BD-620M	1 of 6	MINIMUM DESIGN WIND PRESSURE (PSF) FOR LATERAL BRACING DURING CONSTRUCTION: added CW and AND PRESSURE DISTRIBUTION TO GIRDERS to the title; added the wind pressure distribution to each girder in the schematic.
	3 of 6	NOTES, Note 3: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	5 of 6	NOTES, Note 3: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
BD-621M	1 of 3	PILE ANCHORAGE DETAILS: added note below detail title listing three conditions for which the shown anchorage is required. <i>[e-Notification No. 67]</i> NOTES, Note 9: corrected referenced sheet number for weep hole details. REFERENCE DRAWINGS: removed BD-625M R.C. ABUT. MISCELLANEOUS DETAILS from list.
	2 of 3	TYPICAL SECTION WITHOUT BACKWALL . . . – STEM HEIGHT LESS THAN 12'-0": Added SEE NOTE 13 call-out that was inadvertently deleted in initial 2016 edition.
BD-622M	1 of 5	ABUTMENT SECTION, Bearing Seat Slope: replaced 1V :10H with 1" / FT.
	2 of 5	SECTION D-D, SECTION E-E & ALT. BARRIER REINFORCEMENT SECTION: revised #4 rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from the optional construction joint to the end of the lap.

Standard	Sheet	Description of Changes
BD-622M (cont.)	2 of 5 (cont.)	SECTION C-C and ALTERNATE SECTION C-C: added call-out for the class of cement concrete to be used in the flared safety wings above and below the optional horizontal construction joint.
	3 of 5	SECTION F-F (with or without curb block): revised #4 hairpin rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from optional construction joint to the end of the lap. PLAN VIEW (2 places): revised #5 rebar lap length form 2'-6" to 2'-7".
	4 of 5	SECTION K-K: revised #4 rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from the construction joint to the end of the lap.
BD-624M	1 of 5	GENERAL NOTES: deleted Note 1 and re-numbered subsequent notes.
	2 of 5	SECTION C-C and ALTERNATE SECTION C-C: added call-out for the class of cement concrete to be used in the flared safety wings above and below the optional horizontal construction joint. SECTIONS D-D & E-E and ALT. BARRIER REINF. SECTION: revised #4 hairpin rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from the optional construction joint to the end of the lap.
	3 of 5	SECTION F-F (with and without curb block): revised #4 hairpin rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from the construction joint to the end of the lap.
	4 of 5	SECTION K-K: revised #4 rebar to #5 rebar lap length from 2'-1" to 2'-2" and moved leader line from the construction joint to the end of the lap.
BD-626M	1 of 9	GENERAL ANCHOR WALL DESIGN METHODOLOGY, Note 7: added "WITH THE EXCEPTION OF SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN ALTERNATE," to first sentence, and added DEFLECTION TOWARDS THE BACKFILL FOR SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN DESIGNS SHALL BE PREVENTED IN ORDER TO AVOID OR REDUCE CRACKING ON EXPOSED FACE at end of note. NOTES TO DESIGNER: added Note 23: DESIGN CONCRETE AND REINFORCEMENT FOR A TEST LOAD OF 125% TO 150% OF UNFACTORED LOAD PER AASHTO ARTICLE 11.9.8.1 IN ADDITION TO THE STRENGTH CONDITION. FOR SINGLE PILE W/C.I.P. WALL AND COLUMN ALTERNATE, DESIGNER MUST...AND SPECIAL PROVISIONS.
	3 of 9	DOUBLE PILE DESIGN W/PRECAST LAGGING – WALL ELEVATION: corrected line-type for steel pile centerlines.
	5 of 9	SECTION G-G: modified soldier pile note " . . . Sheet 3 for CONFIGURATIONS and weld details)".
	7 of 9	SECTION J-J: Front face reinforcement mat modified. Added FF WALL callout. EMBEDDED ANCHORAGE DETAIL: rebar Details callout modified and added CIRCULAR BLOCKOUT callout.
	9 of 9	GUIDERAIL AT TOP OF WALL and BARRIER DETAIL 4: Replaced TYPE 1 with TYPE A in foundation drain's geotextile callout. Added DETAIL X – EXTRA WALL REINFORCEMENT AT TENDON ANCHORAGE
BD-627M	1 of 8	REFERENCE DRAWINGS: added RC-21M, RC-27M and BC-799M. CONTRACT DRAWING NOTES, Note 2: deleted fourth sentence with reference to BC-799M. INSTRUCTIONS TO DESIGNER: removed item 3 and renumbered subsequent items. INSTRUCTIONS TO DESIGNER: added item 9 regarding crash test level.
	2 of 8	MOMENT SLAB (BURIED): revised #6 rebar horizontal leg length from 2'-3" MIN. to 2'-4". Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in both Moment Slab details. MOMENT SLAB (AT-GRADE): removed MIN. from dimension of #4 rebar horizontal leg length.
	3 of 8	Revised terminology in detail title from REINFORCEMENT FOR BARRIER WITH <u>BITUMINOUS CONCRETE</u> SHOULDER to REINFORCEMENT FOR BARRIER WITH <u>ASPHALT-PAVED</u> SHOULDER. REINFORCEMENT FOR BARRIER WITH <del>BITUMINOUS CONCRETE</del> ASPHALT-PAVED SHOULDER: revised #6 rebar leg length from 2'-0" to 2'-4". Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in both Moment Slab details.

Standard	Sheet	Description of Changes
BD-627M (cont.)	4 of 8	Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in the MOMENT SLAB WITH ASPHALT OVERLAY detail. MOMENT SLAB WITH ASPHALT OVERLAY . . . : removed MIN. from dimension of #4 rebar horizontal leg length.
	5 of 8	MOMENT SLAB (BURIED): revised #6 rebar horizontal leg length from 2'-3" MIN. to 2'-4". MOMENT SLAB (BURIED): revised #6 vertical lap length from 2'-6" MIN. to 3'-1" MIN. MOMENT SLAB (AT-GRADE): removed MIN. from dimension of #4 rebar horizontal leg length. MOMENT SLAB (AT-GRADE): revised #6 vertical lap length from 2'-6" MIN. to 3'-1" MIN. Added note ■ AT DISCRETION OF THE DISTRICT BRIDGE ENGINEER, MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0" FOR REHABILITATION PROJECTS, SEE SHEET 7 which is referenced from the Barrier Moment Slab Width dimension in both Moment Slab details.
	6 of 8	PLAN – BARRIER MOMENT SLAB (Precast & C.I.P. Barrier): updated Tie Bar/Tie Bolt reference from RC-20M to RC-27M (4 instances). PLAN – BARRIER MOMENT SLAB (Precast & C.I.P. Barrier): revised Moment Slab Length dimension from (VARIES) 30'-0" MIN., 40'-0" MAX. to a fixed L = 30'-0" and revised the maximum number of pavements joints between moment slab joints from ONE to TWO.
	7 of 8	Added FOR REHABILITATION PROJECTS to sheet title in Title Block. BARRIER TO GUIDE RAIL TRANSITION, PLAN and MOMENT SLAB ADJACENT TO BRIDGE: added moment slab width dimension call-out: MOMENT SLAB WIDTH, W, SEE TABLE ON THIS SHEET FOR MINIMUM. TO MATCH PAVEMENT SHOULDER WIDTH. BARRIER TO GUIDE RAIL TRANSITION, PLAN and MOMENT SLAB ADJACENT TO BRIDGE: added moment slab length dimension call-out: MOMENT SLAB LENGTH, L, SEE TABLE ON THIS SHEET. Added table MINIMUM MOMENT SLAB DIMENSIONS FOR REHABILITATION PROJECTS.
BD-628M	1 of 36	INDEX OF SHEETS: added new Sheet 36 - TYPE 5 DETAILS.
	2 of 36	INSTRUCTIONS TO DESIGNER NOTES, Note 9, fourth bullet: revised terminology from BITUMINOUS PAPER ITEMS to ASPHALT-SATURATED PAPER ITEMS.
	3 of 36	SECTION A-A (Types 1 & 2): revised rebar lap splice length from 2'-9" to 3'-4".
	5 of 36	PLAN 2 – TYPE 1 AND TYPE 2: added OR CONTRACTION JOINT to joint call-outs and added references to Details B and D and Note 7. DETAIL B – CONSTRUCTION JOINT: revisions to match latest RC-23M include: combined two details with and without asphalt overlay into one detail that does not show the overlay, modified detail title, made top reinforcement discontinuous, dimensioned the joint key; etc. Revised NOTE A to NOTE B; revised note to match latest RC-23M. Added DETAIL D – CONTRACTION JOINT and NOTE D: detail and note match latest RC-23M. JOINT SEALING DETAIL: revisions to match latest RC-23M include: modified depth and width, added backer rod, referenced Note 8, etc. NOTES: added Note 7 regarding construction and contraction joint requirements and Note 8 with referenced specifications for joint material.
	8 of 36	SECTION E-E's four locations of Optional Keyed Construction Joints called-outs.: added AND NOTE 7 ON after SEE DETAIL B. Added OR CONTRACTION JOINT (SEE DETAIL D AND NOTE 7 ON SHEET 5). SECTION E-E (Types 1 & 2): #5 rebar splice length revised from 2'-9" to 3'-4". DETAIL D: replaced CLOSED CELL NEOPRENE SPONGE to PREFORMED CELLULAR POLYSTYRENE.
	19 of 36	SECTION J-J: rebar splice length revised from 2'-9" to 3'-1".
	20 of 36	DETAIL K: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	21 of 36	DETAIL R: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	24 of 36	TYPE 3 APPROACH SLAB: removed #6 bar from inside 180 hook of #6 from approach slab.
	26 of 36	SECTION O-O: rebar splice length revised from 2'-9" to 3'-4".

Standard	Sheet	Description of Changes
BD-628M (cont.)	29 of 36	Replaced bar marks with bar size (e.g. EA4 BARS replaced with #4) throughout and added a note that bars below the beam seat do not need to be epoxy-coated.
		PEDESTAL REINFORCEMENT ELEVATION: vertical rebar lap length at bottom of stem revised from 1'-3" to 2'-2"; vertical rebar lap length at keyed construction joint revised from 1'-9" to 2'-2".
	30 of 36	Replaced bar marks with bar size (e.g. ES6 BARS replaced with #6) throughout.
	31 of 36	DRAIN TROUGH REINFORCEMENT DETAIL: replaced bar marks with bar size (e.g. EA5 BARS replaced with #5).
	32 of 36	SECTION W-W: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
	33 of 36	SECTION R-R: revised CLOSED CELL NEOPRENE SPONGE to PREFORMED CELLULAR POLYSTYRENE.
	34 of 36	SECION Q-Q and SECTION A-A: replaced bar marks with bar size (e.g. EC4 BARS replaced with #4) throughout and added a note that bars below the beam seat do not need to be epoxy-coated.
		SECTION A-A: vertical rebar lap splice length revised from 2'-1" to 2'-2".
	35 of 36	DETAIL A: added SECTION R-R arrows.
		NOTES: added Note 8 - FOR SECTIONS R-R & W-W, SEE SHEET 36.
		SECTION X-X: revised rebar splice length from 2'-9" to 3'-1".
		PLAN - TYPE 5: added reinforced slab extension at barrier flare with new SECTION W-W call-out.
	36 of 36	DETAIL P: updated bolt designation from ASTM A325 to ASTM F3125 GRADE A325.
		Added a new sheet with new Sections W-W and R-R which are cut from the PLAN view on the previous sheet.
BD-629M	4 of 15	Revised splice length of circular ties from 1'-6" to 1'-10" in six details.
	7 of 15	SECTIONS A-A & C-C and OPTIONAL END TREATMENTS: revised rebar lap length from 18" to 1'-10" LAP.
	8 of 15	SECTIONS A-A & C-C and OPTIONAL END TREATMENTS: revised rebar lap length from 18" to 1'-10" LAP.
	10 of 15	SECTIONS A-A & C-C: revised splice length of circular ties from 1'-6" to 1'-10".
	12 of 15	SECTIONS A-A, B-B & C-C: revised splice length of circular ties from 1'-6" to 1'-10".
BD-631M	2 of 2	TYPICAL HEADWALL ELEVATION: revised lap length from 4'-1" to 4'-3".
BD-632M	1 of 15	NOTES, No. 11: corrected preformed drain limit from 2' MINIMUM THICK to 2' MINIMUM HIGH.
		NOTES: added Note 19 regarding additional excavation for bedding material (moved here from Sht. 4, Note 19) and added instruction for leveling bearing areas; renumbered subsequent notes.
		NOTES: added Note 21 regarding encasement of stone bedding materials.
		TYPICAL BOX SECTION: Added bedding material beneath box culvert
		SECTION ALONG C.L. CULVERT: deleted unused leader and dimension lines for culvert length; added note to call-out for and dimension of compacted or flowable backfill at inlet to clarify that this backfill is only along exterior face of end sections and wingwalls.
	3 of 15	SECTION B-B: revised vertical rebar lap splice length from 2'-1" to 2'-2" and moved leader line from the optional construction joint to the start of the lap; added call-out for optional construction joint.
	4 of 15	Updated references to notes on this sheet and Sheet 1 that were renumbered (5 instances).
		BOX DETAILS - WELDED WIRE FABRIC: chamfer size revised from 3/4"x3/4" to 3/4"x3/4" MIN. / 1"X1" MAX
		Added Note beneath DESIGN DATA box: REFER TO SHEET 14 FOR END SECTION SKEW ORIENTATION REQUIREMENTS.
		BOX DETAILS - WELDED WIRE FABRIC: added 2'-0" MIN. BEDDING IF ROCK IS ENCOUNTERED to bedding thickness dimension.
		NOTES, Note 15: revised terminology from BITUMINOUS OVERLAY to ASPHALT PAVEMENT OVERLAY.
		NOTES: moved Note 19 to Sheet 1 as Note 19; renumbered subsequent notes.
		NOTES: added Note 28 regarding acceptability of skewed segments for phased construction.
		NOTES: added Note 29 regarding encasement of stone bedding materials.

Standard	Sheet	Description of Changes
BD-632M (cont.)	4 of 15 (cont.)	DESIGN DATA, INSTRUCTIONS: replaced Minimum Wall and Slab Thickness bullet points with Table.
	5 of 15	PRECAST CULVERT WITH PRECAST END SECTION: revised terminology from BITUMINOUS BOND BREAKER to ASPHALT-SATURATED BOND BREAKER, removed 1'-0"...MIN. from BEDDING call-out, and updated number of referenced notes (2 instances).
		PRECAST WINGWALL CONNECTION DETAILS: switched location of SHIP LAP JOINT and KEYED JOINT details.
		PRECAST WINGWALL CONNECTION DETAILS - KEYED JOINT and SHIP LAP JOINT: replaced D (depth of key or ship lap) with 3" and added PUB 408 SECTION 1085.2(m) to Joint Sealing Material's call-out.
		PRECAST WINGWALL CONNECTION DETAILS - SHIP LAP JOINT: revised ship lap dimension from 1/2" TO 1" to 1/2" MIN. TO 1 1/2" MAX. and added 5" MIN. FOR T ≥ 15" to 3" MIN. FOR T < 15"
	6 of 15	PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS – PROFILE: Revised terminology from BITUMINOUS BOND BREAKER to ASPHALT-SATURATED BOND BREAKER, removed 1'-0"...MIN. from BEDDING call-out, and updated number of referenced note in THREADED INSERTS call-out.
		ALTERNATE CUTOFF WALL WITH GROUTED ROCK – DETAIL A (WITHOUT APRON): removed 1'-0"...MIN. from BEDDING call-out.
	7 of 15	Switched location of GENERAL NOTES and POST-TENSIONING NOTES.
		POST-TENSIONING NOTES: moved notes 7 and 8 to General Notes; inserted three new notes regarding full contact of joint sealing material, increasing number and adjusting location of strands, and reference for additional notes.
		POST-TENSION END SECTION (2 places): updated number of referenced note in WEEP HOLE call-out.
	9 of 15	Switched location of the TYPICAL HAUNCH SECTION DETAIL and the ALTERNATE HAUNCH SECTION DETAIL.
		CONFIGURATION FOR SLAB/WALL W/PT: revised Dimension 'F' from 1 1/2" to 1 1/2" MAX, 1" MIN.
	11 of 15	TYPICAL INTERIOR BAFFLE - PROFILE & APRON BAFFLE OPENING DETAIL: #5 rebar embedment lengths revised from 1'-3" MIN. to 1'-9" MIN.
	12 of 15	TYP. PRECAST SECTION (NORMAL) – SYMMETRICAL and UNSYMMETRICAL: removed WITH 3/8" NOMINAL MAX. SIZE AGGREGATE from end of ** note; removed 1'-0" MIN. and SEE NOTE 19 SHEET 4 from BEDDING call-out.
	14 of 15	New Sheet titled R.C. BOX CULVERT - PRECAST CONCRETE SEGMENT JOINT DETAILS including Design Instructions (with plan view schematics) and Design Example.
	15 of 15	New Sheet titled PRECAST BOX CULVERT WITH APRON - C.I.P. CONCRETE WEDGE TRANSITION
BD-633M	1 of 2	ARCH WEEPHOLE DETAIL: added TYPE A specification to the CLASS 4 GEOTEXTILE call-out.
BD-636M	--	Replaced PAIDD COMPUTER PROGRAM with PENNDOT ACCEPTED SOFTWARE throughout (17 total instances on 8 sheets)
		Updated the Pub. 280 title from "PENNSYLVANIA INSTALLATION DIRECT DESIGN MANUFACTURING SPECIFICATION" to "MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" throughout (4 instances on 2 sheets)
		In title block on Sheets 3 thru 10, added PAIDD to beginning of the subtitle.
	1 of 10	NOTES, Note 13: revised reference for pipe spacing sketch from [SEE PAIDD SPECIFICATIONS FOR SKETCH] to [SEE SKETCH IN APPENDIX H OF DESIGN MANUAL, PART 4, STRUCTURES].
	2 of 10	TABLE A: removed references to PAIDD computer program.
	3 of 10	RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES: updated fourth subheading from MATERIALS AND TESTING DIVISION to STRUCTURAL MATERIALS SECTION.
		RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES, STRUCTURAL MATERIALS SECTION, Item No. 2: removed OR PAIDD.


Standard	Sheet	Description of Changes
BD-636M (cont.)	3 of 10 (cont.)	RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES, BUREAU OF PROJECT DELIVERY, Item No. 1: removed AND PAIDD.
		RESPONSIBILITIES FOR DESIGN, FABRICATION AND INSTALLATION OF CONCRETE PIPES, BUREAU OF PROJECT DELIVERY: Added two items as follows: 4. PAIDD SOFTWARE PACKAGE NO LONGER MAINTAINED BY PENNSYLVANIA PIPE ASSOCIATION. 5. REVIEW/ACCEPT PIPE ANALYSIS SOFTWARE PACKAGES FOR DEPARTMENT USE.
		DESIGN TABLES FOR HORIZONTAL ELLIPTICAL PIPE-STANDARD INSTALLATION- TYPE A / TYPE B: added Proof Test values to both tables.
		NOTES, Note 7, item (a): added new sentence to beginning - USE CORRESPONDING VALUES IN PROOF TEST LOAD TABLE TO TEST CONCRETE PIPE
BD-637M	6 sheets	Added new standard ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME.
BD-653M	1 of 2	FRAMING PLAN FOR SPREAD BOX BEAMS: revised diaphragm thicknesses as follows: from 10" to 1'-0" for interior and intermediate diaph., from 1'-0" to 1'-2" for end diaph. at piers and abutments with backwalls, and from 1'-3" to 1'-6" for end diaph. at abutments without backwalls.
		FRAMING PLAN FOR I-BEAMS: revised diaphragm thicknesses as follows: from 10" to 1'-0" for intermediate diaph. and from 1'-0" to 1'-2" for end diaph. at piers and abutments with backwalls.
BD-655M	1 of 2	Added ties to the concrete diaphragms beneath the P/S beam top flanges. (8 details)
		GENERAL NOTES: deleted Note 1 and re-numbered subsequent notes; updated references to re-numbered notes throughout standard.
		GENERAL NOTES, Note 7 (formerly 8): added INSERTS TO BE GALVANIZED OR COMPLETELY ZINC-ELECTROPLATED.
BD-656M	2 of 7	FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: revised rebar lap length from 1'-0" MIN. to 1'-11" MIN.
	3 of 7	TYP. LONGIT. SECTS. FOR ADJ. BOX BEAMS (COMP.) – ABUTMENT WITHOUT BACKWALL: revised terminology from BITUMINOUS PAVEMENT to ASPHALT PAVEMENT.
	4 of 7	TYPICAL LONGITUDINAL SECTIONS (all 3 sections): revised terminology from BITUMINOUS PAVEMENT to ASPHALT PAVEMENT.
	7 of 7	ABUTMENT WITH BACKWALL: added #6 rebar inside of 180 degree hook in end of box beam.
BD-660M	1 of 2	NOTES: added Note 1 regarding providing material and workmanship in accordance with Pub. 408 and re-numbered subsequent notes.
		NOTES, Note 2 (formerly 1): updated referenced AASHTO/DM-4 article from 5.14.1.4 to 5.12.3.3.
BD-661M	1 of 8	GENERAL NOTES: deleted Note 1 and re-numbered subsequent notes.
		ADJACENT BOX BEAMS PLAN-TYPICAL BEAM and VIEW C-C END ELEVATION: added 1" Ø non-ferrous drain holes and call-outs.
	2 of 8	ADJACENT BOX BEAM with beam notch: moved dimension line to align with stirrup instead of beam notch.
	4 of 8	36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: revised shape of #4 rebar anchoring the barrier to the box beam.
		36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER: revised the horizontal leg of rebar anchoring the barrier into the box beam from 1'-0" to 1'-4" and the embedment of the vertical leg into beam from 1'-0" MIN. to 1'-4" MIN; added an asterisk (*) to the embedment length call-out of the vertical leg; added the following note below the detail: * OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.
		36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER and 36" & 48" COMPOSITE ADJACENT BOX BEAMS TYPICAL SIDEWALK: added (MIN.) to dimension of the required height into the barrier of the rebar anchoring the barrier to the box beam.
		REINFORCEMENT DETAIL FOR BARRIERS WITH TYPICAL SIDEWALK: increased three rebar embedment lengths from 1'-0" MIN. to 1'-4" MIN.; added an asterisk (*) to the embedment length call-out of the vertical leg; added the following note below the detail: * OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.

Standard	Sheet	Description of Changes
BD-661M (cont.)	4 of 8 (cont.)	REINFORCEMENT DETAIL FOR BARRIER WITH TYPICAL SIDEWALK: for consistency, repositioned leader lines for embedment lengths to the point where the bar is bent horizontal instead of where it enters the beam (2 instances).
		LEGEND Item 12: updated DM-4 Section from DC5.14.1.4.8 to DC5.12.3.3.8.
	5 of 8	ALTERNATE SIDEWALK REINFORCEMENT DETAIL: horizontal leg length revised from 12" to 1'-6" NORMAL WEIGHT CONCRETE / 1'-9" LIGHT WEIGHT CONCRETE.
		LEGEND Item 12: updated DM-4 Section from DC5.14.1.4.8 to DC5.12.3.3.8.
	6 of 8	Added 1" Ø non-ferrous drain holes and call-outs to all plan and elevation views (6 instances).
		ALTERNATE END BLOCK REINFORCEMENT SPLICING DETAIL: revised rebar lap length from 1'-7" MIN. to 1'-9" MIN.
	7 of 8	TYPICAL STRAND PATTERN – PLANK BEAM: added asterisks (*) to number of strands in the second row; added the following note below the detail: * TRANSVERSE TENDON POCKET SIZE AND LOCATION COULD REDUCE AVAILABLE STRANDS IN SECOND ROW.
	8 of 8	ADJACENT BOX BEAM WITH TYPE 3 OR 4 APPROACH SLAB: added #6 rebar inside of 180 degree hook.
BD-662M	1 of 4	GENERAL NOTES, Note 1: revised to refer to PUBLICATION 408.
		GENERAL NOTES, Note 16: updated Article number from 5.10.10.1 to 5.9.4.4.1 to match 2017 AASHTO Specifications.
		AASHTO I-BEAM - ELEVATION: PRESTRESS ZONE + 2" replaced with SEE GENERAL NOTE 14. <i>[correction of e-Notification No. 66]</i>
		ADDITIONAL NOTCH REINF. END VIEW: LOWER LIMIT OF 601 BARS TO BE 2" ABOVE PRESTRESS ZONE replaced with SEE GENERAL NOTE 14. <i>[correction of e-Notification No. 66]</i>
		STANDARD PA I-BEAM - ELEVATION: replaced PRESTRESS ZONE + 2" with SEE GENERAL NOTE 14. <i>[correction of e-Notification No. 66]</i>
		END VIEW: replaced LOWER LIMIT OF 601 BARS TO BE 2" ABOVE PRESTRESS ZONE with SEE GENERAL NOTE 14. <i>[correction of e-Notification No. 66]</i>
		AASHTO I-BEAM TYPICAL SECTION & OPTIONAL 404 DETAIL: revised OPTIONAL LAP lengths from 1'-3" MIN. to 1'-4" MIN.
	2 of 4	PA BULB-TEE BEAM - ELEVATION: replaced PRESTRESS ZONE + 2" with SEE GENERAL NOTE 14 ON SHT. 1. <i>[correction of e-Notification No. 66]</i>
		ADDITIONAL NOTCH REINF. END VIEW: LOWER LIMIT OF 601 BARS TO BE 2" ABOVE PRESTRESS ZONE replaced with SEE GENERAL NOTE 14 ON SHEET 1. <i>[correction of e-Notification No. 66]</i>
	3 of 4	26" BOTTOM FLANGE: replaced N STRANDS with 12 STRANDS.
BD-664M	1 of 4	TYPICAL DIAPHRAGM details (2 details): added extra ties in diaphragms near beam flanges.
		NOTES: deleted Note 1 and re-numbered subsequent notes; updated references to re-numbered notes throughout the standard.
		SECTION A-A: revised diaphragm thickness from 3' MIN. to 2'-8" MIN.
	2 of 4	2" CLR. increased to 2 1/2" CLR. in three details at top of sheet.
		TYPICAL DIAPHRAGM DETAIL FASCIA BEAM and SECTION B-B: revised diaphragm thickness from 2'-6" MIN. to 2'-8" MIN.
		SECTION C-C: #5 rebar leg length revised from 2'-0" to 2'-1".
	3 of 4	PIER PLAN: revised diaphragm thickness from 2'-6" MIN. to 2'-8" MIN.
	4 of 4	OPTIONAL POSITIVE MOMENT CONNECTION DETAIL AT PIER: revised clearance of hairpin rebars from 2" to 2 1/2" CLR. (TYP.)
		SECTION F-F: revised #5 rebar leg length from 2'-0" to 2'-1".
BD-666M	1 of 1	SECTION - FLEXURE STRENGTHENING OF BOX BEAM: replaced W with 10" MAX. at three places. Replaced X MIN. with 3" MIN.
		ELEVATION - SHEAR STRENGTHENING OF SPREAD BOX BEAM: replaced W with 10" MAX. and replaced X" MIN. with 3" MIN.

Standard	Sheet	Description of Changes
BD-667M	1 of 9	GENERAL NOTES, Note 8: revised rebar lap splice length for #4 bar from 2'-1" to 2'-2", for #5 bar from 2'-7" to 2'-9" and for #6 bar from 3'-1" to 3'-3".
		GENERAL NOTES: deleted Note 28 and re-numbered subsequent notes.
	3 of 9	SECTION A-A: added 12" MAX. (TYP.) dimension for rebars in bottom of cap beam; added 2" (TYP.) for distance of rebar from flange of pile.
		SECTIONS C-C and D-D: revised rebar lap splice length from 2'-1" MIN. to 2'-2" MIN. and removed OVERLAP from call-outs (4 instances).
		LEGEND, Item 7: revised rebar lap splice length from 2'-1" MIN. to 2'-2" MIN. and replaced OVERLAP with LAP LENGTH.
	5 of 9	ATTACHED RECTANGULAR WINGWALL ELEVATION and ATTACHED TAPERED WINGWALL ELEVATION: At maximum length dimension, added note to see Table 2 for minimum length.
		ATTACHED TAPERED WINGWALL ELEVATION and DETACHED WINGWALL ELEVATION: revised #5 rebar lap splice length from 2'-1" MIN. to 2'-9" MIN.
		SECTIONS K-K & N-N: revised rebar lap splice length from 2'-1" to 2'-2"; moved leader line from the gutter line to the start of the lap; and revised rebar leg lengths for increased lap length and cover to start of lap.
		SECTION M-M: #6 rebar embedment length revised from 1'-8" to 2'-1".
		Added TABLE 2 label to MINIMUM ATTACHED WINGWALL LENGTH (L) table under Table 1 and added WALL TYPE heading to first column.
	7 of 9	MINIMUM APPROACH SLAB LENGTH TABLE: replaced skew angle ranges in third and fourth column headings with specific skew angles and added a third note below table clarifying how to use table for skews between those given in table.
		LEGEND, Note 7: in first line revised 2'-1" OVERLAP to 2'-2" LAP LENGTH.
	8 of 9	PIPE PILE-TO-PILE CAP CONNECTION DETAIL, SECTION W-W: revised length of vertical leg of main reinforcement bars from 4'-0" to 4'-4".
	9 of 9	Added three new end diaphragm bracing details: END DIAPHRAGM BRACING (STAY-IN-PLACE), CONNECTION DETAIL - FIRST BAY ERECTED, and CONNECTION DETAIL - ADDITIONAL BAY.
		Added list of NOTES to accompany the new end diaphragm bracing details.
BD-668M	1 of 3	BAR DETAIL: horizontal leg length revised from 1'-0" to 1'-6" for NORMAL WEIGHT CONCRETE and 1'-9" for LIGHTWEIGHT CONCRETE.
	2 of 3	SECTION F-F: revised terminology from BITUMINOUS APPROACH to ASPHALT PAVEMENT APPROACH.
	3 of 3	VERTICAL BAR & PA TYPE 10M BARRIER BAR DETAILS: horizontal leg length revised from 1'-0" to 1'-6" for NORMAL WEIGHT CONCRETE and 1'-9" for LIGHTWEIGHT CONCRETE.
BD-676M	4 of 6	CONCRETE CAP DETAIL: added 3" height to bottom of the weep hole from top of the moment slab.
	5 of 6	PRECAST CONCRETE PANEL – ELEVATIONS (2 details): perimeter rebar bend length revised from 11" MIN. to 1'-3" MIN. for UNCOATED OR GALVANIZED and from 1'-4" MIN. to 1'-6" MIN. for EPOXY COATED.
	6 of 6	PRECAST CONCRETE PLANEL WITH OPTIONAL SLOPED BOTTOM – ELEVATIONS (2 details): perimeter rebar bend length revised from 11" MIN. to 1'-3" MIN. for UNCOATED OR GALVANIZED and from 1'-4" MIN. to 1'-6" MIN. for EPOXY COATED.
BD-677M	4 of 20	Welded Wire Fabric designation updated in six post cross sections: replaced WWF4x4-D4xD4 with 4x4-W4.0xW4.0
	11 of 20	ELEVATION: removed 6" MIN. spacing to ties at bottom of caisson, and added 3" spacing of ties from Optional Rough Construction Joint.
	16 of 20	ELEVATION: removed 6" MIN. spacing to ties at bottom of caisson, and added 3" spacing of ties from Optional Rough Construction Joint.
	17 of 20	ELEVATION: removed 6" MIN. spacing to ties at bottom of caisson, and added 3" spacing of ties from Optional Rough Construction Joint.
BD-678M	1 of 14	GENERAL NOTES, Note 3, Third Bullet: revised seismic acceleration coefficient “A” from 0.09 to 0.15.

Standard	Sheet	Description of Changes
BD-679M	2 of 11	DESIGN PARAMETERS, Note 1: revised number of BD-601M's Note from 28 to 26.
	4 of 11	MOMENT SLAB NOTES, Note 3: revised terminology from BITUMINOUS CONCRETE SHOULDER to ASPHALT-PAVED SHOULDER.
	5 of 11	PRECAST CONCRETE PANEL - Elevations: perimeter rebar bend length revised from 11" MIN. to 1'-3" MIN. for UNCOATED OR GALVANIZED and from 1'-4" MIN. to 1'-6" MIN. for EPOXY COATED.
BD-680M	5 of 8	STANDARD & SLOPED PANELS - Elevation Views: revised hooked leg length of #5 perimeter rebars from 1'-1" to 1'-7" for UNCOATED and from 1'-8" to 1'-11" for EXPOXY COATED.
	7 of 8	FOOTING REINFORCEMENT LAYOUT FOR STANDARD PANELS: #4 rebar splice length revised from 1'-9" to 1'-10".
BD-680M (cont.)	7 of 8 (cont.)	FOOTING STEP DETAILS FOR STANDARD PANELS: #4 rebar splice length revised from 1'-9" to 1'-10" (2 places) and top leg length revised from 1'-3" to 1'-5" (2 places).
	8 of 8	FOOTING PLANS AT END PANELS (3 options): SPLICE #4 BAR length revised from 1'-9" MIN. to 1'-10" MIN.
BD-697M	3 of 4	BEAM SEAT & INTEGRATED APPROACH DETAIL: revised terminology from BITUMINOUS PAVEMENT to ASPHALT PAVEMENT
		NOTES, Note 4: revised ROYSTON OR BITUMEN WATERPROOFING to WATERPROOFING MEMBRANE OR WATERPROOFING ASPHALT BINDERS.






<div>OS-299 (7-08)</div> <div><div>pennsylvania</div><div>DEPARTMENT OF TRANSPORTATION</div></div>	TRANSMITTAL LETTER	<b>PUBLICATION:</b>  Publication 218M April 2016 Edition Change No. 1
		<b>DATE:</b>  August 4, 2017
<b>SUBJECT:</b>  <b>Revisions to Standards for Bridge Design April 2016 Edition</b>		
<b>INFORMATION AND SPECIAL INSTRUCTIONS:</b>  Incorporate the attached revisions into the April 2016 Edition of Publication 218M.  The revisions pertain primarily to:  *Manual for Assessing Safety Hardware (MASH) 2016 Edition  *Adding a new Standard Drawing for Type 31 Strong Post Guide Rail (RC-51M) (31" height to top of W-beam rail element)  *Deleting an existing Standard Drawing for Type 2 Strong Post Guide Rail (RC-52M) (27 3/4" height to top of W-Beam rail element).  These revised Standard Drawings should be adopted on all new and existing designs as soon as possible without affecting any letting schedules and in conjunction with the current Publication 408 Specifications. Regardless, revised standards must be used on projects let after December 31, 2017.		
STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-609M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).  Revised Note 10 with updated weights of PA Structure Mounted Guide Rail bridge barriers for dead load calculations.
BD-610M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-628M	Sheet 4	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 5	Revised Notes 4 and 5 to indicate Type 31-SC guide rail and posts.
	Sheet 6	Revised Note 4 to indicate Type 31-SC posts.
	Sheet 7	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 19	Revised Note 3 to indicate Type 31-SC posts.
	Sheet 20	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 21	Revised Note 5 to indicate RC-51M.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M (cont.)	Sheet 21	Revised Note 6 to indicate Type 31-SC posts.
	Sheet 26	Revised Note 6 to indicate Type 31-SC posts.
	Sheet 27	Revised Notes 6 and 7 to indicate Type 31-SC guide rail and posts.
	Sheet 28	Revised Notes 5 and 6 to indicate Type 31-SC guide rail and posts.
	Sheet 35	Revised Notes 5 and 6 to indicate Type 31-SC guide rail and posts.
BD-631M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
	Sheet 2	Revised Typical Section (Metal Culverts) to indicate:  *RC-51M (2 locations);  *31-S, 31-SC, and 31-SCC guide rail with an increase in distances between the guide rail post and the collar;  *Class A Cement Concrete Slab with an increase in dimensions to 5' x 5' x 8".
BD-632M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).  Revised Section Along Centerline Culvert to indicate:  *RC-51M;  *Class A Cement Concrete Slab with an increase in dimensions to 5' x 5' x 8".
	Sheet 2	Revised Section A-A to indicate RC-51M and Type 31 Strong Post Guide Rail.
	Sheet 4	Revised Box Details - Welded Wire Fabric detail to indicate chamfer sizes of 3/4" x 3/4".
	Sheets 5-6	Revised Profile, Precast Culvert with Precast End Section (Sheet 5) and Profile, Culvert with Cast-in-Place Wingwalls (Sheet 6) to indicate:  *RC-51M;  *31-S-, 31-SC, and 31-SCC guide rail with an increase in distances between the guide rail post and the collar. SECTION E-E: Added 3/4" x 3/4" CHAMFER (TYP.) callout.
	Sheet 7	
	Sheet 8	Revised Section F-F to indicate RC-51M and Type 31 Strong Post Guide Rail.
BD-641M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-643M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-644M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-645M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).



STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-647M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail).
BD-649M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail). Deleted reference drawing RC-55M (Type 2 Weak Post Median Barrier).
BD-650M	Sheet 1	Revised reference drawing to RC-51M (Type 31 Strong Post Guide Rail). Deleted reference drawing RC-55M (Type 2 Weak Post Median Barrier).

<p><b>CANCEL AND DESTROY THE FOLLOWING:</b></p> <p>The following revised BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work:</p> <p>Index Sheet - Apr. 29, 2016 BD-609M - Apr. 29, 2016 BD-610M - Apr. 29, 2016 BD-628M - Apr. 29, 2016 BD-631M - Apr. 29, 2016 BD-632M - Apr. 29, 2016 BD-641M - Apr. 29, 2016 BD-643M - Apr. 29, 2016 BD-644M - Apr. 29, 2016 BD-645M - Apr. 29, 2016 BD-647M - Apr. 29, 2016 BD-649M - Apr. 29, 2016 BD-650M - Apr. 29, 2016</p>	<p><b>ADDITIONAL COPIES ARE AVAILABLE FROM:</b></p> <p><input type="checkbox"/> PennDOT SALES STORE (717) 787-6746 phone (717) 787-8779 fax ra-penndotsalesstore.state.pa.us</p> <p><input checked="" type="checkbox"/> PennDOT website - <a href="http://www.dot.state.pa.us">www.dot.state.pa.us</a> <i>Click on Forms, Publications &amp; Maps</i></p> <p><input type="checkbox"/> DGS warehouse (PennDOT employees ONLY)</p> <hr/> <p><b>APPROVED FOR ISSUANCE BY:</b></p> <p>LESLIE S. RICHARDS Secretary of Transportation</p> <p>BY:</p> <p></p> <p>Brian G. Thompson, P.E. Director, Bureau of Project Delivery, Highway Administration</p>
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<div>OS-299 (7-08)</div> <div></div>	TRANSMITTAL LETTER	<div>PUBLICATION: Publication 218M April 2016 Edition</div> <div>DATE: April 29, 2016</div>
<div>SUBJECT:</div> <div>Standards for Bridge Design, BD-600M Series April 2016 Edition</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <p>These standards may be used immediately and can be adopted as soon as practical on all new and existing designs without affecting letting schedules. All projects with T.S. &amp; L. submissions after July 1, 2016 should incorporate these new standards.</p> <p>The 2016 Edition incorporates Changes 1 through 3 issued for the 2010 Edition.</p> <p>A description of the changes made to the 2010 Edition since Change 3 of 2014 and additional revisions of each standard are listed in the attached multi-sheet Table. Note highlighted details and/or notes on each standard are revisions made since Change 3 of Nov. 21, 2014.</p>		
<div>CANCEL AND DESTROY THE FOLLOWING:</div> <div>Existing BD-600M Series standards need to be retained for projects under construction and for future rehabilitation work.</div>	<div>ADDITIONAL COPIES ARE AVAILABLE FROM:</div> <div><div><input checked="" type="checkbox"/> PennDOT SALES STORE (717) 787-6746 phone (717) 787-8779 fax ra-penndotsalesstore.state.pa.us</div><div><input checked="" type="checkbox"/> PennDOT website - <a href="http://www.dot.state.pa.us">www.dot.state.pa.us</a> Click on Forms, Publications &amp; Maps</div><div><input checked="" type="checkbox"/> DGS warehouse (PennDOT employees ONLY)</div></div> <div>APPROVED FOR ISSUANCE BY:</div> <div>Leslie S. Richards – Secretary of Transportation</div> <div>By:  Brian G. Thompson, P.E., Director of Bureau of Project Delivery, Highway Administration</div>	

STANDARD	SHEET	DESCRIPTION OF CHANGES
All	All	Removed all metric units.
BD-600M	1	Updated Number of Sheets for BD-601M and BD-617M, expanded two standards' titles and removed BD-642M.
BD-601M	1 of 11	TYPICAL SLAB PANEL 2: switched the longitudinal reinforcements over the transverse reinforcements in the top mat. NOTE No. 4: added STAGGER LONGITUDINAL REBARS SUCH THAT NO REBAR IN THE TOP MAT IS DIRECTLY ABOVE A REBAR IN THE BOTTOM MAT. Added Note 29.
	10 of 11	Added a new Sheet to include the new deck reinforcement tables. Indicated the new rebar tables are required for continuous span bridges and optional for simple span bridges.
BD-605M	1 of 6	GENERAL NOTES: added Note 4 to allow inclusion of scuppers in precast deck slabs per project-to-project base. Added Reference drawings.
	6 of 6	Revised the post-tensioning duct coupling detail.
BD-609M	1 of 1	Corrected the heads of bolts in Section A-A to be rounded for consistency.
BD-610M	17 shts.	Added a note to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
	16 of 17	Sections G-G, H-H, J-J and K-K were re-labeled to be J-J, K-K, N-N and L-L.
BD-612M	3 shts.	Added a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
BD-615M	3 shts.	Added notes for preferred lighting pole locations and additional requirements if not. Fixed the discrepancies at many locations. Added a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
	3 of 3	Note 4: Revised to require Anchor Angles to be galvanized.
BD-616M	1 of 2	Added General Note 13: FOR BOLT DIAMETER EQUAL OR GREATER THAN 1", THE HOLE DIAMETER SHALL BE 1/8" PLUS DIAMETER OF BOLT. ALSO, ADJUST EDGE DISTANCE, CENTER TO CENTER BOLT SPACINGS, CLEARANCES, ETC.
BD-617M	16 shts.	Add a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M. Updated notes at many places for clarification.
BD-618M	1 of 12	Expanded limitation of usage for concrete vertical wall barrier to allow for new structures. Note 5: Eliminated the length restriction of vertical wall barrier for use on rehab. Clarified the beam seat types to avoid the confusion for slopped beam seat option. Added a note to applicable details to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M
	12 of 12	Note 4: Revised to require Anchor Angles to be galvanized. Added notes for preferred lighting pole locations and additional requirements if not. Fixed the inconsistencies at many locations.
BD-619M	2 of 5	Corrected the factor of WS in Strength III to comply with Table 3.4.1.1P-1 of DM-4.
	3 of 5	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size.
BD-620M	1 of 6	Clarified the basic wind speed used in this standard has already included a 1.4 load factor.
BD-627M	4 of 8	MOMENT SLAB WITH ALTERNATE SIDEWALK: Revised slope from 2% to 1.5%.
BD-629M	3,7 & 8 of 15	ELEVATION: Remove mid-height splice requirement for column's vertical reinforcement in Seismic Zone 1.
BD-632M	5 of 13	Moved the cutoff wall for precast box culvert with precast end section from outside of the end

STANDARD	SHEET	DESCRIPTION OF CHANGES
		section to underneath of the end section.
	7 of 13	Added the requirement of galvanized strap in the vertical walls for connection of multiple end sections.
BD-633M	1 of 2	Updated Note 10 to indicate using LRFD for footing design.
BD-641M	1 of 8	Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER were revised to be consistent with DM-4. Added a note under NOTES TO DESIGNER 1 to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected. Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size.
	6-8 of 8	Eliminated some column pipe sizes due to the lack of availability on Sheets 6-8.
BD-642M	All	Eliminated this standard due to the lack of availability of the pipe sizes.
BD-643M	1 of 6	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Added a note under NOTES TO DESIGNER to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected. Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER were revised to be consistent with DM-4.
	4 of 6	Corrected the term "ultimate" underneath the table of design criteria for consistency.
	5 & 6 of 6	Eliminated some column pipe sizes due to the lack of availability.
BD-644M	1 of 13	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER were revised to be consistent with DM-4.
	4 of 13	Added Note below Design Criteria table.
	8 of 13	Corrected the term "ultimate" underneath the table of design criteria for consistency.
	10-13 of 13	Eliminated some column pipe sizes due to the lack of availability.
BD-645M	1 of 7	Added a note under NOTES TO DESIGNER to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected. Corrected the term "ultimate" underneath the table of design criteria for consistency on Sheet 4. Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER are revised to be consistent with DM-4.
	4 of 7	Corrected the term "ultimate" underneath the table of design criteria for consistency.
	6 & 7 of 7	Eliminated some column pipe sizes due to the lack of availability.
BD-647M	1 of 5	Revised the standard hole size: standard hole diameter is 1/16" plus the nominal diameter of the bolt for bolts less than 1", 1/8" plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1". Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size. Corrected the wind speed to 90MPH (3 second gust) to be consistent with value used to produce designs. Added a note under NOTES TO DESIGNER to indicate the designer to ensure the availability of

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-647M (continued)		pipe size prior to PSE submittal if any pipe other than shown on the standard is selected.
	2 & 3 of 5	Added Note below Design Criteria table.
	4 & 5 of 5	Eliminated some column pipe sizes due to the lack of availability
BD-649M	1 of 6	Notes for DMS under DESIGN CRITERIA and NOTES TO DESIGNER are revised to be consistent with DM-4. Revised the standard hole size: standard hole diameter is 1/16” plus the nominal diameter of the bolt for bolts less than 1”, 1/8” plus the nominal diameter of the bolt for bolts with nominal diameter equal to or greater than 1”. Added a note for the designer to ensure the edge clear distance and the hole clear distance due to revision of the standard hole size.
	2 of 6	Added a note under NOTES TO DESIGNER on Sheet 1 to indicate the designer to ensure the availability of pipe size prior to PSE submittal if any pipe other than shown on the standard is selected.
	4 & 5 of 6	Eliminated some column pipe sizes due to the lack of availability.
BD-650M	4 of 4	Clarified the U-bar type in both panel connection details.
BD-651M	1 & 2 of 2	Revised the dowel bar to be stainless steel for corrosion protection.
BD-652M	2 of 3	Corrected the section properties for PA I-beams 26/54 and 24/63.
BD-656M	7 shts.	Added a note to all applicable abutment section to indicate longitudinal rebar on top on top rebar mat is similar but not shown. Increase the width full depth diaphragm at abutment without backwall for spread box beam to 1'-6". Added a note to indicate BRADD designed bridge still may use 1'-3" for this diaphragm. Increase the concrete cover to 2 ½” for all diaphragms.
BD-658M	1 of 1	Revised the required curtain wall for spread box beam in Section E-E to be optional when required for aesthetics, similar to the requirement for I-Beam in Section F-F
BD-660M	1 of 2	DECK PLACEMENT NOTE 4: added THE POINT OF CONTRAFLEXURE FOR PRESTRESSED CONCRETE CONTINUOUS BRIDGES SHALL BE CALCULATED AS THE SUM OF SIMPLE SPAN MOMENTS DUE TO DL1 AND CONTINUOUS MOMENTS FROM DL2. Drawing title revised to include FORMS, PRESTRESSED and AND STEEL. DECK PLACEMENT SEQUENCE SCHEMES FOR CONTINUOUS BRIDGES: added AND SEE NOTE 4 OF DECK PLACEMENT NOTES to Placement 4 dimension callout.
	2 of 2	Added a detail of deck placement for steel girder during phased/staged construction. LONGITUDINAL REINFORCEMENT STAGGER DETAIL IN NEGATIVE MOMENT REGION – added dimensions of staggered bar cutoffs to be development length and 2 x development length.
BD-661M	1 of 8	ADJACENT BOX BEAMS PLAN - TYPICAL BEAM: added 6" MIN. dimension between end of void and transverse tendon.
	2 of 8	Removed Legend 5 since it is not consistent with DM-4 and is not being used by PSLRFD computer program.
BD-662M	3 of 4	BEAM DAP DETAIL – SECTION B-B AT LOW END OF BEAM: Corrected the dimension A to be measured along CL-beam(currently was mistakenly specified to be measured normal to CL-bearings)
BD-665M	1 of 3	SECTION A-A: diaphragm cover increased to 2.5". Updated the material specifications referenced.
BD-667M	All	Added a note to indicate transverse rebar on top in top rebar mat of the deck slab is shown and longitudinal rebar on top is similar. This was due to the revision of BD-601M.
	1 of 9	Added note underneath the typical elevation to require the top 15ft pile or entire pile length, whichever is smaller, needs to be galvanized for corrosion protection.
	9 of 9	Added note to indicate that the stability of the remaining existing structure for the proposed condition needs to be checked.
BD-676M	4 of 6	Revised the single face concrete barrier (roadway item) to moment slab with typical concrete barrier as they did not exist on the roadway standards.
BD-677M	2 of 20	DESIGN PARAMETERS, Note 4, last bullet point: replace CHIEF with DISTRICT in last line.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-677M (continued)	20 of 20	Clarified the usage (maximum spacing and minimum caisson length) for Types E and F post.
BD-678M	4,8,9,11,12 of 14	Corrected the bundle ties spacing to be “MAX” in many caisson elevation views.
BD-679M	4 of 11	Revised the exposed height of the single face concrete barrier to 2’-8” to be consistent with RC-58M
BD-697M	1 of 4	DESIGN METHODOLOGY’s Note 1: added MAXIMUM in fifth, sixth and seventh bullet points prior to WATER. CONSTRUCTION METHODOLOGY’s Note 5: added WHERE DIFFERENTIAL SETTLEMENT IS ANTICIPATED, OR ENCOUNTERED, PROVIDE A VERTICAL CONTROL JOINT IN THE WALL FACE TO REDUCE OR ELIMINATE CRACKING OF BLOCKS
	2 of 4	Added an optional end treatment of CMU block facing at wing ends.



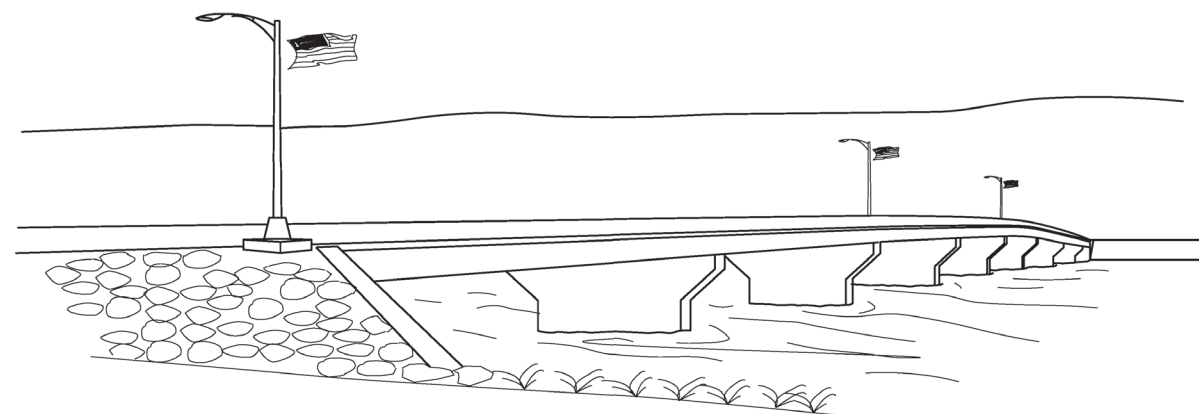
# COMMONWEALTH OF PENNSYLVANIA



**pennsylvania**

DEPARTMENT OF TRANSPORTATION

## **BUREAU OF PROJECT DELIVERY STANDARDS FOR BRIDGE DESIGN**



**BD-600M SERIES**

**APRIL 2016 EDITION**

PUB. #218M

Click on the desired Standard to view.

Highlighting throughout the standards indicates revisions to the April 2016 Edition. The highlighting color indicates whether the most recent revision was part of Change #1, #2, #3, #4, #5, #6, #7 or #8. Refer to the legend on this index sheet or on the first sheet of each standard.

To obtain a clean printout without highlighting, select "Print" and in the dialogue box under "Comments and Forms" select "Document" from the pull-down menu.

INDEX OF STANDARDS FOR BRIDGE DESIGN with e-Notifications' red markups

SUBJECT	STD. DWG. NO.	TITLE	NO. OF SHTS.	DATE
SUPERSTRUCTURE	BD-600M	INDEX OF STANDARDS FOR BRIDGE DESIGN	1	JUL. 10, 2025
	BD-601M	CONCRETE DECK SLAB	12	FEB. 14, 2023
	BD-604M	GRID REINFORCED CONCRETE BRIDGE DECK	4	AUG. 30, 2019
	BD-605M	FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES	6	AUG. 30, 2019
	BD-609M	PA 3-RAIL BRIDGE BARRIER	3	OCT. 7, 2024
	BD-610M	PA BRIDGE BARRIER	11	OCT. 7, 2024
	BD-611M	CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES	3	AUG. 30, 2019
	BD-612M	UTILITY ATTACHMENT TO SUPERSTRUCTURE	3	AUG. 30, 2019
	BD-613M	HIGH LOAD MULTI-ROTATIONAL POT BEARINGS	7	NOV. 23, 2022
	<del>BD-615M</del>	<del>PA HT BRIDGE BARRIER</del>		<del>DISCONTINUED</del>
	BD-616M	FIELD SPLICE	2	NOV. 23, 2022
	BD-617M	PA TYPE 10M BRIDGE BARRIER	10	OCT. 7, 2024
	BD-618M	CONCRETE VERTICAL WALL BRIDGE BARRIER	12	OCT. 7, 2024
	BD-619M	CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS	5	AUG. 30, 2019
	BD-620M	STEEL GIRDER BRIDGES LATERAL BRACING CRITERIA AND DETAILS	6	NOV. 23, 2022
ABUTMENTS AND PIERS	BD-621M	REINFORCED CONCRETE ABUTMENTS	3	AUG. 30, 2019
	BD-622M	R.C. ABUTMENTS WITH BACKWALL	13	OCT. 7, 2024
	BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL	4	OCT. 7, 2024
	BD-625M	WINGWALL LENGTH	1	APR. 29, 2016
	BD-626M	ANCHORED WALLS	9	AUG. 30, 2019
	BD-627M	MOMENT SLABS	8	NOV. 23, 2022
	BD-628M	BRIDGE APPROACH SLABS	35	NOV. 23, 2022
CULVERTS AND PIPES	BD-629M	REINFORCED CONCRETE PIERS	15	NOV. 23, 2022
	BD-631M	END WALL DETAILS	2	FEB. 14, 2023
	BD-632M	R.C. BOX CULVERT	16	OCT. 7, 2024
	BD-633M	R.C. ARCH CULVERT	2	AUG. 30, 2019
	BD-634M	GABION END WALLS	1	APR. 29, 2016
	BD-635M	DESIGN TABLES FOR METAL CULVERTS	4	APR. 29, 2016
	BD-636M	REINFORCED CONCRETE PIPES	10	AUG. 30, 2019
SIGN STRUCTURES	<del>BD-637M</del>	<del>ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME</del>	<del>6</del>	<del>FEB. 14, 2023</del>
	BD-641M	OVERHEAD SIGN STRUCTURES-CANTILEVER AND CENTER-MOUNT STRUCTURES - STRUT LENGTHS UP TO 40'	7	JUL. 10, 2025
	<del>BD-643M</del>	<del>OVERHEAD SIGN STRUCTURES-2 POST PLANAR TRUSS SPANS FROM 30' TO 100'</del>	<del>6</del>	<del>DISCONTINUED</del>
	BD-644M	OVERHEAD SIGN STRUCTURES-2 POST AND 4 POST TRI-CHORD TRUSS SPANS FROM 60' TO 200'	10	JUL. 10, 2025
	BD-645M	OVERHEAD SIGN STRUCTURES-4 POST 4 CHORD TRUSS SPANS FROM 100' TO 200'	6	JUL. 10, 2025
	BD-647M	MONOPIPE SIGN STRUCTURES	7	JUL. 10, 2025
	BD-649M	CHANGEABLE MESSAGE SIGNS - CENTER-MOUNT SIGN STRUCTURES	6	JUL. 10, 2025
	BD-650M	CHANGEABLE MESSAGE SIGNS - TRUSS SIGN STRUCTURES	4	JUL. 10, 2025

SUBJECT	STD. DWG. NO.	TITLE	NO. OF SHTS.	DATE
PRESTRESSED CONCRETE STRUCTURES*	BD-651M	REQUIREMENTS FOR TENDONS, DOWELS SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS	2	NOV. 23, 2022
	BD-652M	PRESTRESSED BEAM SIZES AND SECTION PROPERTIES	3	APR. 29, 2016
	BD-653M	TYPICAL FRAMING PLANS AND DETAILS	2	NOV. 23, 2022
	BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS	2	AUG. 30, 2019
	BD-656M	TYPICAL LONGITUDINAL SECTIONS	7	AUG. 30, 2019
	BD-657M	I-BEAM AND BOX BEAM BRIDGES	1	APR. 29, 2016
	BD-658M	SHEAR BLOCK DETAILS AT PIER - PRESTRESSED CONCRETE I-BEAM, BULB-TEE AND BOX BEAM BRIDGES	1	APR. 29, 2016
	BD-660M	DECK SLAB, FORMS AND STEEL REINFORCEMENT PLACEMENT	2	NOV. 23, 2022
	BD-661M	BOX BEAM REINFORCEMENT DETAILS	8	NOV. 23, 2022
	BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS	4	AUG. 30, 2019
	<del>BD-663M</del>	<del>CONCRETE DECK SLAB DESIGN &amp; DETAILS FOR FLEX BEAM BRIDGES</del>	<del>6</del>	<del>JUNE 1, 2021</del>
	BD-664M	CONTINUITY FOR LIVE LOAD DETAILS - I-BEAM AND PA BULB-TEE BEAM BRIDGES	4	AUG. 30, 2019
	BD-665M	CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES	3	APR. 29, 2016
	BD-666M	CFRP STRENGTHENING PRESTRESSED CONCRETE BEAMS	1	NOV. 23, 2022
	BD-667M	INTEGRAL ABUTMENT	10	NOV. 23, 2022
	BD-668M	PRECAST CHANNEL BEAM BRIDGES	3	NOV. 23, 2022
SOUND BARRIER WALLS	BD-676M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS	6	AUG. 30, 2019
	BD-677M	GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS	20	AUG. 30, 2019
	BD-678M	GROUND MOUNTED SOUND BARRIERS STEEL POSTS	14	AUG. 30, 2019
	BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS	11	FEB. 19, 2021
	BD-680M	OFFSET SOUND BARRIER WALLS	8	AUG. 30, 2019
	BD-697M	GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM	5	NOV. 23, 2022

USE THESE STANDARDS AS A GUIDE IN THE PREPARATION OF STRUCTURAL PLANS, IN CONJUNCTION WITH THE BC-700M SERIES STANDARD DRAWINGS.

DESIGN COMPUTATIONS ARE NOT REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS TAKEN VERBATIM FROM A STANDARD; E.G. A PRESTRESSED BEAM SECTION AS SHOWN ON A STANDARD MAY BE USED IF THE CORRESPONDING DIMENSION AND DESIGN DATA OF THE STRUCTURE BEING DESIGNED ARE IDENTICAL TO THOSE SHOWN ON THE STANDARD.

REASONABLE MODIFICATIONS OF THE DETAILS SHOWN ON THE STANDARDS MAY BE REQUIRED IF CONDITIONS WARRANT.

\* BD-660M ALSO APPLIES TO STEEL BRIDGE DESIGN

APRIL 2016 EDITION

- SEE CHANGE #1 FOR AUG. 4, 2017 STANDARD REVISIONS.
- SEE CHANGE #2 FOR AUG. 30, 2019 STANDARD REVISIONS.
- SEE CHANGE #3 FOR FEB. 19, 2021 STANDARD REVISIONS.
- SEE CHANGE #4 FOR JUNE 1, 2021 STANDARD REVISIONS.
- SEE CHANGE #5 FOR NOV. 23, 2022 STANDARD REVISIONS.
- SEE CHANGE #6 FOR FEB. 14, 2023 STANDARD REVISIONS.
- SEE CHANGE #7 FOR OCT. 7, 2024 STANDARD REVISIONS.
- SEE CHANGE #8 FOR JUL. 10, 2025 STANDARD REVISIONS.

GENERAL NOTES:

1. DESIGN SPECIFICATIONS:
2. MATERIAL STRENGTH:
3. DEAD LOAD:
4. DESIGN CONTROLS:
5. USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.
6. FOR ALL BARRIER REINFORCEMENT AND FOR HOOKED OR BENT BARS IN THE DECK SLAB, DO NOT USE RAIL STEEL (A 996). SEE DESIGN MANUAL PART 4, SECTION D5.4.3.1.
7. DESIGN TABLES ARE VALID FOR NORMAL WEIGHT CONCRETE DECKS. FOR LIGHTWEIGHT CONCRETE DECKS, INCREASE LENGTH L LISTED IN REINFORCEMENT TABLES SHEETS 10 AND 11 BY 13".
8. DETAIL ALL BARS ON THE CONTRACT DRAWINGS.
9. ALL DETAILS SHOWN ALSO APPLY TO P/S I-BEAMS, PA BULB-TEE AND P/S SPREAD BOX BEAMS EXCEPT AS NOTED.
10. FOR HAUNCH DETAILS, SEE SHEET 9.
11. FOR SKEW ANGLES 75° AND MORE, PLACE TRANSVERSE REINFORCEMENT IN DECK SLAB PARALLEL TO CENTERLINE OF BEARINGS.
12. SEE BC-767M AND BD-656M FOR ADDITIONAL REINFORCEMENT AT END OF DECK.
13. FOR TRANSITION OF LONGITUDINAL REINFORCEMENT FROM POSITIVE MOMENT AREA TO NEGATIVE MOMENT AREA, USE AASHTO ARTICLES 5.12.3.3 AND 6.10.1.7 AS MODIFIED BY DESIGN MANUAL PART 4, SECTIONS D5.12.3.3 AND D6.10.1.7.
14. DESIGN IS BASED ON DECKS SUPPORTED ON 3 OR MORE BEAMS.
15. THE STRENGTH DESIGN OF THE OVERHANG IS BASED ON THE ASSUMPTION THAT THE ENTIRE OVERHANG HAS A MINIMUM THICKNESS OF T + 1". THE BEAM HAUNCH MAY BE CONSIDERED AS EFFECTIVE IN CONTRIBUTING TO THIS THICKNESS FOR THE OVERHANG DESIGN ONLY.
16. THE 42" AND 45" F-SHAPE CONCRETE BARRIERS AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNATED AS MASH TL-5. THE 42" F-SHAPE CONCRETE BARRIER IS DESIGNATED AS TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42". THE ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-2. THE 50" SPLIT CONCRETE MEDIAN BARRIER AND 50" CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-4. THE 32" SPLIT CONCRETE MEDIAN BARRIER, 32" F-SHAPE CONCRETE BARRIER AND 32" CONCRETE MEDIAN BARRIER ARE DESIGNATED AS MASH TL-3.
17. DECK DESIGN TABLES ARE BASED ON THE EQUIVALENT STRIP METHOD AS PER AASHTO, ARTICLE 4.6.2.1.
18. FACTORED MOMENT = 1.25 (SLAB AND BARRIER MOMENT) + 1.5 (FWS MOMENT) + 1.75 (1+IM/100) (L.L. MOMENT)
19. DYNAMIC LOAD ALLOWANCE (IM) = 50%
20. SEE TABLES ON SHEETS 10 AND 11 FOR VALUES OF S, T, S1, S2, S3, S3', S6, S7, So, AND L.
21. FOR DECK SLAB AND BARRIER DETAILS AND REINFORCEMENT FOR ADJACENT PRESTRESSED CONCRETE BOX BEAMS, SEE BD-660M AND BD-661M.
22. FOR BARRIER REINFORCEMENT DETAILS, SEE SHEETS 7 AND 8.
23. OVERHANG LENGTH MUST NOT EXCEED THE REQUIREMENTS OF DESIGN MANUAL PART 4, SECTION D9.7.1.5.1P.
24. THE SLAB REINFORCEMENT SHOWN ON SHEETS 10 AND 11 IS APPLICABLE FOR THE BARRIERS SHOWN ON SHEET 2, 3, 4 AND 5, PA TYPE 10M, PA BRIDGE BARRIER AND CONCRETE VERTICAL WALL BRIDGE BARRIERS AND BARRIERS WITH FENCES AND HANDRAILS. REDESIGN OF THE DECK IS REQUIRED WHEN OTHER ATTACHMENTS SUCH AS LIGHT POLES AND SIGN STRUCTURES ARE USED. SEE NOTE 25 FOR MODIFICATIONS REQUIRED WHEN SOUND BARRIERS ARE USED.
25. CONCRETE SOUND BARRIER SHOWN ON BC-779M AND BD-679M MAY BE MOUNTED ON THE TOP OF BARRIER AS DETAILED ON SHEET 2. STANDARD REINFORCEMENT MAY BE USED AS FOLLOWS: LIMITATIONS
- HEIGHT OF SOUND BARRIER (ABOVE TOP OF BARRIER) ≤ 10'.
- WEIGHT OF SOUND BARRIER PLUS THE WEIGHT OF BARRIER AND DECK SLAB MINUS 650 LB. MAY NOT BE IN EXCESS OF 600 LB. PER FOOT OF LENGTH.
- DECK DESIGN PROCEDURE
- USING THE TABLES AND NOTES ON SHEETS 10 AND 11, ESTABLISH STANDARD DECK THICKNESS, REINFORCEMENT AND THE DESIGNATED MAXIMUM ALLOWANCE OVERHANG LENGTH BASED ON THE BEAM SPACING, S.
- INCREASE THE DESIGNATED DECK THICKNESS BY 1/2", AND USE THIS THICKNESS ACROSS FULL WIDTH OF BRIDGE.
- DECREASE THE DESIGNATED MAXIMUM ALLOWABLE OVERHANG LENGTH, So, BY 7".
- INCREASE THE LENGTH OF S7 BARS BY 9".
- WHERE CONDITIONS EXCEED THE ABOVE LIMITATIONS, PERFORM SPECIAL DECK DESIGN.
26. FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF BARRIERS/DIVISORS SHOWN ON BD-601M ARE AS FOLLOWS:
- 45" F-SHAPE CONCRETE BARRIER 700 LB./FT,
- 42" F-SHAPE CONCRETE BARRIER 650 LB./FT,
- 32" F-SHAPE CONCRETE BARRIER 520 LB./FT,
- 50" SPLIT CONCRETE MEDIAN BARRIER 750 LB./FT,
- 32" SPLIT CONCRETE MEDIAN BARRIER 520 LB./FT,
- 50" CONCRETE MEDIAN BARRIER 960 LB./FT,
- 32" CONCRETE MEDIAN BARRIER 700 LB./FT,
- CONCRETE MOUNTABLE DIVISOR TYPE A 260 LB./FT,
- TYPE B 280 LB./FT,
- SPLIT CONCRETE MOUNTABLE DIVISOR TYPE A 130 LB./FT,
- TYPE B 140 LB./FT,
- 42" VERTICAL WALL CONCRETE BARRIER ON ALTERNATE SIDEWALK (WITHOUT RAILING) 530 LB./FT.
27. TABLES 1-4 PROVIDED ON SHEET 10 CONSIDER THE TOP MAT TRANSVERSE BAR AS THE TOP BAR AND ARE ONLY APPLICABLE TO SIMPLE SPAN SUPERSTRUCTURE PROJECTS. TABLES 1-4 PROVIDED ON SHEET 11 CONSIDER THE TOP MAT LONGITUDINAL BAR AS THE TOP BAR AND SHALL BE USED FOR CONTINUOUS SPAN SUPERSTRUCTURE PROJECTS AND ARE OPTIONAL FOR USE IN SIMPLE SPAN SUPERSTRUCTURE PROJECTS.
28. MECHANICALLY GRIND BRIDGE DECKS WITHOUT OVERLAYS ON INTERSTATE, LIMITED ACCESS AND NHS ROUTES UNLESS EXEMPTED BY THE DISTRICT BRIDGE ENGINEER. INCLUDE MECHANICAL GRINDING SPECIFICATION IN CONTRACT. TO ACCOMMODATE MECHANICAL GRINDING, DECK SLAB SHALL BE PLACED WITH AN ADDITIONAL ¼" THICKNESS (T+ ¼") AND A TOP CLEAR COVER INCREASED BY ¼".
29. FOR BRIDGE DECKS WITH AN EPOXY, LATEX MODIFIED CONCRETE (LMC), OR POLYESTER POLYMER CONCRETE (PPC) OVERLAY, THE ½" INTEGRAL WEARING SURFACE MAY BE ELIMINATED WITH DISTRICT BRIDGE ENGINEER APPROVAL, THEREBY REDUCING THE CONCRETE DECK SLAB THICKNESS AND TOP CONCRETE COVER BY ½".

LEGEND:

- ① WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.
- ② EXTEND ONE HALF OF THE S1, BOTTOM TRANSVERSE BARS, ACROSS THE FULL WIDTH OF THE OVERHANG. THE ALTERNATE BARS WHICH DO NOT EXTEND INTO THE OVERHANG SHALL EXTEND 6" MINIMUM BEYOND THE INTERIOR EDGE OF THE FLANGE OF THE FASCIA BEAM.
- ③ BUNDLE THE BARS LISTED AS S7 IN THE REINFORCEMENT TABLES TO EACH S2 BAR.
- ④ BEGIN S3 AND S3' BARS AT LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT, SEE SHEET 9. S3 AND S3' BARS DO NOT NEED TO BE PLACED OVER THE BEAM FOR SPREAD BOX BEAM BRIDGE.
- ⑤ FOR EMBEDMENT INTO THE CONCRETE BARRIER, SEE SHEET 7.
- ⑥ FOR DRIP NOTCH DETAILS, SEE BC-775M.
- ⑦ UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.
- ⑧ FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP. (SEE NOTE 24)
- ⑨ FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 2.
- ⑩ IF THE BARRIER IS POSITIONED DIRECTLY ABOVE A GIRDER THE S7 BAR, IF REQUIRED, MUST EXTEND THE DISTANCE "L" BEYOND THE ADJACENT BEAMS ON EACH SIDE.
- ⑪ DECK SLAB LAP SPLICE LENGTH: NORMAL WEIGHT CONCRETE: 3'-0" #5 BARS  
3'-7" #6 BARS  
LIGHT WEIGHT CONCRETE: 3'-6" #5 BARS  
4'-2" #6 BARS
- ⑫ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTER LINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 & S7 BARS. BEVEL DRAINS AS PER BC-751M.
- ⑬ WHEN A TRAFFIC BARRIER IS MOUNTED ON THE DECK BETWEEN TWO GIRDERS, PROVIDE TOP AND BOTTOM REINFORCEMENT AREA IN THE DECK IN THE BAY WHERE THE BARRIER EXISTS, AT LEAST EQUAL TO THE OVERHANG TOP REINFORCEMENT AREA AS SHOWN ON SHEETS 10 AND 11. IF S7 BARS ARE REQUIRED THEY SHOULD MATCH THE SPACING OF THE S2 BARS ON THE TOP MAT AND S1 BARS ON THE BOTTOM MAT.
- ⑭ TO BE USED WHEN MATCHING DETAIL IS SPECIFIED IN APPROACH ROADWAY.
- ⑮ TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.
- ⑯ SPACE BARS S3, S3', S4, S5, AND S6 SYMMETRICALLY ABOUT THE PANEL CENTERLINE.
- ⑰ PROVIDE HAUNCH TO COMPENSATE FOR IRREGULARITIES IN CAMBER. SEE TABLE 1, SHEET 9 FOR MINIMUM HAUNCH REQUIREMENTS.
- ⑱ FOR PRESTRESSED CONCRETE BRIDGES MADE CONTINUOUS, DESIGN S5 AND S6 BARS IN ACCORDANCE WITH DM-4 ARTICLE D5.12.3.3.
- ⑲ USE BEAM HAUNCH DETAILS SHOWN WITH REMOVABLE DECK FORMS. FACE OF HAUNCH IS VERTICAL WHEN PERMANENT METAL DECK FORMS ARE USED IN PLACING THE DECK. BEAM HAUNCH DETAIL SHALL CONFORM TO BC-732M.
- ⑳ SPLICES SHOULD BE OUTSIDE OF NEGATIVE MOMENT AREA IF POSSIBLE, IF NOT , CENTER BAR LENGTH ON CENTER OF NEGATIVE MOMENT AREA. STAGGER SPLICES AS PER BD-660M.

CONTRACT DRAWING NOTE:

1. THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42" F-SHAPE CONCRETE BARRIER IS USED: THE 42" F-SHAPE CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42".

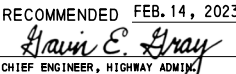
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-65M	CONCRETE MOUNTABLE CURBS
BD-609M	PA 3-RAIL BRIDGE BARRIER
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-656M	TYP. LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BC-701M	PROTECTIVE FENCE
BC-706M	PA 3-RAIL BRIDGE BARRIER
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-719M	BRIDGE DECK TEMPORARY BARRIERS
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
BC-722M	LIGHTING POLE ANCHORAGE
BC-732M	PERMANENT METAL DECK FORMS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
BC-752M	CONCRETE DECK SLAB DETAILS
BC-762M	TOOTH EXPANSION DAM
BC-767M	NEOPRENE STRIP SEAL DAM
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-779M	STRUCTURE MOUNTED SOUND BARRIER WALLS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

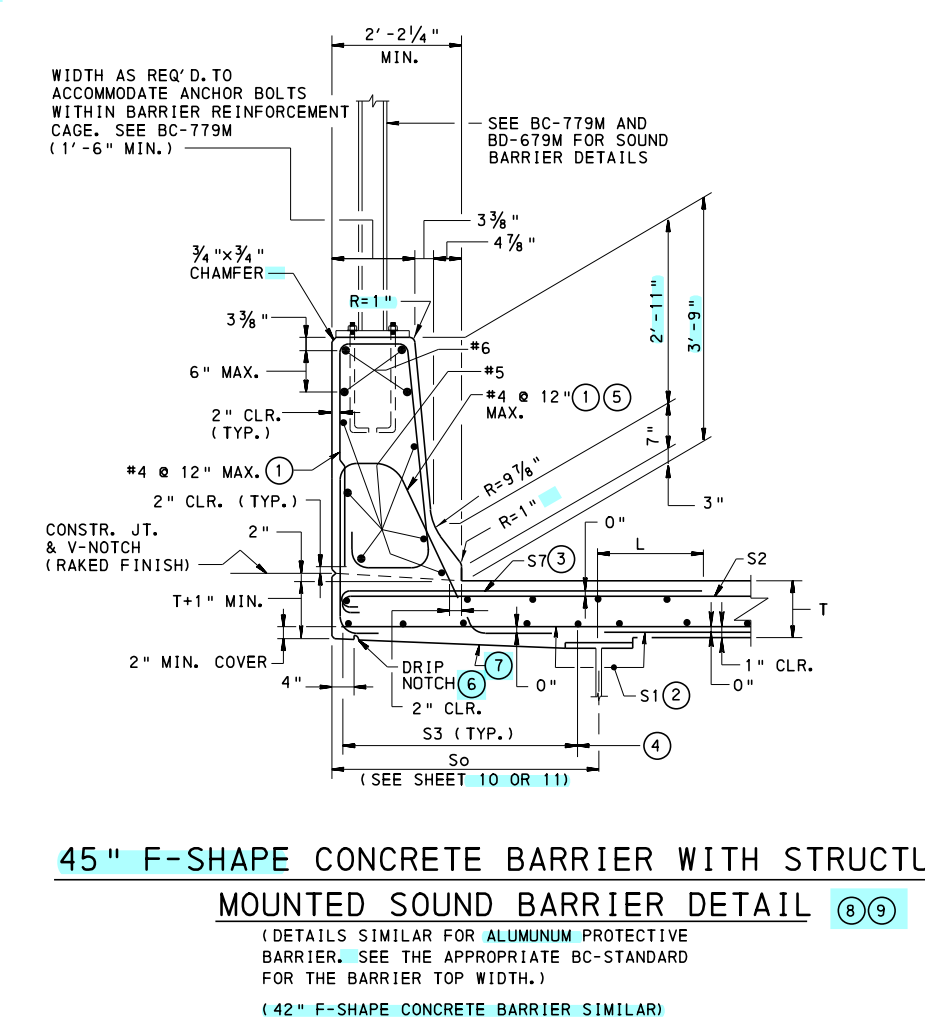
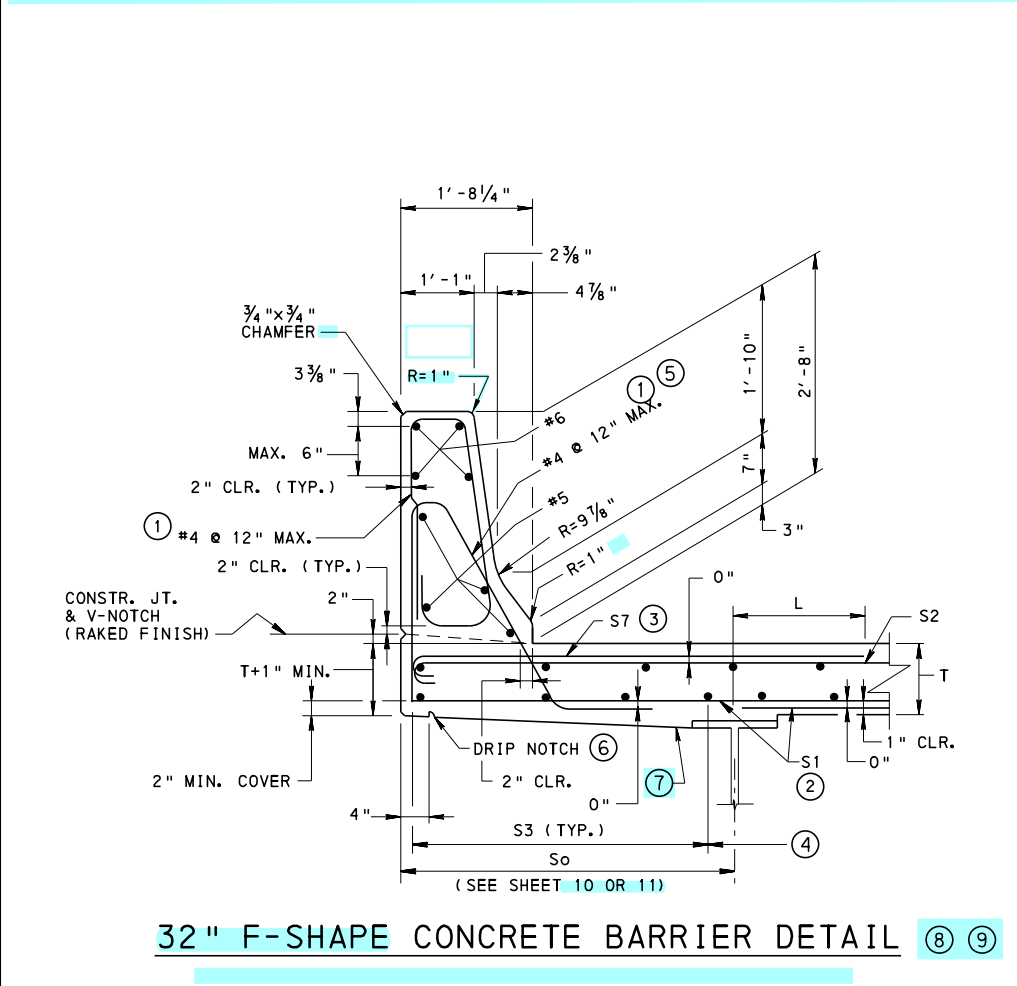
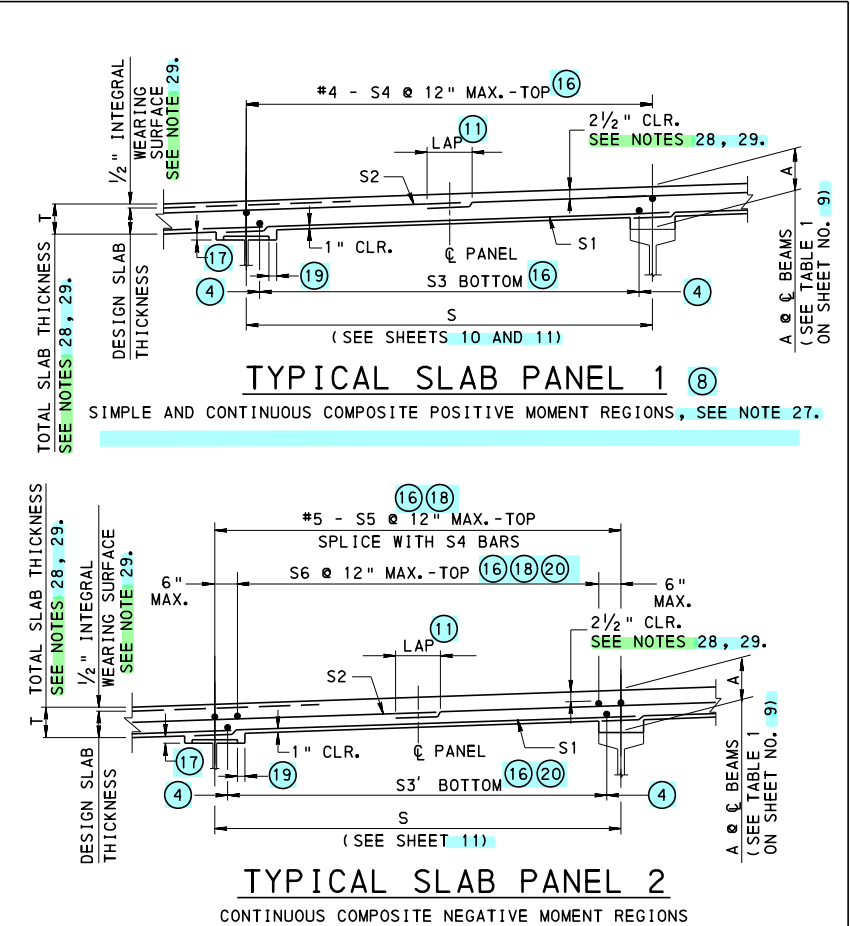
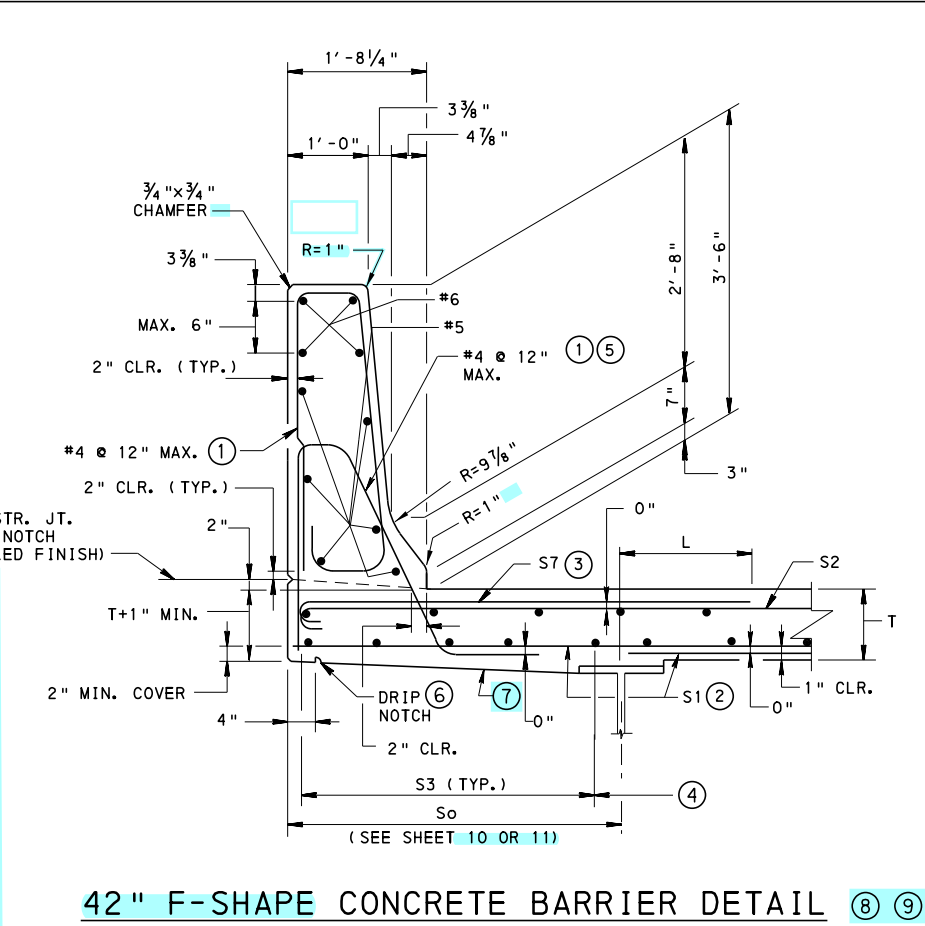
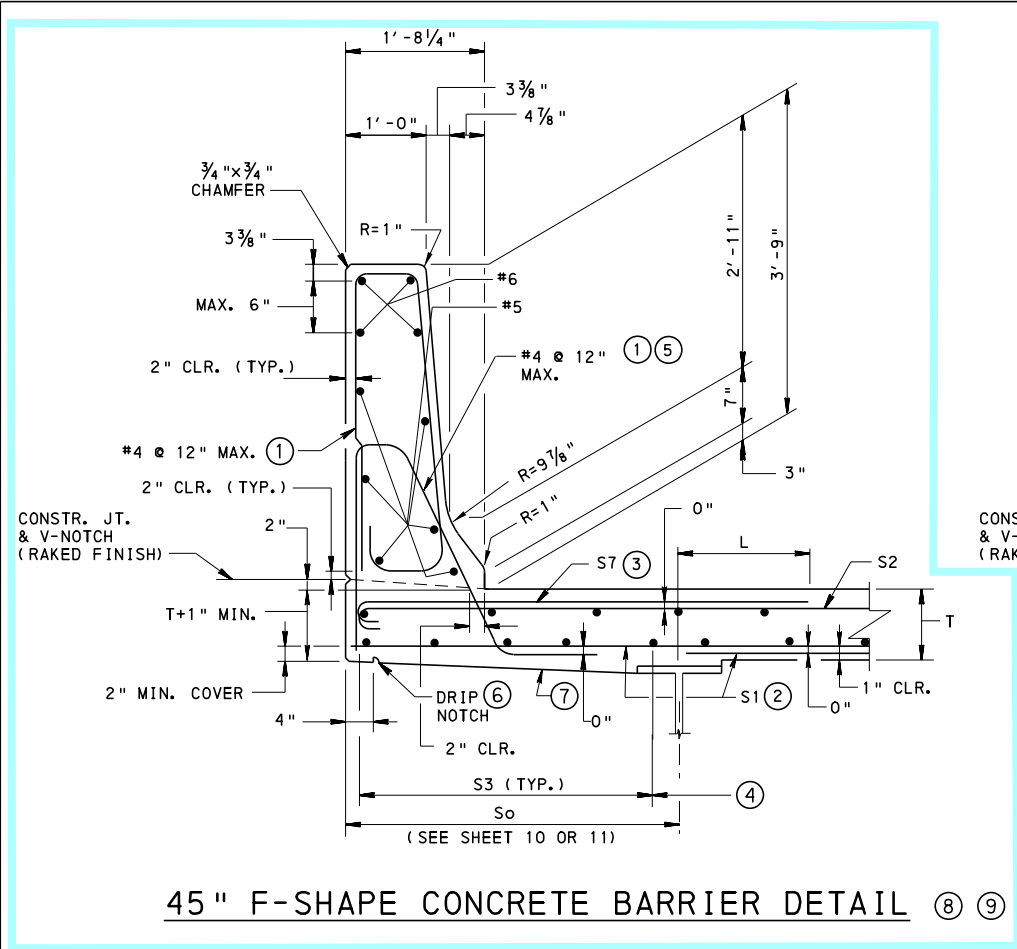
STANDARD  
CONCRETE DECK SLAB  
DESIGN & DETAILS  
FOR BEAM BRIDGES

RECOMMENDED FEB. 14, 2023  
  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023  
  
CHIEF ENGINEER, HIGHWAY DIVISION

SHEET 1 OF 12  
BD-601M

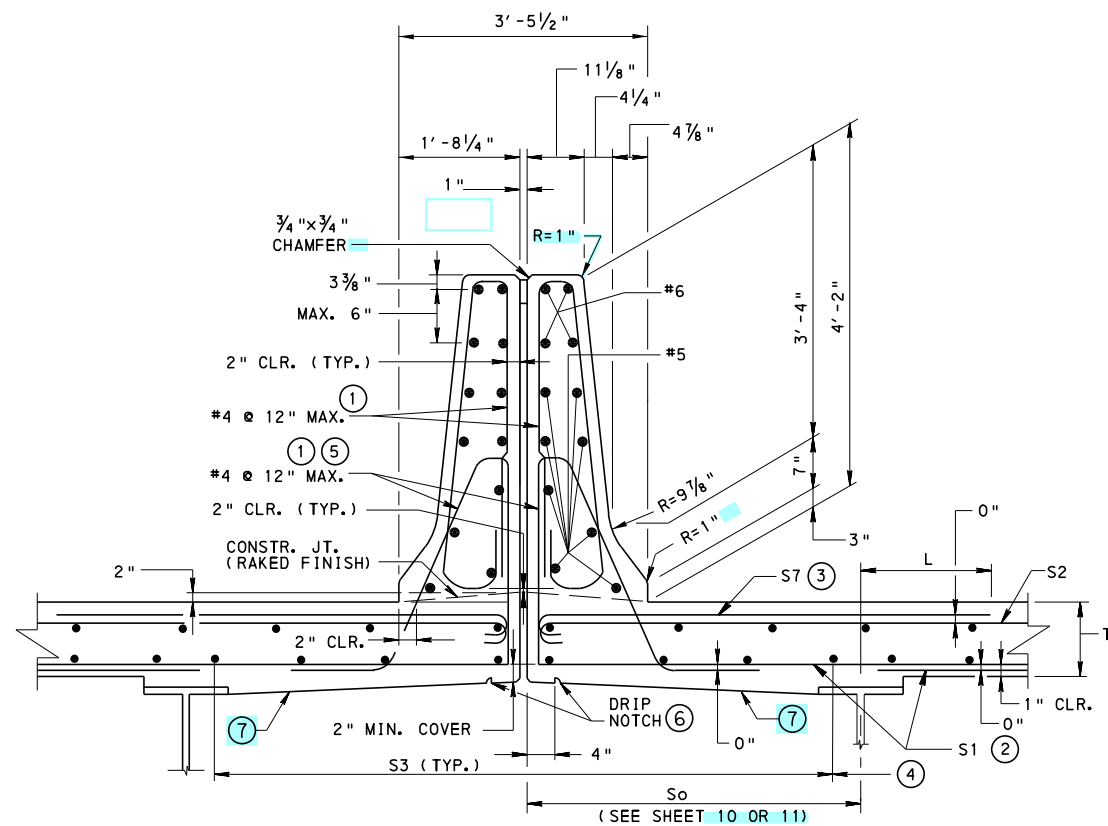




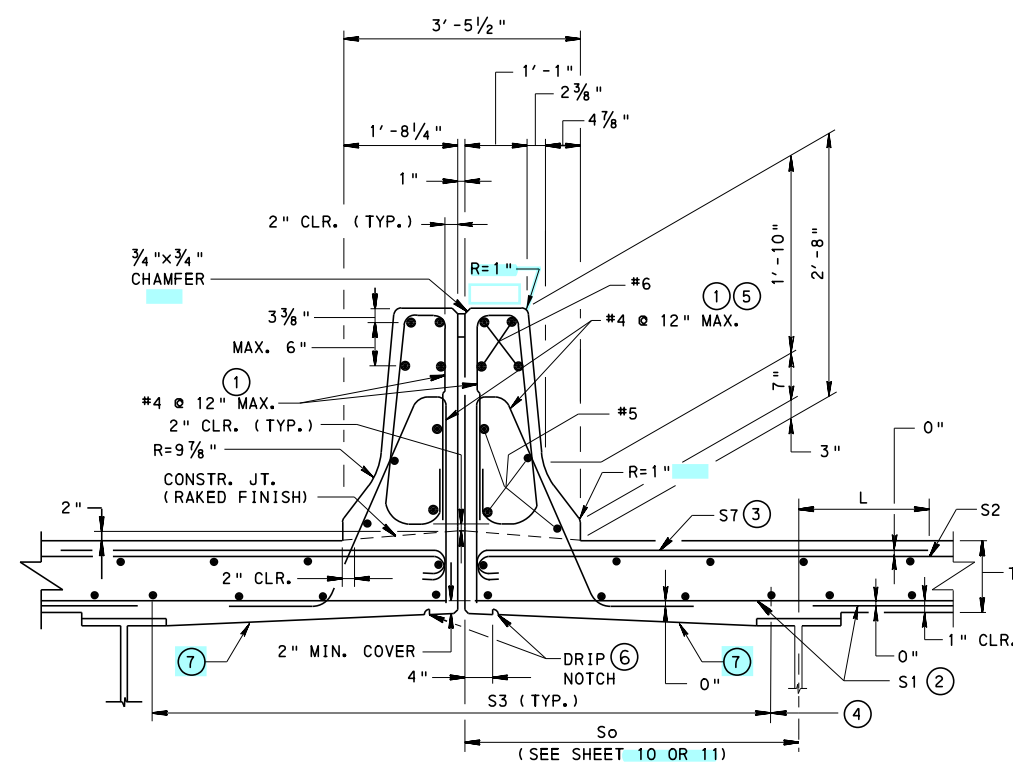
- NOTES:**
- FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
  - BARRIER LAP SPLICE LENGTH:
 

NORMAL WEIGHT CONCRETE:	3'-7" #5 BARS
	4'-4" #6 BARS
LIGHT WEIGHT CONCRETE:	4'-2" #5 BARS
	5'-1" #6 BARS

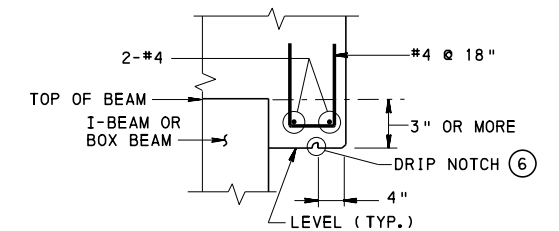




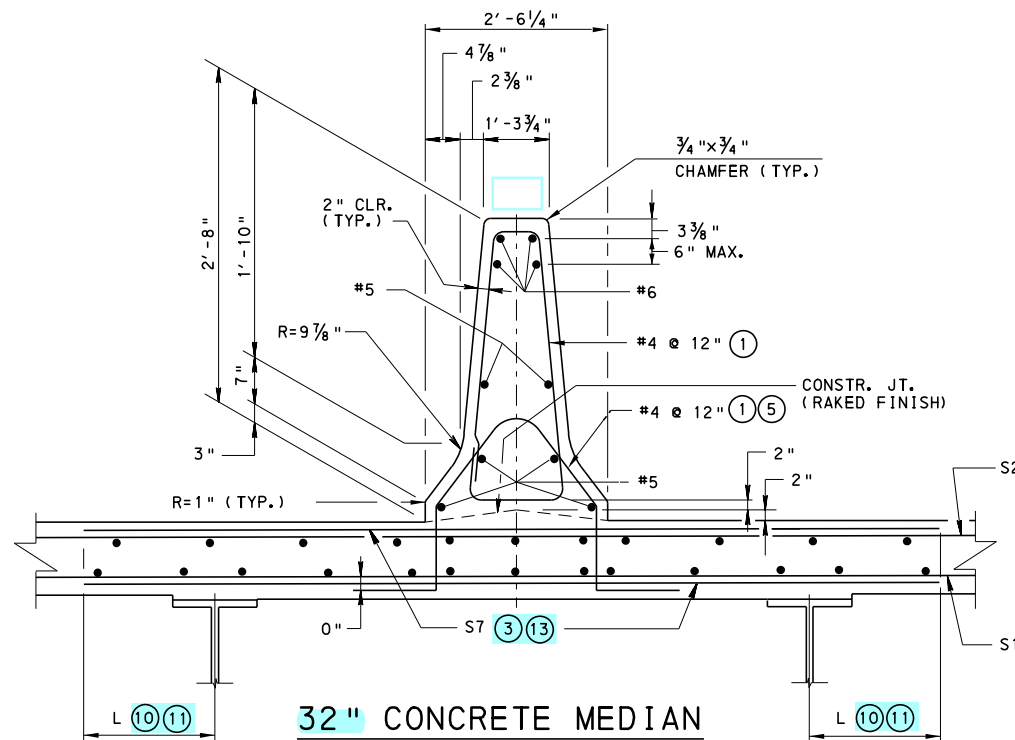
**50" SPLIT CONCRETE  
MEDIAN BARRIER DETAIL** (8) (9) (14)  
(SEE BC-788M FOR OPEN JOINT DETAIL)



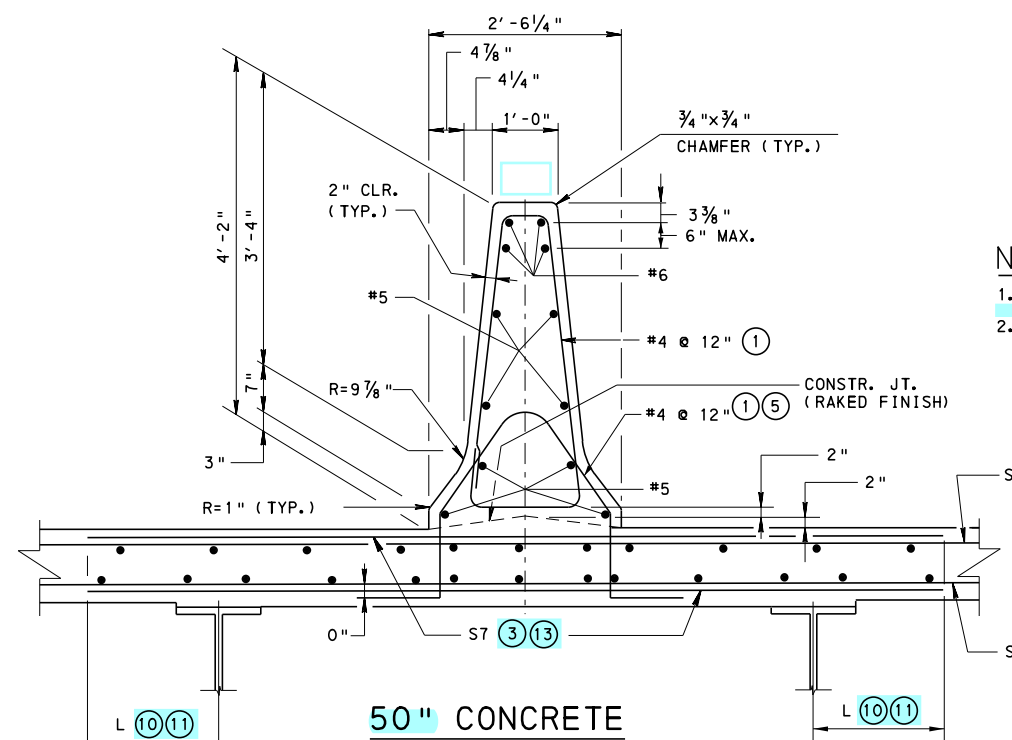
**32" SPLIT CONCRETE  
MEDIAN BARRIER DETAIL** (8) (9) (14)  
(SEE BC-788M FOR OPEN JOINT DETAIL)



**TYPICAL  
OVERHANG REINFORCEMENT**  
(TO BE USED WHEN THE OVERHANG IS 3" OR MORE IN DEPTH)



**32" CONCRETE MEDIAN  
BARRIER DETAIL** (8) (9) (14) (15)



**50" CONCRETE  
MEDIAN BARRIER DETAIL** (8) (9) (14) (15)

**NOTES:**

- FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
- BARRIER LAP SPLICE LENGTH: **NORMAL WEIGHT CONCRETE:** 3'-7" #5 BARS  
4'-4" #6 BARS  
**LIGHT WEIGHT CONCRETE:** 4'-2" #5 BARS  
5'-1" #6 BARS

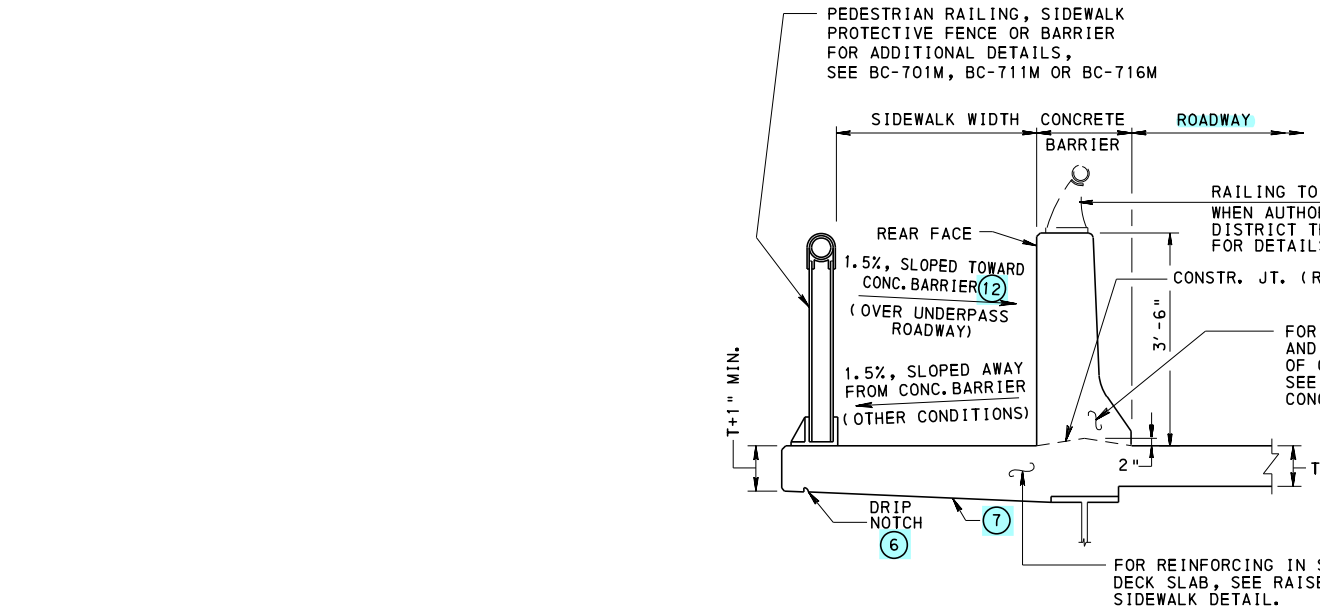
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

**STANDARD  
CONCRETE DECK SLAB  
DESIGN & DETAILS  
FOR BEAM BRIDGES**

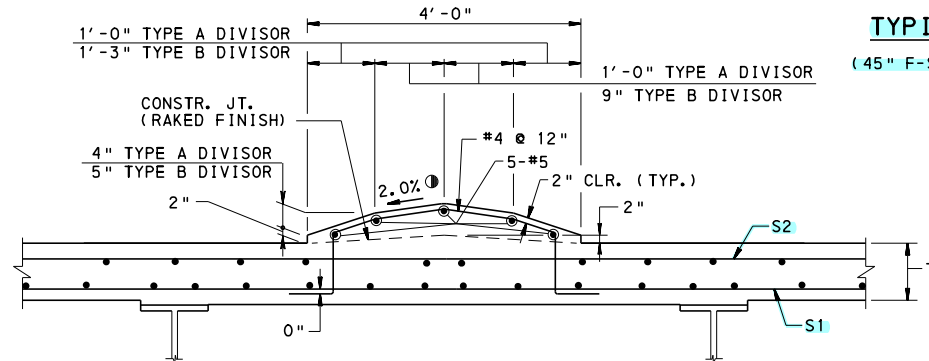
RECOMMENDED FEB. 14, 2023  
*L. L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023  
*Gray E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 12  
BD-601M

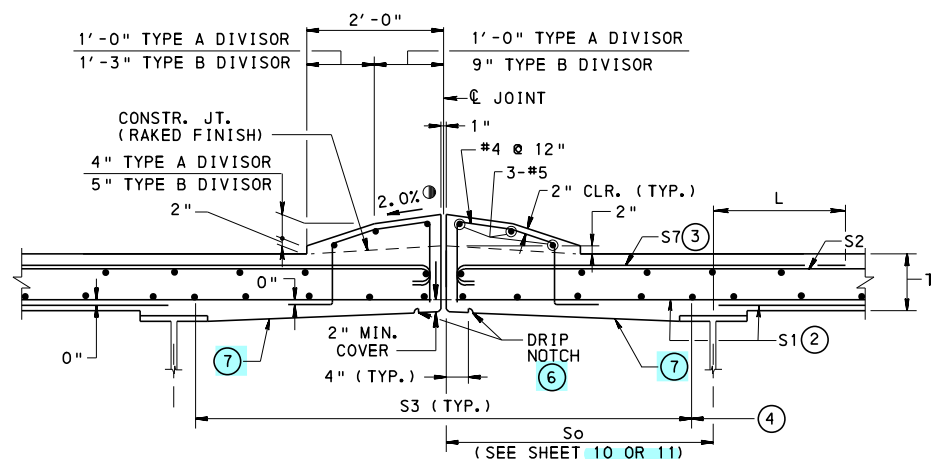


**TYPICAL SIDEWALK DETAIL**  
(45" F-SHAPE CONCRETE BARRIER SIMILAR)

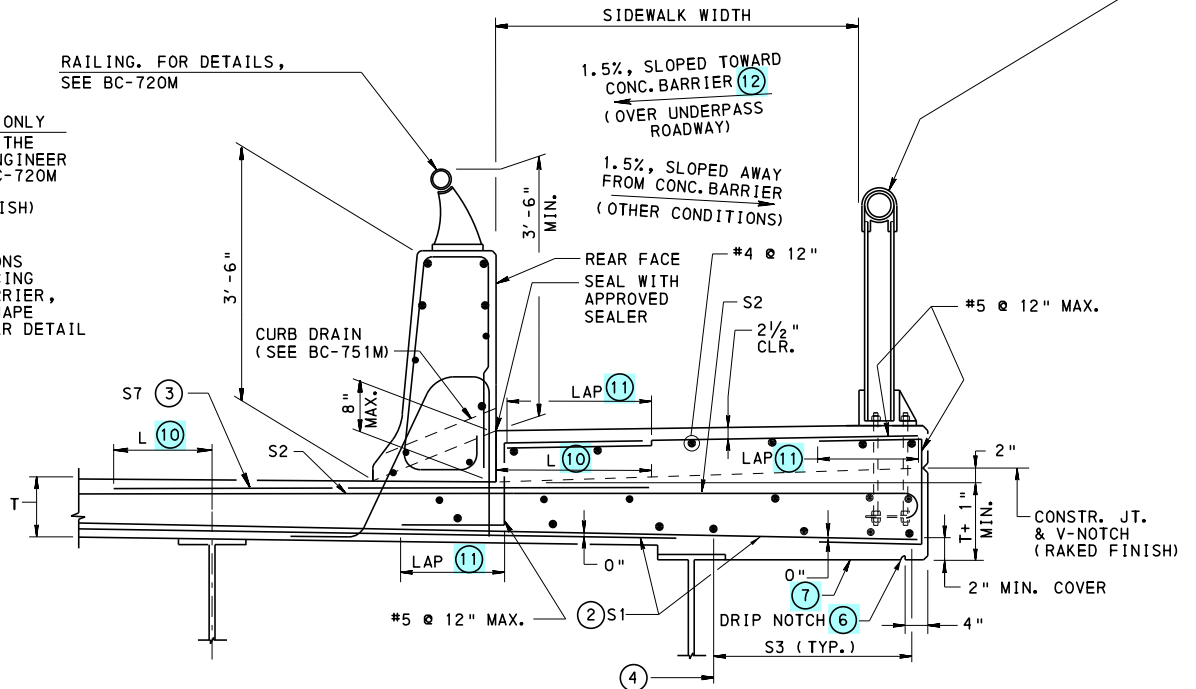


- 1. FOR TYPE A AND B DIVISORS, SET CROSS SLOPE AT 2.0%. WHERE WIDER THAN SHOWN DIVISORS ARE USED, PROVIDE WIDTH AND SET CROSS SLOPE BETWEEN 1.0% AND 2.0%.

**CONCRETE MOUNTABLE DIVISOR DETAIL** (8)(9)(14)(15)  
(NOT FOR USE AS A TRAFFIC BARRIER, SEE RC-65M.)

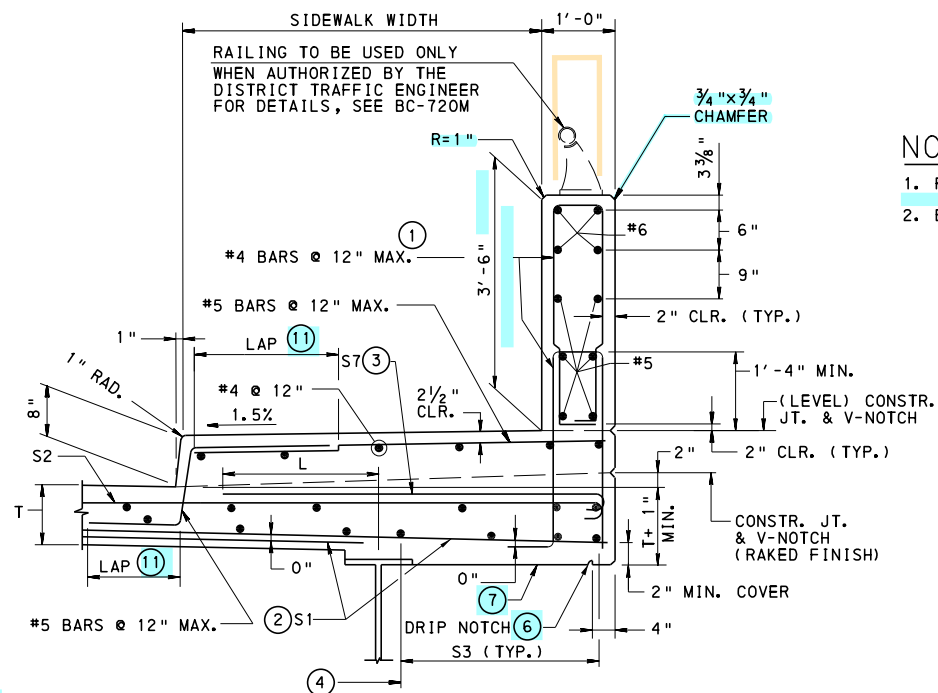


**SPLIT CONCRETE MOUNTABLE DIVISOR DETAIL** (8)(9)(14)(15)  
(SEE BC-788M FOR OPEN JOINT DETAIL)  
(NOT FOR USE AS A TRAFFIC BARRIER, SEE RC-65M.)



**RAISED SIDEWALK DETAIL** (8)(9)  
(SEE SHEET 2 FOR BARRIER REINFORCEMENT)  
(42" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 45" F-SHAPE CONCRETE BARRIER SIMILAR)

**PROTECTED SIDEWALKS**  
REQUIRED FOR BRIDGES WITH A POSTED VEHICULAR SPEED GREATER THAN 45 MPH OR A STRUCTURE LENGTH LONGER THAN 200 FEET, UNLESS WAIVED BY THE DEPARTMENT (SEE DM-4 DC2.3.2.2.2).



**ALTERNATE SIDEWALK WITH 42\"/>**

PERMITTED FOR BRIDGES WITH A POSTED VEHICULAR SPEED LESS THAN OR EQUAL TO 45 MPH AND A STRUCTURE LENGTH LESS THAN OR EQUAL TO 200 FEET, SEE DM-4 DC2.3.2.2.2.

**NOTES:**

- FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
- BARRIER LAP SPLICE LENGTH:
 

NORMAL WEIGHT CONCRETE:	3'-7" #5 BARS
	4'-4" #6 BARS
LIGHT WEIGHT CONCRETE:	4'-2" #5 BARS
	5'-1" #6 BARS

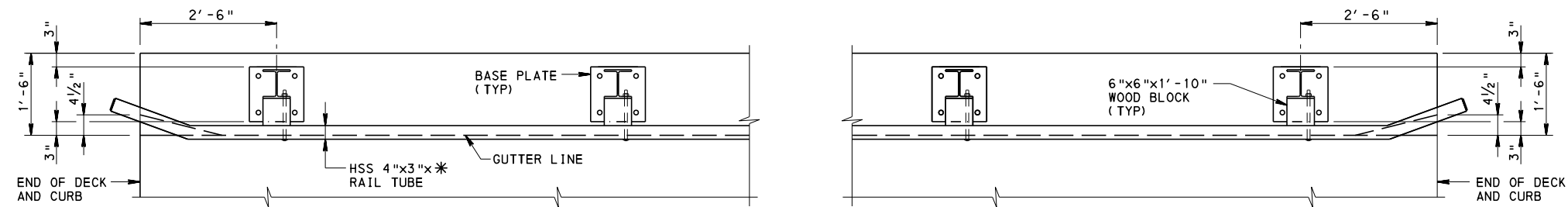
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF BRIDGE

**STANDARD**  
**CONCRETE DECK SLAB**  
**DESIGN & DETAILS**  
**FOR BEAM BRIDGES**

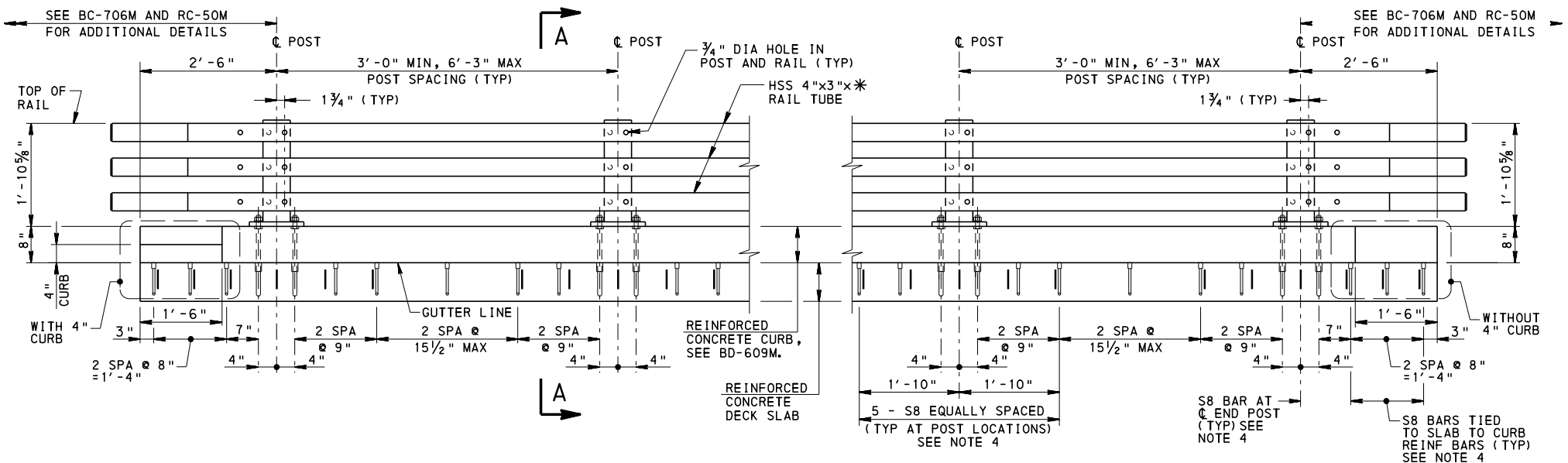
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CHIEF BRIDGE ENGINEER

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SHEET 4 OF 12  
BD-601M

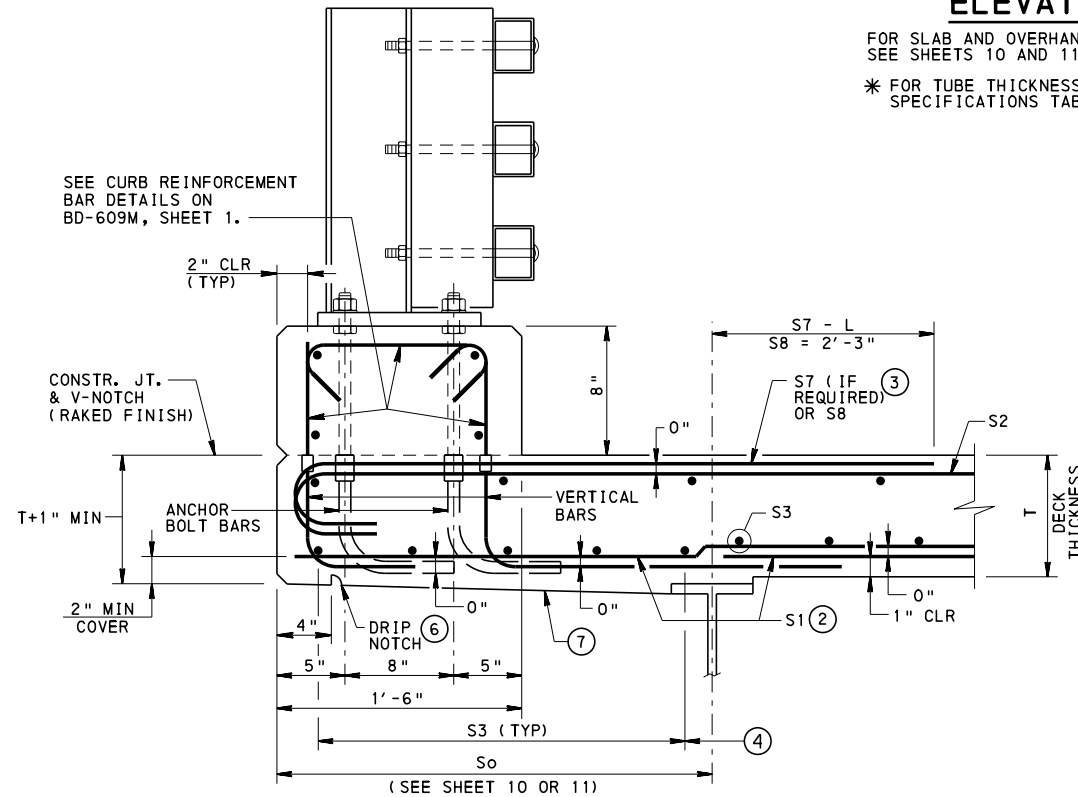


PLAN



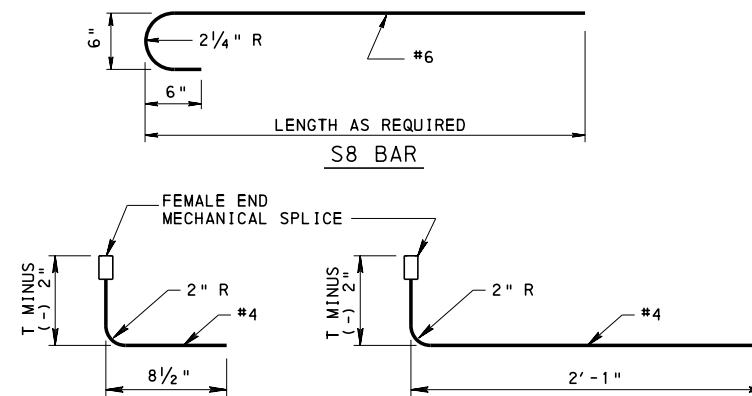
ELEVATION

FOR SLAB AND OVERHANG REINFORCEMENT  
SEE SHEETS 10 AND 11, TABLES 1 THRU 4.  
\* FOR TUBE THICKNESS, SEE TUBE RAIL  
SPECIFICATIONS TABLE ON BC-706M.

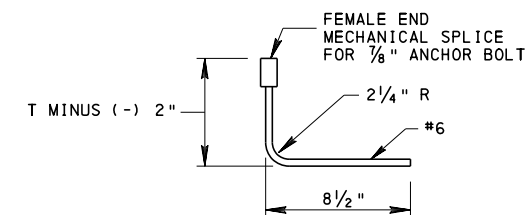


SECTION A-A (8) (9)

NOTE:  
PRIOR TO CONSTRUCTING CURB AND DECK,  
ANCHOR BOLTS SHALL BE INSTALLED WITH  
EITHER A TEMPLATE OR ACTUAL POST W/  
BASEPLATE INSTALLED TO ENSURE PROPER  
ANCHOR BOLT ALIGNMENT & PLACEMENT.



SLAB TO CURB REINFORCEMENT BAR DETAILS  
MECHANICAL SPLICE AS LISTED IN BULLETIN 15



ANCHOR BOLT BAR DETAIL  
MECHANICAL SPLICE AS LISTED IN BULLETIN 15

NOTES:

1. FOR ADDITIONAL NOTES AND LEGEND, SEE SHEET 1.
2. THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.
3. FOR PA 3-RAIL BRIDGE BARRIER DETAILS, SEE BD-609M.
4. PROVIDE S8 BARS ONLY WHEN S7 BARS ARE NOT REQUIRED.

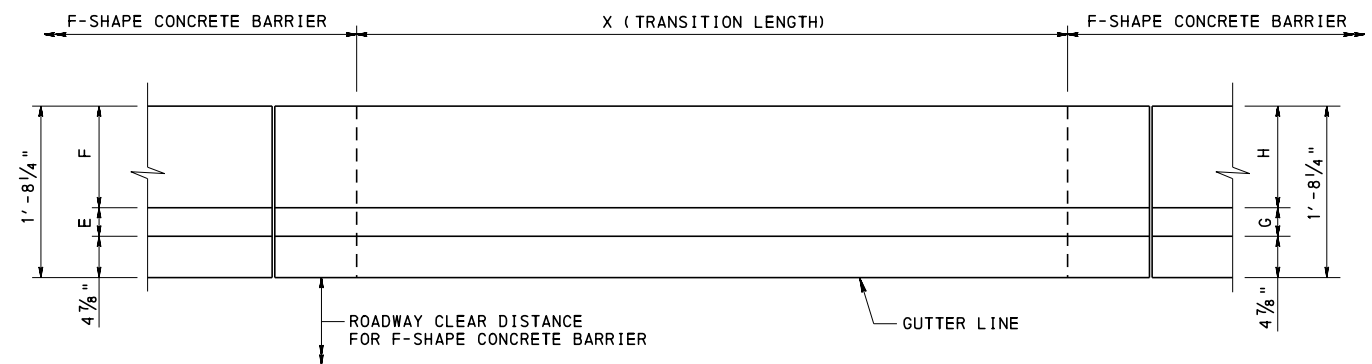
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CONCRETE DECK SLAB  
PA 3-RAIL BRIDGE BARRIER  
FOR BEAM BRIDGES

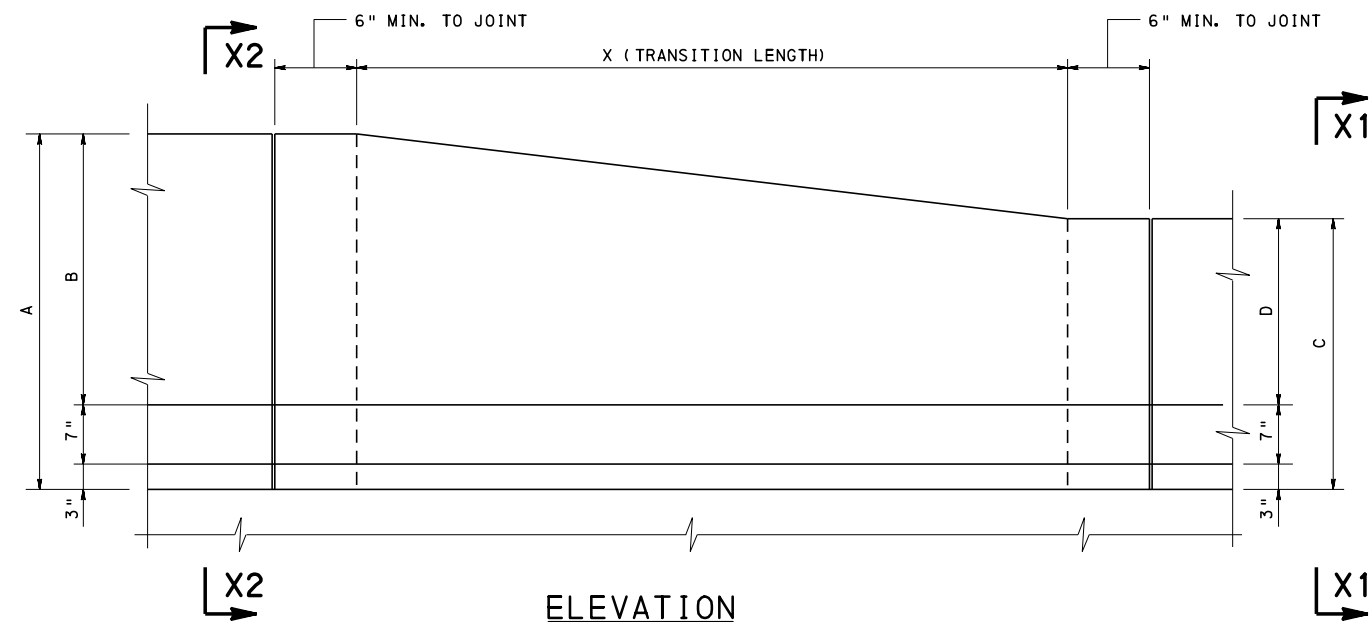
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SHEET 5 OF 12  
BD-601M



PLAN



ELEVATION

F-SHAPE TO F-SHAPE CONCRETE BARRIER TRANSITION

NOTES:

- 1. FOR SECTIONS X1-X1 AND X2-X2, SEE SPECIFIC F-SHAPE CONCRETE BARRIER DETAIL, SHEET 2.

TRANSITION	A	B	C	D	E	F	G	H	X
45" F-SHAPE TO 32" F-SHAPE	3'-9"	2'-11"	2'-8"	1'-10"	3 3/8"	1'-0"	2 3/8"	1'-1"	6'-6" MIN.
42" F-SHAPE TO 32" F-SHAPE	3'-6"	2'-8"	2'-8"	1'-10"	3 3/8"	1'-0"	2 3/8"	1'-1"	5'-0" MIN.
45" F-SHAPE TO 42" F-SHAPE	3'-9"	2'-11"	3'-6"	2'-8"	3 3/8"	1'-0"	3 3/8"	1'-0"	2'-0" MIN.

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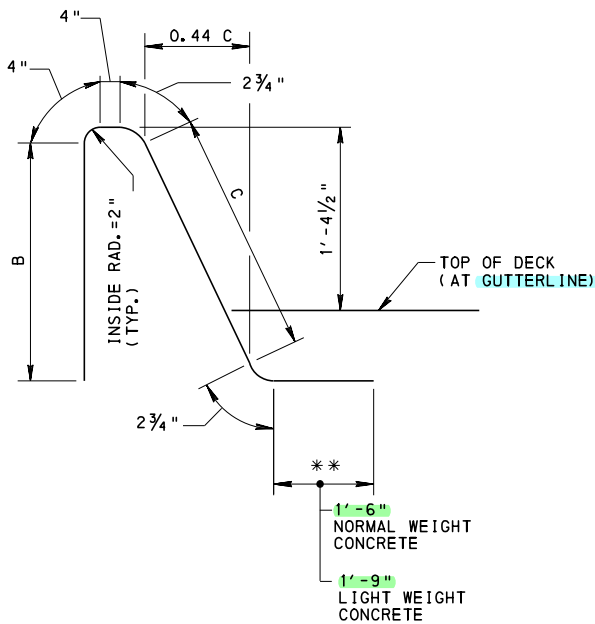
STANDARD  
CONCRETE DECK SLAB  
F-SHAPE CONCRETE  
BARRIER TRANSITIONS

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*[Signature]*  
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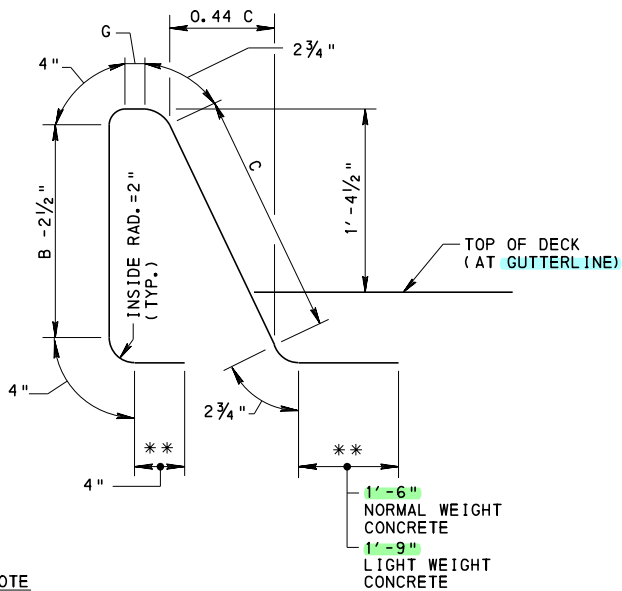
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SHEET 6 OF 12  
BD-601M

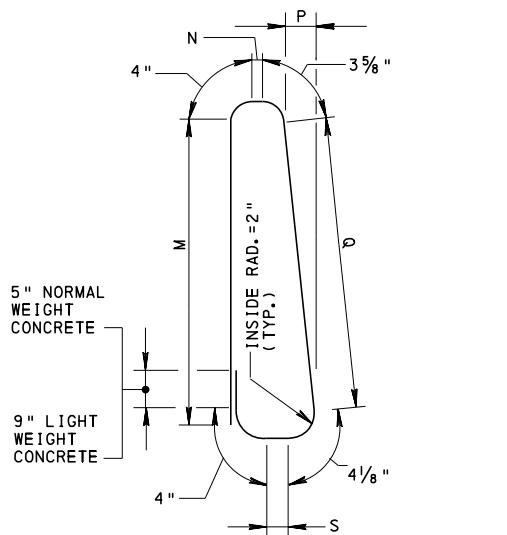
\*\* WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE  
SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO  
PROVIDE NECESSARY DIMENSIONS.



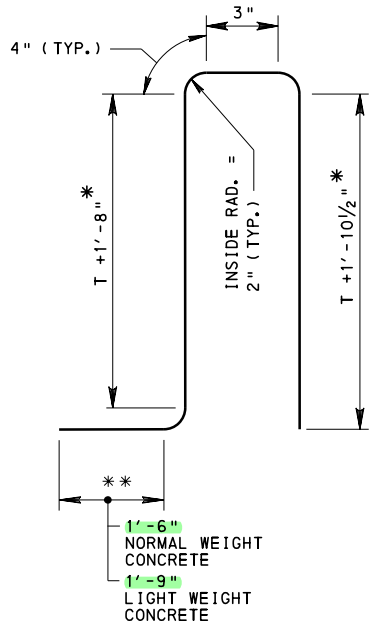
**F-SHAPE BARRIERS  
AND SPLIT MEDIAN BARRIERS**  
(FOR DIMENSIONS "B" AND "C", SEE TABLE 1)



**F-SHAPE BARRIERS WITH SOUND BARRIERS  
AND ALUMINUM PROTECTIVE BARRIER**  
(FOR DIMENSIONS "B" AND "C", SEE TABLE 1)



**F-SHAPE BARRIERS  
AND SPLIT MEDIAN BARRIERS**  
(FOR DIMENSIONS M, N, P, Q AND S, SEE TABLE 2)  
(DETERMINE DIMENSIONS N AND S FOR BARRIER  
WITH SOUND BARRIER)



**ALTERNATE SIDEWALK WITH 42"  
VERTICAL WALL CONCRETE BARRIER**  
\* DETAILED FOR SIDEWALK DEPTH OF 8"

**TABLE 1**

B AND C DIMENSIONS		
T	F-SHAPE BARRIERS AND SPLIT MEDIAN BARRIERS	
	B	C
8.0 "	1' - 9 "	1' - 11 "
8.5 "	1' - 9 1/2 "	1' - 11 1/2 "
9.0 "	1' - 10 "	2' - 0 "
9.5 "	1' - 10 1/2 "	2' - 0 1/2 "
10.0 "	1' - 11 "	2' - 1 1/4 "
10.5 "	1' - 11 1/2 "	2' - 1 3/4 "
11.0 "	2' - 0 "	2' - 2 1/4 "
11.5 "	2' - 0 1/2 "	2' - 2 3/4 "

**TABLE 2**

	M, N, P, Q AND S DIMENSIONS				
	M	N	P	Q	S
45" F-SHAPE CONCRETE BARRIER	3' - 0 1/2 "	3 3/8 "	3 3/8 "	2' - 10 3/4 "	6 3/4 "
42" F-SHAPE CONCRETE BARRIER	2' - 9 1/2 "	3 3/8 "	3 3/8 "	2' - 7 3/4 "	6 3/4 "
32" F-SHAPE CONCRETE BARRIER AND 32" SPLIT MEDIAN BARRIER	1' - 11 1/2 "	4 1/2 "	2 1/4 "	1' - 9 3/4 "	6 3/4 "
50" SPLIT CONCRETE MEDIAN BARRIER	3' - 5 1/2 "	2 1/2 "	4 1/8 "	3' - 3 3/4 "	6 3/4 "

**REINFORCEMENT DETAILS**

**REINFORCEMENT BAR NOTES**

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.

**NOTES:**

FOR NOTES, SEE SHEET 1.

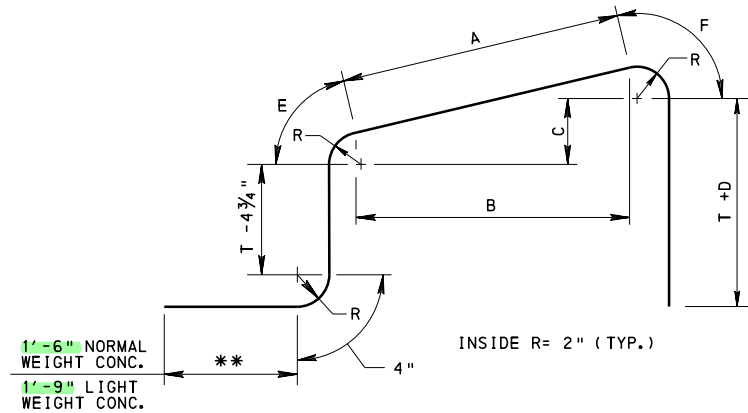
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**STANDARD  
CONCRETE DECK SLAB  
DESIGN & DETAILS  
FOR BEAM BRIDGES**

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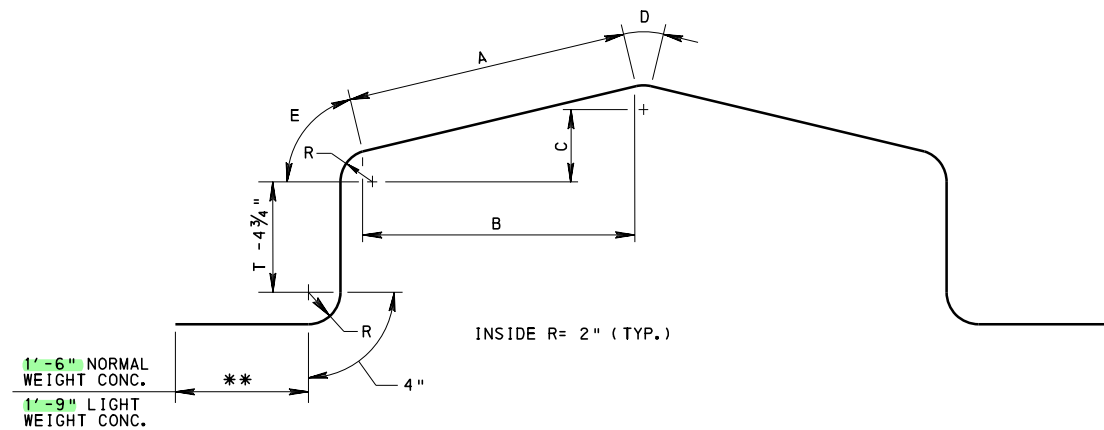
SHEET 7 OF 12  
BD-601M



**SPLIT CONCRETE MOUNTABLE DIVISOR**  
(FOR DIMENSIONS A, B, C, D, E AND F, SEE TABLE 3)

TABLE 3						
A, B, C, D, E AND F DIMENSIONS						
SPLIT DIVISORS	A	B	C	D	E	F
TYPE A	15 1/4"	15"	3"	5/8"	3 1/2"	4 1/4"
TYPE B	15 3/4"	15 1/4"	4 1/4"	1 1/2"	3 1/4"	4 1/2"

(WHERE WIDER THAN SHOWN DIVISORS ARE USED, PROVIDE WIDTH AND A, B, C AND D DIMENSIONS)



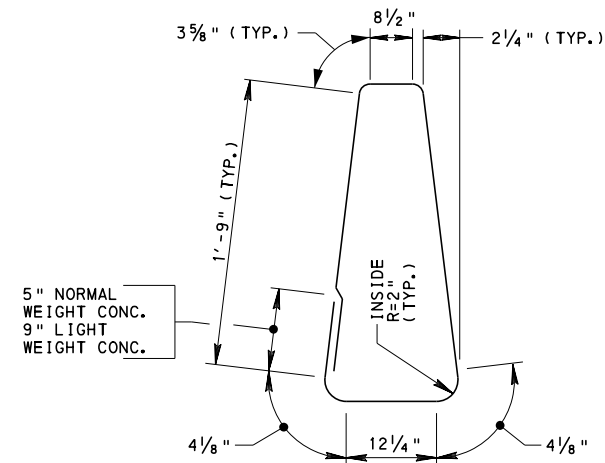
**CONCRETE MOUNTABLE DIVISOR**  
(FOR DIMENSIONS A, B, C, D, AND E, SEE TABLE 4)

TABLE 4					
A, B, C, D, AND E DIMENSIONS					
DIVISORS	A	B	C	D	E
TYPE A	19 3/4"	19 1/2"	4 1/4"	1/2"	3 1/2"
TYPE B	20 1/4"	20"	5 1/4"	1/2"	3 3/8"

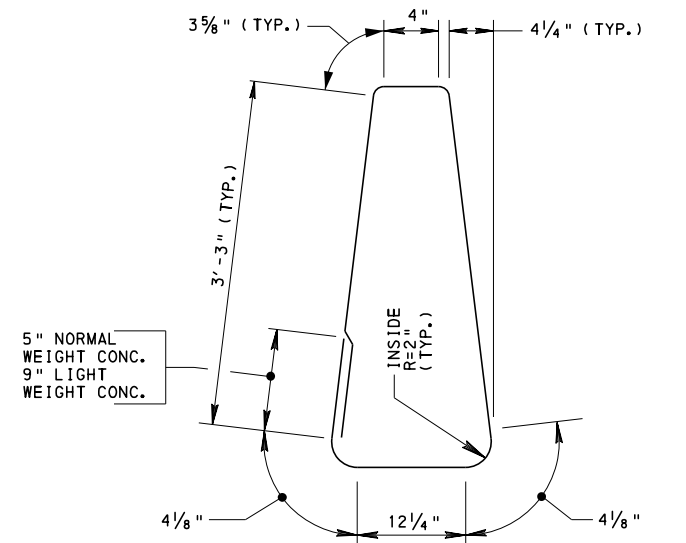
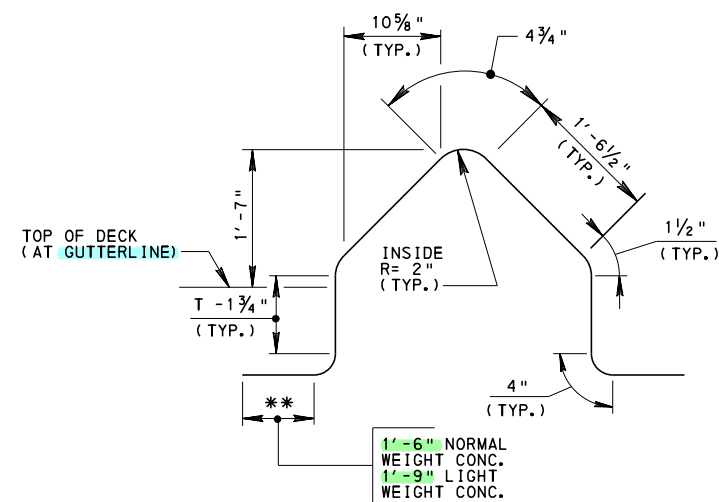
(WHERE WIDER THAN SHOWN DIVISORS ARE USED, PROVIDE WIDTH AND A, B, AND C DIMENSIONS)

### REINFORCEMENT DETAILS

\*\* WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.



**32" CONCRETE MEDIAN BARRIER**



**50" CONCRETE MEDIAN BARRIER**

**NOTES:**  
FOR NOTES, SEE SHEET 1.

### REINFORCEMENT BAR NOTES

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.

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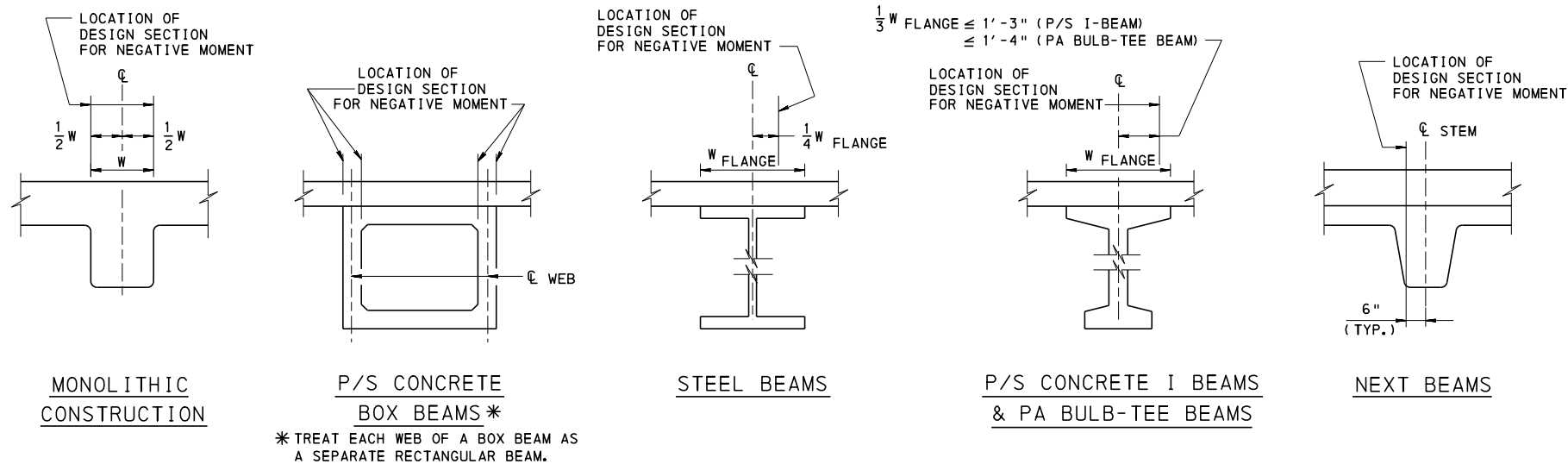
**STANDARD**  
**CONCRETE DECK SLAB**  
**DESIGN & DETAILS**  
**FOR BEAM BRIDGES**

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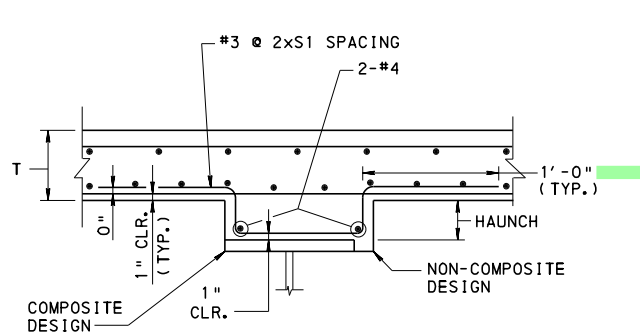
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SHEET 8 OF 12  
BD-601M





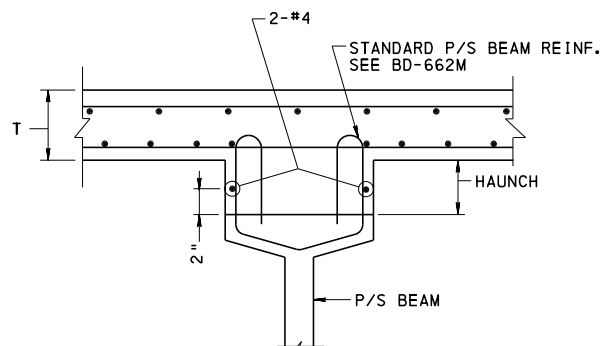
## LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT IN DECK SLABS



### STEEL BEAMS

PROVIDE WHEN HAUNCH THICKNESS IS 3" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH

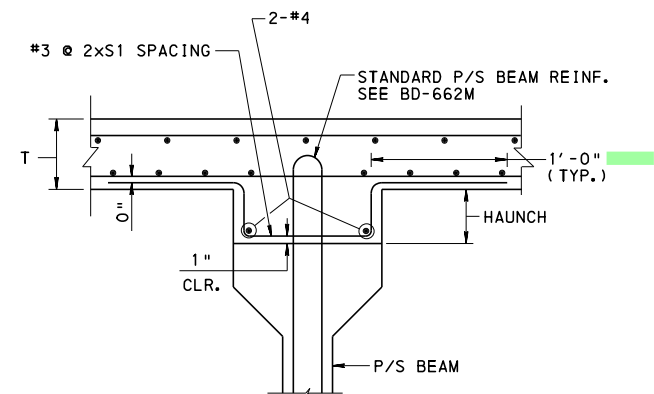
FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



### AASHTO TYPE P/S CONC. I-BEAM (P/S SPREAD BOX BEAM SIMILAR)

PROVIDE WHEN HAUNCH THICKNESS IS 5" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



### P/S CONC. PA I-BEAM & PA BULB-TEE BEAMS

PROVIDE WHEN SIP FORMS ARE PRESENT AND HAUNCH THICKNESS IS 5" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH OR WHEN SIP FORMS ARE NOT PRESENT AND THE HAUNCH THICKNESS IS 3" OR GREATER ANYWHERE ACROSS WIDTH OF HAUNCH.

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

TABLE 1: MINIMUM HAUNCH THICKNESSES	
STEEL I-BEAMS AND PLATE GIRDERS	
PLAN CAMBER	H
UP TO 1/2"	1/2"
OVER 1/2" TO 3"	3/4"
OVER 3"	1"
P/S CONC. I-BEAMS, PA BULB-TEE AND SPREAD BOX BEAMS	
PLAN CAMBER	H
ALL	1/2"
<div>1. "T" IS THE DECK THICKNESS AS INDICATED ON SHEETS 2, 3 AND 4.</div> <div>2. PROVIDE THE SPECIFIED MINIMUM HAUNCH THICKNESSES ALONG THE FULL LENGTH OF BEAMS, INCLUDING SPLICE PLATE REGIONS OF STEEL BEAM BRIDGES.</div> <div>3. "A" IS THE DIMENSION FROM TOP OF DECK TO TOP OF BEAM AT THE CENTERLINE OF BEAM. INCLUDE THE FOLLOWING WHEN DETERMINING DIMENSION "A":</div> <div>• DECK THICKNESS, "T"</div> <div>• MINIMUM HAUNCH THICKNESS, "H"</div> <div>• EFFECT OF DECK CROSS SLOPE</div>	
<div>STEEL BEAM/GIRDER</div> <div>P/S CONCRETE BEAM</div>	

## HAUNCH REINFORCEMENT DETAILS

### INSTRUCTIONS FOR DETAILING HAUNCH REINFORCEMENT ON CONSTRUCTION PLANS

1. DETAIL HAUNCH REINFORCEMENT ON THE REINFORCEMENT BAR SCHEDULE.
2. SHOW HAUNCH REINFORCEMENT DETAILS ON THE CONSTRUCTION PLANS.
3. SHOW THE LIMITS OF HAUNCH REINFORCEMENT ALONG THE LENGTH OF EACH BEAM/GIRDER ON THE SLAB PLAN OR ON ANOTHER APPROPRIATE DETAIL.
4. INCLUDE ONE OF THE FOLLOWING NOTES ON THE PLANS:

#### WHEN HAUNCH REINFORCEMENT IS REQUIRED

"THE HAUNCH REINFORCEMENT QUANTITY SHOWN ON THE REINFORCEMENT BAR SCHEDULE PROVIDES THE AMOUNT NECESSARY TO COVER THE LIMITS SHOWN ON SHEET \*\*. PROVIDE ADDITIONAL HAUNCH REINFORCEMENT IN OTHER REGIONS ALONG THE LENGTH OF THE BEAM WHERE ACTUAL HAUNCHES EXCEED THE THICKNESSES SPECIFIED IN BC-752M."

\*\* PROVIDE APPROPRIATE SHEET NUMBER(S).

#### WHEN HAUNCH REINFORCEMENT IS NOT REQUIRED BASED ON COMPUTED BEAM CAMBERS

"BEAM HAUNCH REINFORCEMENT WAS NOT DETERMINED TO BE REQUIRED FOR THE COMPUTED BEAM CAMBERS. HOWEVER, PROVIDE HAUNCH REINFORCEMENT IN ACCORDANCE WITH BC-752M WHERE IRREGULAR BEAM CAMBERS OR OTHER CONSTRUCTION CONDITIONS PROVIDE ACTUAL HAUNCHES THAT EXCEED THE THICKNESSES SPECIFIED IN BC-752M."

### NOTES:

FOR NOTES, SEE SHEET 1.

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CONCRETE DECK SLAB  
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SHEET 9 OF 12  
BD-601M

TABLE 1: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 0 IN.								
USE FOR: * PRECAST PRESTRESSED SPREAD BOX BEAMS * PLANK BEAMS * STEEL I-BEAMS WITH TOP FLANGE WIDTH < 12"								
S	T (in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	1 #6	2'-8"	3'-1"	
4'-7"	8	#5 Ø9-1/2	#5 Ø10	#4 Ø9	1 #5	2'-10"	3'-1"	
4'-11"	8	#5 Ø9	#5 Ø9	#4 Ø9	1 #5	3'-1"	2'-10"	
5'-2"	8	#5 Ø9	#5 Ø8	#4 Ø9	1 #4	3'-3"	2'-10"	
5'-6"	8	#5 Ø9	#5 Ø7-1/2	#4 Ø8-1/2	1 #4	3'-5"	2'-10"	
5'-10"	8	#5 Ø9	#5 Ø7	#4 Ø8-1/2	1 #4	3'-8"	2'-5"	
6'-2"	8	#5 Ø8-1/2	#5 Ø6-1/2	#4 Ø8	1 #4	3'-10"	2'-6"	
6'-6"	8	#5 Ø8	#5 Ø6	#4 Ø7-1/2	1 #4	4'-1"	2'-4"	
6'-10"	8	#5 Ø8	#5 Ø5-1/2	#4 Ø7-1/2	1 #4	4'-3"	2'-3"	
7'-2"	8	#5 Ø7-1/2	#5 Ø5-1/2	#5 Ø11	1 #4	4'-5"	2'-3"	
7'-6"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø11	1 #4	4'-5"	2'-3"	
7'-10"	8	#5 Ø7	#6 Ø7	#5 Ø10	---	3'-9"	---	B,C
8'-2"	8	#5 Ø7	#6 Ø7	#5 Ø10	---	3'-9"	---	B,C
8'-6"	8	#5 Ø7	#6 Ø7	#5 Ø10	---	3'-9"	---	B,C
8'-10"	8	#5 Ø6-1/2	#6 Ø6-1/2	#5 Ø9-1/2	---	3'-10"	---	B,C
9'-2"	8-1/2	#5 Ø6-1/2	#6 Ø7	#5 Ø9-1/2	---	3'-11"	---	B,C
9'-6"	8-1/2	#5 Ø6-1/2	#6 Ø7	#5 Ø9-1/2	---	3'-11"	---	B,C
9'-10"	8-1/2	#5 Ø6	#6 Ø6-1/2	#5 Ø9	---	4'-0"	---	B,C
10'-2"	9	#5 Ø6-1/2	#6 Ø6-1/2	#5 Ø9-1/2	---	4'-3"	---	B,C
10'-5"	9	#5 Ø6	#6 Ø6	#5 Ø9	---	4'-5"	---	B,C
10'-9"	9	#5 Ø6	#6 Ø6	#5 Ø9	---	4'-5"	---	B,C
11'-1"	9-1/2	#5 Ø6	#6 Ø6	#5 Ø9	---	4'-7"	---	B,C
11'-5"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9	---	4'-10"	---	B,C
11'-9"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	---	4'-10"	---	B,C
12'-1"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	---	4'-10"	---	B,C
12'-5"	10	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	---	5'-2"	---	B,C
12'-9"	10	#5 Ø6	#6 Ø5-1/2	#5 Ø10	---	5'-2"	---	B,C
13'-1"	10-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10	---	5'-5"	---	B,C
13'-5"	10-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10	---	5'-5"	---	B,C
13'-9"	11	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	---	5'-8"	---	B,C
14'-1"	11-1/2	#5 Ø6-1/2	#6 Ø5-1/2	#5 Ø11	---	6'-0"	---	
14'-5"	11-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	---	6'-0"	---	
14'-9"	11-1/2	#5 Ø6-1/2	#6 Ø5-1/2	#5 Ø11	---	6'-0"	---	
15'-1"	11-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø11	---	6'-0"	---	

TABLE 3: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 6 IN.								
USE FOR: * PRECAST PRESTRESSED I-BEAMS WHEN: 18" < TOP FLANGE WIDTH < 36" * STEEL I-BEAMS WHEN: 24" ≤ TOP FLANGE WIDTH < 48" * NEXT BEAMS								
S	T (in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	1 #6	2'-8"	3'-3"	
4'-7"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	1 #6	2'-10"	3'-3"	
4'-11"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø9	1 #6	3'-1"	3'-4"	
5'-2"	8	#5 Ø9	#5 Ø11	#4 Ø9	1 #6	3'-3"	3'-6"	
5'-6"	8	#5 Ø9	#5 Ø10	#4 Ø8-1/2	1 #5	3'-5"	3'-2"	
5'-10"	8	#5 Ø9	#5 Ø9	#4 Ø8-1/2	1 #5	3'-8"	3'-2"	
6'-2"	8	#5 Ø8-1/2	#5 Ø9	#4 Ø8	1 #5	3'-10"	3'-2"	
6'-6"	8	#5 Ø8	#5 Ø8-1/2	#4 Ø7-1/2	1 #4	4'-0"	3'-1"	
6'-10"	8	#5 Ø8	#5 Ø8	#4 Ø7-1/2	1 #4	4'-2"	3'-0"	
7'-2"	8	#5 Ø7-1/2	#5 Ø7-1/2	#5 Ø11	1 #4	4'-3"	3'-0"	A,C
7'-6"	8	#5 Ø7	#5 Ø7	#5 Ø11	1 #4	4'-5"	3'-0"	A,C
7'-10"	8	#5 Ø7	#5 Ø7	#5 Ø10	1 #4	4'-5"	3'-0"	A,C
8'-2"	8	#5 Ø7	#5 Ø7	#5 Ø10	1 #4	4'-5"	2'-11"	A,C
8'-6"	8	#5 Ø7	#5 Ø6-1/2	#5 Ø10	1 #4	4'-7"	2'-9"	A,C
8'-10"	8	#5 Ø6-1/2	#5 Ø6-1/2	#5 Ø9-1/2	1 #4	4'-7"	2'-11"	A,C
9'-2"	8	#5 Ø6	#5 Ø6	#5 Ø9	1 #4	4'-10"	2'-9"	A,C
9'-6"	8	#5 Ø6	#5 Ø5-1/2	#5 Ø9	1 #4	5'-0"	2'-9"	A,C
9'-10"	8	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø8-1/2	1 #4	5'-0"	2'-9"	A,C
10'-2"	8-1/2	#5 Ø6	#5 Ø5-1/2	#5 Ø9	---	4'-3"	---	B,C
10'-5"	8-1/2	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø8-1/2	---	4'-3"	---	B,C
10'-9"	8-1/2	#5 Ø5-1/2	#6 Ø7	#5 Ø8-1/2	---	4'-5"	---	B,C
11'-1"	9	#5 Ø5-1/2	#6 Ø7	#5 Ø8-1/2	---	4'-7"	---	B,C
11'-5"	9	#5 Ø5-1/2	#6 Ø6-1/2	#5 Ø8-1/2	---	4'-9"	---	B,C
11'-9"	9	#5 Ø5-1/2	#6 Ø6-1/2	#5 Ø8-1/2	---	4'-9"	---	B,C
12'-1"	9-1/2	#5 Ø5-1/2	#6 Ø6	#5 Ø8-1/2	---	5'-3"	---	B,C
12'-5"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-6"	---	B,C
12'-9"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø8	---	5'-6"	---	B,C
13'-1"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-6"	---	B,C
13'-5"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø8-1/2	---	5'-6"	---	B,C
13'-9"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø8-1/2	---	5'-6"	---	B,C
14'-1"	10	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-10"	---	B,C
14'-5"	10	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-10"	---	B,C
14'-9"	10-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	6'-0"	---	
15'-1"	10-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	6'-0"	---	

DESIGN NOTES:

- BEAM SPACING, "S"
  - ALL EXCEPT SPREAD BOX BEAMS AND NEXT BEAMS:
    - S = MAXIMUM BEAM SPACING, CENTERLINE TO CENTERLINE OF ADJACENT BEAMS
  - SPREAD BOX BEAMS:
    - S = MAXIMUM BEAM SPACING - 2'-7" [36" WIDE BEAMS]
    - S = MAXIMUM BEAM SPACING - 3'-7" [48" WIDE BEAMS]
  - NEXT BEAMS:
    - S = 4'-3" FOR BEAM SPACING ≤ 10'-0" (BEAM WIDTH)
    - S = BEAM SPACING - 6'-0" FOR BEAM SPACING > 10'-0" (BEAM WIDTH)
    - WHERE S < 4'-3", USE S = 4'-3"
- "T" = TOTAL SLAB THICKNESS, INCLUDES 1/2" INTEGRAL WEARING SURFACE.
- OVERHANG LENGTH, "So"
  - FOR DEFINITION OF "So", SEE DETAILS THIS SHEET.
  - THE So VALUES SHOWN IN THE TABLES INDICATE THE MAXIMUM ALLOWABLE OVERHANG LENGTHS UTILIZING THE SPECIFIED REINFORCEMENT.
  - FOR SPLIT MEDIAN BARRIERS, REDUCE THE So VALUES LISTED IN THE TABLES BY 1".
  - SEE NOTES 24, 25 AND 26 ON SHEET 1 FOR ADDITIONAL LIMITATIONS.
- FOR LOCATION OF REINFORCEMENT BARS, SEE SHEETS 2, 3 AND 4. FOR LOCATION OF DIMENSION "L", SEE SHEETS 2, 3 AND 4.
- THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE TRANSVERSE BARS AS THE TOP BAR IN THE MAT.

TABLE 2: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 3 IN.								
USE FOR: * PRECAST PRESTRESSED I-BEAMS WITH TOP FLANGE WIDTH < 18" * STEEL I-BEAMS WHEN: 12" ≤ TOP FLANGE WIDTH < 24"								
S	T (in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	1 #6	2'-8"	3'-0"	
4'-7"	8	#5 Ø9-1/2	#5 Ø11	#4 Ø9	1 #6	2'-10"	3'-2"	
4'-11"	8	#5 Ø9	#5 Ø10	#4 Ø9	1 #5	3'-1"	2'-10"	
5'-2"	8	#5 Ø9	#5 Ø9	#4 Ø9	1 #5	3'-3"	2'-11"	
5'-6"	8	#5 Ø9	#5 Ø8-1/2	#4 Ø8-1/2	1 #4	3'-5"	3'-0"	
5'-10"	8	#5 Ø9	#5 Ø8	#4 Ø8-1/2	1 #4	3'-8"	2'-9"	
6'-2"	8	#5 Ø8-1/2	#5 Ø7-1/2	#4 Ø8	1 #4	3'-10"	2'-8"	
6'-6"	8	#5 Ø8	#5 Ø7	#4 Ø7-1/2	1 #4	4'-1"	2'-8"	
6'-10"	8	#5 Ø8	#5 Ø7	#4 Ø7-1/2	1 #4	4'-2"	2'-8"	A,C
7'-2"	8	#5 Ø7-1/2	#5 Ø6-1/2	#5 Ø11	1 #4	4'-4"	2'-6"	A,C
7'-6"	8	#5 Ø7	#5 Ø6	#5 Ø11	1 #4	4'-6"	2'-6"	A,C
7'-10"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø10	1 #4	4'-8"	2'-6"	A,C
8'-2"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø10	1 #4	4'-8"	2'-6"	A,C
8'-6"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø10	1 #4	4'-8"	2'-6"	A,C
8'-10"	8	#5 Ø6-1/2	#5 Ø5-1/2	#5 Ø9-1/2	1 #4	4'-8"	2'-4"	A,C
9'-2"	8	#5 Ø6	#5 Ø5-1/2	#5 Ø9	1 #4	4'-8"	2'-4"	A,C
9'-6"	8-1/2	#5 Ø6-1/2	#5 Ø5-1/2	#5 Ø9-1/2	---	4'-0"	---	B,C
9'-10"	8-1/2	#5 Ø6	#5 Ø5-1/2	#5 Ø9	---	4'-0"	---	B,C
10'-2"	8-1/2	#5 Ø6	#6 Ø7	#5 Ø9	---	4'-2"	---	B,C
10'-5"	9	#5 Ø6	#6 Ø7	#5 Ø9	---	4'-4"	---	B,C
10'-9"	9	#5 Ø6	#6 Ø6-1/2	#5 Ø9	---	4'-6"	---	B,C
11'-1"	9	#5 Ø5-1/2	#6 Ø6	#5 Ø8-1/2	---	4'-8"	---	B,C
11'-5"	9-1/2	#5 Ø6	#6 Ø6-1/2	#5 Ø9	---	4'-8"	---	B,C
11'-9"	9-1/2	#5 Ø6	#6 Ø6	#5 Ø9	---	4'-11"	---	B,C
12'-1"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-2"	---	B,C
12'-5"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	---	5'-2"	---	B,C
12'-9"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-2"	---	B,C
13'-1"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-2"	---	B,C
13'-5"	10	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	---	5'-6"	---	B,C
13'-9"	10-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10	---	5'-9"	---	B,C
14'-1"	10-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9-1/2	---	5'-9"	---	B,C
14'-5"	11	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	---	6'-0"	---	
14'-9"	11	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9-1/2	---	6'-0"	---	
15'-1"	11-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	---	6'-0"	---	

TABLE 4: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 12 IN.								
USE FOR: * PRECAST PRESTRESSED PA BULB-TEE AND I-BEAMS WITH TOP FLANGE WIDTH ≥ 36" * STEEL I-BEAMS OR STEEL CLOSED BOXES WITH TOP FLANGE WIDTH ≥ 48"								
S	T (in.)	S1	S2	S3	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	1 #6	2'-8"	3'-9"	
4'-7"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	1 #6	2'-10"	3'-9"	
4'-11"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø9	1 #6	3'-1"	3'-9"	
5'-2"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø9	1 #6	3'-3"	3'-9"	
5'-6"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø8-1/2	1 #6	3'-5"	3'-9"	
5'-10"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø8-1/2	1 #6	3'-8"	3'-10"	
6'-2"	8	#5 Ø8-1/2	#5 Ø11-1/2	#4 Ø8	1 #6	3'-10"	3'-11"	
6'-6"	8	#5 Ø8	#5 Ø11-1/2	#4 Ø7-1/2	1 #6	4'-1"	4'-1"	
6'-10"	8	#5 Ø8	#5 Ø11	#4 Ø7-1/2	1 #6	4'-3"	4'-0"	
7'-2"	8	#5 Ø7-1/2	#5 Ø11	#5 Ø11	1 #6	4'-6"	4'-0"	
7'-6"	8	#5 Ø7	#5 Ø10	#5 Ø11	1 #5	4'-8"	3'-10"	
7'-10"	8	#5 Ø7	#5 Ø9-1/2	#5 Ø10	1 #5	4'-10"	3'-10"	
8'-2"	8	#5 Ø7	#5 Ø9	#5 Ø10	1 #5	4'-11"	3'-10"	
8'-6"	8	#5 Ø7	#5 Ø9	#5 Ø10	1 #5	4'-11"	3'-10"	
8'-10"	8	#5 Ø6-1/2	#5 Ø8-1/2	#5 Ø9-1/2	1 #4	4'-8"	3'-9"	
9'-2"	8	#5 Ø6	#5 Ø8	#5 Ø9	1 #4	4'-10"	3'-8"	
9'-6"	8	#5 Ø6	#5 Ø7-1/2	#5 Ø9	1 #4	4'-11"	3'-5"	A,C
9'-10"	8	#5 Ø5-1/2	#5 Ø7	#5 Ø8-1/2	1 #4	5'-1"	3'-5"	A,C
10'-2"	8	#5 Ø5-1/2	#5 Ø7	#5 Ø8-1/2	1 #4	5'-1"	3'-4"	A,C
10'-5"	8	#5 Ø5-1/2	#5 Ø6-1/2	#5 Ø7-1/2	1 #4	5'-4"	4'-0"	A,C
10'-9"	8	#5 Ø5-1/2	#5 Ø6	#5 Ø7-1/2	1 #4	5'-6"	4'-0"	A,C
11'-1"	8-1/2	#5 Ø5-1/2	#5 Ø6	#5 Ø7-1/2	1 #4	5'-10"	4'-0"	A,C
11'-5"	8-1/2	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø7-1/2	---	4'-10"	---	B,C
11'-9"	8-1/2	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø7-1/2	---	4'-10"	---	B,C
12'-1"	9	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø7-1/2	---	5'-0"	---	B,C
12'-5"	9	#5 Ø5-1/2	#6 Ø7	#5 Ø7-1/2	---	5'-3"	---	B,C
12'-9"	9	#6 Ø7	#6 Ø7	#5 Ø7	---	5'-3"	---	B,C
13'-1"	9-1/2	#5 Ø5-1/2	#6 Ø7	#5 Ø8	---	5'-5"	---	B,C
13'-5"	9-1/2	#5 Ø5-1/2	#6 Ø6-1/2	#5 Ø8	---	5'-8"	---	B,C
13'-9"	9-1/2	#6 Ø7	#6 Ø6	#5 Ø7	---	5'-10"	---	B,C
14'-1"	9-1/2	#5 Ø5-1/2	#6 Ø6	#5 Ø8-1/2	---	5'-10"	---	B,C
14'-5"	9-1/2	#6 Ø7	#6 Ø6	#5 Ø7-1/2	---	5'-10"	---	B,C
14'-9"	9-1/2	#6 Ø7	#6 Ø5-1/2	#5 Ø7-1/2	---	6'-0"	---	
15'-1"	10	#6 Ø7	#6 Ø6	#5 Ø7-1/2	---	6'-0"	---	

- FOR OTHER BEAMS NOT LISTED UNDER THE HEADING OF



TABLE 1: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 0 IN.										
USE FOR: * PRECAST PRESTRESSED SPREAD BOX BEAMS * PLANK BEAMS * STEEL I-BEAMS WITH TOP FLANGE WIDTH < 12"										
S	T (in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 09-1/2	#5 08-1/2	#4 09	#4 06	#5 1 #6		2'-5"	3'-5"	
4'-7"	8	#5 07	#5 07-1/2	#4 09	#4 06	#5 1 #5		2'-10"	3'-1"	
4'-11"	8	#5 09	#5 07	#4 08-1/2	#4 06	#5 1 #5		3'-1"	3'-0"	
5'-2"	8	#5 09	#5 07	#4 08-1/2	#4 06	#5 1 #5		3'-5"	2'-11"	
5'-6"	8	#5 09	#5 06-1/2	#4 08-1/2	#4 06	#5 1 #5		3'-8"	2'-11"	
5'-10"	8	#5 09	#5 06-1/2	#4 08-1/2	#4 06	#5 1 #5		3'-8"	2'-11"	
6'-2"	8	#5 08-1/2	#5 06	#4 08	#4 06	#5 1 #5		3'-10"	2'-11"	
6'-6"	8	#5 08	#5 06	#4 07-1/2	#4 06	#5 1 #5		4'-1"	2'-11"	
6'-10"	8	#5 08	#5 05-1/2	#4 07-1/2	#4 06	#5 1 #5		4'-3"	2'-11"	
7'-2"	8-1/2	#5 07-1/2	#6 06-1/2	#5 011	#5 06	#5 1 #5		4'-5"	2'-11"	
7'-6"	8-1/2	#5 07	#6 06-1/2	#5 010	#5 06	#5 1 #5		4'-5"	2'-11"	
7'-10"	8-1/2	#5 07	#6 06	#5 010	#5 06	#5 1 #4		3'-9"	2'-5"	A,B,C
8'-2"	8-1/2	#5 07	#6 06	#5 010	#5 06	#5 1 #4		3'-9"	2'-5"	A,B,C
8'-6"	8-1/2	#5 07	#6 06	#5 010	#5 06	#5 1 #4		3'-9"	2'-5"	A,B,C
8'-10"	8-1/2	#5 06-1/2	#6 06	#5 09-1/2	#5 06	#5 1 #4		3'-10"	2'-5"	A,B,C
9'-2"	8-1/2	#5 06-1/2	#6 06	#5 09-1/2	#5 06	#6 1 #4		3'-11"	2'-5"	A,B,C
9'-6"	8-1/2	#5 06-1/2	#6 06	#5 09-1/2	#5 06	#6 1 #4		3'-11"	2'-5"	A,B,C
9'-10"	8-1/2	#5 06	#6 05-1/2	#5 08-1/2	#5 06	#6 --		4'-0"	--	
10'-2"	9	#5 06-1/2	#6 06	#5 09-1/2	#5 06	#6 1 #4		4'-3"	2'-5"	A,B,C
10'-5"	9	#5 06	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-5"	2'-5"	A,B,C
10'-9"	9	#5 06	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-5"	2'-5"	A,B,C
11'-1"	9-1/2	#5 06	#6 05-1/2	#5 09	#5 06	#6 1 #4		4'-7"	2'-5"	A,B,C
11'-5"	9-1/2	#5 06	#6 05-1/2	#5 09	#5 06	#6 1 #4		4'-10"	2'-5"	A,B,C
11'-9"	10	#5 06	#6 05-1/2	#5 09	#5 06	#6 1 #4		4'-10"	2'-5"	A,B,C
12'-1"	10	#5 06	#6 05-1/2	#5 09	#5 06	#6 1 #4		4'-10"	2'-5"	A,B,C
12'-5"	10-1/2	#5 06	#6 05-1/2	#5 09-1/2	#5 06	#6 1 #4		5'-2"	2'-5"	A,B,C
12'-9"	10-1/2	#5 06	#6 05-1/2	#5 09-1/2	#5 06	#6 1 #4		5'-2"	2'-5"	A,B,C
13'-1"	10-1/2	#5 06	#6 05-1/2	#5 09-1/2	#5 06	#6 1 #4		5'-5"	2'-5"	A,B,C
13'-5"	11	#5 06	#6 05-1/2	#5 09-1/2	#5 06	#6 1 #4		5'-5"	2'-5"	A,B,C
13'-9"	11	#5 06	#6 05-1/2	#5 010	#5 06	#6 1 #4		5'-8"	2'-5"	A,B,C
14'-1"	11-1/2	#5 06-1/2	#6 05-1/2	#5 011	#5 06	#6 1 #4		6'-0"	2'-5"	A,B,C
14'-5"	11-1/2	#5 06	#6 05-1/2	#5 010	#5 06	#6 1 #4		6'-0"	2'-5"	A,B,C
14'-9"	12	#5 06-1/2	#6 05-1/2	#5 011	#5 06	#6 1 #4		6'-0"	2'-5"	A,B,C
15'-1"	12	#5 06	#6 05-1/2	#5 010-1/2	#5 06	#6 1 #4		6'-0"	2'-5"	A,B,C

TABLE 3: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 6 IN.										
USE FOR: * PRECAST PRESTRESSED I-BEAMS WHEN: 18" < TOP FLANGE WIDTH < 36" * STEEL I-BEAMS WHEN: 24" ≤ TOP FLANGE WIDTH < 48" * NEXT BEAMS										
S	T (in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 09-1/2	#5 010-1/2	#4 09	#4 06	#5 1 #6		2'-8"	4'-2"	
4'-7"	8	#5 09-1/2	#5 010	#4 09	#4 06	#5 1 #6		2'-10"	4'-2"	
4'-11"	8	#5 09	#5 09-1/2	#4 08-1/2	#4 06	#5 1 #6		3'-1"	4'-2"	
5'-2"	8	#5 09	#5 08-1/2	#4 08-1/2	#4 06	#5 1 #6		3'-3"	4'-2"	
5'-6"	8	#5 09	#5 08	#4 08-1/2	#4 06	#5 1 #5		3'-5"	3'-8"	
5'-10"	8	#5 09	#5 08	#4 08-1/2	#4 06	#5 1 #5		3'-8"	3'-8"	
6'-2"	8	#5 08-1/2	#5 07-1/2	#4 08	#4 06	#5 1 #5		3'-10"	3'-8"	
6'-6"	8	#5 08	#5 07	#4 07-1/2	#4 06	#5 1 #5		4'-0"	3'-8"	
6'-10"	8	#5 08	#5 06-1/2	#4 07-1/2	#4 06	#5 1 #5		4'-2"	3'-8"	
7'-2"	8	#5 07-1/2	#5 06	#5 011	#5 06	#5 1 #5		4'-3"	3'-8"	
7'-6"	8	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #5		4'-5"	3'-8"	
7'-10"	8	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #5		4'-5"	3'-8"	
8'-2"	8	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #5		4'-5"	3'-8"	
8'-6"	8	#5 07	#5 06	#5 010	#5 06	#5 1 #6		4'-7"	4'-2"	
8'-10"	8	#5 06-1/2	#5 05-1/2	#5 09-1/2	#5 06	#5 1 #6		4'-7"	4'-2"	
9'-2"	8-1/2	#5 06	#6 06	#5 08-1/2	#5 06	#5 1 #6		4'-10"	4'-2"	
9'-6"	8-1/2	#5 06	#6 05-1/2	#5 08-1/2	#5 06	#5 1 #5		5'-0"	3'-8"	
9'-10"	8-1/2	#5 05-1/2	#6 05-1/2	#5 08	#5 06	#5 1 #5		5'-0"	3'-8"	
10'-2"	8-1/2	#5 06	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-3"	3'-2"	A,B,C
10'-5"	8-1/2	#5 05-1/2	#6 05-1/2	#5 08	#5 06	#6 1 #4		4'-3"	3'-2"	A,B,C
10'-9"	8-1/2	#5 05-1/2	#6 05-1/2	#5 08	#5 06	#6 1 #4		4'-5"	3'-2"	A,B
11'-1"	9	#5 05-1/2	#6 06	#5 08	#5 06	#6 1 #4		4'-7"	3'-2"	A,B
11'-5"	9	#5 05-1/2	#6 06	#5 08	#5 06	#6 1 #4		4'-9"	3'-2"	A,B
11'-9"	9	#5 05-1/2	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-9"	3'-2"	A,B
12'-1"	9-1/2	#5 05-1/2	#6 06	#5 08-1/2	#5 06	#6 1 #4		5'-3"	3'-2"	A,B
12'-5"	9-1/2	#5 05-1/2	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		5'-6"	3'-2"	A,B
12'-9"	9-1/2	#5 05-1/2	#6 05-1/2	#5 08	#5 06	#6 1 #4		5'-6"	3'-2"	A,B
13'-1"	10	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		5'-6"	3'-2"	A,B
13'-5"	10	#5 05-1/2	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		5'-6"	3'-2"	A,B
13'-9"	10-1/2	#5 05-1/2	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		5'-6"	3'-2"	A,B,C
14'-1"	10-1/2	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		5'-10"	3'-2"	A,B
14'-5"	10-1/2	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		5'-10"	3'-2"	A,B
14'-9"	11	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		6'-0"	3'-2"	A,B,C
15'-1"	11	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		6'-0"	3'-2"	A,B,C

#### DESIGN NOTES:

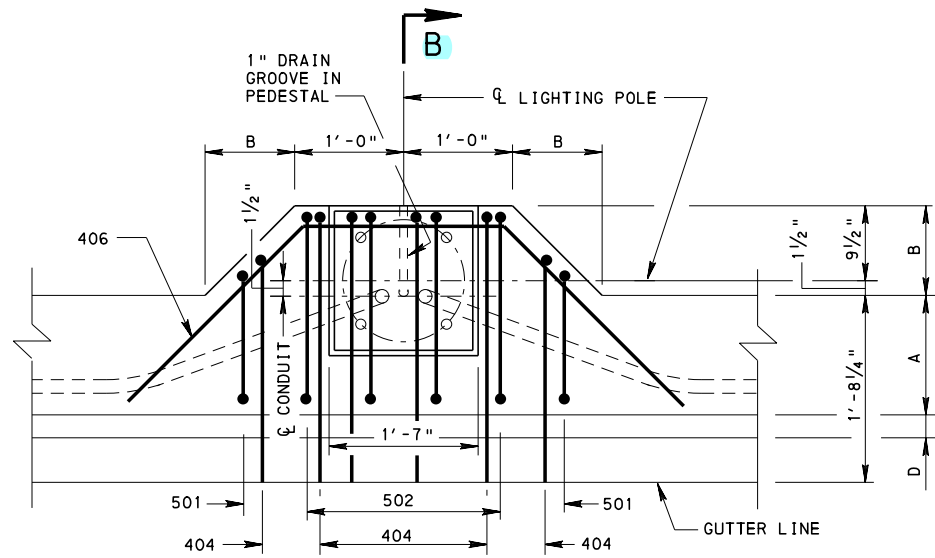
- BEAM SPACING, "S"
  - ALL EXCEPT SPREAD BOX BEAMS AND NEXT BEAMS:
    - S = MAXIMUM BEAM SPACING, CENTERLINE TO CENTERLINE OF ADJACENT BEAMS
  - SPREAD BOX BEAMS:
    - S = MAXIMUM BEAM SPACING - 2'-7" [36" WIDE BEAMS]
    - S = MAXIMUM BEAM SPACING - 3'-7" [48" WIDE BEAMS]
  - NEXT BEAMS:
    - S = 4'-3" FOR BEAM SPACING ≤ 10'-0" (BEAM WIDTH)
    - S = BEAM SPACING - 6'-0" FOR BEAM SPACING > 10'-0" (BEAM WIDTH)
    - WHERE S < 4'-3", USE S = 4'-3"
- "T" = TOTAL SLAB THICKNESS, INCLUDES 1/2" INTEGRAL WEARING SURFACE.
- OVERHANG LENGTH, "So"
  - FOR DEFINITION OF "So", SEE DETAILS THIS SHEET.
  - THE So VALUES SHOWN IN THE TABLES INDICATE THE MAXIMUM ALLOWABLE OVERHANG LENGTHS UTILIZING THE SPECIFIED REINFORCEMENT.
  - FOR SPLIT MEDIAN BARRIERS, REDUCE THE So VALUES LISTED IN THE TABLES BY 1".
  - SEE NOTES 24, 25 AND 26 ON SHEET 1 FOR ADDITIONAL LIMITATIONS.
- FOR LOCATION OF REINFORCEMENT BARS IN THE BOTTOM MAT, SEE SHEETS 2, 3 AND 4. FOR LOCATION OF DIMENSION "L", SEE SHEETS 2, 3 AND 4.

- THE TOP MAT REINFORCING PROVIDED IN THE TABLES ON THIS SHEET CORRELATE WITH THE LONGITUDINAL BARS AS THE TOP BAR IN THE MAT. THIS CONFIGURATION IS NOT GRAPHICALLY DEPICTED IN THIS STANDARD EXCEPT IT IS SHOWN IN THE DETAIL TITLED "TYPICAL SLAB PANEL 2" ON SHEET 2.
- FOR OTHER BEAMS NOT LISTED UNDER THE HEADING OF THE TABLES ABOVE, DETERMINE THE DISTANCE FROM THE DESIGN SECTION FOR NEGATIVE MOMENT TO THE CENTERLINE OF BEAM USING THE SKETCHES ON SHEET 8. USE THE REINFORCEMENT TABLE WHICH CAPTION SHOWS A DISTANCE FROM THE DESIGN SECTION FOR NEGATIVE MOMENT TO THE CENTERLINE OF BEAMS EQUAL TO OR SMALLER THAN THE CALCULATED DISTANCE.

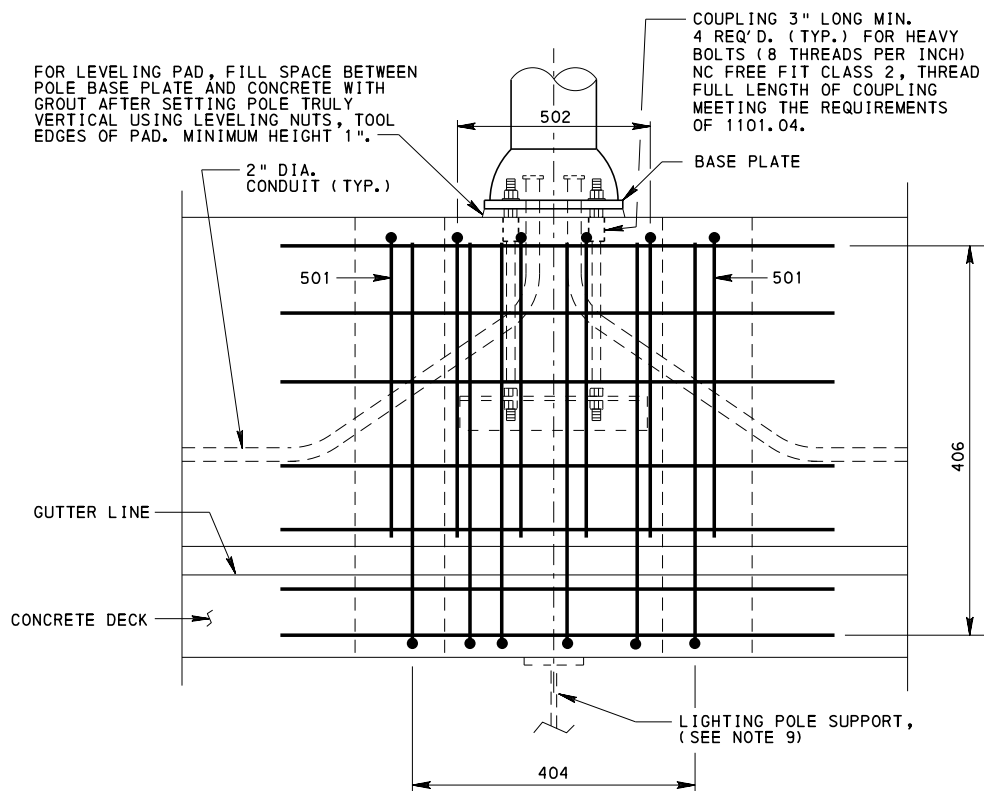
#### NOTES:

- THE OVERHANG LENGTH, So, SHOWN MAY BE INCREASED BY UP TO 5 INCHES IF #5 S7 BARS REPLACE THE #4 S7 BARS SHOWN. THE LENGTH "L" SHALL BE TAKEN NO LESS THAN 4'-3".
- WHEN THE LENGTH OF THE OVERHANG IS INCREASED IN ACCORDANCE WITH NOTE (A) ABOVE, THE INCREASED OVERHANG LENGTH SHALL NOT EXCEED THE LIMITS STATED IN DESIGN MANUAL PART 4, SECTION D9.7.1.5.1P.
- EVERY OTHER S7 BAR SHOWN MAY BE ELIMINATED.

TABLE 2: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 3 IN.										
USE FOR: * PRECAST PRESTRESSED I-BEAMS WITH TOP FLANGE WIDTH < 18" * STEEL I-BEAMS WHEN: 12" ≤ TOP FLANGE WIDTH < 24"										
S	T (in.)	S1	S2	S3	S3'	S6	S7	So	L	NOTES
4'-3"	8	#5 09-1/2	#5 09-1/2	#4 09	#4 06	#5 1 #6		2'-8"	3'-8"	
4'-7"	8	#5 09-1/2	#5 09	#4 09	#4 06	#5 1 #6		2'-10"	3'-8"	
4'-11"	8	#5 09	#5 08	#4 08-1/2	#4 06	#5 1 #5		3'-1"	3'-2"	
5'-2"	8	#5 09	#5 08	#4 08-1/2	#4 06	#5 1 #5		3'-3"	3'-2"	
5'-6"	8	#5 09	#5 07-1/2	#4 08-1/2	#4 06	#5 1 #5		3'-5"	3'-2"	
5'-10"	8	#5 09	#5 07	#4 08-1/2	#4 06	#5 1 #5		3'-8"	3'-2"	
6'-2"	8	#5 08-1/2	#5 06-1/2	#4 08	#4 06	#5 1 #5		3'-10"	3'-2"	
6'-6"	8	#5 08	#5 06-1/2	#4 07-1/2	#4 06	#5 1 #5		4'-1"	3'-2"	
6'-10"	8	#5 08	#5 06	#4 07-1/2	#4 06	#5 1 #5		4'-2"	3'-2"	
7'-2"	8	#5 07-1/2	#5 05-1/2	#5 011	#5 06	#5 1 #5		4'-4"	3'-2"	
7'-6"	8	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #6		4'-6"	3'-8"	
7'-10"	8	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #6		4'-8"	3'-8"	
8'-2"	8-1/2	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #5		4'-8"	3'-2"	
8'-6"	8-1/2	#5 07	#5 05-1/2	#5 010	#5 06	#5 1 #5		4'-8"	3'-2"	
8'-10"	8-1/2	#5 06-1/2	#5 05-1/2	#5 09-1/2	#5 06	#5 1 #5		4'-8"	3'-2"	
9'-2"	8-1/2	#5 06	#5 05-1/2	#5 08-1/2	#5 06	#5 1 #5		4'-8"	3'-2"	
9'-6"	9	#5 06-1/2	#5 05-1/2	#5 09-1/2	#5 06	#6 1 #4		4'-0"	2'-8"	A,B,C
9'-10"	9	#5 06	#6 06-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-0"	2'-8"	A,B
10'-2"	9	#5 06	#6 06-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-2"	2'-8"	A,B
10'-5"	9	#5 06	#6 06	#5 08-1/2	#5 06	#6 1 #4		4'-4"	2'-8"	A,B,C
10'-9"	9	#5 06	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		4'-6"	2'-8"	A,B,C
11'-1"	9	#5 05-1/2	#6 05-1/2	#5 08	#5 06	#6 1 #4		4'-8"	2'-8"	A,B,C
11'-5"	9-1/2	#5 06	#6 06	#5 09	#5 06	#6 1 #4		4'-8"	2'-8"	A,B,C
11'-9"	9-1/2	#5 06	#6 05-1/2	#5 09	#5 06	#6 1 #4		4'-11"	2'-8"	A,B,C
12'-1"	9-1/2	#5 05-1/2	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		5'-2"	2'-8"	A,B
12'-5"	10	#5 06	#6 05-1/2	#5 09-1/2	#5 06	#6 1 #4		5'-2"	2'-8"	A,B,C
12'-9"	10	#5 05-1/2	#6 05-1/2	#5 08-1/2	#5 06	#6 1 #4		5'-2"	2'-8"	A,B,C
13'-1"	10-1/2	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		5'-2"	2'-8"	A,B,C
13'-5"	10-1/2	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		5'-5"	2'-8"	A,B,C
13'-9"	10-1/2	#5 06	#6 05-1/2	#5 010	#5 06	#6 1 #4		5'-9"	2'-8"	A,B
14'-1"	11	#5 05-1/2	#6 05-1/2	#5 09	#5 06	#6 1 #4		5'-9"	2'-8"	A,B,C
14'-5"	11	#5 06	#6 05-1/2	#5 010	#5 06	#6 1 #4		6'-0"	2'-8"	A,B,C
14'-9"	11-1/2	#5 05-1/2	#6 05-1/2	#5 09-1/2	#5 06	#6 1 #4		6'-0"	2'-8"	A,B,C
15'-1"	11-1/2	#5 06	#6 05-1/2	#5 010-1/2	#5 06	#6 1 #4		6'-0"	2'-8"	A,B,C



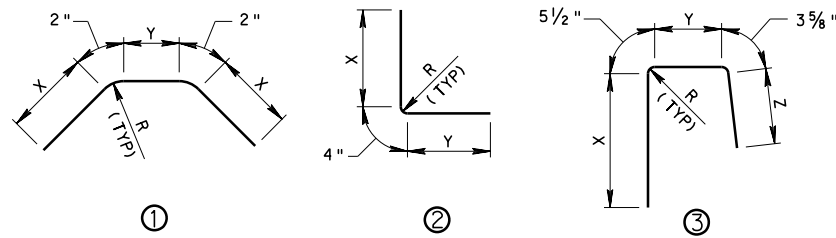
PLAN



ELEVATION

BARRIER TYPE	"A "	"B "	"C "	"D "
45" F-SHAPE CONCRETE BARRIER	1'-0"	11"	3'-9"	3 3/8"
42" F-SHAPE CONCRETE BARRIER	1'-0"	11"	3'-6"	3 3/8"
32" F-SHAPE CONCRETE BARRIER	1'-1"	11"	2'-8"	2 3/8"

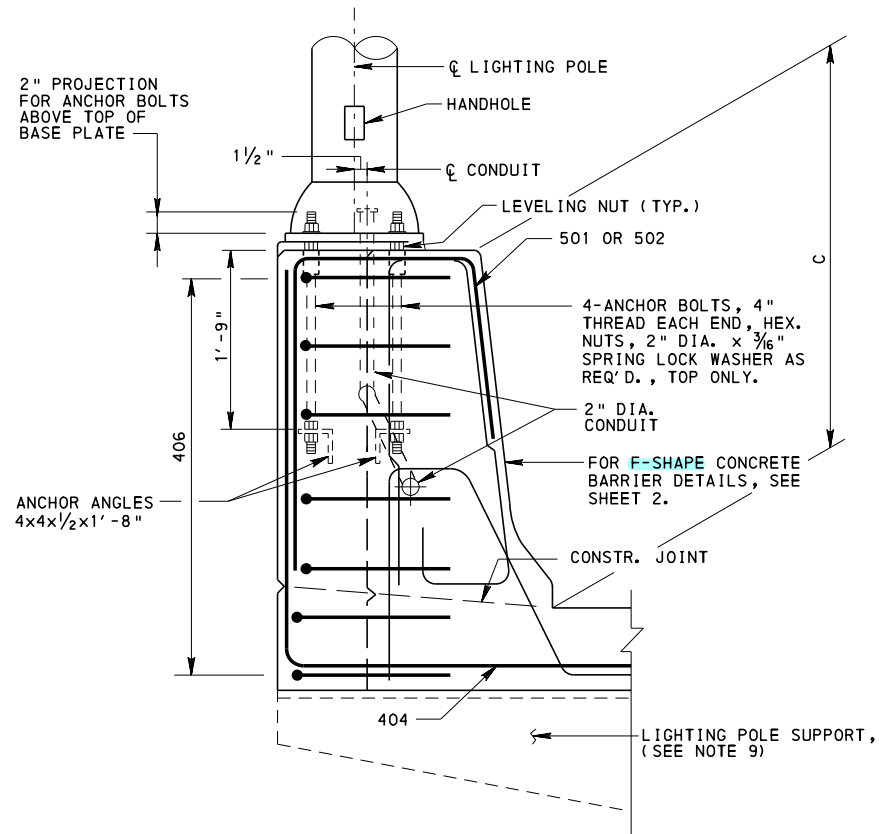
REINFORCEMENT TABLE											
MARK	SIZE	LENGTH 45" F-SHAPE	LENGTH 42" F-SHAPE	LENGTH 32" F-SHAPE	NUMBER	TYPE	45" F-SHAPE	42" F-SHAPE	32" F-SHAPE	Y	Z
404	4	8'-5"	8'-2"	7'-4"	6	②	4'-1"	3'-10"	3'-0"	4'-0"	----
406	4	5'-11"	5'-11"	5'-11"	7	①	2'-0"	2'-0"	2'-0"	1'-7"	----
501	5	5'-6 5/8"	5'-3 5/8"	4'-7 5/8"	2	③	2'-11"	2'-8"	2'-0"	4 1/2"	1'-6"
502	5	5'-10 5/8"	5'-10 5/8"	5'-2 5/8"	4	③	2'-11"	2'-8"	2'-0"	11 1/2"	1'-6"



## REINFORCEMENT DETAILS

### REINFORCEMENT BAR NOTES

- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
- RADIUS, R= 2", FOR #4 BARS AND R= 3", FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.



SECTION B-B

### NOTES:

- PROVIDE MATERIALS AND **PERFORM WORK** IN ACCORDANCE WITH PUBLICATION 408.
- SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
- SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
- CONFORM ANCHOR MATERIALS TO 1101.4 PUB.408, ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.
- SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
- PROVIDE 2" CLEAR ON ALL REINFORCEMENT UNLESS NOTED.
- PROVIDE A MINIMUM OF 2 1/2" CONCRETE COVER FOR CONDUIT.
- FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE SHEET 2.
- PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. REFER TO BD-655M FOR ABUTMENT DETAILS AND BD-658M FOR PIER DETAILS TO HELP DEVELOP LIGHT POLE SUPPORT DETAIL. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM.
- FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.

### PROVISIONS FOR FUTURE LIGHTING

MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA.	ANCHOR BOLT DIAMETER
50'-0" MAX.	15"	1"

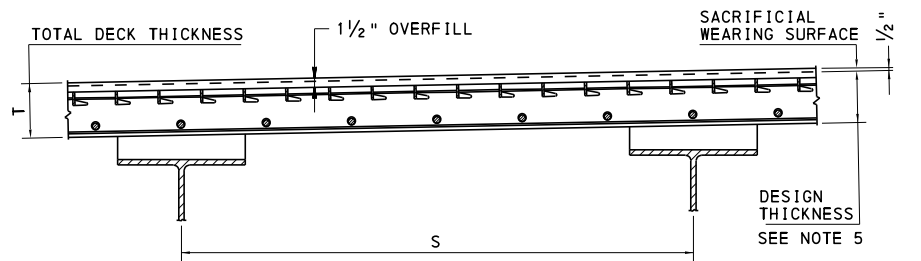
## COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

## STANDARD CONCRETE DECK SLAB LIGHTING POLE ANCHORAGE DETAILS FOR BEAM BRIDGES

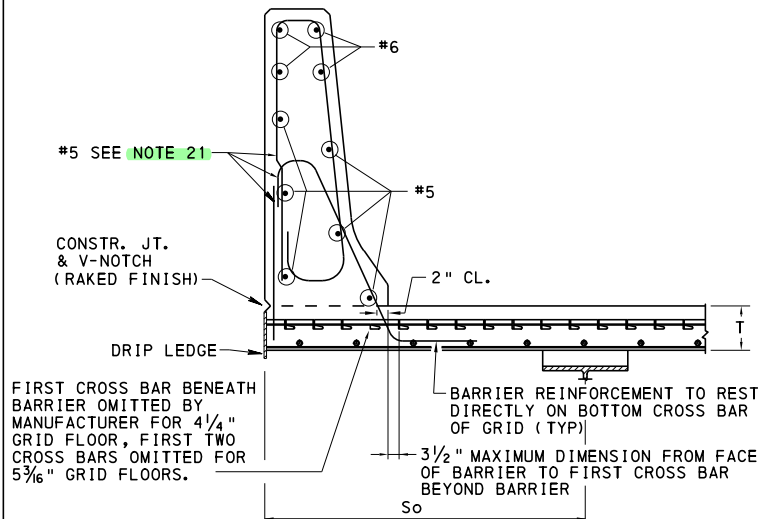
RECOMMENDED FEB. 14, 2023  
*L. E. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023  
*L. E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

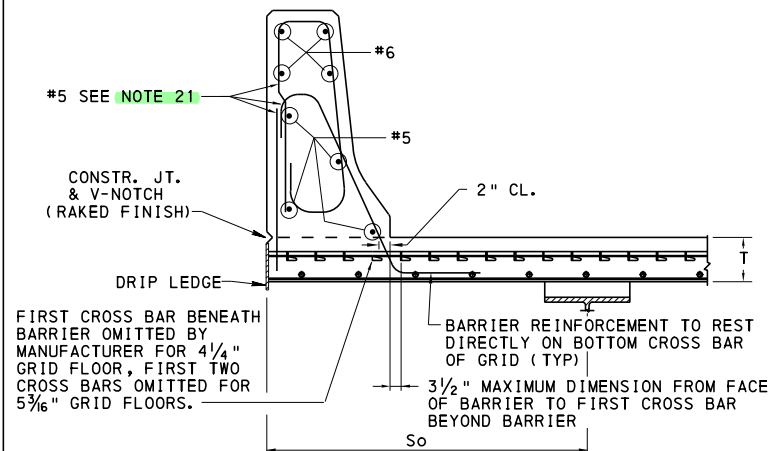
SHEET 12 OF 12  
BD-601M



**TYPICAL GRID REINFORCED CONCRETE DECK PANEL**  
DECK ATTACHMENT, PANEL SPLICE AND HAUNCH DETAILS SHOWN ON SHEET 2.  
TYPICAL HAUNCH FOR GIRDERS SHOWN FOR ILLUSTRATION ONLY.

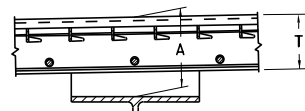


**TYPICAL CONCRETE BARRIER DETAIL**



**ALTERNATE CONCRETE BARRIER DETAIL**

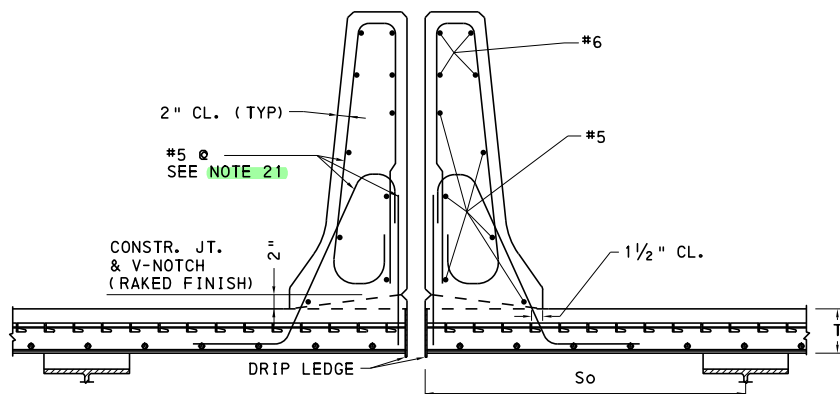
TO BE USED ONLY IF AUTHORIZED BY CHIEF BRIDGE ENGINEER



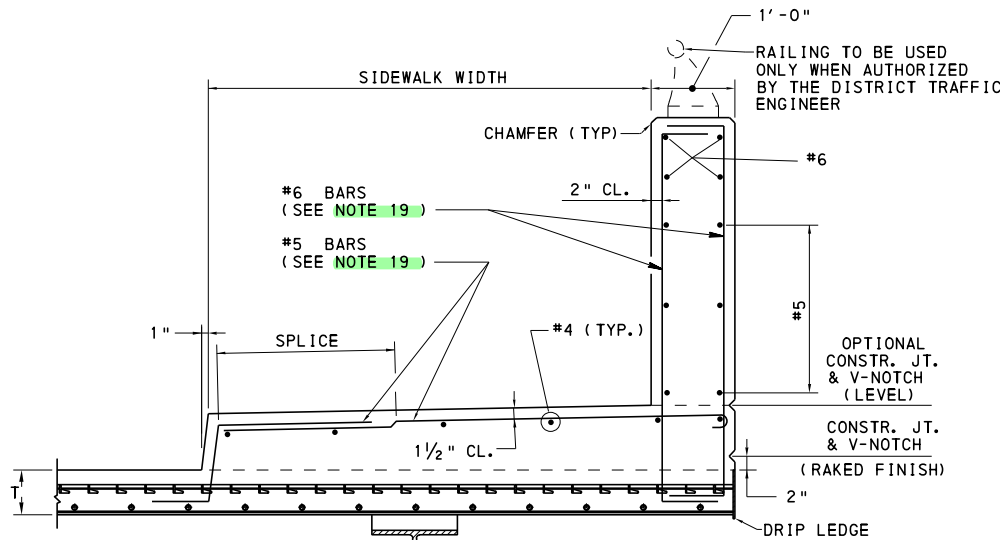
PLAN CAMBER (in)	A (in)
UP TO 1 1/2"	T + 1/2"
OVER 1 1/2" TO 3"	T + 3/4"
OVER 3"	T + 1"

- VARIATION IN FLANGE THICKNESS IS NOT INCLUDED IN "A". MODIFY "A" FOR A CONCAVE (SAG) VERTICAL CURVE.
- ADD EFFECT OF DECK CROSS SLOPE TO "A" TO PROVIDE MINIMUM HAUNCH WIDTH ACROSS FULL WIDTH OF BEAM FLANGE.
- ADD THICKNESS OF TOP SPLICE PLATES TO "A" FOR GIRDERS WITH SPLICES, AS APPLICABLE.

**HAUNCH DETAIL**



**SPLIT MEDIAN BARRIER**



**ALTERNATE SIDEWALK DETAIL**

### BARRIER NOTES

19. 4 1/4" FULL DEPTH GRID REINFORCED CONCRETE BRIDGE DECK SHOWN, DETAILS ARE APPROPRIATE FOR 5 5/16" FULL DEPTH DECK DESIGNS AS WELL.
20. FILL HALF DEPTH GRIDS FULL DEPTH FOR A MINIMUM DISTANCE OF 3'-0" FROM THE OUTSIDE EDGE OF THE DECK.
21. WITHIN 14'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER, AND AT THE END OF THE BRIDGE, REDUCE MAXIMUM SPACING OF REINFORCEMENT TO HALF THE SHOWN SPACING.
22. CLEAN AND ROUGHEN TOP OF CONCRETE DECK WHICH LIES DIRECTLY BENEATH THE BARRIER PRIOR TO POURING THE BARRIER CONCRETE TO ENSURE ADEQUATE SHEAR TRANSFER.
23. ATTACHMENT DETAIL APPLICABLE FOR ALL OVERLAY TYPES.
24. FOR BARRIER SIDEWALK AND MEDIAN BARRIER DIMENSIONS SEE BD-601M. FOR BARRIER REINFORCEMENT DIMENSIONS NOT SHOWN, SEE BD-601M. FOR BRIDGE BARRIER **TO GUIDE RAIL TRANSITION** DETAILS, SEE **RC-50M**.

### NOTES:

1. ALL REINFORCEMENT BARS SHOWN MEET THE REQUIREMENTS OF ASTM A615, A996, OR A706.
2. DESIGN SPECIFICATIONS:
  - AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND COMMENTARY
  - DESIGN MANUAL PART 4, VOLUME 1, PART B DESIGN SPECIFICATIONS.
3. MATERIAL STRENGTH:
  - STEEL BARS AND SHAPES:
    - AASHTO M270, GRADE 36,  $f = 36 \text{ ksi}$
    - AASHTO M270, GRADE 50,  $f = 50 \text{ ksi}$
  - REINFORCEMENT STEEL:
    - $f_y = 60 \text{ ksi}$
  - CONCRETE:
    - $f'_c = 4,000 \text{ psi}$  CLASS AAAP CONCRETE
    - MODULAR RATIO ( $E_s/E_c$ )  $N = 8$
4. DEAD LOAD:
  - DENSITY OF NORMAL WEIGHT CONCRETE  $150 \text{ lbs/ft}^3$
  - DENSITY OF LIGHTWEIGHT CONCRETE  $115 \text{ lbs/ft}^3$
  - DEAD LOAD OF VARIOUS GRID REINFORCED SYSTEMS, USING BOTH NORMAL AND LIGHTWEIGHT CONCRETE, AND INTEGRAL OVERFILL, ARE SHOWN IN THE TABLES ON SHEETS 4 OR 5.
5. PROVIDE 1 1/2" CONCRETE COVER ON REINFORCEMENT BARS UNLESS OTHERWISE NOTED.
6. PROVIDE 1 1/2" COVER OVER GRID. THE TOP 1/2" OF THE OVERFILL/OVERLAY IS CONSIDERED SACRIFICIAL.
7. SEE NOTES ON SHEET 4 FOR STEEL GRID COATING OPTIONS.
8. USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT. FOR BARRIER REINFORCEMENT, DO NOT USE RAIL STEEL (A996). SEE DESIGN MANUAL PART 4, SECTION D 5.4.3.1.
9. DESIGN TABLES ARE VALID FOR BOTH NORMAL WEIGHT AND LIGHTWEIGHT CONCRETE.
10. WHEN THE HAUNCH HEIGHT (MEASURED FROM TOP OF BEAM TO BOTTOM OF SLAB) EXCEEDS 3", PROVIDE HAUNCH REINFORCEMENT.
11. DESIGN IS BASED ON DECKS SUPPORTED ON 3 OR MORE BEAMS.
12. THE TYPICAL BARRIER, THE ALTERNATE SIDEWALK DETAIL AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNED TO RESIST A VEHICULAR COLLISION FORCE AT TEST LEVEL 5. THE SPLIT MEDIAN BARRIERS AND THE ALTERNATE BARRIER ARE DESIGNED TO RESIST A VEHICULAR COLLISION AT TEST LEVEL 4. WHEN NO LONGITUDINAL DECK JOINT IS PROVIDED, CONTINUE ROADWAY MEDIAN BARRIER ACROSS THE STRUCTURE (SEE STANDARD DRAWING RC-57M FOR ATTACHMENT DETAILS).
13. DECK DESIGN TABLES ARE BASED ON THE ORTHOTROPIC PLATE FORMULA AS PER 1994 AASHTO LRFD, ARTICLE 4.6.2.1.8.
14. FACTORED MOMENT =  $1.25(\text{SLAB \& PARAPET MOMENT}) + 1.5(\text{FWS MOMENT}) + 1.75(1+IM/100)(\text{LL MOMENT})$
15. DYNAMIC LOAD ALLOWANCE (IM) = 50%
16. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS SEE BC-788M.
17. THE BRIDGE BARRIERS ON THIS STANDARD HAVE NOT BEEN UPDATED FOR MASH COMPLIANCE. DO NOT USE THE BARRIERS SHOWN ON THIS STANDARD.
18. SHEET 4 SHALL BE USED FOR PRELIMINARY DESIGN ONLY.

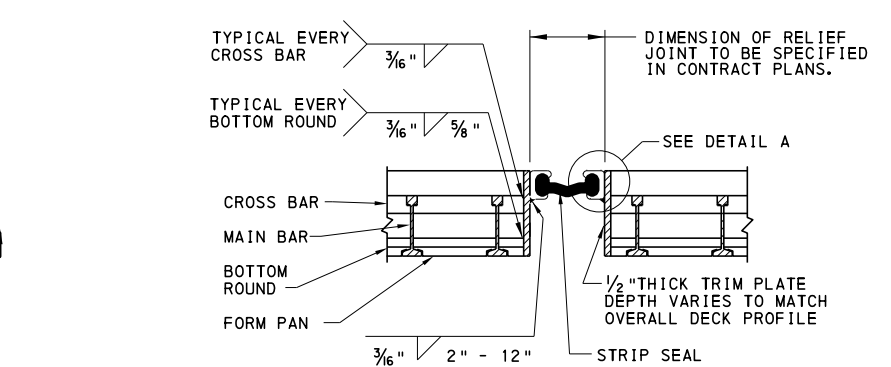
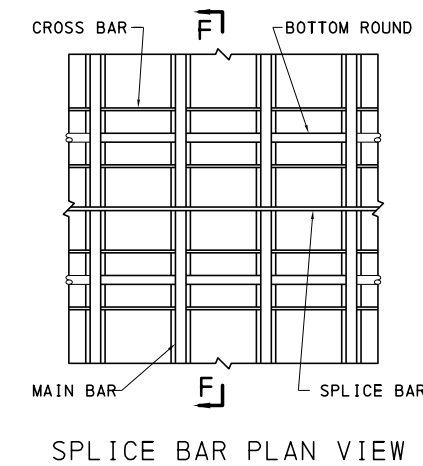
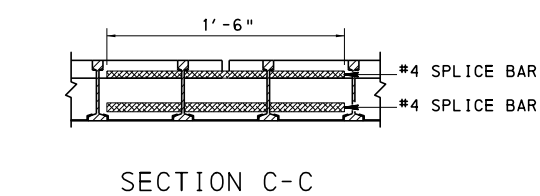
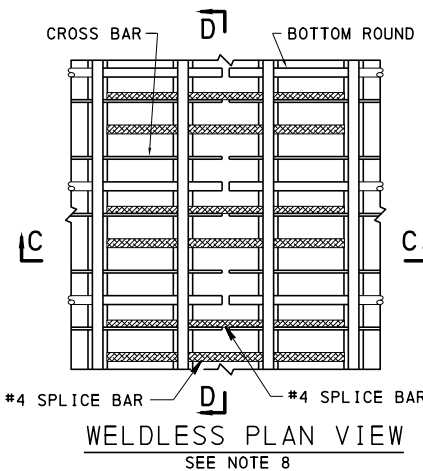
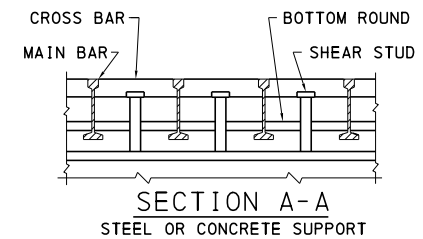
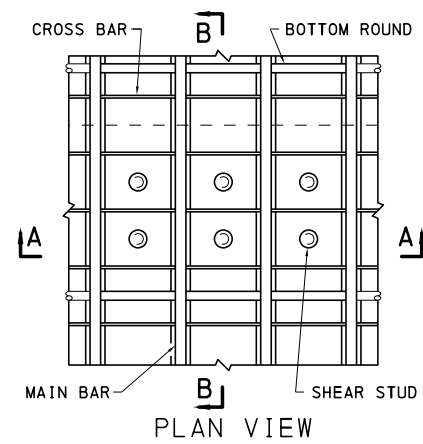
## COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

### STANDARD GRID REINFORCED CONCRETE BRIDGE DECK DESIGN & DETAILS FOR BEAM BRIDGES

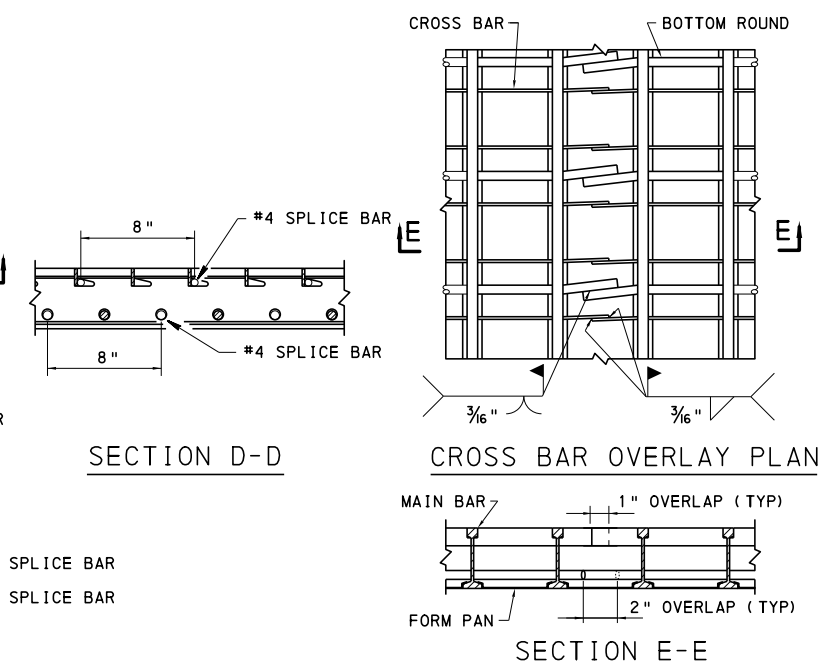
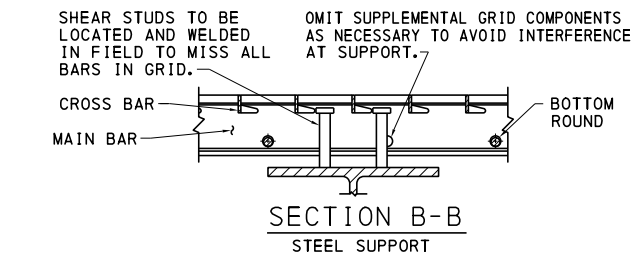
BC-726M	STEEL GRID REINFORCED CAST IN PLACE CONCRETE BRIDGE DECK FOR BEAM BRIDGES DESIGN & DETAILS
BC-751M	BRIDGE DRAINAGE
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BD-601M	CONCRETE DECK SLAB
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
REFERENCE DRAWINGS	

RECOMMENDED AUG. 30, 2019 <i>John J. Russo</i> ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 <i>Mark V. Bator</i> ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 1 OF 4 <b>BD-604M</b>
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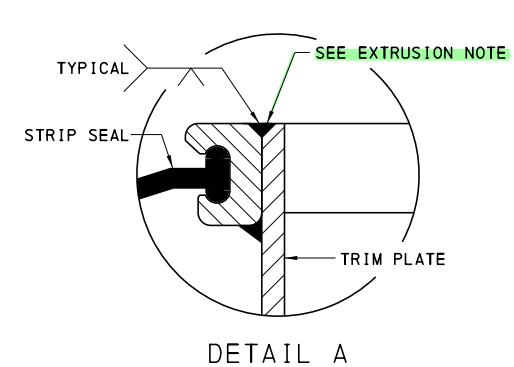
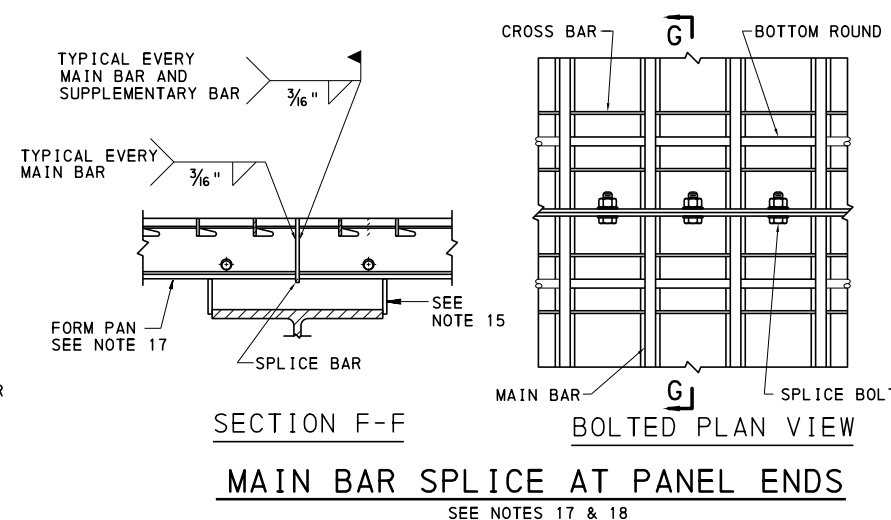




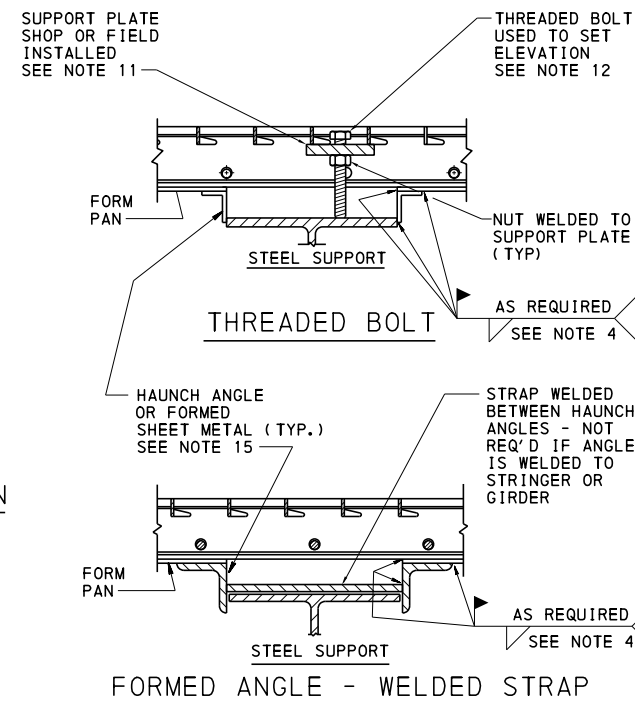
## TYPICAL EXPANSION/RELIEF JOINT



## SPLICE BETWEEN PANELS



EXTRUSION NOTE:  
ONE-PIECE EXTRUSION IN LIEU OF TWO-PIECE MEMBER (EXTRUSION AND PLATE COMBINATION) IS PERMITTED. WELD IN ACCORDANCE WITH AASHTO/AWS D1.5M SPECIFICATIONS.



## NOTES:

### DECK ATTACHMENT:

1. ATTACH GRID REINFORCED CONCRETE BRIDGE DECKS TO BRIDGE FRAMING ELEMENTS (STRINGER, GIRDERS) WITH HEADED SHEAR STUDS. DESIGNED ACCORDING TO AASHTO LRFD ARTICLE 9.7.1.2.
2. DESIGNER IS TO PROVIDE DESIGN FOR SHEAR STUDS. MAKE SHEAR STUD SPACINGS CONSISTENT WITH GRID MAIN BAR SPACING.
3. USE FULL DEPTH FILL FOR ALL GRID DESIGNS, INCLUDING HALF DEPTH FLOORS, OVER FRAMING MEMBERS.
4. IF GRID REINFORCED DECKS ARE TO BE WELDED TO SUPPORTS, A MINIMUM 1/4" x 3" FILLET WELD SHALL BE USED AT EACH GRID I-BEAM (OR TEE) INTERSECTION WITH EACH BRIDGE STRINGER OR GIRDER.
5. A VARIETY OF CONSTRUCTION METHODS HAVE BEEN USED TO SET THE PROPER ELEVATION OF A GRID REINFORCED DECK. SOME OF THE MORE COMMON METHODS ARE DESCRIBED IN A BRIDGE GRID FLOORING MANUFACTURER'S ASSOCIATION (BGFMA) PUBLICATION TITLED "GRID REINFORCED CONCRETE DECK ATTACHMENT", WHICH IS HEREBY INCORPORATED INTO THESE STANDARDS. SEE "ELEVATION OPTIONS" NOTES ON THIS SHEET FOR METHODS OF ACHIEVING PROPER DECK ELEVATION AND HAUNCH FORMING.
6. ALTERNATE DECK ELEVATION/HAUNCH FORMING METHODS MAY BE SUBMITTED BY THE CONTRACTOR FOR ENGINEER'S APPROVAL.
7. GRID OR SUPPORT MECHANISM MAY BE TACK WELDED INTERMITTENTLY TO PREVENT MOVEMENT DURING CONCRETE POURING OPERATION.

### WELDLESS SPLICE BETWEEN PANELS:

8. SPLICE REBAR MAY BE INSERTED EITHER THROUGH SLOT IN GRID I-BEAM THROUGH WHICH CROSS BARS ARE PLACED, OR THROUGH A SEPARATE PUNCHED SLOT.

### ELEVATION OPTIONS:

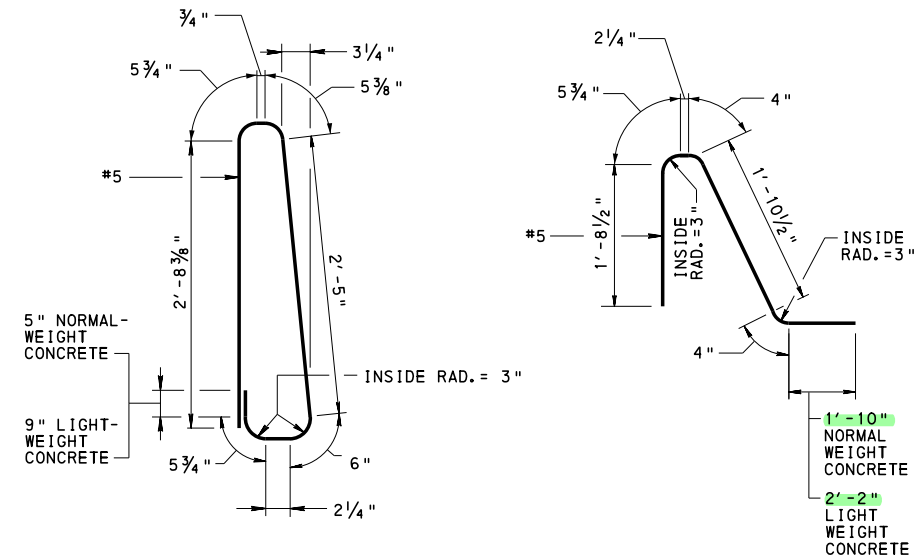
9. SUITABILITY OF ELEVATION OPTION DEPENDS ON LIVE LOAD PLACED ON GRID PRIOR TO FILLING WITH CONCRETE.
10. REGARDLESS OF ELEVATION OPTION USED, USE HEADED SHEAR STUDS FOR DECK ATTACHMENT TO BEAMS.
11. SUPPORT PLATE TO BE SHOP OR FIELD INSTALLED UNDER CROSS BARS AS SHOWN IN THREADED BOLT ELEVATION DETAIL, OR UNDER MAIN GRID BARS WHERE APPLICABLE.
12. TACK WELDING THREADED STUD TO SUPPORT IS PERMITTED TO ENABLE LEVELING OF PANEL.
13. ANY CONSTRUCTION LOADS PLACED ON THE GRID BEFORE CONCRETE IS POURED, AS WELL AS THE WEIGHT OF THE WET CONCRETE, MUST BE ACCOUNTED FOR IN THE DESIGN AND SPACING OF THE SUPPORT ASSEMBLY.
14. THREADED BOLT TO BE UNCOATED A307M STEEL.
15. HAUNCH ANGLE MAY BE WELDED TO STRINGER/GIRDER WHERE PERMITTED BY ENGINEER.
16. HEADED SHEAR STUDS NOT SHOWN IN ELEVATION DETAILS FOR CLARITY.
17. OMIT CONCRETE FORM PAN OVER SUPPORT MEMBERS.
18. CHOICE OF SPLICE OPTION DEPENDS ON PRESENCE OF TRAFFIC DURING CONSTRUCTION AND WIDTH BETWEEN STAGES. FOR ATYPICAL CONDITIONS (SPLICE BETWEEN STRINGERS, FOR EXAMPLE) CONTACT MANUFACTURER.

### MISC. NOTES:

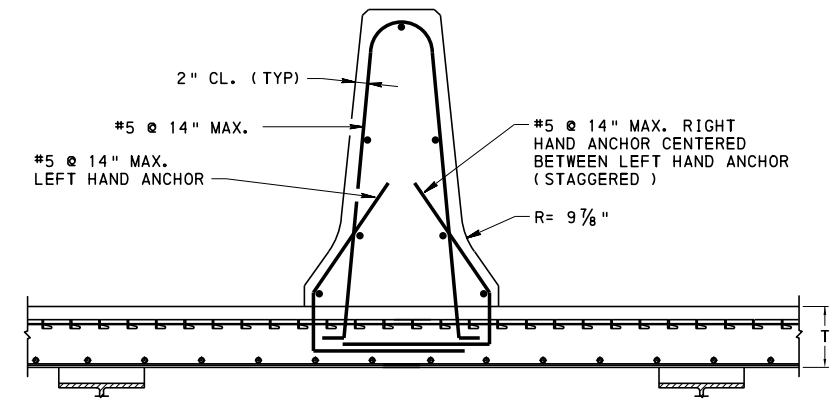
19. REFER TO BC-767M FOR JOINT DETAILS AT SIDEWALKS, ETC.
20. REFER TO BC-751M FOR SCUPPER DETAILS.

<p align="center"><b>COMMONWEALTH OF PENNSYLVANIA</b>  <b>DEPARTMENT OF TRANSPORTATION</b>          BUREAU OF PROJECT DELIVERY</p>		
<p align="center"><b>STANDARD</b>  <b>GRID REINFORCED CONCRETE BRIDGE DECK</b>  <b>DESIGN &amp; DETAILS</b>  <b>FOR BEAM BRIDGES</b></p>		
RECOMMENDED AUG. 30, 2019  ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019  ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 2 OF 4 BD-604M

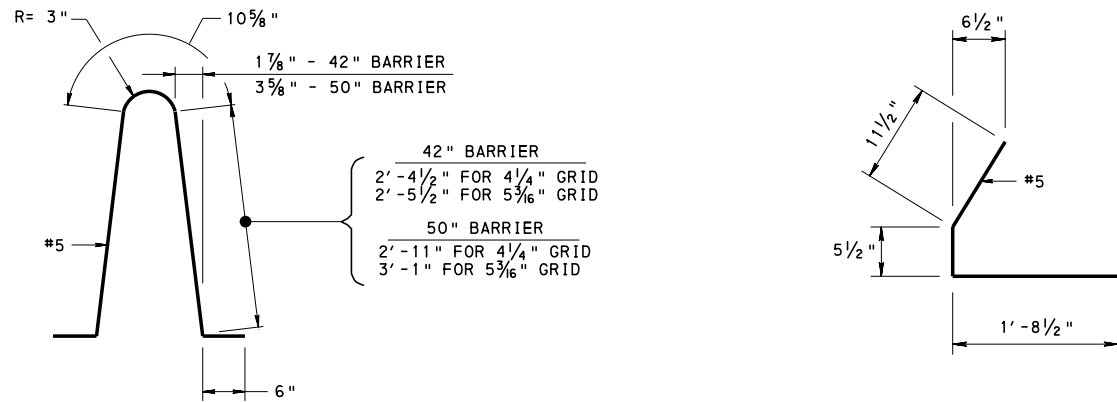
NOTE:  
DIMENSIONS INDICATED FOR TYPICAL  
BARRIER HEIGHT OF 3'-6", ADJUST  
DIMENSIONS ACCORDINGLY IF  
ALTERNATE BARRIER IS APPROVED.



BARRIER REINFORCEMENT



MODIFIED CONCRETE MEDIAN BARRIER DETAIL  
SOME GRID CROSS BARS MAY BE OMITTED TO FACILITATE REBAR PLACEMENT



MODIFIED MEDIAN BARRIER REINFORCEMENT

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MAXIMUM SPANS FOR INFINITE FATIGUE LIFE

TABLE 1: FULL DEPTH FLOORING DESIGNS

BEARING BAR (IN)	BEARING BAR SPACING (IN)	NUMBER OF SUPPLEMENTAL BARS (SEE NOTE 3)	SIZE OF SUPPLEMENTAL BARS (IN)	MAXIMUM SPAN (FT) (SEE NOTE 2)	TYPE OF CONCRETE FILL	OVERALL DECK WEIGHT (STEEL AND CONCRETE)		CANTILEVER REBAR SIZE AND SPACING (SEE NOTE 1)	MAXIMUM OVERHANG BASED ON THE CAPACITY OF DECK STRENGTHENED TO RESIST PL-3 CRASH LOAD (FT) (SEE NOTE 4)	MAXIMUM OVERHANG BASED ON 0.625 x INTERIOR SPAN (FT)
						NORMAL WEIGHT CONCRETE	LIGHT WEIGHT CONCRETE			
						(LBS/FT²)	(LBS/FT²)			
4¼	6	0	—	7.0	OVERFILL	83	70	#4 @ 6"	4.0	4.0
				7.0	FLUSH FILL	62	53			
4¼	8	0	—	4.0	OVERFILL	81	68	#5 @ 4"	3.5	2.5
				4.0	FLUSH FILL	60	51			
5⅜	6	0	—	5.0	OVERFILL	96	81	#4 @ 6"	4.5	3.0
				5.0	FLUSH FILL	75	64			
5⅜	8	0	—	3.5	OVERFILL	94	79	#4 @ 8"	4.0	2.0
				3.5	FLUSH FILL	73	62			
5⅜	6	1	1 x ⅝	8.5	OVERFILL	97	82	N/A	4.5	5.0
				8.0	FLUSH FILL	76	65			
5⅜	8	1	1 x ⅝	6.0	OVERFILL	96	80	#4 @ 8"	4.0	3.5
				6.0	FLUSH FILL	75	63			
5⅜	10	1	1 x ⅝	5.0	OVERFILL	94	78	#5 @ 10"	3.5	3.0
				5.0	FLUSH FILL	73	61			
5⅜	6	2	1 x ⅝	11.0	OVERFILL	100	85	N/A	5.0	6.5
				8.0	FLUSH FILL	76	68			
5⅜	8	2	1 x ⅝	8.5	OVERFILL	97	82	N/A	4.0	5.0
				6.0	FLUSH FILL	76	65			
5⅜	10	2	1 x ⅝	7.0	OVERFILL	95	80	#4 @ 10"	3.5	4.0
				5.0	FLUSH FILL	74	63			

TABLE 2: HALF DEPTH FLOORING DESIGNS

BEARING BAR (IN)	BEARING BAR SPACING (IN)	NUMBER OF SUPPLEMENTAL BARS (SEE NOTE 3)	SIZE OF SUPPLEMENTAL BARS (IN)	MAXIMUM SPAN (FT) (SEE NOTE 2)	TYPE OF CONCRETE FILL	OVERALL DECK WEIGHT (STEEL AND CONCRETE)		CANTILEVER REBAR SIZE AND SPACING (SEE NOTE 1)	MAXIMUM OVERHANG BASED ON THE CAPACITY OF DECK STRENGTHENED TO RESIST PL-3 CRASH LOAD (FT) (SEE NOTE 4)	MAXIMUM OVERHANG BASED ON 0.625 x INTERIOR SPAN (FT)
						NORMAL WEIGHT CONCRETE	LIGHT WEIGHT CONCRETE			
						(LBS/FT²)	(LBS/FT²)			
5⅜	6	1	1 x ⅝	7.5	OVERFILL	70	60	N/A	4.5	5.0
				7.5	FLUSH FILL	49	43			
5⅜	8	1	1 x ⅝	6.0	OVERFILL	67	57	#4 @ 8"	4.0	3.5
				6.0	FLUSH FILL	46	40			
5⅜	10	1	1 x ⅝	4.5	OVERFILL	66	56	#5 @ 10"	3.5	3.0
				4.5	FLUSH FILL	45	39			
5⅜	6	2	1 x ⅝	11.0	OVERFILL	72	63	N/A	5.0	6.5
				11.0	FLUSH FILL	51	46			
5⅜	8	2	1 x ⅝	8.0	OVERFILL	69	59	N/A	4.0	5.0
				8.0	FLUSH FILL	48	42			
5⅜	10	2	1 x ⅝	6.5	OVERFILL	67	57	#4 @ 10"	3.5	4.0
				6.5	FLUSH FILL	46	40			

NOTES ON TABLES:

1. COLUMN LABELED "CANTILEVER REBAR" INDICATES SIZE AND SPACING OF REBAR WHICH MUST BE INSERTED FLUSH WITH TOP OF GRID INTO GRID REINFORCED DECK OVERHANG.
2. SPAN LENGTHS INDICATED ARE BASED BOTH ON HISTORICAL DATA AND FIELD TESTED INSTALLATIONS. IT IS ACKNOWLEDGED THAT THERE ARE DISCREPANCIES WHEN SPAN LENGTH OF VARIOUS DECK DESIGNS ARE COMPARED.
3. ALL LISTED DESIGNS REQUIRE THE USE OF STEEL GRADE 50 EXCEPT DECK DESIGN 5⅜" I-BEAM @ 6" C/C WITH TWO (2) SUPPLEMENTARY BARS WHICH REQUIRES THE USE OF GRADE 36.
4. REFER TO LRFD AASHTO SECTION 13.2 FOR DEFINITION OF PL-3 LOADING.

NOTES:

GRID SURFACES COATING:

1. SURFACES OF GRID IN CONTACT WITH CONCRETE NEED NOT BE COATED IF GRID IS TO RECEIVE AN OVERLAY. IF THIS OPTION IS USED, APPLY AN APPROVED COATING SYSTEM TO THE UNDERSIDE AND EXPOSED SURFACES OF THE GRID. FOR EXAMPLE THE UNDERSIDE OF THE GRID COULD BE PAINTED WITH THE SAME SYSTEM USED TO COAT BRIDGE SUPERSTRUCTURE.
2. THE STEEL GRID MAY BE FABRICATED FROM UNCOATED WEATHERING STEEL, IN WHICH CASE THE CONCRETE FORM PANS TO BE MADE FROM PRE-GALVANIZED SHEETS MEETING ASTM A653, G-90.
3. FOR ADDITIONAL CORROSION PROTECTION, A COATING SYSTEM MAY BE APPLIED TO ALL GRID SURFACES (INCLUDING THOSE IN CONTACT WITH THE CONCRETE). FOR EXAMPLE, STEEL GRID PANELS MAY BE HOT DIP GALVANIZED, IN WHICH CASE NO ADDITIONAL COATING OF UNDERSIDE IS REQUIRED.

DECK OVERLAY:

1. UNLESS PROHIBITED DUE TO PROJECT DECK DEAD LOAD RESTRICTIONS, ALL GRID REINFORCED CONCRETE BRIDGE DECKS ARE TO RECEIVE AN OVERLAY WHEN INITIALLY INSTALLED. IF A PROJECT REQUIRES A FLUSH FILLED DECK, COAT ALL GRID SURFACES WITH AN APPROVED PAINT SYSTEM, OR HOT DIP GALVANIZE THEM.
2. INTEGRAL OVERLAYS (POURED MONOLITHICALLY WITH CONCRETE PLACED INTO GRID) IS A RECOMMENDED METHOD OF CONSTRUCTING AN OVERLAY. WEIGHTS SHOWN IN MAXIMUM SPAN TABLES FOR "OVERFILL" BASED ON 1¼" THICKNESS OF CONCRETE ABOVE TOP OF STEEL GRID BARS.
3. **ASPHALT PAVEMENT** OVERLAYS MAY BE APPLICABLE IN ACCORDANCE WITH PUB 408, SECTION 420, 680, 1080.3(e), AND AS DIRECTED BY THE ENGINEER.
4. EXERCISE GREAT CARE WHEN USING SEPARATELY POURED RIGID OVERLAYS OF SPECIAL MIX DESIGNS (MICRO-SILICA, LMC, FOR EXAMPLE) TO INSURE ADEQUATE CLEANING OF THE TOP OF THE FLUSH FILLED GRID SURFACE PRIOR TO PLACEMENT OF THE OVERLAY. THE SAME PRECAUTIONS APPLIES FOR ANY SPECIAL POLYMER OVERLAY.

STANDARD SHOP PRACTICES, FABRICATION AND ERECTION TOLERANCES:

REFER TO BRIDGE GRID FLOORING MANUFACTURER'S ASSOCIATION (BGFMA) PUBLICATION "STANDARD SHOP PRACTICES AND FABRICATION TOLERANCES FOR GRID REINFORCED CONCRETE DECKS", FOR ADDITIONAL GUIDANCE.

EFFECTIVE FLANGE WIDTH:

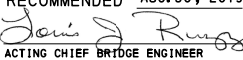
DESIGN GRIDS TO BEHAVE COMPOSITE WITH SUPPORTS; SHEAR STUD DESIGN IS TO BE IN ACCORDANCE WITH AASHTO SPECIFICATIONS. STANDARD AASHTO CRITERIA FOR DETERMINING EFFECTIVE WIDTH OF FLANGE APPLY, IN WHICH T = OVERALL DEPTH OF DECK, INCLUDING INTEGRAL OVERFILL OR PROPERLY BONDED RIGID OVERLAY (LESS ½" SACRIFICIAL WEARING COURSE). FOR EXAMPLE, FOR A HALF DEPTH 5⅜" GRID WITH A 1¾" OVERFILL, T = 6⅞" (5⅜" + 1¾" - 1/2 ").

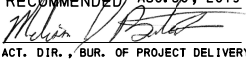
COMPOSITE GIRDER DESIGN:

FOR COMPUTATION OF COMPOSITE SECTION PROPERTY OF GIRDER IN POSITIVE MOMENT REGION, ALL GRID CROSS BARS PLUS ACTUAL CONCRETE THICKNESS ARE COUNTED. FOR EXAMPLE, FOR A HALF DEPTH 5⅜" GRID, (2½" OF CONCRETE WITHIN THE GRID AND A 1¾" INTEGRAL OVERFILL OR 4¼" TOTAL), DESIGN TO USE ALL CROSS BARS AND 3¾" (4¾" LESS ½" SACRIFICIAL) OF CONCRETE ACROSS THE EFFECTIVE WIDTH. PRESENCE OF CONCRETE IS NEGLECTED IN NEGATIVE MOMENT REGION, AND FABRICATION NOTCHES IN CROSS BARS ARE DEDUCTED.

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FOR BEAM BRIDGES

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ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 4

BD-604M

CHANGE 2

GENERAL NOTES

- 1. USE OF THIS STANDARD REQUIRES PERMISSION FROM THE DISTRICT BRIDGE ENGINEER. THE STANDARD IS INTENDED TO BE UTILIZED BY DESIGNERS OF ACCELERATED BRIDGE CONSTRUCTION PROJECTS AND BY CONTRACTORS FOR VALUE ENGINEERING OR DESIGN-BUILD PROJECTS.
- 2. THIS STANDARD APPLIES TO STRAIGHT BRIDGES WITH A SKEW BETWEEN 90 DEGREES AND 60 DEGREES INCLUSIVE, CONSTRUCTED WITH EITHER PRESTRESSED CONCRETE PA BULB-TEE BEAMS OR STEEL BEAMS/GIRDERS.
- 3. SPANS CROSSING ROADWAYS AND RAILROADS SHALL USE REMOVABLE HAUNCH FORMWORK. ALL OTHER SPANS SHALL USE STAY-IN-PLACE HAUNCH FORMWORK. SEE SHEET 4 FOR HAUNCH FORMWORK DETAILS.
- 4. IF SCUPPER IS DETERMINED TO BE REQUIRED ON THE DECK SLAB, DESIGNER MUST ENSURE THE DECK SLAB REINFORCEMENT ADEQUACY AT SCUPPER AND DECK GEOMETRY ADEQUACY AT LONGITUDINAL POST TENSIONING DUCT IF APPLICABLE.

DESIGN NOTES

- 1. MINIMUM STRUCTURAL THICKNESS OF PRECAST CONCRETE DECK PANELS SHALL BE 8". THICKER PANELS MAY BE REQUIRED TO ACCOMMODATE POST-TENSIONING ANCHORAGES AND ANCHORAGE REINFORCEMENT. PRECAST CONCRETE DECK PANEL THICKNESS SHALL INCLUDE A 1/4" ALLOWANCE FOR GRINDING.
- 2. WEARING SURFACE SHALL BE EITHER EPOXY BASED SURFACE TREATMENT FOR BRIDGE DECKS, 3/8" MIN. THICKNESS OR LATEX MODIFIED CONCRETE WEARING SURFACE, 1 1/4" MIN. THICKNESS AS DIRECTED BY THE DISTRICT BRIDGE ENGINEER. WEARING SURFACE SHALL BE PLACED AFTER ALL CLOSURE POURS, JOINTS, HAUNCHES, AND SHEAR BLOCKOUTS HAVE BEEN GROUTED/CONCRETED, CURED, AND GROUND SMOOTH AS REQUIRED.
- 3. ULTRA HIGH PERFORMANCE CONCRETE STRENGTH VARIES WITH TIME, DESIGNER SHOULD CHECK WITH MANUFACTURER TO DETERMINE APPROPRIATE MATERIAL FOR PROJECT SCHEDULE.
- 4. THE DESIGN OF LONGITUDINAL POST-TENSIONING SHALL BE IN ACCORDANCE WITH AASHTO SECTION 9.7.5. FOR CONTINUOUS SPANS, THE DESIGNER SHALL PROVIDE ADDITIONAL PRESTRESS IN DECK TO OVERCOME THE SERVICE LOAD TENSILE STRESS DUE TO NEGATIVE COMPOSITE DEAD LOAD AND LIVE LOAD MOMENTS TO ACHIEVE AN EFFECTIVE MINIMUM PRESTRESS OF 0.250 KSI IN DECK UNDER ALL SERVICE LOADING CONDITIONS.
- 5. DESIGNER SHALL PROVIDE THE NUMBER, LOCATION, FORCE AND STRESSING SEQUENCE OF THE POST-TENSIONING TENDONS. GENERAL ZONE REINFORCING SHALL BE DESIGNED BY THE DESIGNER AND DEPICTED ON THE CONTRACT DRAWINGS. FINAL DESIGN OF POST-TENSIONING SYSTEM AND LOCAL ZONE REINFORCING SHALL BE PERFORMED BY THE CONTRACTOR. THE PLANS SHALL NOTE THE ASSUMPTIONS USED TO DEVELOP THE POST TENSIONING FORCE INCLUDING THE ASSUMPTIONS USED FOR LOSS CALCULATIONS.
- 6. THE NUMBER AND LOCATION OF LIFTING DEVICES SHALL BE DETERMINED BY THE DESIGNER AND SHOWN ON THE CONTRACT DRAWINGS. THE DESIGNER SHALL VERIFY THAT THE PANELS ARE STABLE AND STRUCTURALLY ADEQUATE WHEN LIFTED BY THE SELECTED LOCATIONS. DESIGN OF LIFTING DEVICES SHALL BE PERFORMED BY THE CONTRACTOR.
- 7. DESIGN OF BEAMS SHALL ACCOUNT FOR UNEQUAL DISTRIBUTION OF DEAD LOAD CAUSED BY NON-SYMMETRIC PANELS. NOTE DEAD LOAD OF PRECAST PANEL (INCLUDING BARRIER) IS APPLIED TO NONCOMPOSITE BEAM SECTION. ON THE CONTRACT DRAWINGS, PROVIDE THE FRACTION OF DECK PANEL WEIGHT ASSUMED TO BE CARRIED BY EACH OF THE BEAMS.
- 8. VERTICAL ADJUSTMENT DEVICES SHALL BE SIZED USING TWICE THE TRIBUTARY AREA TO ACCOUNT FOR THE POSSIBILITY THAT ALL DEVICES MAY NOT BE IN CONTACT WITH THE BEAMS DURING INITIAL PLACEMENT.
- 9. DESIGN OF THE DECK OVERHANG AND BRIDGE BARRIER REINFORCING SHALL ACCOUNT FOR THE OPEN JOINTS IN THE BRIDGE BARRIER.
- 10. DEAD LOAD OF EPOXY BASED SURFACE TREATMENT FOR BRIDGE DECKS, 3/8" MIN. THICKNESS SHALL BE TAKEN AS 7 LB/SF.

- 11. DEAD LOAD OF LATEX MODIFIED CONCRETE WEARING SURFACE, 1 1/4" MIN. THICKNESS SHALL BE TAKEN AS 16 LB/SF.
- 12. MATERIALS: REINFORCEMENT STEEL fy = 60 KSI  
CONCRETE f'c = 5 KSI MIN. (DECK AND BARRIER)
- 13. CONCRETE COVER: DECK TOP COVER = 2 1/2"  
DECK BOTTOM COVER = 1"  
BARRIER = 2"  
TRANSVERSE JOINTS = 1 1/2"  
LONGITUDINAL JOINTS = 1 1/2"
- 14. DESIGNER SHALL DESIGN THE PRECAST PANEL REINFORCEMENT. THE USE OF BD-601M DESIGN TABLES FOR PRECAST PANEL REINFORCEMENT DOES NOT CONSTITUTE A DESIGN. HOWEVER, THE PRECAST PANEL REINFORCEMENT SHALL NOT BE LESS THAN WHAT WOULD BE DETERMINED FROM THE BD-601M DESIGN TABLES.

DRAWING NOTES

- 1. PROVIDE MATERIALS AND WORK QUALITY IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
- 2. SUBMIT SHOP DRAWINGS FOR PRECAST CONCRETE DECK PANELS AND ASSOCIATED COMPONENTS.
- 3. CONTRACTOR MUST PERFORM FINAL DESIGN OF POST-TENSIONING SYSTEM. POST-TENSIONING CALCULATIONS MUST ACCOUNT FOR PROPOSED HARDWARE AND ARE TO BE SUBMITTED AS PART OF SHOP DRAWING SUBMISSION.
- 4. CONTRACTOR TO DESIGN LIFTING DEVICES AND CALCULATIONS MUST BE SUBMITTED AS PART OF SHOP DRAWING SUBMISSION.
- 5. BLAST CLEAN INSIDE FACES OF SHEAR BLOCKOUTS AND SHEAR KEYS TO CREATE AN EXPOSED AGGREGATE FINISH.
- 6. BLAST CLEAN TRANSVERSE AND LONGITUDINAL JOINTS OF PRECAST PANELS TO CREATE AN EXPOSED AGGREGATE FINISH.
- 7. ASSESS THE STABILITY OF EXTERNAL PRECAST DECK PANELS DUE TO ASYMMETRICAL AND/OR ECCENTRIC LOADING. MAINTAIN STABILITY OF PRECAST DECK PANELS DURING LIFTING, TRANSPORTATION AND ERECTION OF THE PANELS UNTIL CLOSURE POURS AND POST-TENSIONING OPERATIONS ARE COMPLETE.

SEQUENCE OF CONSTRUCTION

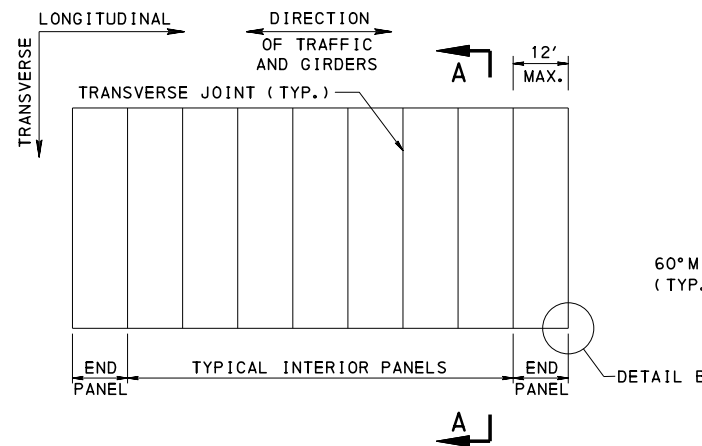
- 1. ERECT BEAMS AND INSTALL DIAPHRAGMS.
- 2. IF STAY-IN-PLACE HAUNCH FORMWORK IS APPLICABLE, PLACE FORMWORK PER DETAILS ON SHEET 4. REMOVABLE FORMS ARE PLACED AFTER PANELS ARE SET (SEE STEP 9 BELOW).
- 3. PREPARE PANELS BY PRE-SETTING THE VERTICAL ADJUSTMENT DEVICES TO THE REQUIRED ANTICIPATED DEPTH.
- 4. SET PRECAST DECK PANELS STARTING AT EITHER ABUTMENT AND PROGRESS ALONG BEAM/GIRDER LINE TO OPPOSITE ABUTMENT.
- 5. ADJUST EACH PANEL TO PROPER ELEVATION USING VERTICAL ADJUSTMENT DEVICES. ADJUST TORQUE IN VERTICAL ADJUSTMENT DEVICE TO PROPERLY DISTRIBUTE DECK DEAD LOAD TO BEAMS (AS DETERMINED BY DESIGN).
- 6. PLACE FORMWORK FOR TRANSVERSE JOINTS. COUPLE POST-TENSIONING DUCTS (IF REQUIRED). PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION. FILL TRANSVERSE JOINTS WITH ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, IF APPLICABLE OR NON-SHRINK EPOXY GROUT PER SECTION 1080.2(c) OF PENNDOT PUB.408.
- 7. TRANSVERSE JOINT MATERIAL SHALL REACH A MINIMUM STRENGTH OF 4 KSI BEFORE PROCEEDING TO NEXT STEP.
- 8. INSTALL POST-TENSIONING STRANDS IN DUCTS AND TENSION TO SPECIFIED STRESS (IF REQUIRED). GROUT DUCTS WITHIN 3 CALENDAR DAYS AFTER TENSIONING. PUMP GROUT FROM LOW END OF BRIDGE AND FILL POST-TENSIONING DUCTS FULL LENGTH OF BRIDGE (IF REQUIRED). IF GROUTING IS NOT GOING TO BE PERFORMED DURING THE SAME DAY THE TENDONS ARE STRESSED, THEN WITHIN 4 HOURS AFTER STRESSING, PROTECT THE TENDONS AND GROUT DUCTS AGAINST CORROSION AND DEBRIS BY TEMPORARILY SEALING ALL OPENINGS AND VENTS, CLEANING RUST AND OTHER DEBRIS FROM ALL METAL SURFACES TO BE COVERED BY THE GROUT CAP; AND PLACING THE GROUT CAP, INCLUDING A SEAL, OVER THE ANCHOR PLATE UNTIL THE TENDON IS GROUTED. FAILURE TO GROUT THE DUCTS WITHIN 3 CALENDAR DAYS AFTER TENSIONING WILL REQUIRE THE CONTRACTOR TO DEMONSTRATE THE DUCTS ARE UNOBSTRUCTED TO ACHIEVE COMPLETE GROUTING. IF OBSTRUCTION(S) ARE PRESENT, CLEAN DUCTS TO REMOVE OBSTRUCTIONS AND RE-INSPECT PRIOR TO GROUTING.
- 9. IF REMOVABLE HAUNCH FORMWORK IS REQUIRED, PLACE HAUNCH FORMWORK PER DETAILS ON SHEET 4.
- 10. FILL SHEAR BLOCKOUTS AND HAUNCHES WITH ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, IF APPLICABLE OR WITH EPOXY NON-SHRINK GROUT PER SECTION 1080.2(c) OF PENNDOT PUB.408.
- 11. PLACE FORMWORK FOR LONGITUDINAL JOINT IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION.
- 12. PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED SURFACE CONDITION. FILL LONGITUDINAL CLOSURE POUR WITH ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION.
- 13. GROUT POST-TENSIONING BLOCKOUTS (IF REQUIRED). GROUT SHALL BE PLACED IN BLOCKOUTS NO MORE THAN 14 DAYS AFTER TENDONS ARE STRESSED.
- 14. REMOVE ANY REMAINING FORMWORK THAT IS NOT STAY-IN-PLACE.
- 15. PREPARE DECK SURFACE AND PLACE WEARING SURFACE.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
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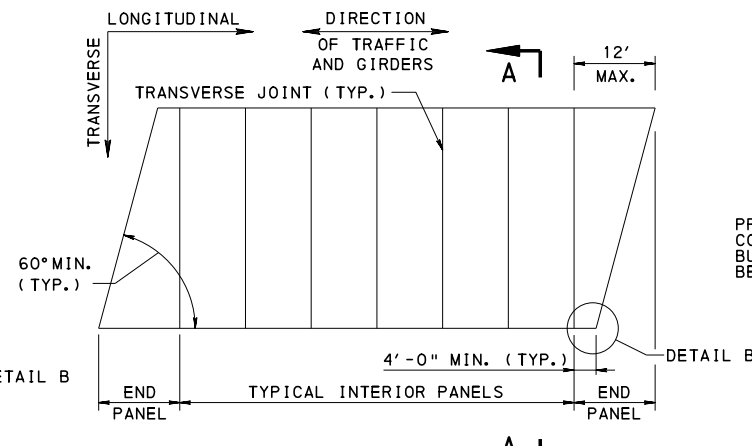
STANDARD  
FULL DEPTH PRECAST CONCRETE DECK  
PANELS FOR PRESTRESSED CONCRETE  
PA BULB-TEE BEAM AND  
STEEL I-BEAM/I-GIRDER BRIDGES

BD-601M	CONCRETE DECK SLAB	RECOMMENDED AUG. 30, 2019	RECOMMENDED AUG. 30, 2019	SHEET 1 OF 6
BC-751M	BRIDGE DRAINAGE	ACTING CHIEF BRIDGE ENGINEER	ACT. DIR., BUR. OF PROJECT DELIVERY	
REFERENCE DRAWINGS				BD-605M



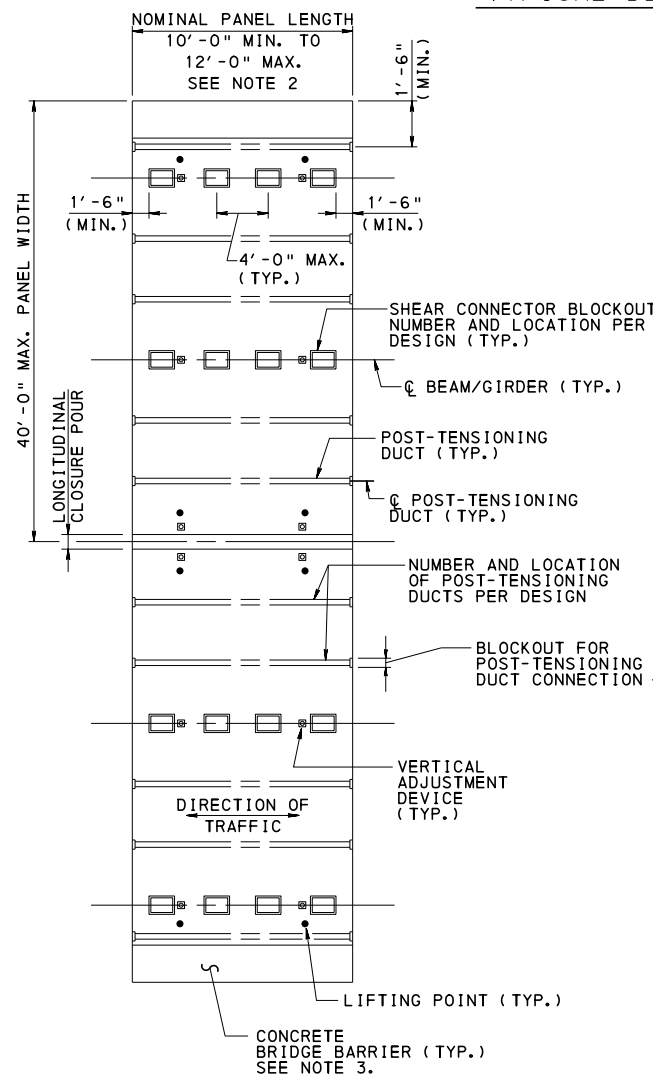


PANELS FOR 90° BRIDGES

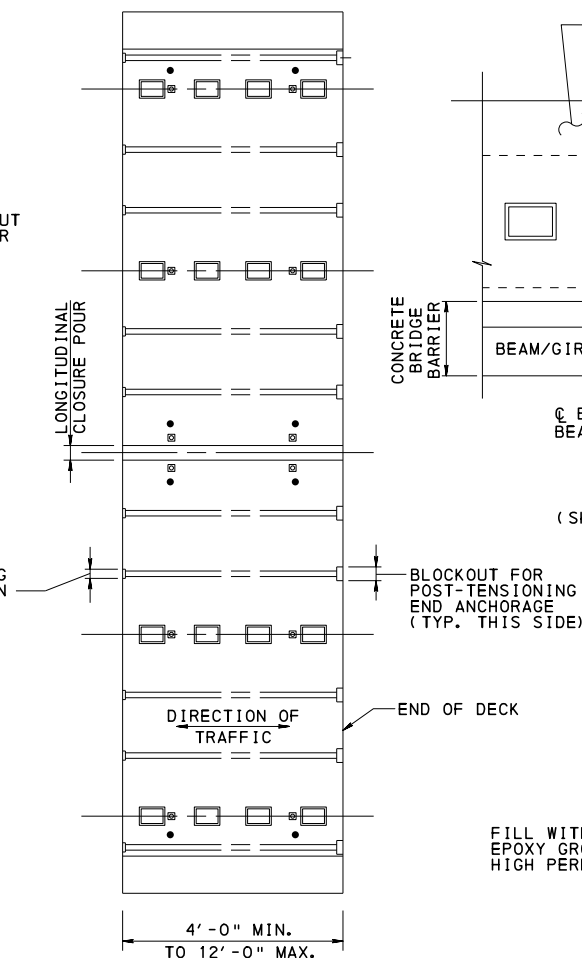


PANELS FOR SKEWED BRIDGES  
BETWEEN 90° AND 60°

TYPICAL DECK LAYOUT

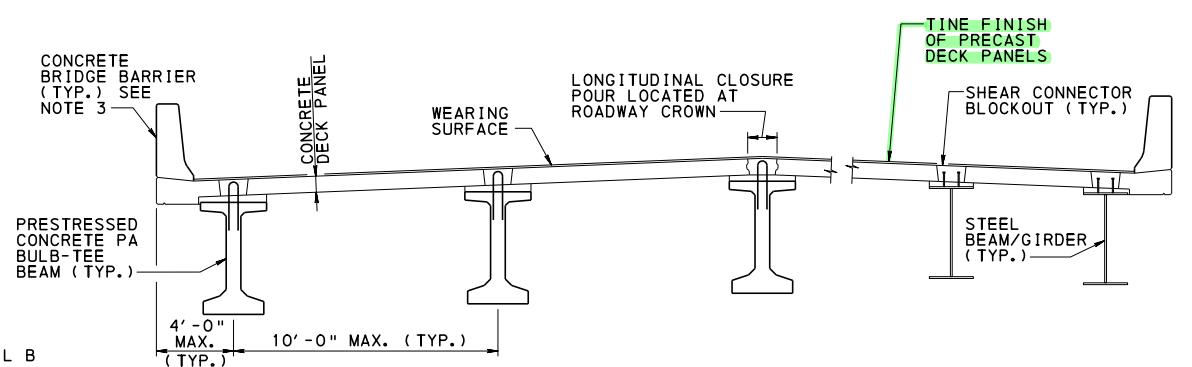


INTERIOR PANEL  
(SEE NOTE 4)

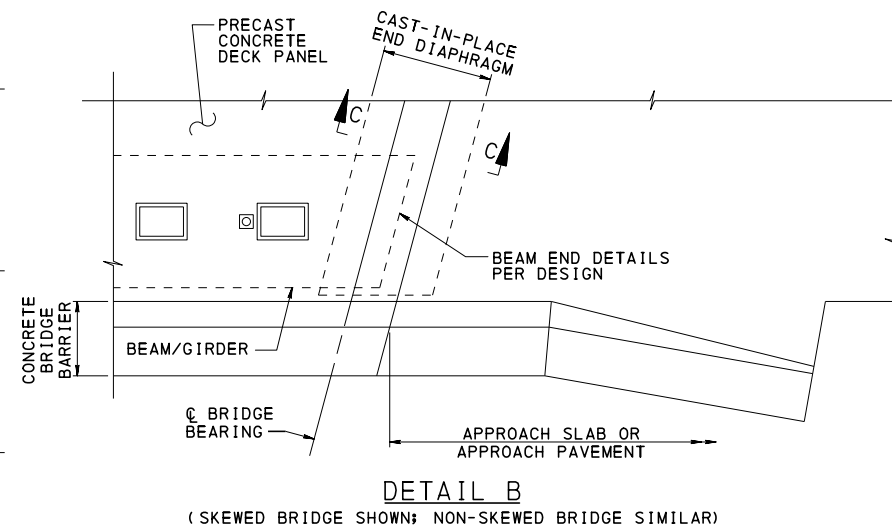


END PANEL  
(SIMILAR TO INTERIOR PANEL EXCEPT AS NOTED)  
(SEE NOTE 4)

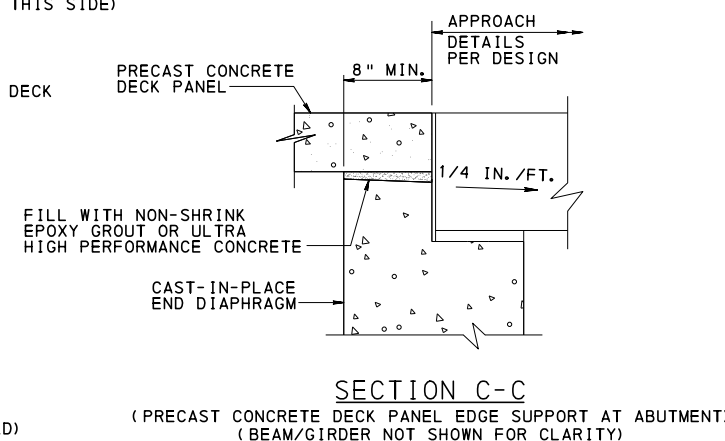
TYPICAL PANEL LAYOUTS



SECTION A-A  
PRECAST CONCRETE DECK PANEL



DETAIL B  
(SKEWED BRIDGE SHOWN; NON-SKEWED BRIDGE SIMILAR)



SECTION C-C  
(PRECAST CONCRETE DECK PANEL EDGE SUPPORT AT ABUTMENT)  
(BEAM/GIRDER NOT SHOWN FOR CLARITY)

#### NOTES:

1. FOR ADDITIONAL NOTES, SEE SHEET 1.
2. PANEL LENGTH TO BE DETERMINED BY DESIGNER. MINIMUM AND MAXIMUM VALUES ARE GUIDELINES FOR INTERIOR PANELS. DESIGNER SHALL VERIFY ABILITY TO SHIP PANELS.
3. BRIDGE BARRIERS SHALL BE CAST INTEGRAL WITH DECK PANEL PRIOR TO ERECTION. BRIDGE BARRIER MAY BE CAST-IN-PLACE AT THE OPTION OF THE CONTRACTOR.
4. PANELS SHOWN WITH LONGITUDINAL POST-TENSIONING. PANELS WITHOUT LONGITUDINAL POST-TENSIONING SIMILAR.
5. FOR DECK PANEL REINFORCEMENT DETAILS, SEE SHEET 3.
6. FOR HAUNCH DETAILS AND SHEAR CONNECTOR BLOCKOUT DETAILS, SEE SHEET 4.
7. FOR BRIDGE BARRIER DETAILS, TRANSVERSE JOINT DETAILS AND LONGITUDINAL CLOSURE POUR DETAILS, SEE SHEET 5.
8. FOR VERTICAL ADJUSTMENT DEVICE DETAILS AND POST-TENSIONING DETAILS, SEE SHEET 6.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

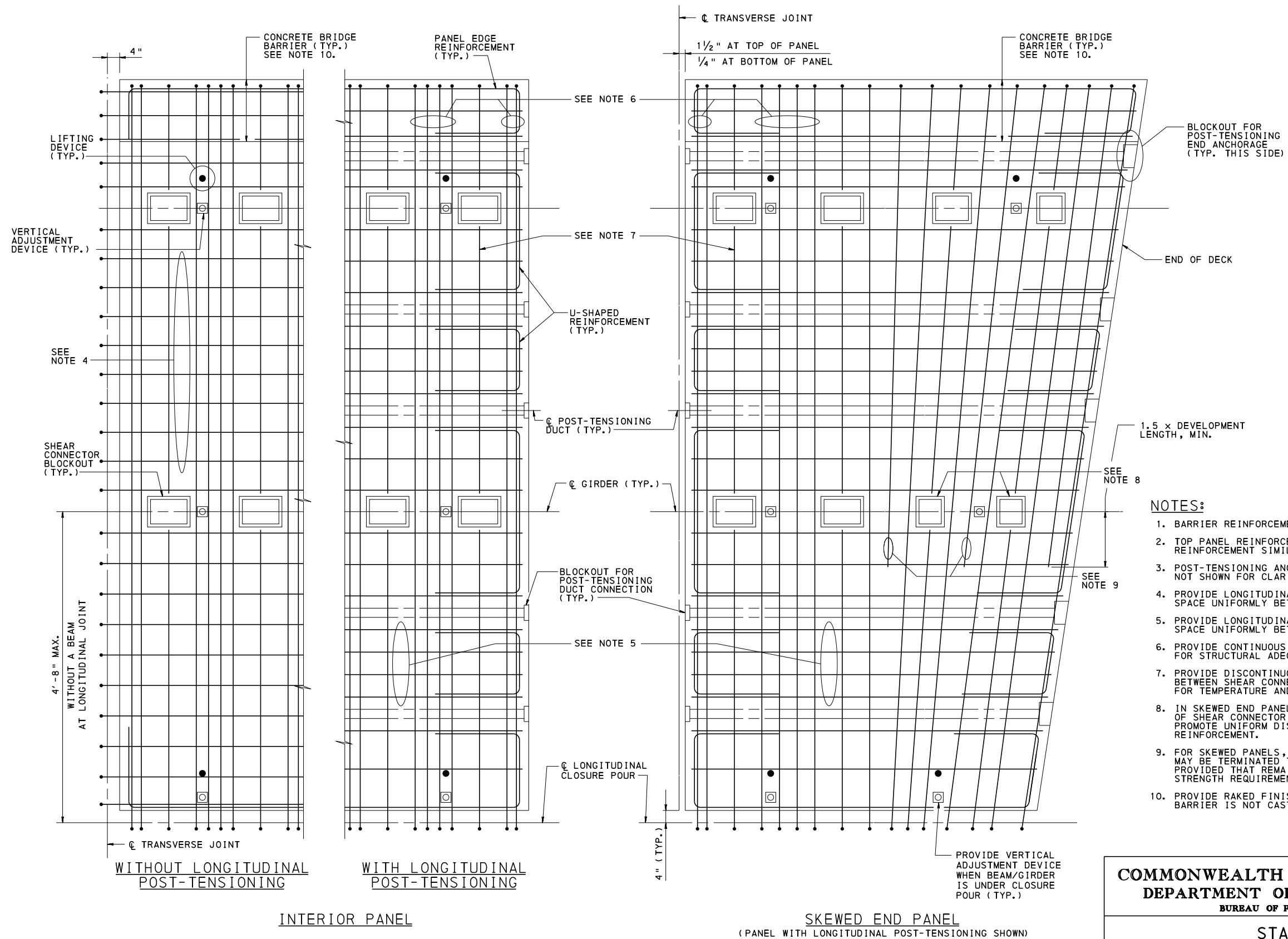
STANDARD  
FULL DEPTH PRECAST CONCRETE DECK  
PANELS FOR PRESTRESSED CONCRETE  
PA BULB-TEE BEAM AND  
STEEL I-BEAM/I-GIRDER BRIDGES

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

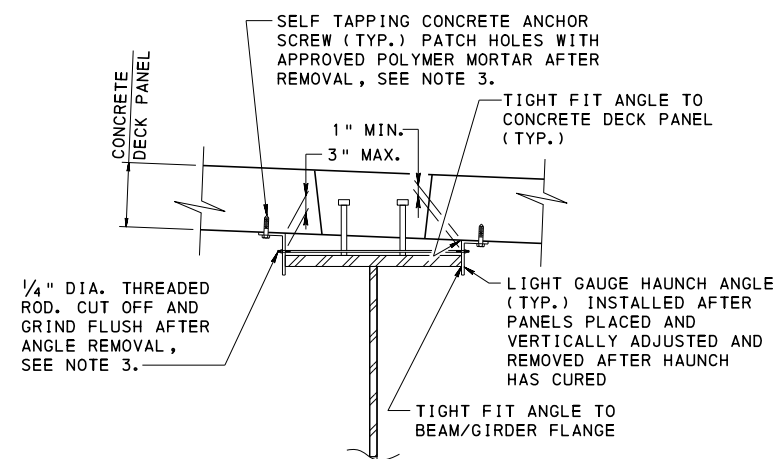
RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 6  
BD-605M

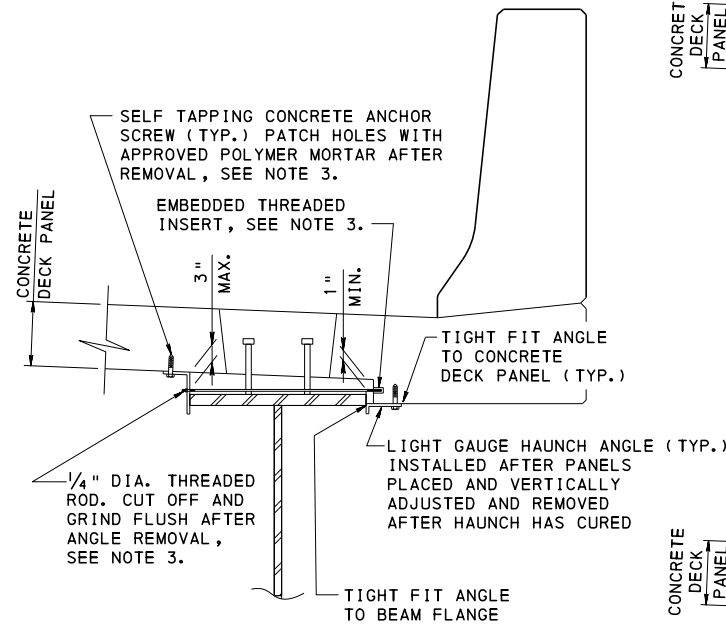




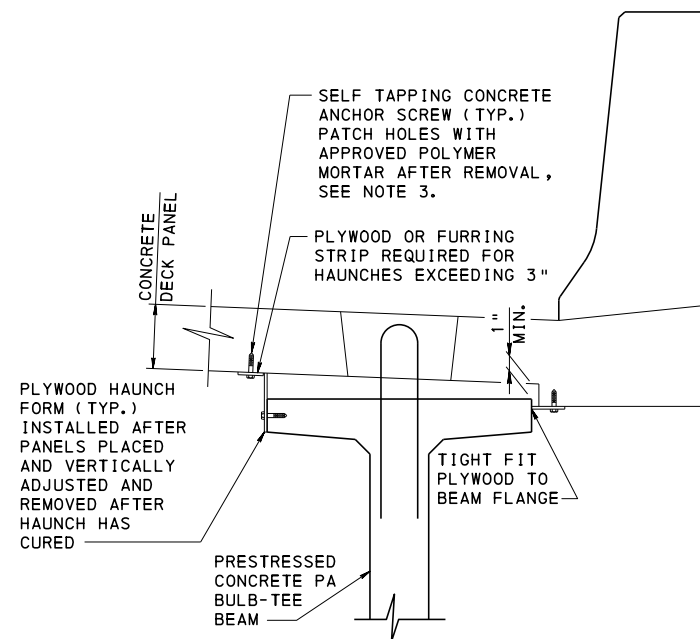
TYPICAL PANEL REINFORCEMENT LAYOUTS



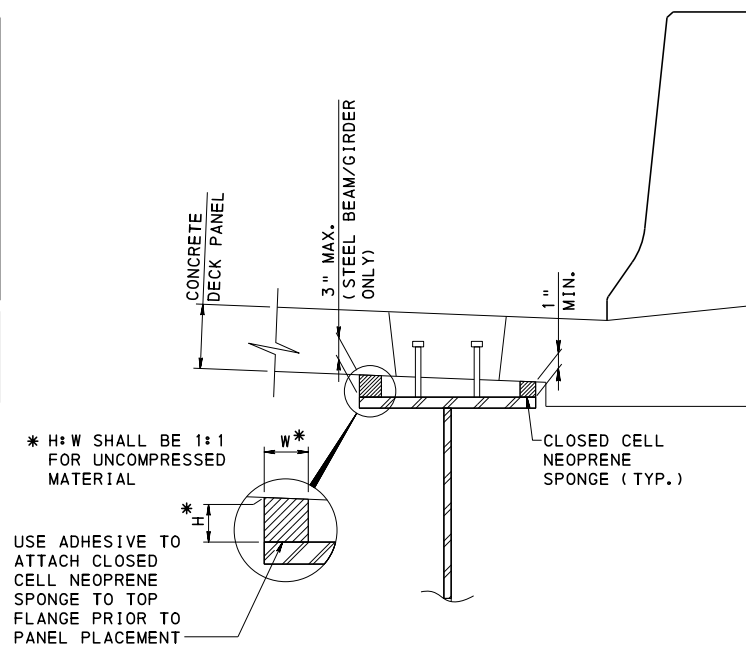
REMOVABLE HAUNCH FORMWORK DETAIL  
INTERIOR STEEL BEAM/GIRDER



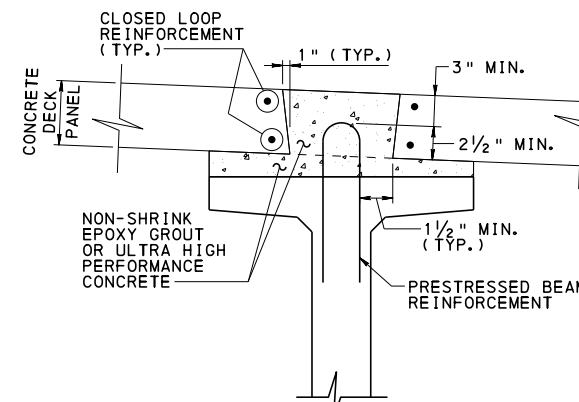
REMOVABLE HAUNCH FORMWORK DETAIL  
STEEL FASCIA BEAM/GIRDER



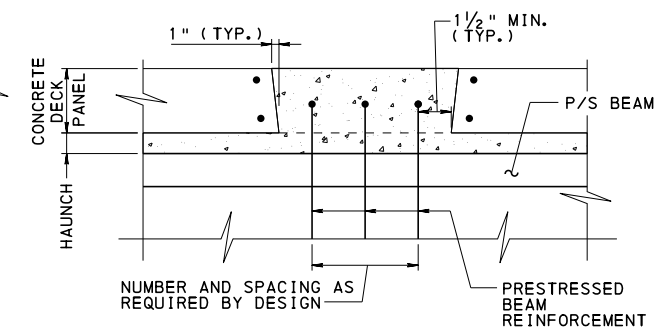
REMOVABLE HAUNCH FORMWORK DETAIL  
PRESTRESSED BEAM



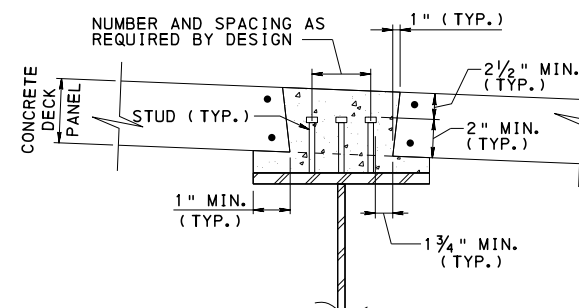
STAY-IN-PLACE HAUNCH FORMWORK DETAIL  
(STEEL BEAM/GIRDER SHOWN, CONCRETE BEAM SIMILAR)



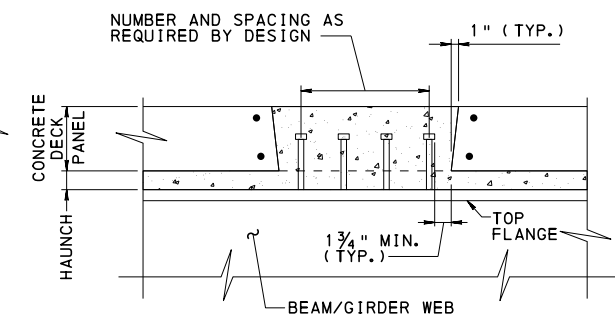
SECTION A-A  
FOR PRESTRESSED BEAM



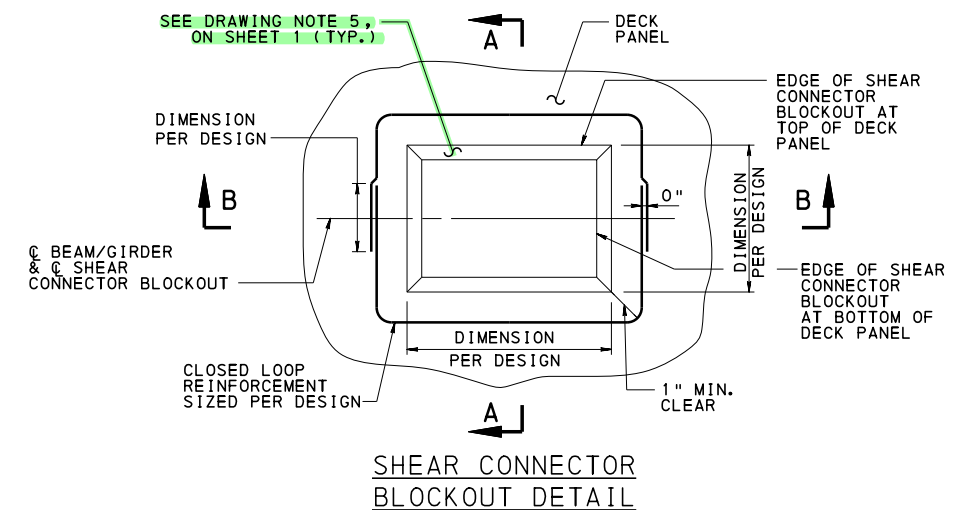
SECTION B-B  
FOR PRESTRESSED BEAM



SECTION A-A  
FOR STEEL BEAM/GIRDER  
(SIMILAR TO PRESTRESSED BEAM  
EXCEPT AS NOTED)



SECTION B-B  
FOR STEEL BEAM/GIRDER



SHEAR CONNECTOR  
BLOCKOUT DETAIL

NOTES:

1. HAUNCH FORMWORK MATERIAL, ATTACHMENT HARDWARE AND PATCHING MATERIAL ARE INCIDENTAL ITEMS TO THE PRECAST DECK.
2. PAINT ALL EXPOSED STEEL WITH APPROVED GALVANIZED SPRAY CONTAINING A MINIMUM OF 92% ZINC.
3. MAXIMUM SPACING OF FORM SUPPORT/ATTACHMENT DEVICES IS 4'-0".

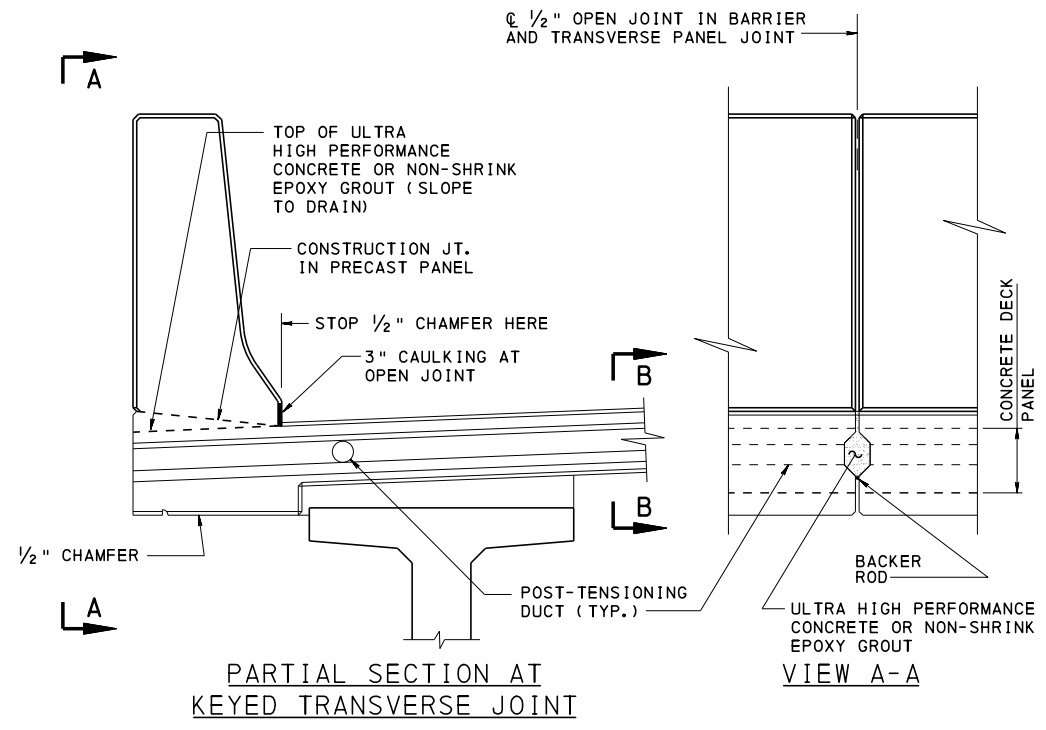
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
FULL DEPTH PRECAST CONCRETE DECK  
PANELS FOR PRESTRESSED CONCRETE  
PA BULB-TEE BEAM AND  
STEEL I-BEAM/I-GIRDER BRIDGES

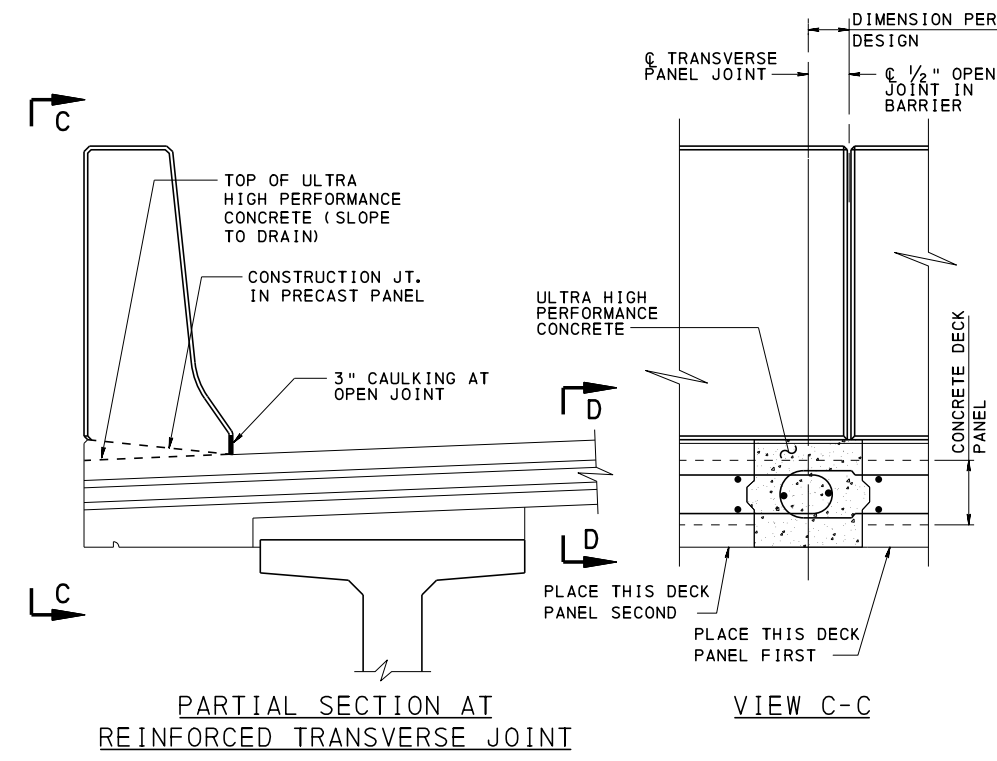
RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

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ACT. DIR., BUR. OF PROJECT DELIVERY

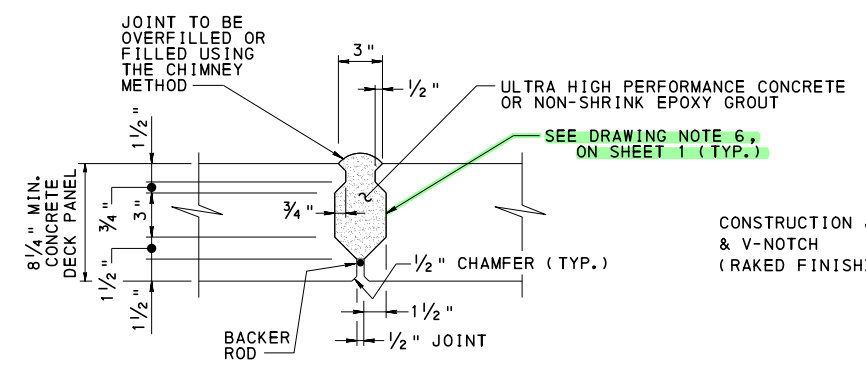
SHEET 4 OF 6  
BD-605M



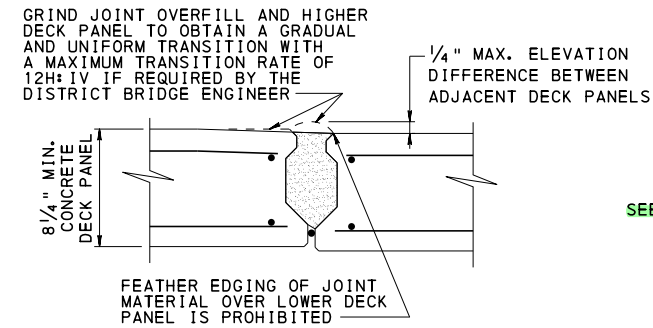
KEYED TRANSVERSE JOINT DETAILS  
(TO BE USED FOR DECKS WITH LONGITUDINAL POST-TENSIONING)



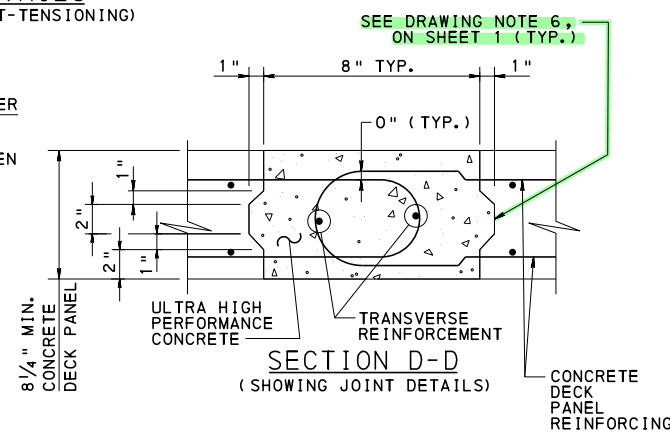
REINFORCED TRANSVERSE JOINT DETAILS  
(TO BE USED FOR DECKS WITHOUT LONGITUDINAL POST-TENSIONING)



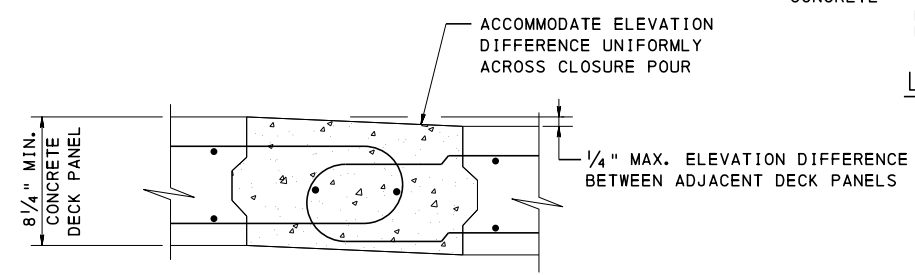
SECTION B-B  
(SHOWING JOINT DIMENSIONS)  
(DECK REINFORCEMENT NOT SHOWN FOR CLARITY)



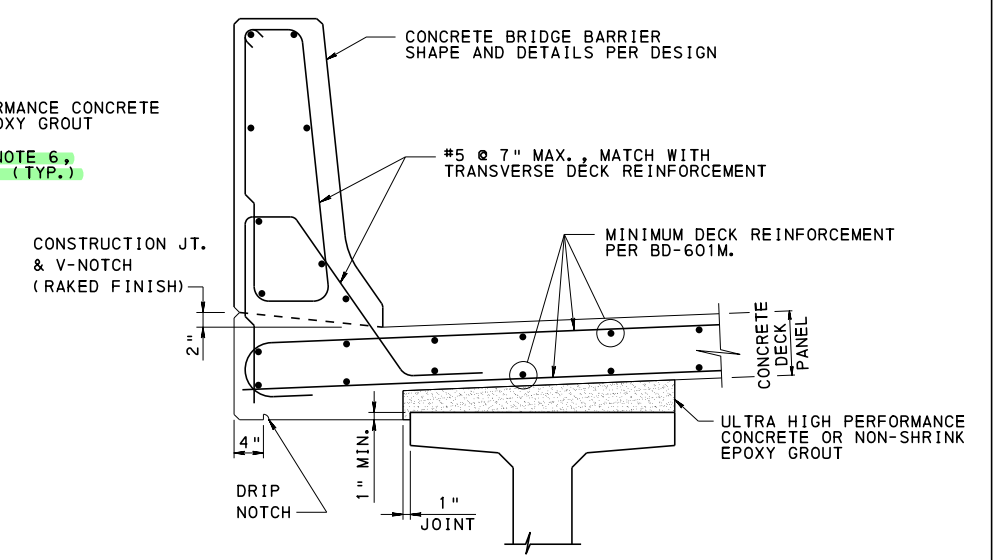
SECTION B-B  
(SHOWING JOINT ALIGNMENT)



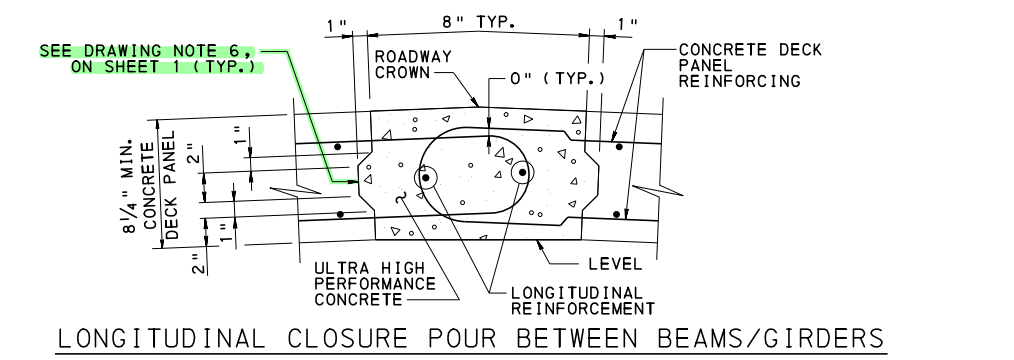
SECTION D-D  
(SHOWING JOINT DETAILS)



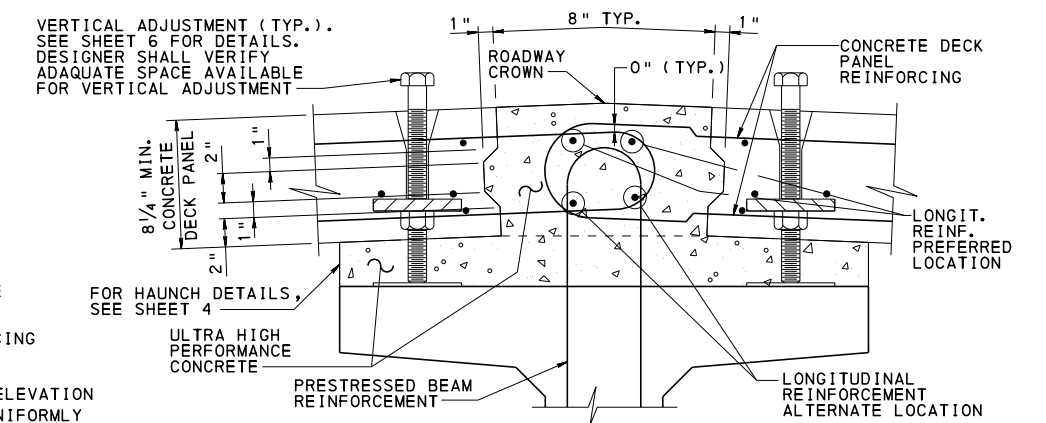
SECTION D-D  
(SHOWING JOINT ALIGNMENT)



CONCRETE BRIDGE BARRIER DETAIL  
TYPICAL BARRIER SHOWN, OTHERS PER DESIGN

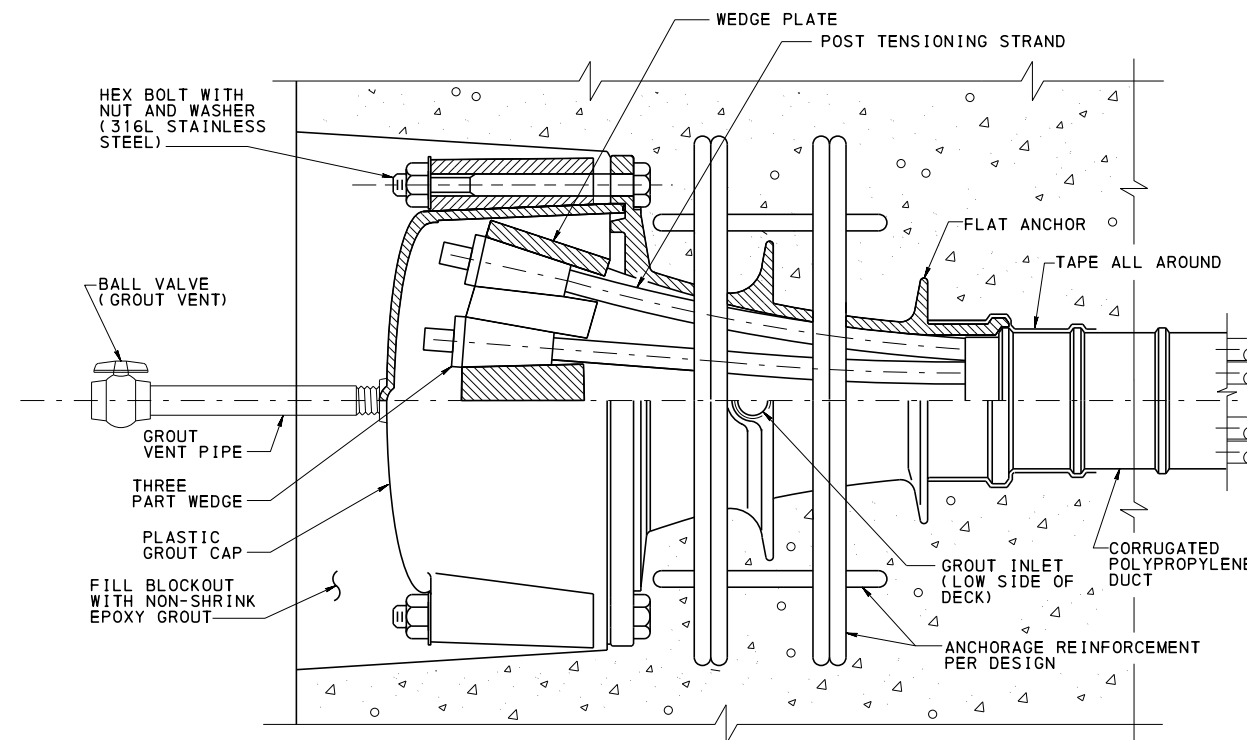


LONGITUDINAL CLOSURE POUR BETWEEN BEAMS/GIRDERS

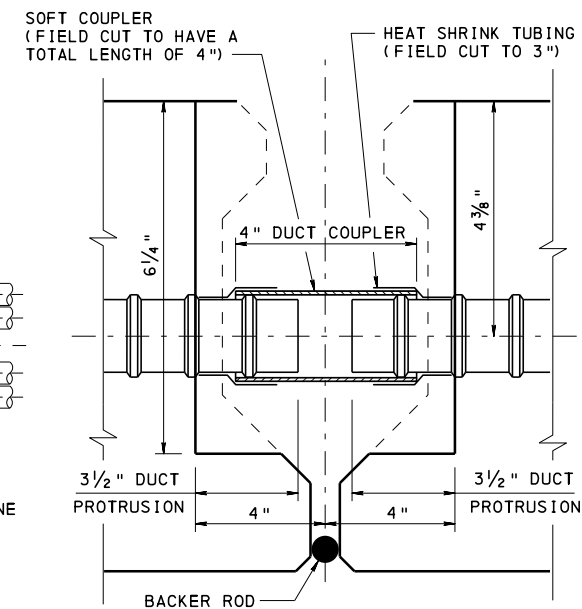


LONGITUDINAL CLOSURE POUR OVER BEAM  
(CONCRETE BEAM SHOWN, STEEL BEAM/GIRDER SIMILAR)  
(HAUNCH DETAILS NOT SHOWN FOR CLARITY)

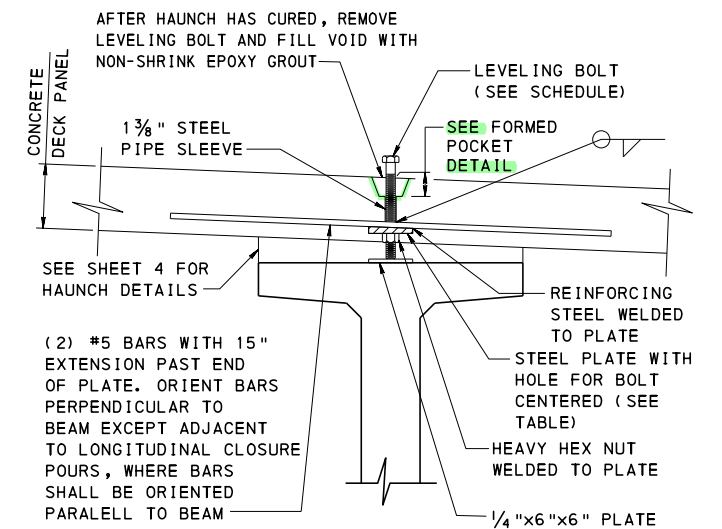
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**  
**STANDARD**  
**FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES**



POST-TENSIONING FLAT ANCHOR PLAN

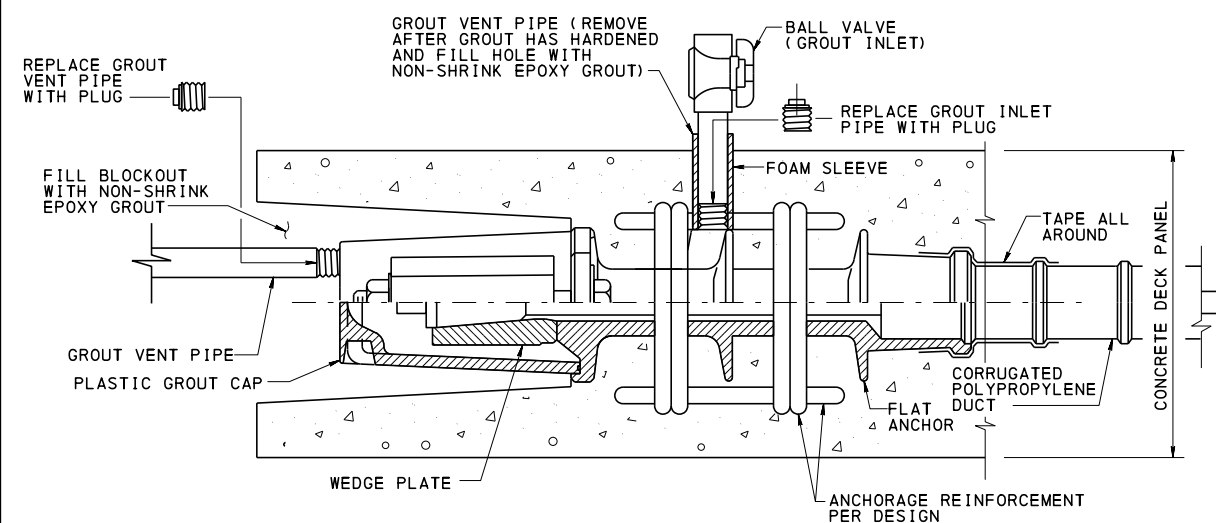


POST-TENSIONING DUCT COUPLING DETAIL  
AT TRANSVERSE JOINT  
(SEE SECTION B-B ON SHEET 5)

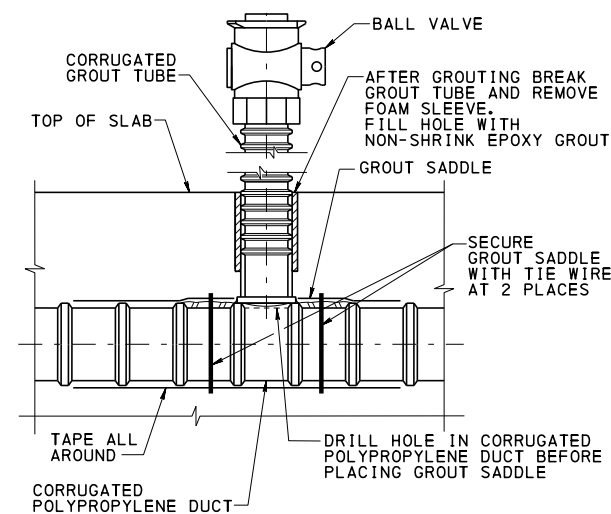


VERTICAL ADJUSTMENT DEVICE  
(VERTICAL ADJUSTMENT ON STEEL BEAM/GIRDER SIMILAR)  
(HAUNCH DETAILS NOT SHOWN FOR CLARITY)  
(MIN. OF 2 LOCATIONS PER BEAM PER PANEL)

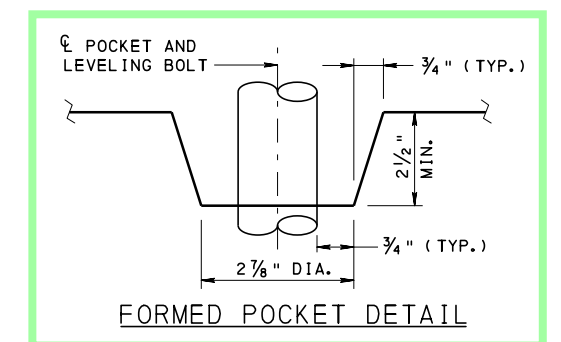
VERTICAL ADJUSTMENT SCHEDULE		
SERVICE LOAD	BOLT DIA.	STEEL PLATE WITH HOLE FOR BOLT CENTERED
10 K	1"	4"x4"x $\frac{5}{8}$ "
20 K	1 1/4"	4"x4"x $\frac{7}{8}$ "



POST-TENSIONING FLAT ANCHOR ELEVATION



POST-TENSIONING PORT DETAIL



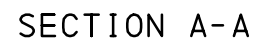
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
FULL DEPTH PRECAST CONCRETE DECK  
PANELS FOR PRESTRESSED CONCRETE  
PA BULB-TEE BEAM AND  
STEEL I-BEAM/I-GIRDER BRIDGES

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bate*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 6  
BD-605M



DECK REINFORCEMENT NOT SHOWN FOR CLARITY

\* FOR TUBE THICKNESS, SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.



1. 2 1/2" MIN, 11" MAX  
COMBINATION FILL AND OVERLAY  
TOTAL WEARING COURSE THICKNESS (h)

CURB REINFORCEMENT  
BAR DETAILS

MECHANICAL SPLICES PRECAST INTO DECK OR TOP SLAB.  
MECHANICAL SPLICES AS LISTED IN BULLETIN 15

RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
BD-601M	CONCRETE DECK SLAB
BD-632M	R.C. BOX CULVERT
BC-706M	PA 3-RAIL BRIDGE BARRIER
BC-734M	ANCHOR SYSTEMS

## REFERENCE DRAWINGS

1. THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.
2. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
3. LOCATE RAIL SPLICES AT EXPANSION JOINTS AND AT OTHER LOCATIONS WHERE NECESSARY. PROVIDE RAILS AS LONG AS PRACTICAL, WITH A MINIMUM OF THREE POSTS BETWEEN SPLICES, UNLESS OTHERWISE REQUIRED FOR EXPANSION. SEE BC-706M FOR RAILING JOINT DETAILS.
4. PROVIDE RAIL TUBES CONTINUOUS OVER NOT LESS THAN TWO RAILING POSTS. NO WELDED BUTT SPLICES WILL BE ALLOWED IN THE RAIL TUBE SECTIONS.
5. LOCATE CENTERLINE OF POST 1'-0" MINIMUM FROM AN EXPANSION JOINT.
6. LOCATE A SCUPPER OR METAL DRAIN 2'-6" MINIMUM FROM CENTER LINE OF POST.
7. PROVIDE A MINIMUM OF TWO RAILING POSTS.
8. USE  $f'c = 3.5$  KSI CLASS AA CEMENT CONCRETE IN THE CURB.
9. PLACE POST AND POST ANCHOR BOLTS NORMAL TO GRADE AND RAILS PARALLEL TO GRADE.
10. COAT ALL SURFACES OF THE BASE PLATE IN CONTACT WITH CONCRETE WITH CAULKING COMPOUND PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND MEETING THE REQUIREMENTS OF PUBLICATION 408, SECTION 705.7(b).
11. DO NOT USE DEFLECTION JOINTS IN THE CURB WITH PA 3-RAIL BRIDGE BARRIERS.
12. PROVIDE POST SPACINGS ON THE PLANS.
13. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-706M.
14. THE MAXIMUM JOINT MOVEMENT FOR THE PA 3-RAIL BRIDGE BARRIER IS 9".
15. CALCULATE THE DEAD LOAD (LB/FT) OF THE PA 3-RAIL BRIDGE BARRIER USING THE FOLLOWING FORMULA:  
$$\text{WEIGHT} = (110 \text{ LBS/AVERAGE POST SPACING}) + 25 \text{ LBS (RAIL TUBE WEIGHT)} + (\text{CURB WEIGHT})$$
  - THE 110 LBS INCLUDES THE WEIGHT OF THE POST, WOOD BLOCK AND TUBE-TO-POST BOLTS.
  - THE RAIL TUBE WEIGHT IS BASED ON 3 RAILS WITH A 3/16" WALL THICKNESS (3x8.15 LBS/FT).
16. ON UNDIVIDED HIGHWAYS WITH TWO-WAY TRAFFIC, PROVIDE END TRANSITIONS THAT CONNECT TO A THREE-BEAM GUIDE RAIL.
17. ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS, PROVIDE APPROACH END TRANSITIONS THAT CONNECT TO A THREE-BEAM GUIDE RAIL AND PROVIDE TRAILING END TRANSITIONS THAT CONNECT TO A W-BEAM GUIDE RAIL IF WARRANTED BY LENGTH OF NEED OR OTHER OBSTRUCTIONS.
18. END CHAMFER ON THE CURB IS NOT REQUIRED ON THE TRAILING END OF THE CURB ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL.
19. 4" CURB AT THE END OF THE CURB IS NOT REQUIRED ON THE TRAILING END OF THE CURB ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL, UNLESS CURB IS PROVIDED ALONG THE ROADWAY.

## STANDARD

PA 3-RAIL BRIDGE BARRIER  
BARRIER DETAILS - 1

RECOMMENDED APPROVED

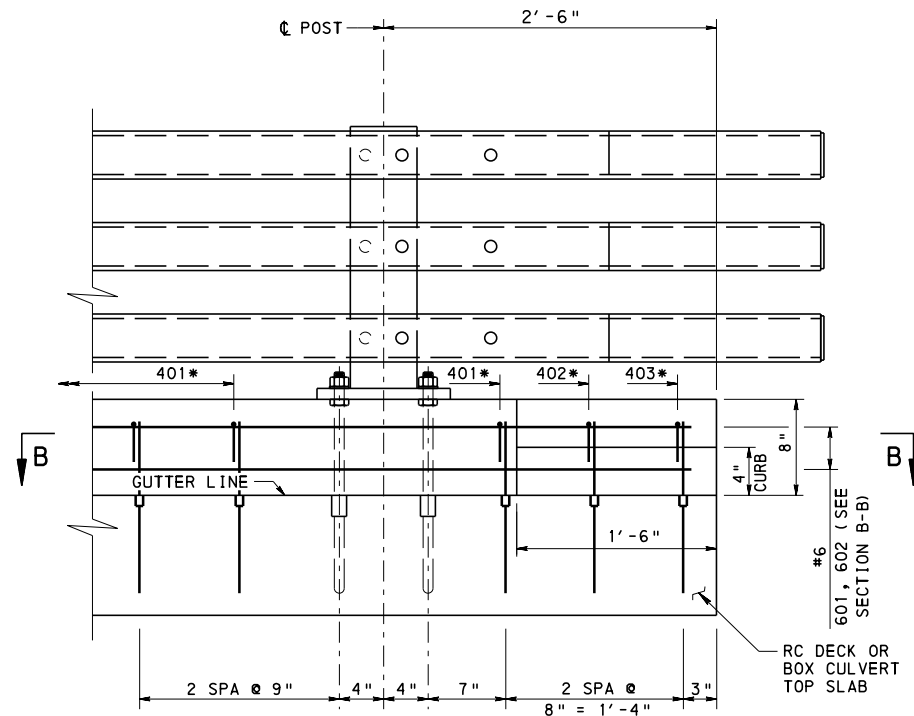
Kristin D. Lange  
CHIEF BRIDGE ENGINEER

RECOMMENDED DATE, 1967, 11/15  
Gavin E. Gray  
 CHIEF ENGINEER, HIGHWAY ADMIN.

BD-609M

## CHANGE 7





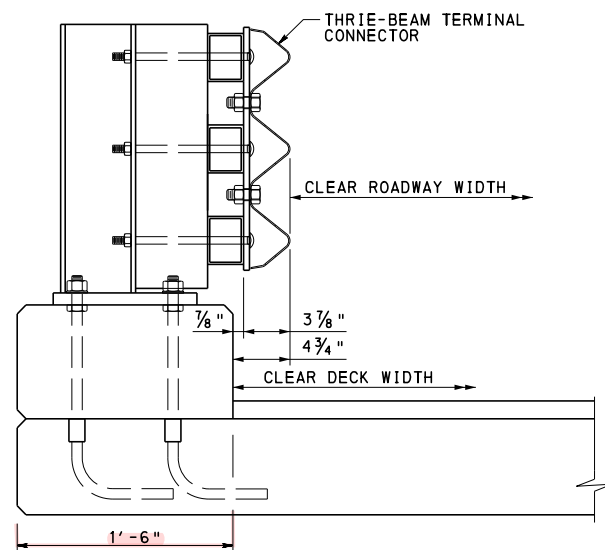
\* SEE CURB REINFORCEMENT BAR DETAILS, SHEET 1.

### ELEVATION

(WEARING COURSE NOT SHOWN)

## PA 3-RAIL BRIDGE BARRIER END TRANSITION WITH THRIE-BEAM CONNECTION

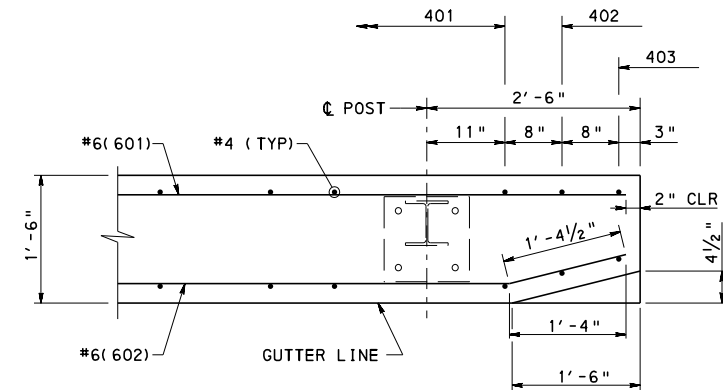
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)  
(GUIDE RAIL, CONNECTION PLATE AND  
BOLTS OMITTED FOR CLARITY)



### CLEAR ROADWAY WIDTH DETAIL

(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)

CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS  
4 3/4" MINIMUM TO ACCOUNT FOR THE THRIE-BEAM OR  
W-BEAM TERMINAL CONNECTOR WIDTH.



### SECTION B-B

#### NOTES:

1. FOR ADDITIONAL REINFORCEMENT DETAILS, SEE SHEET 1.
2. DIMENSIONS ALONG BARS ARE MEASURED ALONG THE OUTSIDE EDGE.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

PA 3-RAIL BRIDGE BARRIER  
BARRIER DETAILS - 2

RECOMMENDED OCT. 7, 2024

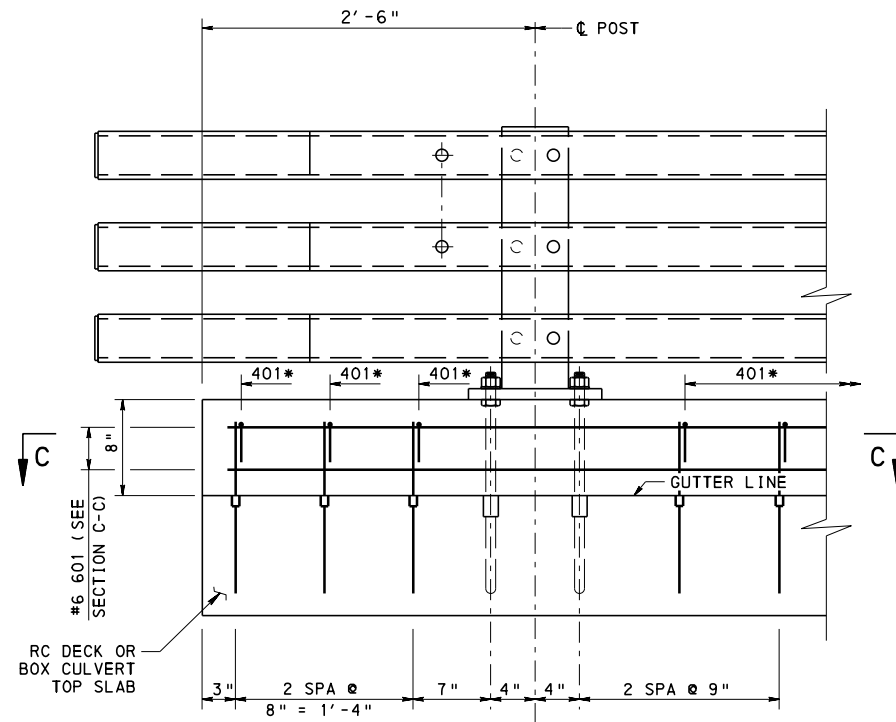
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024

*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 3

BD-609M



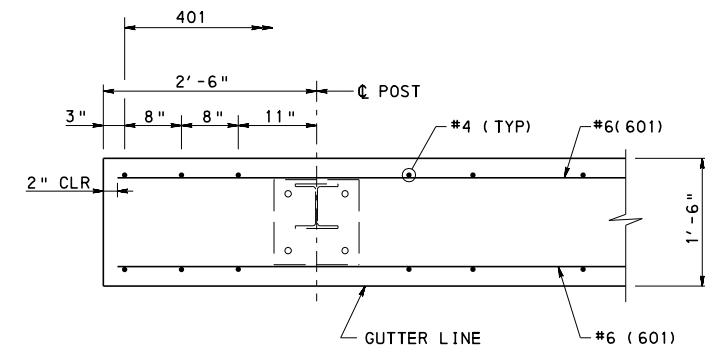
\* SEE CURB REINFORCEMENT BAR DETAILS, SHEET 1.

### ELEVATION

(WEARING COURSE NOT SHOWN)

## PA 3-RAIL BRIDGE BARRIER END TRANSITION WITH W-BEAM CONNECTION

(GUIDE RAIL, CONNECTION PLATE AND BOLTS OMITTED FOR CLARITY)



### SECTION C-C

#### NOTES:

1. FOR ADDITIONAL REINFORCEMENT DETAILS, SEE SHEET 1.
2. DIMENSIONS ALONG BARS ARE MEASURED ALONG THE OUTSIDE EDGE.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

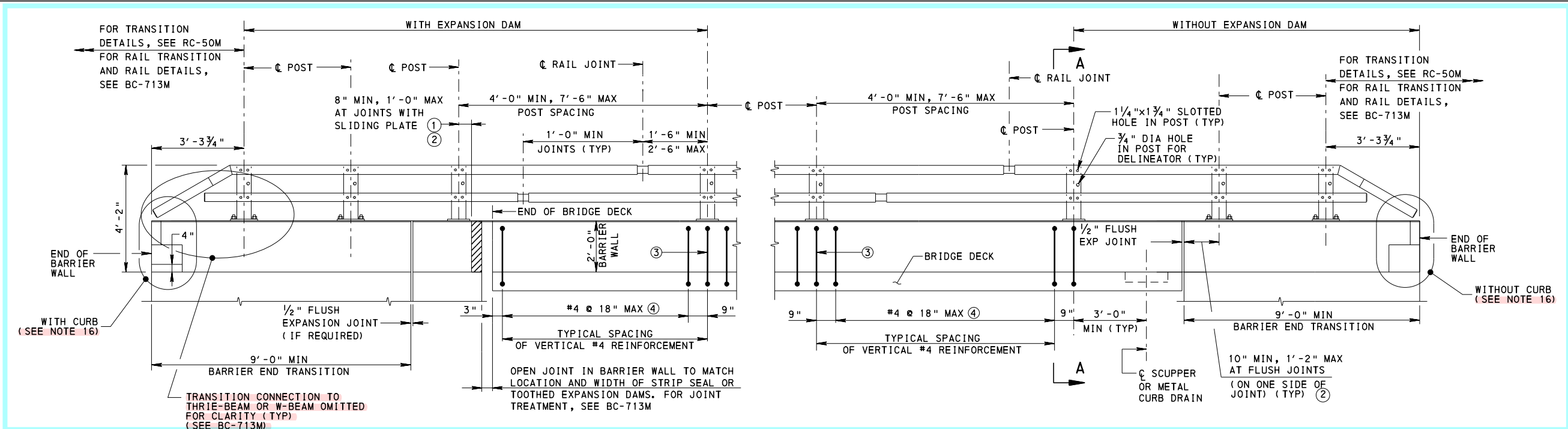
STANDARD

PA 3-RAIL BRIDGE BARRIER  
BARRIER DETAILS - 3

RECOMMENDED OCT. 7, 2024  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 3  
BD-609M



TYPICAL PA BRIDGE BARRIER ELEVATION

NOTES:

- THE PA BRIDGE BARRIER IS DESIGNATED AS MASH TL-5.
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
- LOCATE RAIL SPLICES AT EXPANSION JOINTS AND AT OTHER LOCATIONS WHERE NECESSARY. PROVIDE RAILS AS LONG AS PRACTICAL, WITH A MINIMUM OF THREE POSTS BETWEEN SPLICES, UNLESS OTHERWISE REQUIRED FOR EXPANSION.
- THE MAXIMUM JOINT MOVEMENT FOR THE PA BRIDGE BARRIER IS 9".
- FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-713M.
- PROVIDE RAIL JOINTS IN ALL RAILS IN THE BAY ABOVE AN EXPANSION DAM. SEE BC-713M, SHEET 1, FOR RAIL JOINT DETAILS.
- FOR DEAD LOAD CALCULATIONS, THE MASS OF FOUR TYPES OF PA BRIDGE BARRIER ARE AS FOLLOWS:

TYPICAL	500 LB/FT
SIDEWALK	510 LB/FT
RAISED SIDEWALK	510 LB/FT
ALT. SIDEWALK	510 LB/FT
(ALL CASES ASSUME	5'-9" POST SPACING)
- USE  $f'c = 3.5$  KSI CLASS AA CONCRETE FOR BARRIER WALL.
- DETAILS ARE NOT SHOWN FOR NON-COMPOSITE ADJACENT BOX BEAMS, PRECAST BRIDGE SLABS, PLANK BEAMS, AND PRECAST CHANNEL BEAMS BECAUSE THEY CANNOT BE DESIGNED FOR A MASH TL-5 BARRIER RATING.
- PROVIDE POST SPACINGS ON THE CONTRACT PLANS.
- FOR DETAILS OF THE PA BRIDGE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS AND REINFORCEMENT IN BD-622M AND BD-624M. FOR DETAILS AT THE END OF BARRIER, SEE SHEETS 3 AND 4.
- FOR SECTION A-A, SEE SHEET 2.
- PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL SHEET 2.
- ON UNDIVIDED HIGHWAYS WITH TWO-WAY TRAFFIC, PROVIDE END TRANSITIONS THAT CONNECT TO A THRIE-BEAM GUIDE RAIL.
- ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS, PROVIDE APPROACH END TRANSITIONS THAT CONNECT TO A THRIE-BEAM GUIDE RAIL AND PROVIDE TRAILING END TRANSITIONS THAT CONNECT TO A W-BEAM GUIDE RAIL IF WARRANTED BY THE LENGTH OF NEED OR OTHER OBSTRUCTIONS.
- END CHAMFERS ON THE BARRIER WALL, ARE NOT REQUIRED ON THE TRAILING END OF THE BARRIER WALL ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL.

LEGEND

- POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR POST TO EDGE OF FIXED END OF SLIDING PLATE
- NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL. IF POSTS LOCATED AT EXPANSION JOINT
- PLACE 1-#4 VERTICAL BAR AT POST.
- WITHIN 10'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER WALL, REDUCE SPACING OF REINFORCEMENT TO #4 @ 12" MAX PLACE REINFORCEMENT 3" FROM ANY JOINT.

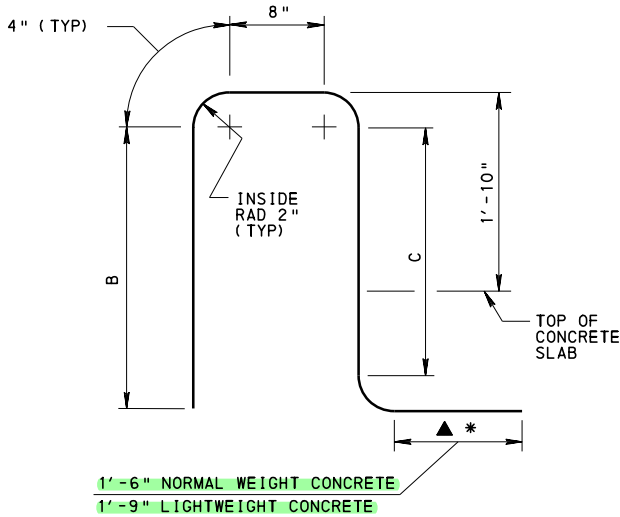
REINFORCEMENT BAR NOTES:

- REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

TABLE 1		
B & C DIMENSIONS		
FOR PA BRIDGE BARRIER		
T	B	C
8.0"	2'-2½"	1'-11"
8.5"	2'-3"	1'-11½"
9.0"	2'-3½"	2'-0"
9.5"	2'-4"	2'-0½"
10.0"	2'-4½"	2'-1"
10.5"	2'-5"	2'-1½"
11.0"	2'-5½"	2'-2"
11.5"	2'-6"	2'-2½"

VERTICAL REINFORCEMENT  
DIMENSION TABLE

NOTE: T DESIGNATES DECK SLAB THICKNESS



VERTICAL REINFORCEMENT  
(FOR DIMENSIONS B & C, SEE TABLE 1)

- ▲ WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO PROVIDE NECESSARY DIMENSIONS.
- \* FOR ALUMINUM PROTECTIVE BARRIER, ADD A SIMILAR 90° HOOK TO THE REAR LEG OF THE REINFORCEMENT.

BC-701M	PROTECTIVE FENCE
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-713M	PA BRIDGE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-721M	ELECTRICAL DETAILS
BC-722M	LIGHTING POLE ANCHORAGE
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-632M	R.C. BOX CULVERT
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER - PRESTRESSED CONCRETE I-BEAM AND BOX BEAM BRIDGES
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES
BD-667M	INTEGRAL ABUTMENT
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
PA BRIDGE BARRIER

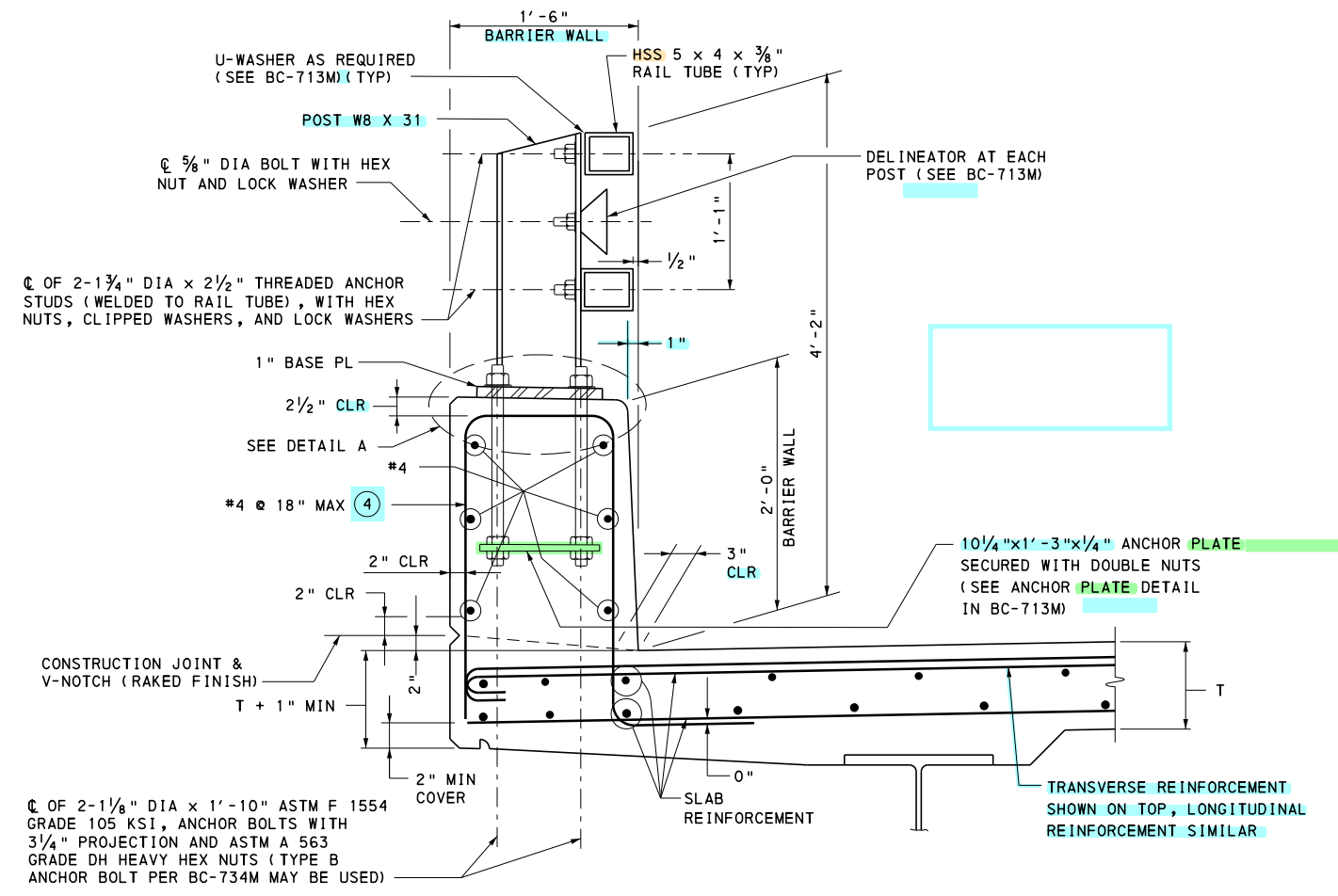
BARRIER DETAILS - 1

RECOMMENDED OCT. 7, 2024  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

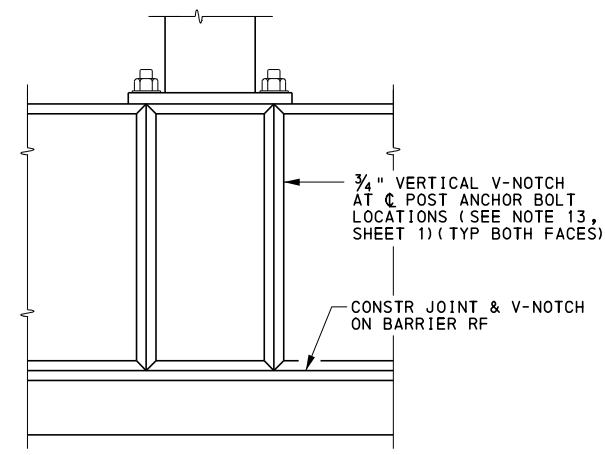
RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 11  
BD-610M

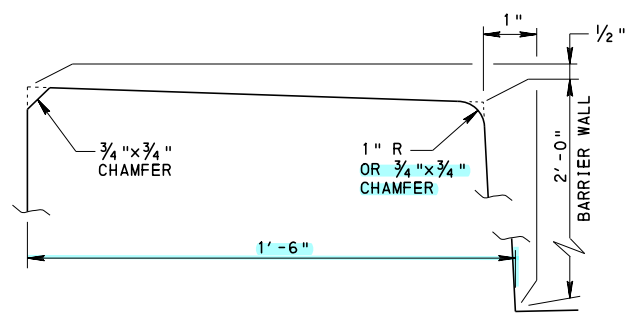




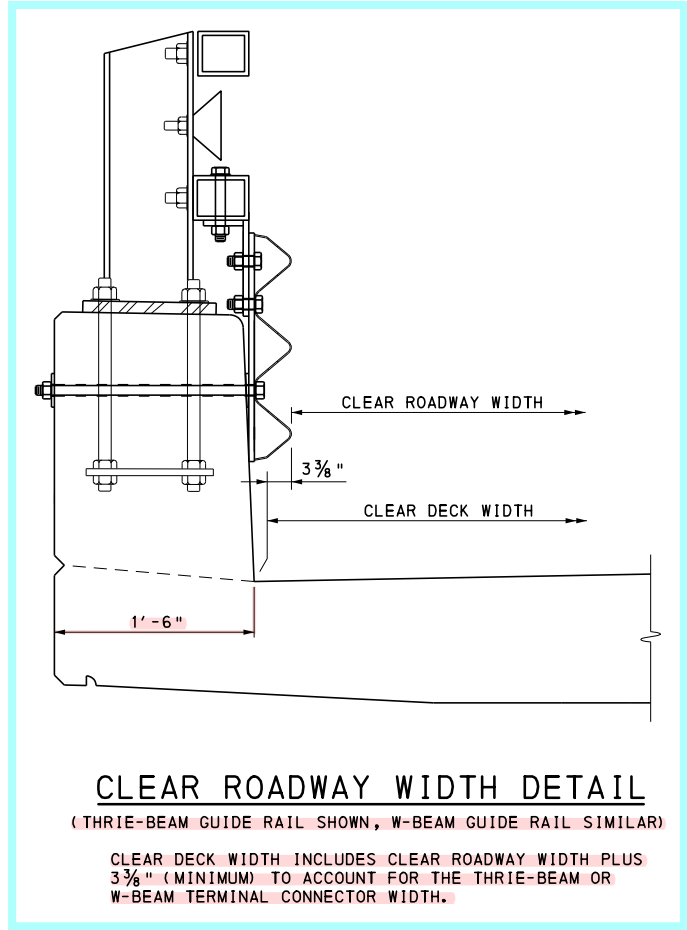
SECTION A-A



VERTICAL V-NOTCH DETAIL  
(BARRIER REAR FACE SHOWN, FRONT FACE SIMILAR)



DETAIL A  
(BASE PLATE AND ANCHOR BOLTS NOT SHOWN FOR CLARITY)



CLEAR ROADWAY WIDTH DETAIL

(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)

CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" (MINIMUM) TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH.

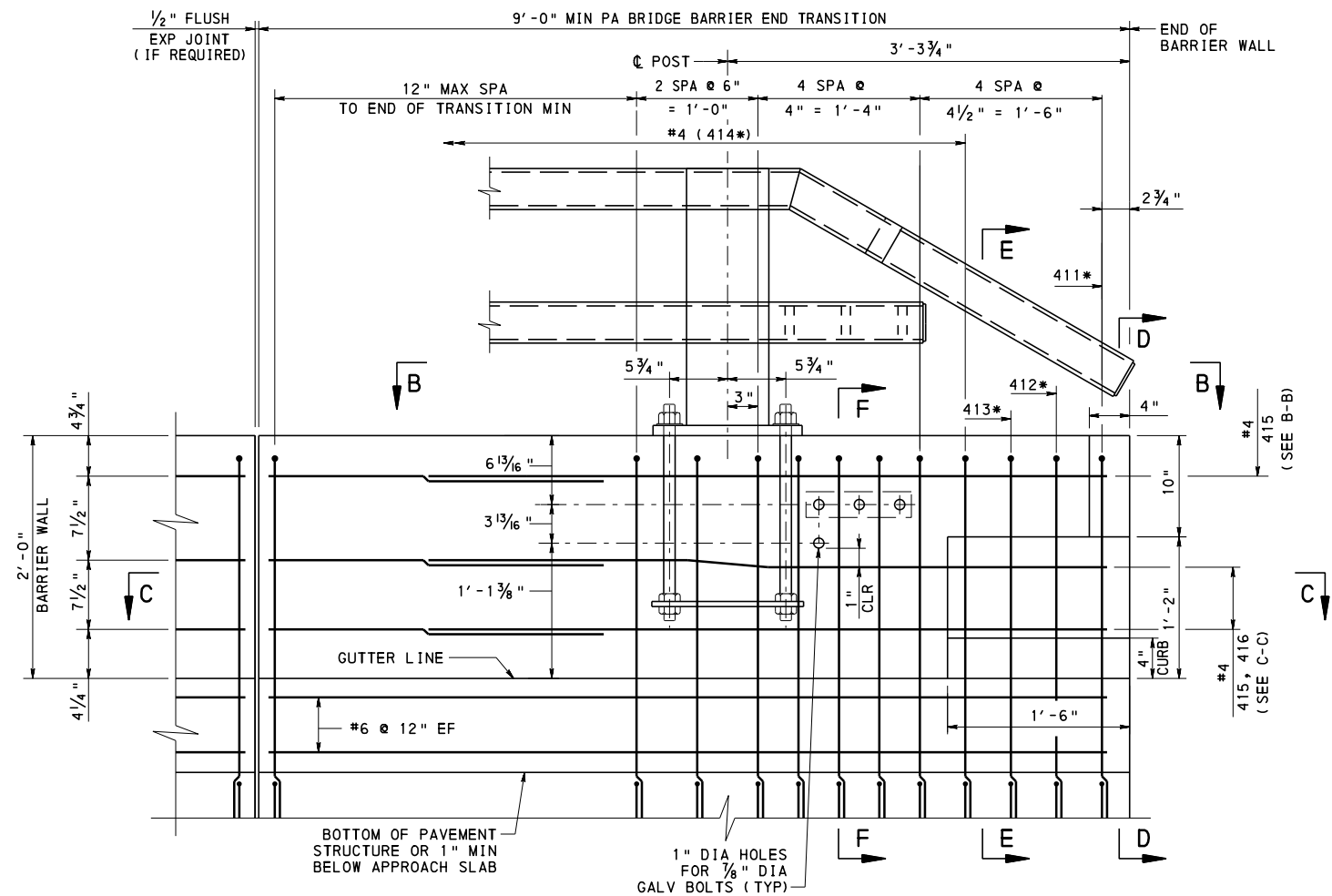
LEGEND:

- ④ WITHIN 10'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER WALL, REDUCE SPACING OF REINFORCEMENT TO #4 @ 12" MAX PLACE REINFORCEMENT 3" FROM ANY JOINT.

NOTES:

- 1. FOR LOCATION OF SECTION A-A, SEE SHEET 1.
- 2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD		
PA BRIDGE BARRIER		
BARRIER DETAILS - 2		
RECOMMENDED OCT. 7, 2024 <i>Kevin D. Lange</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Gavin E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 2 OF 11 BD-610M

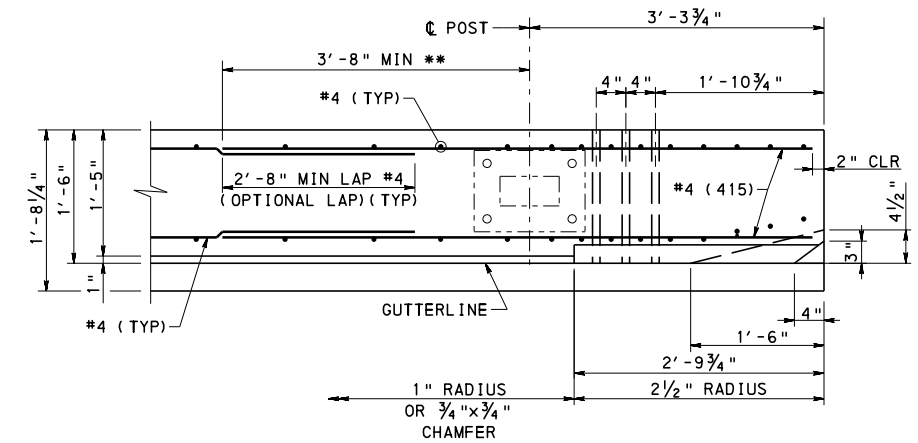


**ELEVATION**

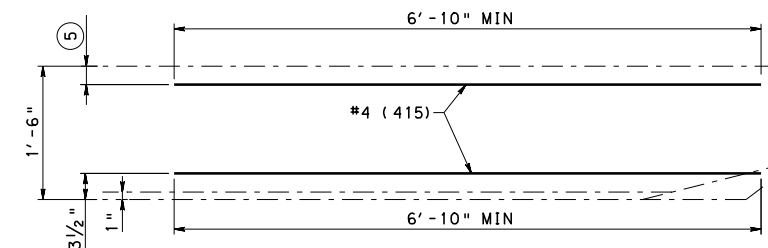
**PA BRIDGE BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION**

(WITH CURB SHOWN, WITHOUT CURB SIMILAR)  
(GUIDE RAIL, CONNECTION PLATE ASSEMBLY  
AND BOLTS OMITTED FOR CLARITY)

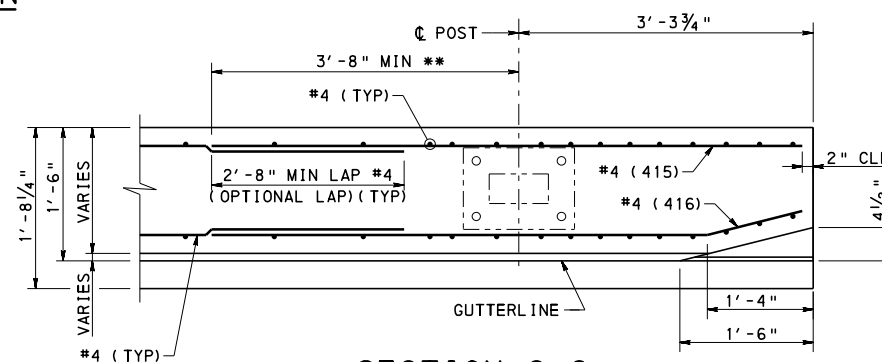
\* SEE VERTICAL REINFORCEMENT DETAIL, SHEET 4.  
\*\* REINFORCEMENT DETAILING SHOWN REPRESENTS A  
CONDITION WHERE AN EXPANSION JOINT IS NOT PRESENT.



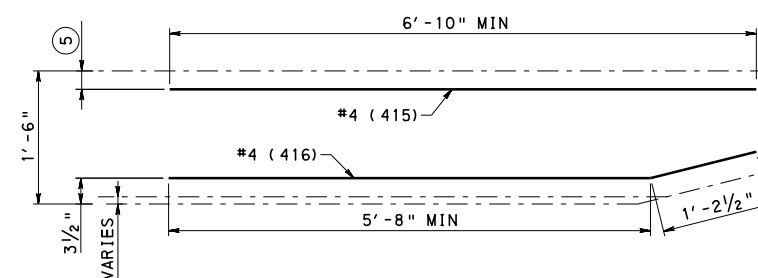
**SECTION B-B**



**HORIZONTAL REINFORCEMENT**  
(SEE NOTE 2)



**SECTION C-C**



**HORIZONTAL REINFORCEMENT**  
(SEE NOTE 2)

**LEGEND:**

- ⑤ 2 1/2" CLR FOR SAFETY WINGS,  
3 1/8" CLR FOR U-WINGS.

**NOTES:**

1. FOR SECTION D-D, E-E AND F-F, SEE SHEET 4.
2. DIMENSIONS ALONG BARS ARE MEASURED  
ALONG THE OUTSIDE EDGE.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

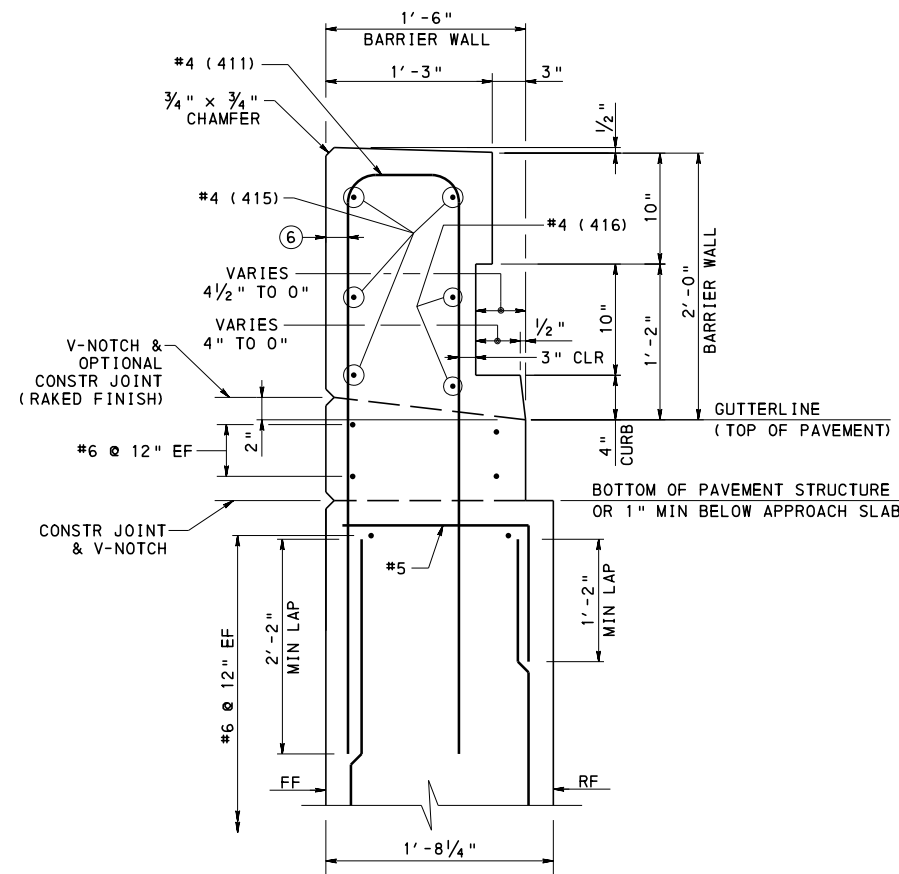
**STANDARD**

**PA BRIDGE BARRIER  
END OF BARRIER DETAILS  
WITH THRIE-BEAM CONNECTION - 1**

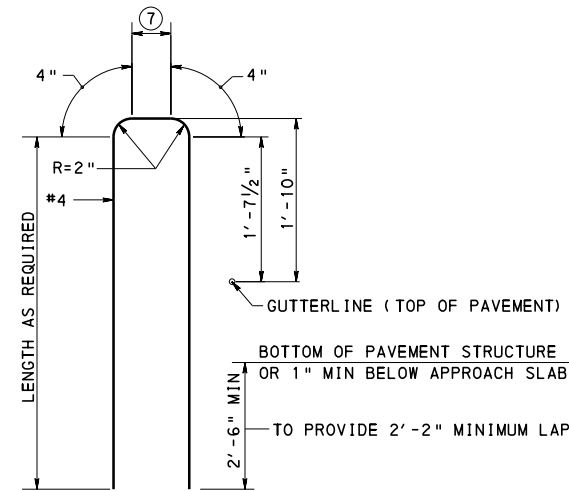
RECOMMENDED OCT. 7, 2024  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

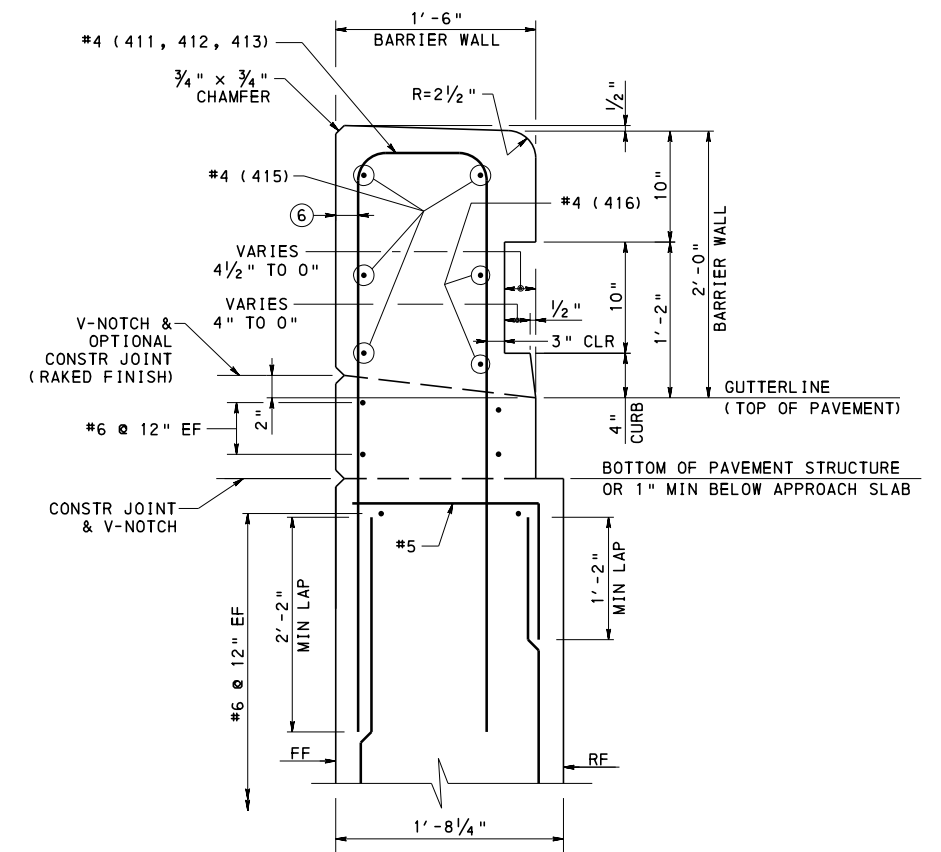
SHEET 3 OF 11  
BD-610M



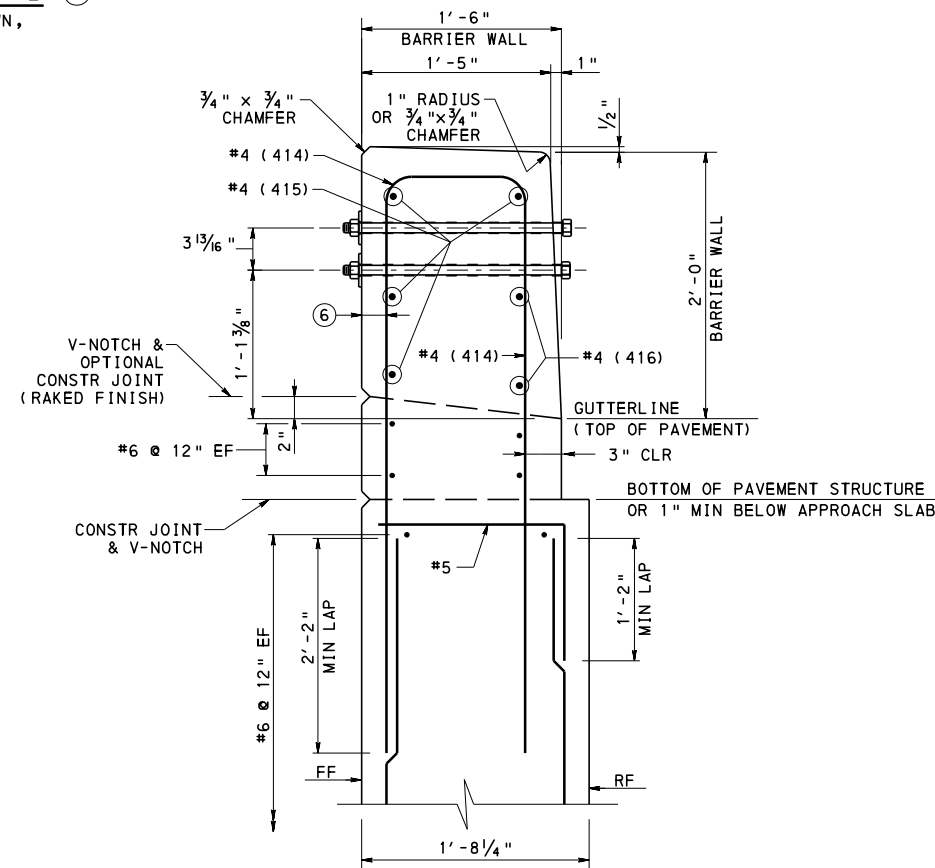
**SECTION D-D** ⑧  
(WITH CURB SHOWN,  
WITHOUT CURB  
SIMILAR)



**VERTICAL  
REINFORCEMENT**



**SECTION E-E** ⑧  
(WITH CURB SHOWN,  
WITHOUT CURB  
SIMILAR)



**SECTION F-F** ⑧

**LEGEND:**

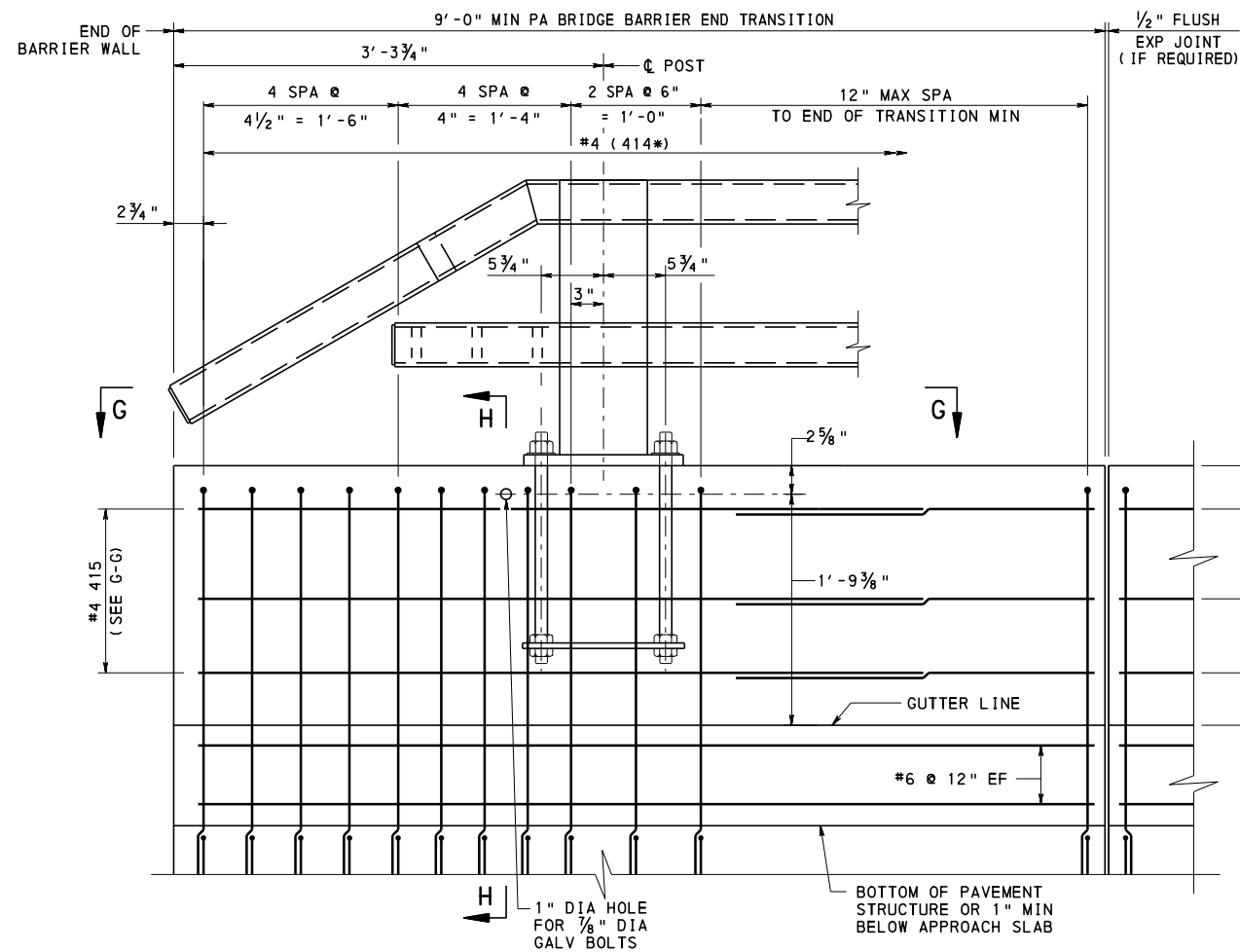
- ⑥ 2" CLR FOR SAFETY WINGS,  
2 5/8" CLR FOR U-WINGS
- ⑦ FOR SAFETY  
WINGS:  
4 1/4" (411)  
5 1/4" (412)  
6 3/8" (413)  
8" (414)
- FOR U-WINGS:  
3 5/8" (411)  
4 5/8" (412)  
5 3/4" (413)  
7 3/8" (414)

- ⑧ REINFORCEMENT AND INFORMATION SHOWN  
FOR SAFETY WING. REINFORCEMENT IN U-WING  
BELOW 1'-6" WIDTH IS AS REQUIRED BY DESIGN.

**NOTES:**

1. FOR SECTION D-D, E-E AND F-F LOCATION, SEE SHEET 3.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD		
PA BRIDGE BARRIER END OF BARRIER DETAILS WITH THRIE-BEAM CONNECTION - 2		
RECOMMENDED OCT. 7, 2024 <i>Kevin D. Lange</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Glenn E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 4 OF 11 BD-610M



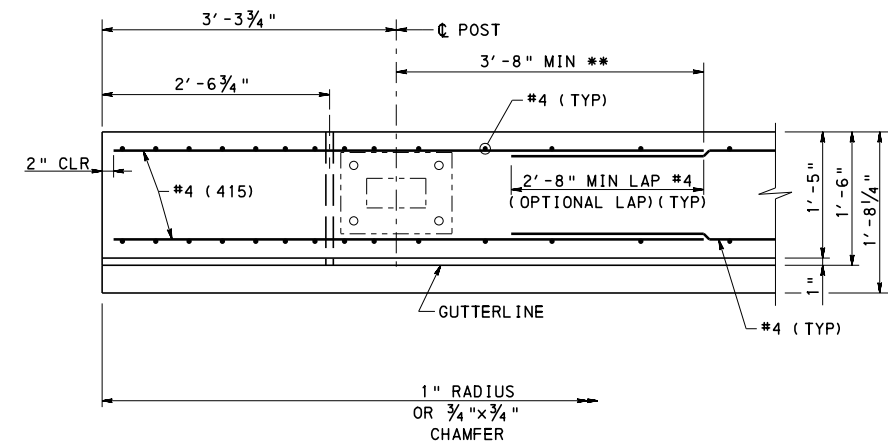
ELEVATION

# PA BRIDGE BARRIER END TRANSITION WITH W-BEAM CONNECTION

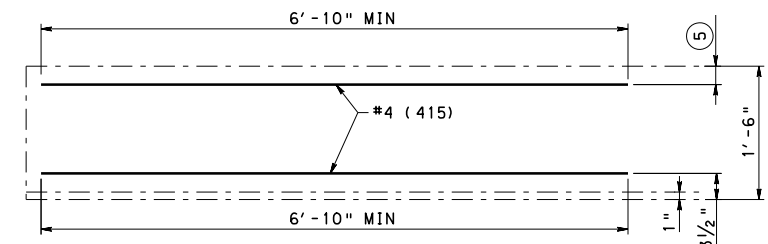
(GUIDE RAIL, CONNECTION PLATE ASSEMBLY  
AND BOLTS OMITTED FOR CLARITY)

\* SEE VERTICAL REINFORCEMENT  
DETAIL, SHEET 4.

\*\* REINFORCEMENT DETAILING SHOWN  
REPRESENTS A CONDITION WHERE  
AN EXPANSION JOINT IS NOT  
PRESENT.



SECTION G-G



HORIZONTAL REINFORCEMENT

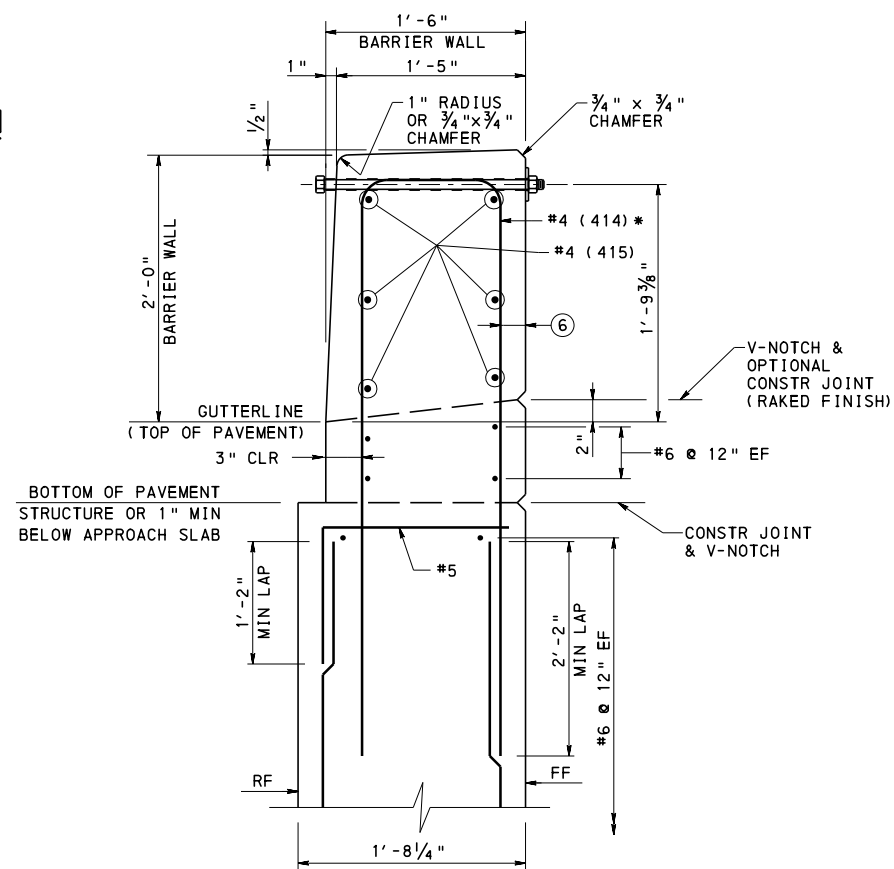
(SEE NOTE 1)

## LEGEND:

- ⑤ 2 1/2" CLR FOR SAFETY WINGS,  
3 5/8" CLR FOR U-WINGS.
- ⑥ 2" CLR FOR SAFETY WINGS,  
2 5/8" CLR FOR U-WINGS
- ⑧ REINFORCEMENT AND INFORMATION SHOWN  
FOR SAFETY WING. REINFORCEMENT IN U-WING  
BELOW 1'-6" WIDTH IS AS REQUIRED BY DESIGN.

## NOTES:

- DIMENSIONS ALONG BARS ARE MEASURED ALONG THE  
OUTSIDE EDGE.
- FOR ADDITIONAL NOTES, SEE SHEET 1.



SECTION H-H ⑧

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

PA BRIDGE BARRIER  
END OF BARRIER DETAILS  
WITH W-BEAM CONNECTION

RECOMMENDED OCT. 7, 2024

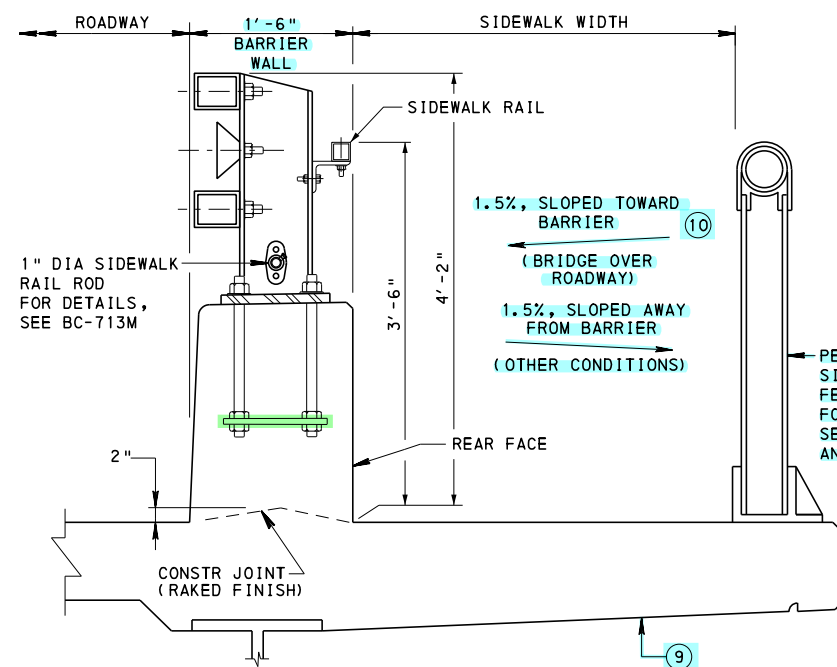
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024

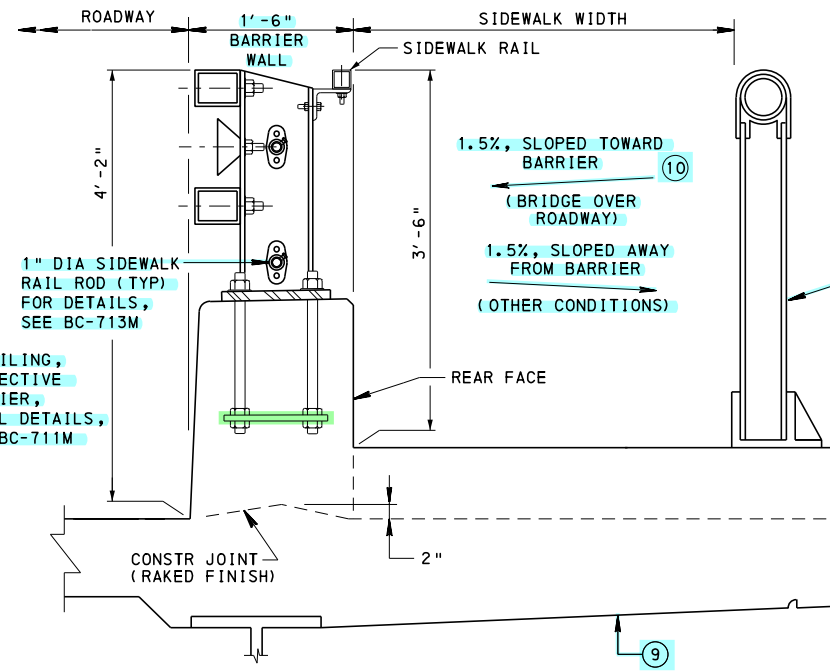
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 11

BD-610M



**TYPICAL SIDEWALK DETAIL**  
(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M)



**RAISED SIDEWALK DETAIL**  
(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)

**LEGEND:**

- 9 UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.
- 10 DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATIONS. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.

PEDESTRIAN RAILING, SIDEWALK PROTECTIVE FENCE OR BARRIER, FOR ADDITIONAL DETAILS, SEE BC-701M, BC-711M AND BC-716M

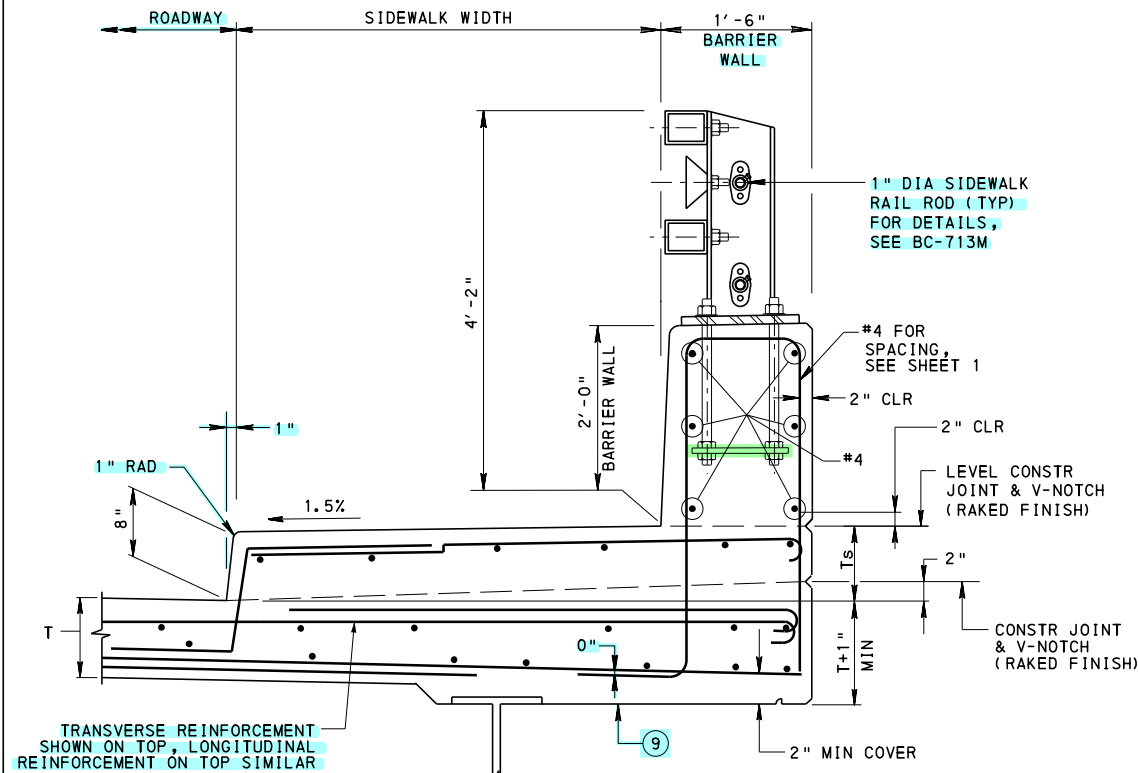
TABLE 1		
B & C DIMENSIONS		
FOR PA BRIDGE BARRIER		
T	B	C
8.0"	2'-2½"	1'-11"
8.5"	2'-3"	1'-11½"
9.0"	2'-3½"	2'-0"
9.5"	2'-4"	2'-0½"
10.0"	2'-4½"	2'-1"
10.5"	2'-5"	2'-1½"
11.0"	2'-5½"	2'-2"
11.5"	2'-6"	2'-2½"

**VERTICAL REINFORCEMENT DIMENSION TABLE**

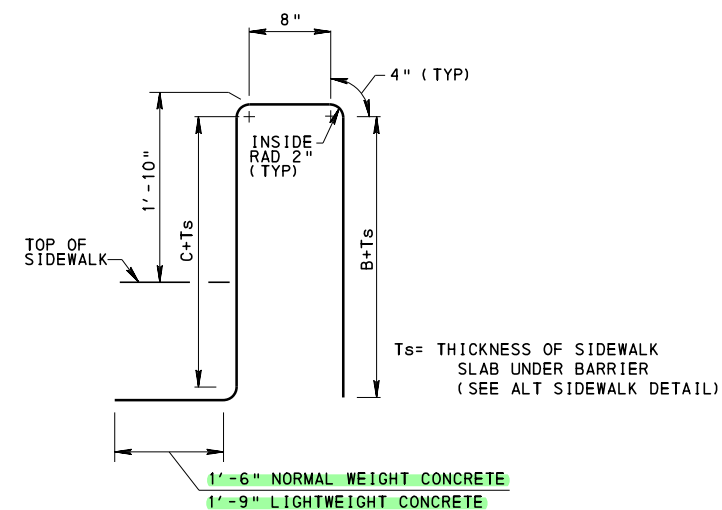
NOTE: T DESIGNATES DECK SLAB THICKNESS

**NOTES:**

- FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
- FOR ADDITIONAL NOTES, SEE SHEET 1.



**ALTERNATE SIDEWALK DETAIL**  
(FOR REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)



**VERTICAL REINFORCEMENT**  
(FOR DIMENSIONS "B & C", SEE TABLE 1)

**REINFORCEMENT BAR NOTES:**

- REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

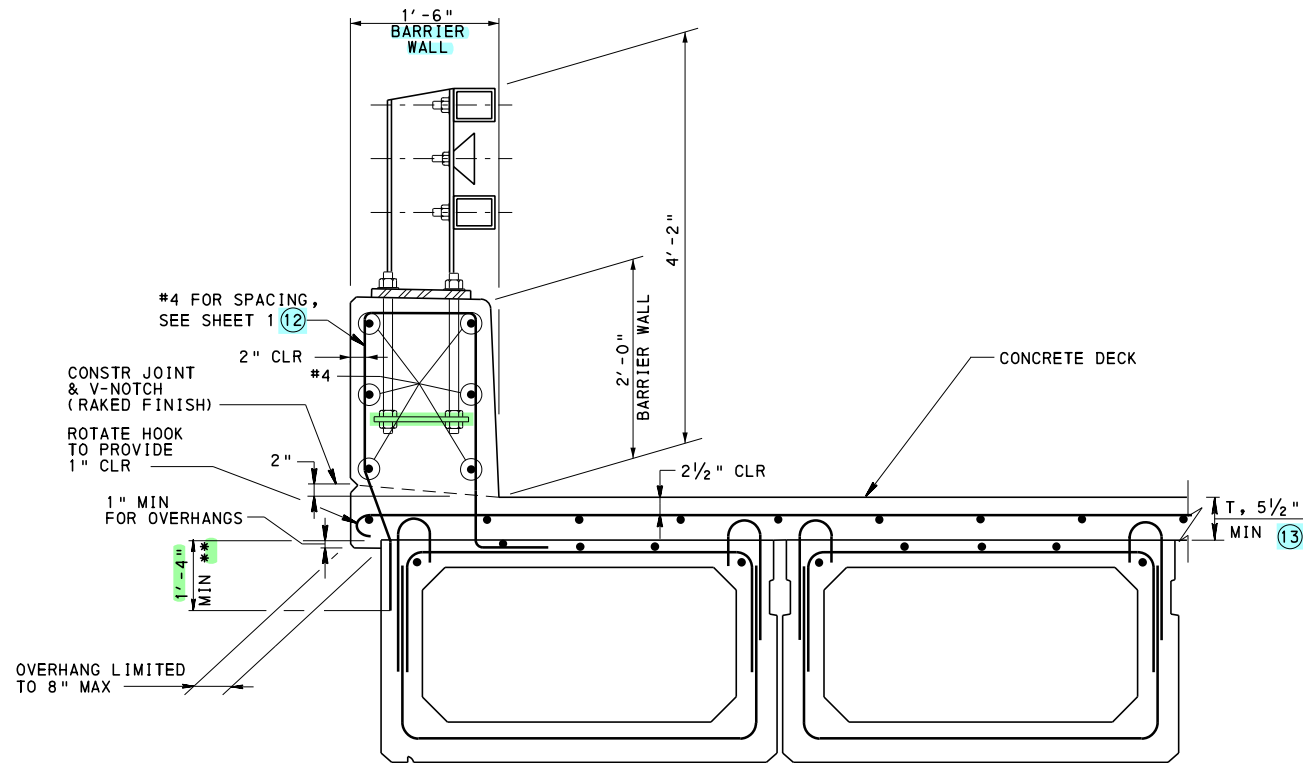
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF BRIDGE

**STANDARD**

**PA BRIDGE BARRIER**

**SIDEWALK DETAILS**

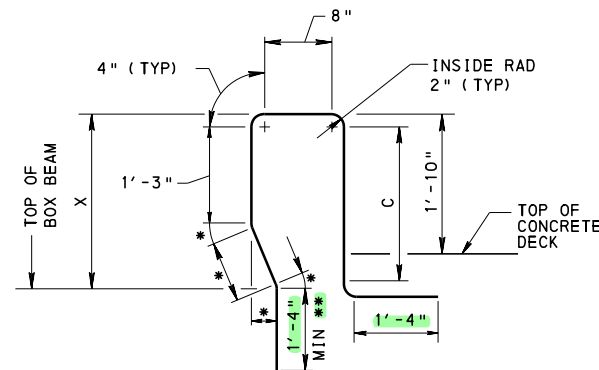
RECOMMENDED OCT. 7, 2024 <i>Kevin D. Lange</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Gavin E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 6 OF 11 <b>BD-610M</b>
----------------------------------------------------------------------------	------------------------------------------------------------------------------------	---------------------------------



36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING BARRIER

TABLE 1		
X AND C DIMENSIONS FOR PA BRIDGE BARRIER		
T	AT COMP. ADJ. BOX BEAMS SUPPORTING BARRIER	
	X	C
5.5"	2'-3½"	2'-0½"
6.0"	2'-4"	2'-1"
6.5"	2'-4½"	2'-1½"
7.0"	2'-5"	2'-2"
7.5"	2'-5½"	2'-2½"
8.0"	2'-6"	2'-3"

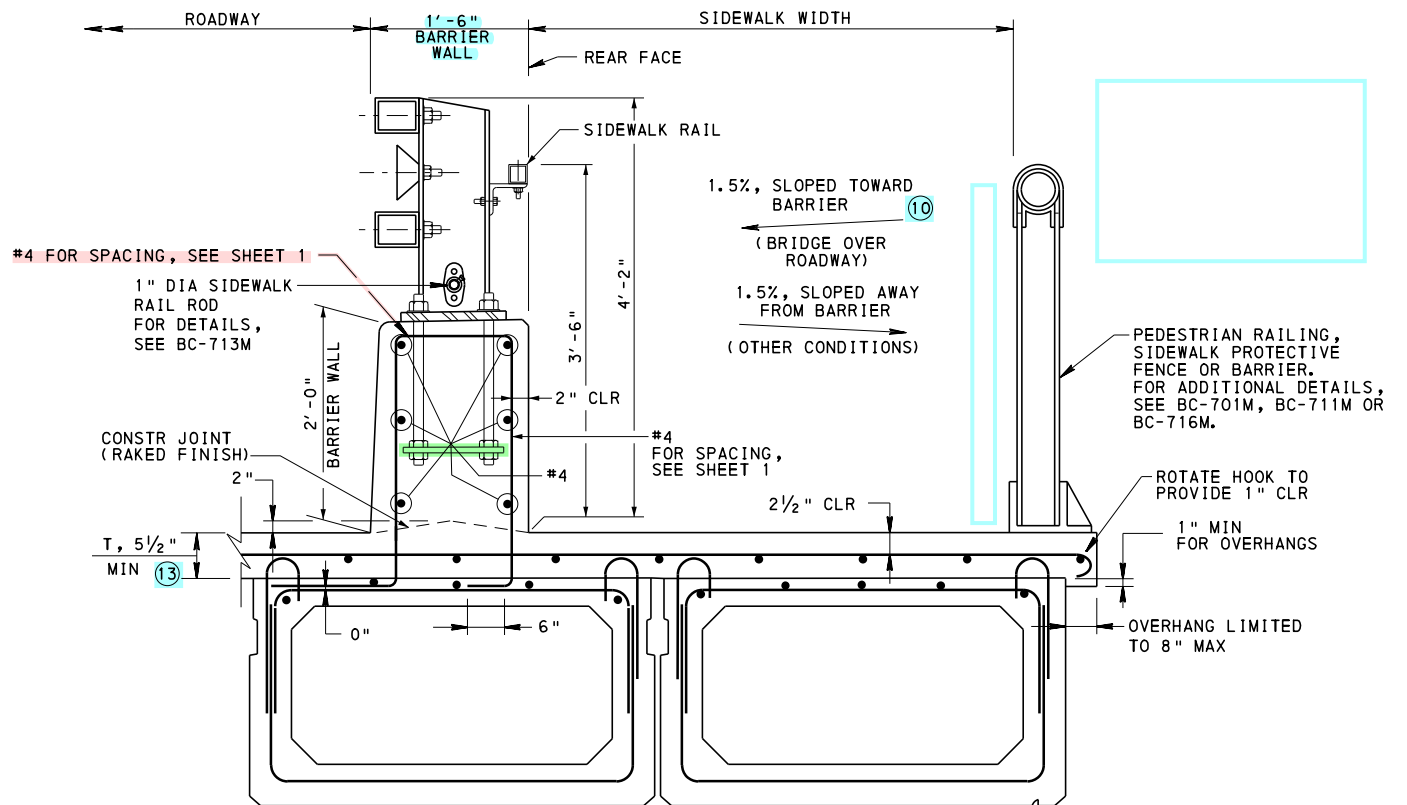
NOTE: T DESIGNATES DECK SLAB THICKNESS



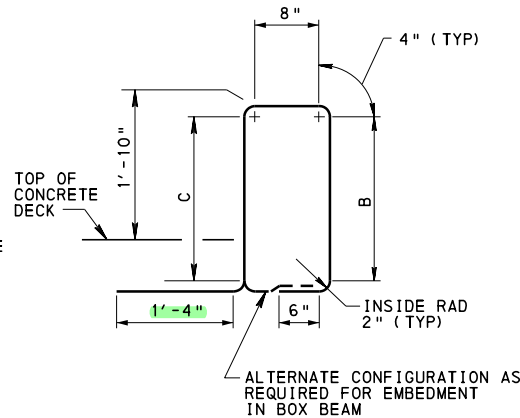
VERTICAL REINFORCEMENT  
(FOR DIMENSIONS "X" AND "C", SEE TABLE 1)

REINFORCEMENT BAR NOTES:

- REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING TYPICAL SIDEWALK (1)  
(RAISED SIDEWALK DETAIL SIMILAR)



VERTICAL REINFORCEMENT  
(FOR DIMENSIONS "B" AND "C", SEE TABLE 2)

TABLE 2		
B AND C DIMENSIONS FOR PA BRIDGE BARRIER		
T	AT COMP. ADJ. BOX BEAMS SUPPORTING SIDEWALK OR RAISED SIDEWALK	
	B	C
5.5"	2'-0½"	2'-0½"
6.0"	2'-1"	2'-1"
6.5"	2'-1½"	2'-1½"
7.0"	2'-2"	2'-2"
7.5"	2'-2½"	2'-2½"
8.0"	2'-3"	2'-3"

NOTE: T DESIGNATES DECK SLAB THICKNESS

LEGEND

- DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATIONS. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.
- USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED TO BE ADJUSTED TO ACCOMMODATE THIS CONDITION.
- BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.
- INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

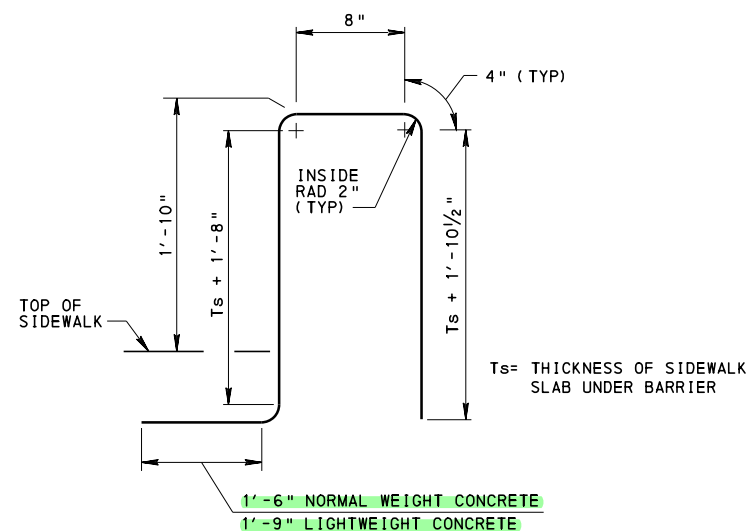
PA BRIDGE BARRIER

ADJACENT BOX BEAM DETAILS - 1

RECOMMENDED OCT. 7, 2024  
Chief Bridge Engineer

RECOMMENDED OCT. 7, 2024  
Chief Engineer, Highway Admin.

SHEET 7 OF 11  
BD-610M



### LEGEND

- ⑬ INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.
- ⑭ FOR DIMENSION, SEE BD-601M, SHEET 4.

1. FOR GEOMETRY AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
2. DETAILS ARE NOT SHOWN FOR NON-COMPOSITE ADJACENT BOX BEAMS, PRECAST BRIDGE SLABS, PLANK BEAMS, AND PRECAST CHANNEL BEAMS BECAUSE THEY CANNOT BE DESIGNED FOR A TL-5 BARRIER RATING.
3. FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.
4. FOR ADDITIONAL NOTES, SEE SHEET 1.

STANDARD

PA BRIDGE BARRIER

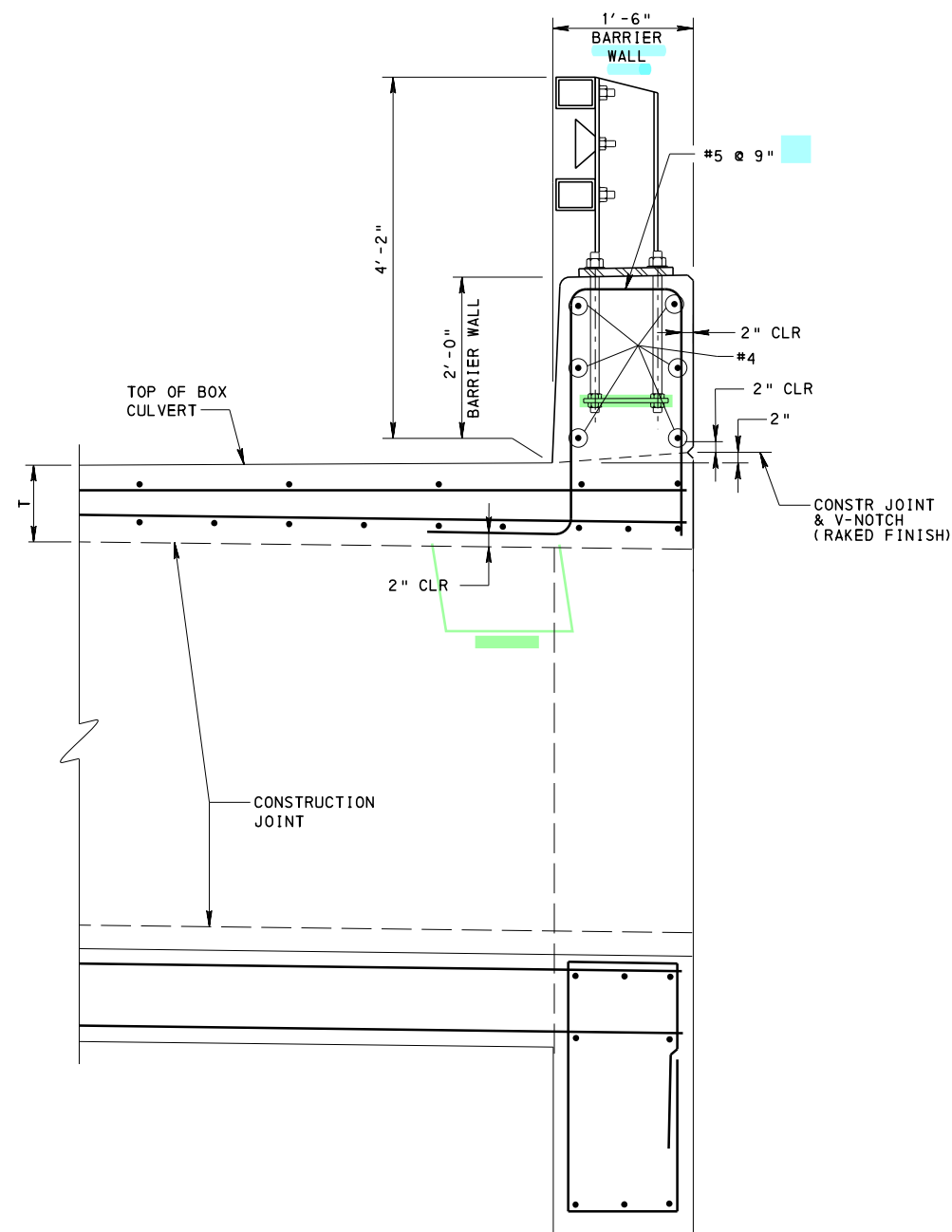
## ADJACENT BOX BEAM DETAILS - 2

RECOMMENDED OCT. 7, 2024  
*Kristin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
Gavin E. Gray  
 CHIEF ENGINEER, HIGHWAY ADMIN.

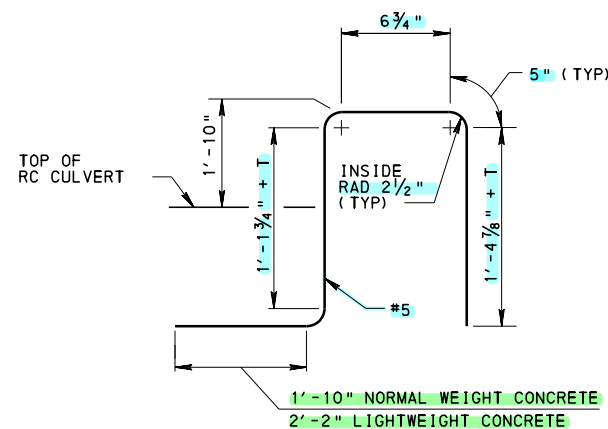
SHEET 8 OF 11  
BD-610M



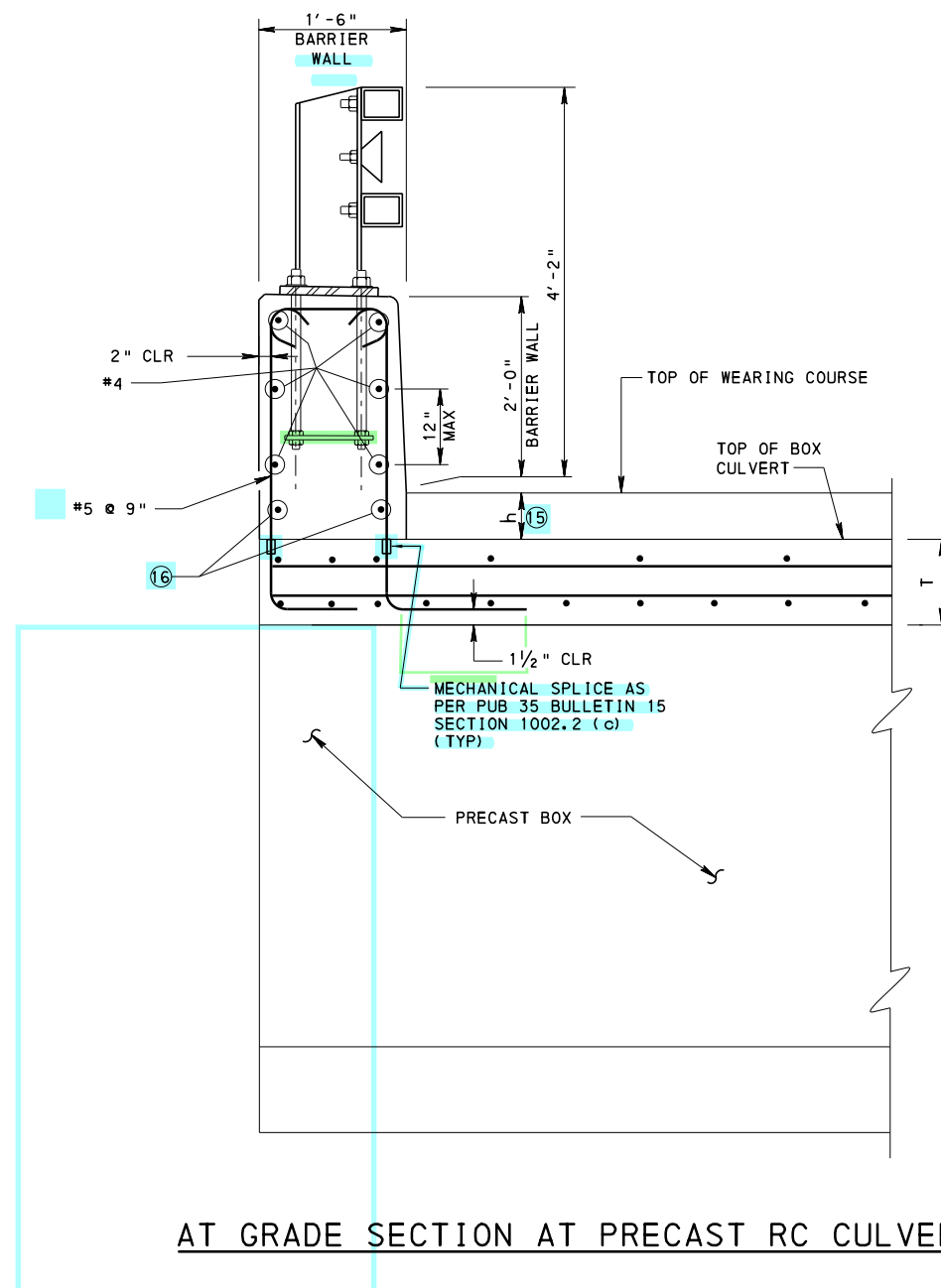


### AT GRADE SECTION AT C.I.P. RC CULVERT

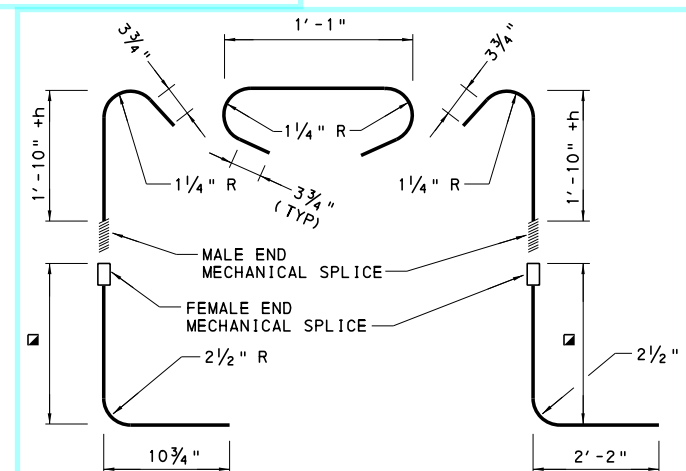
(TYPICAL HEADWALL SECTION)  
NOTE: FOR RC CULVERT DETAILS, SEE BD-632M.



### CAST-IN-PLACE CULVERT VERTICAL REINFORCEMENT



### AT GRADE SECTION AT PRECAST RC CULVERT



### PRECAST CULVERT VERTICAL REINFORCEMENT

ALL VERTICAL REINFORCEMENT #5

FOR T < 10": T-2"  
FOR T ≥ 10": 8" MIN

### REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

### LEGEND:

- 15 2 1/2" MIN, 11" MAX TOTAL THICKNESS (h); h IS THE DISTANCE MEASURED FROM TOP OF BOX CULVERT TO TOP OF WEARING COURSE.
- 16 ADD SETS OF 2 - #4 BARS AS REQUIRED.

### NOTES:

1. FOR PA BRIDGE BARRIER MOUNTED ON CULVERT, PROVIDE REINFORCEMENT AS SHOWN ON THIS SHEET #5 @ 9". FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 2.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

PA BRIDGE BARRIER

BOX CULVERT DETAILS

RECOMMENDED OCT. 7, 2024

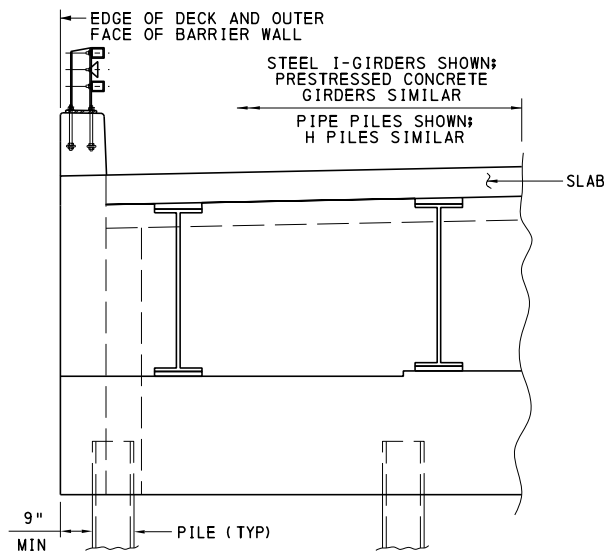
Chief Bridge Engineer

RECOMMENDED OCT. 7, 2024

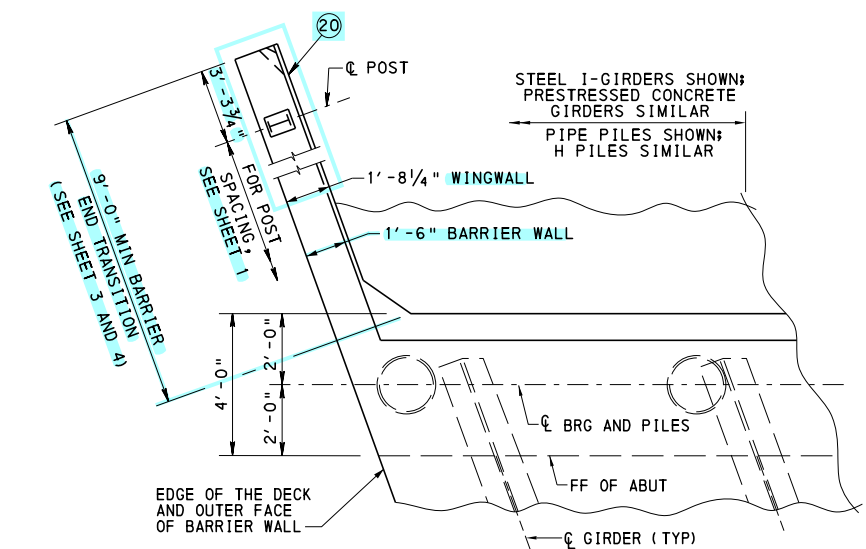
Chief Engineer, Highway Admin.

SHEET 9 OF 11

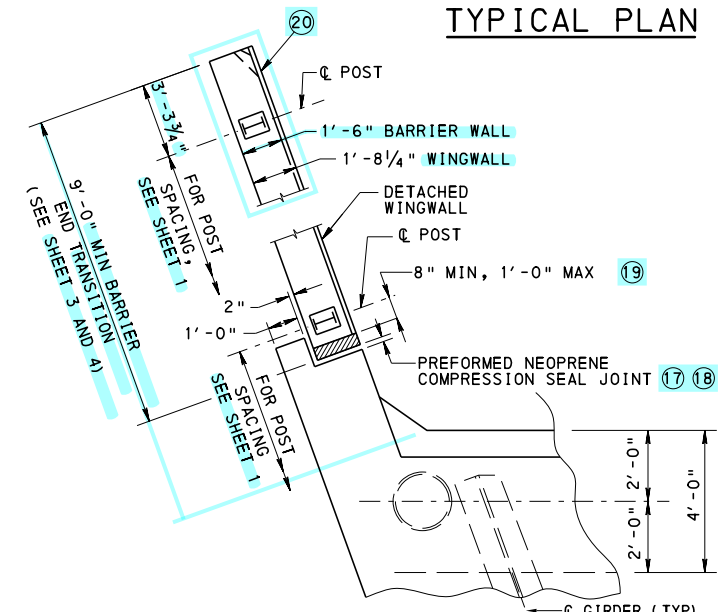
BD-610M



TYPICAL ELEVATION



TYPICAL PLAN

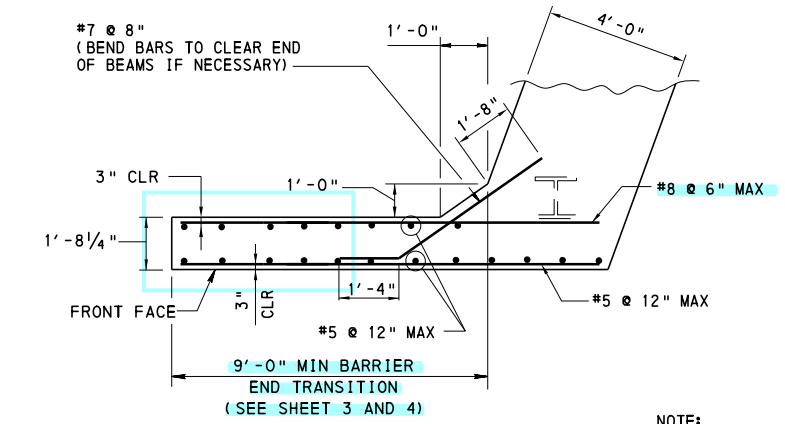


DETACHED WINGWALL PLAN  
(FOR DIMENSIONS AND CALL OUTS NOT SHOWN, SEE TYPICAL PLAN)

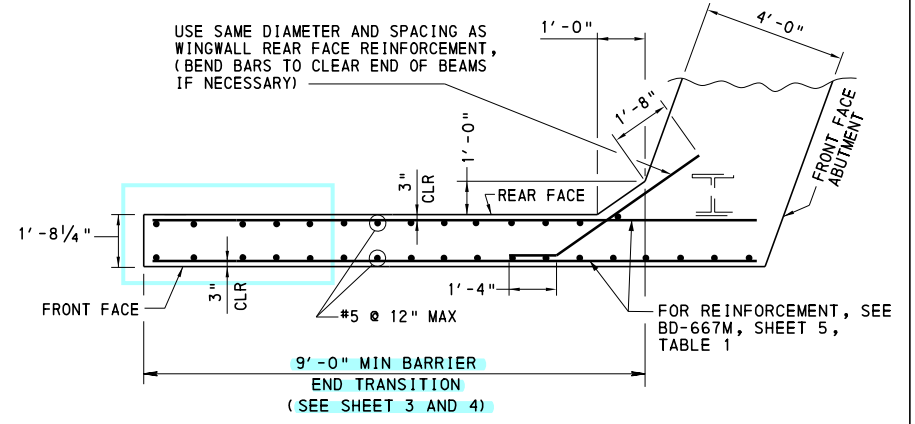
FOR RECTANGULAR WINGWALL REINFORCEMENT: SEE SECTION J-J  
FOR TAPERED WINGWALL REINFORCEMENT: SEE BD-667M, SHEET 5, TABLE 1

LEGEND:

- 17 FOR DETAILS OF THE PREFORMED NEOPRENE COMPRESSION SEAL JOINT, SEE BD-667M, SHEET 6.
- 18 FOR DETAILS OF THE BENT PLATE ON CONCRETE BARRIER WALL, SEE BC-713M.
- 19  $\phi$  POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR  $\phi$  POST TO EDGE OF FIXED END OF SLIDING PLATE.
- 20 SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEETS 3 AND 4.

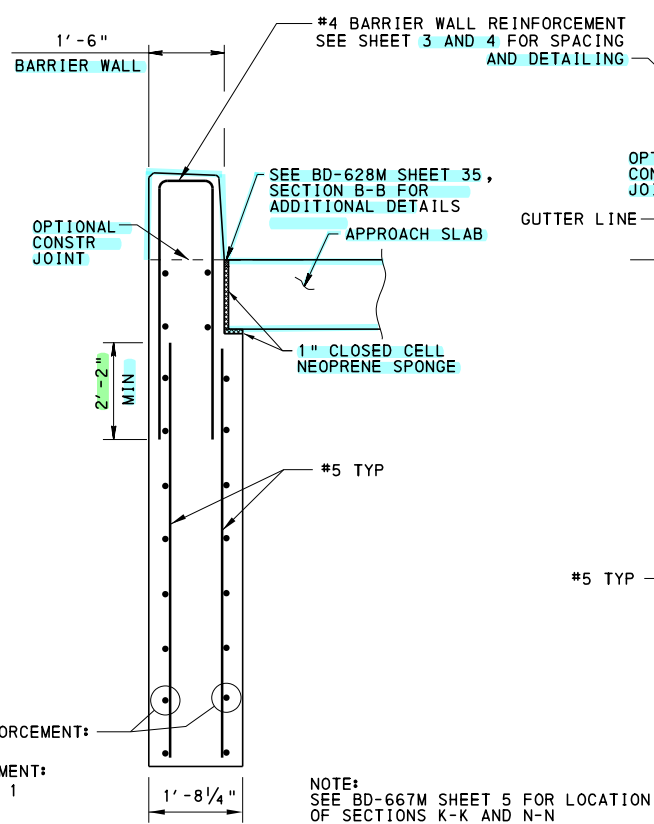


SECTION J-J

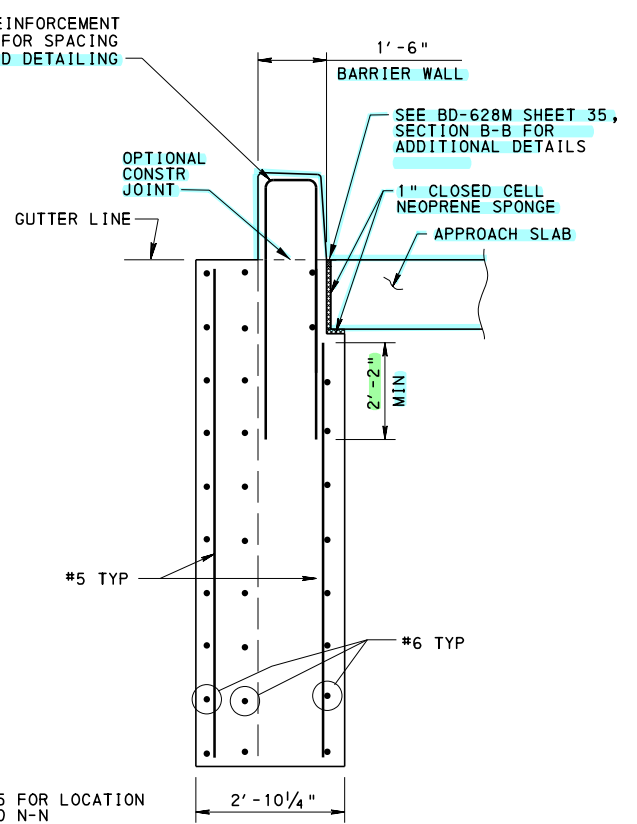


SECTION L-L

NOTE:  
SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS J-J AND L-L.



SECTION K-K  
(RECTANGULAR OR TAPERED WING)



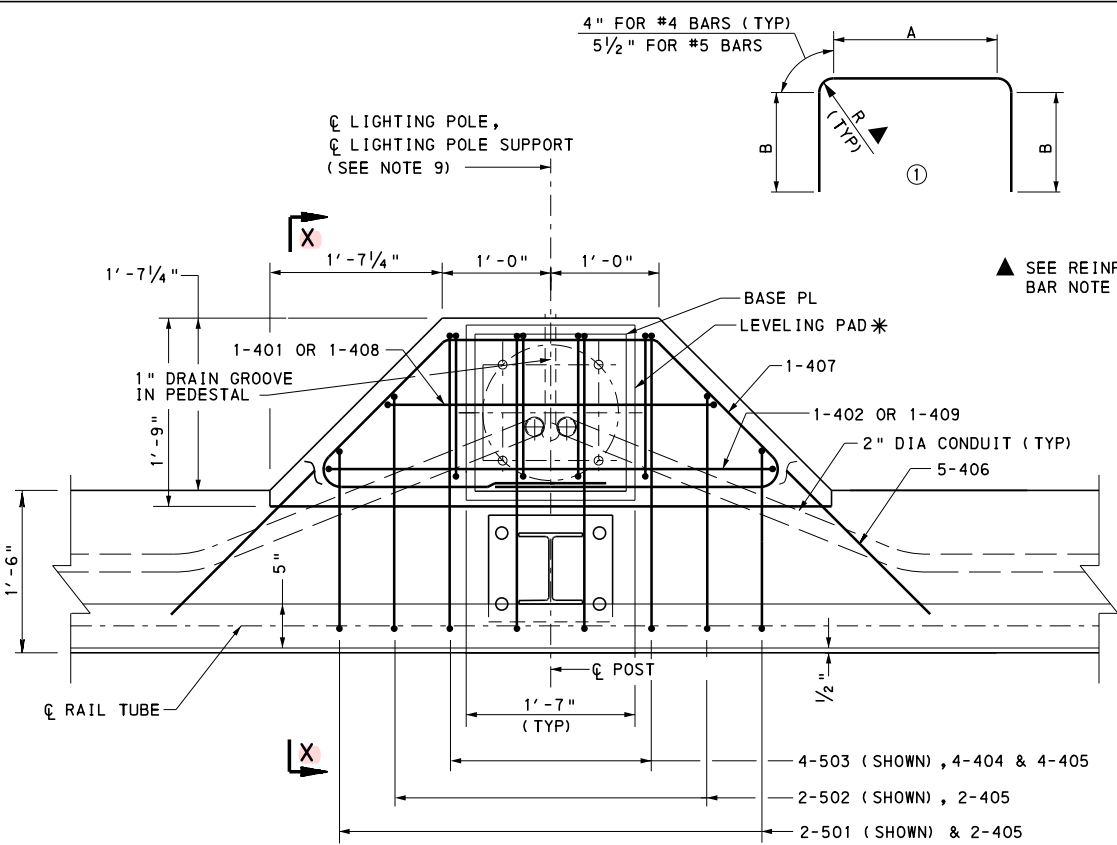
SECTION N-N  
(DETACHED WING)

NOTE:  
SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS K-K AND N-N

NOTES:

- 1. SEE BD-667M FOR ALL OTHER INTEGRAL ABUTMENT DETAILS.
- 2. FOR ADDITIONAL NOTES, SEE SHEET 1.

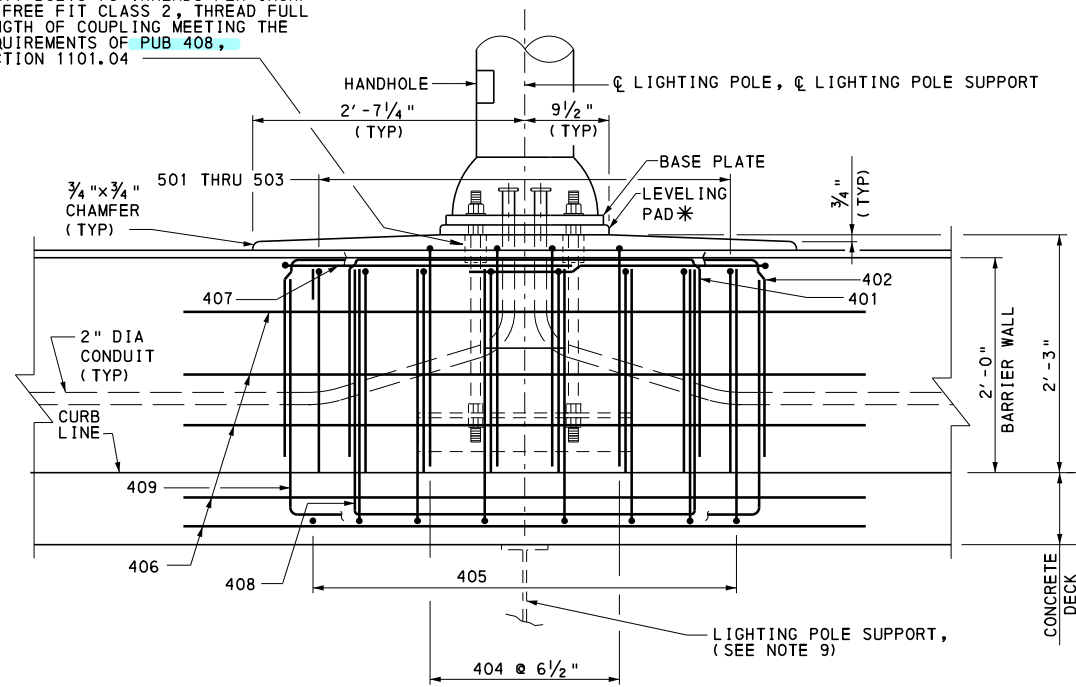
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD		
PA BRIDGE BARRIER		
INTEGRAL ABUTMENT DETAILS		
RECOMMENDED OCT. 7, 2024 <i>Kevin D. Lange</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Glenn E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 10 OF 11 BD-610M



PLAN

(BARRIER REINFORCEMENT NOT SHOWN FOR CLARITY)

4-COUPPLINGS 3" LONG MIN FOR HEAVY BOLTS (8 THREADS PER INCH) NC FREE FIT CLASS 2, THREAD FULL LENGTH OF COUPLING MEETING THE REQUIREMENTS OF PUB 408, SECTION 1101.04



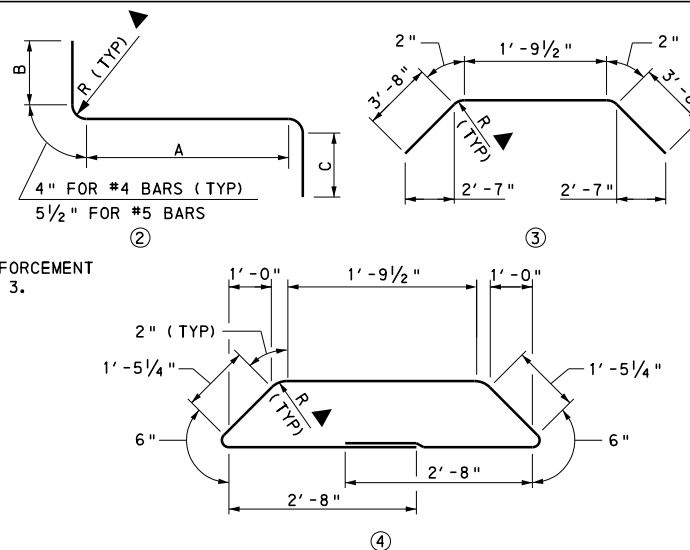
ELEVATION

(RAILING POST, TUBES, BARRIER AND DECK REINFORCEMENT NOT SHOWN FOR CLARITY)

\* FILL SPACE BETWEEN POLE BASE PLATE AND CONCRETE WITH GROUT AFTER SETTING POLE TRULY VERTICAL USING LEVELING NUTS. TOOL EDGES OF PAD. MINIMUM HEIGHT OF LEVELING PAD IS 1".

PROVISIONS FOR FUTURE LIGHTING

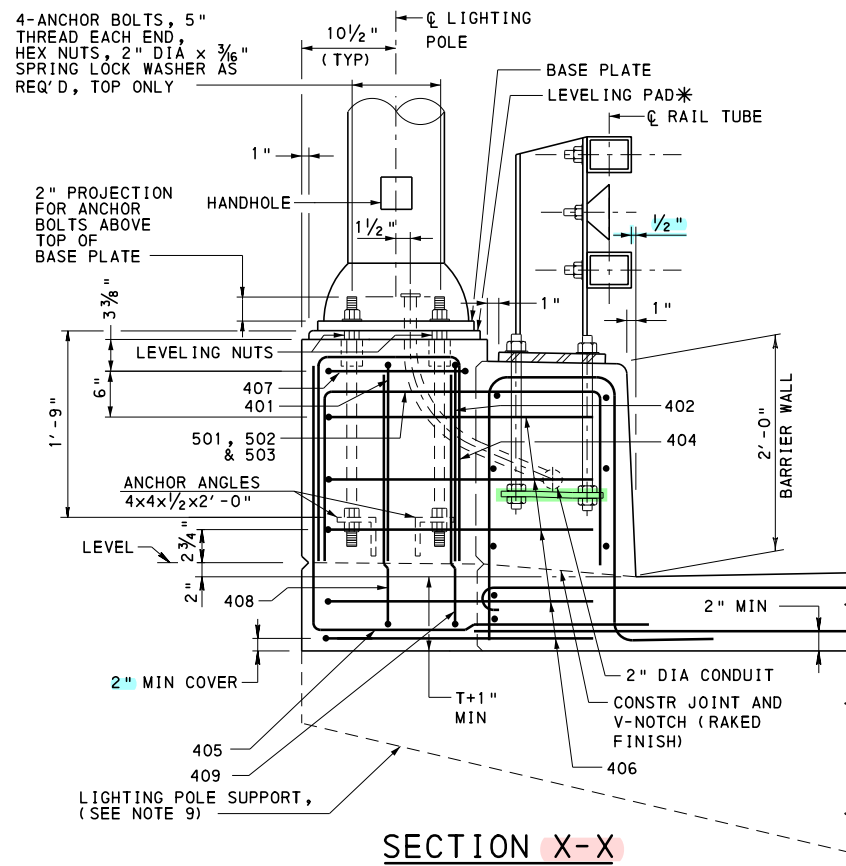
MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA	ANCHOR BOLT DIAMETER
50'-0" MAX	15"	1"



REINFORCEMENT DETAILS

REINFORCEMENT BAR NOTES:

- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).
- RADIUS, R= 2" FOR #4 BARS AND R= 3" FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.



SECTION X-X

REINFORCEMENT TABLE

MARK	SIZE	LENGTH	NUMBER	TYPE	A	B	C
401	4	6'-8"	1	①	2'-9"	1'-7½"	-----
402	4	7'-7"	1	①	3'-8"	1'-7½"	-----
404	4	4'-9"	4	①	1'-0"	1'-6½"	-----
405	4	5'-3½"	8	②	2'-8½"	2'-3"	0"
406	4	9'-5½"	5	③	-----	-----	-----
407	4	11'-4"	1	④	-----	-----	-----
408	4	7'-11"	1	①	2'-9"	2'-3"	-----
409	4	8'-10"	1	①	3'-8"	2'-3"	-----
501	5	4'-3"	2	①	11"	1'-2½"	-----
502	5	4'-9½"	2	①	1'-5½"	1'-2½"	-----
503	5	5'-4"	4	①	2'-0"	1'-2½"	-----

NOTES:

- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
- SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
- SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
- CONFORM ANCHOR MATERIALS AS SPECIFIED IN PUBLICATION 408, SECTION 1101.4. ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.
- SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
- PROVIDE 2" CLEAR ON ALL REINFORCEMENT UNLESS NOTED.
- PROVIDE A MINIMUM OF 2 1/2" CONCRETE COVER FOR CONDUIT.
- FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
- PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM. FOR LIGHT POLE SUPPORTS, USE BD-657M FOR ABUTMENT DETAILS, AND BD-658M FOR PIER DETAILS.
- FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE

STANDARD

PA BRIDGE BARRIER

LIGHTING POLE ANCHORAGE DETAILS

RECOMMENDED OCT. 7, 2024

*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

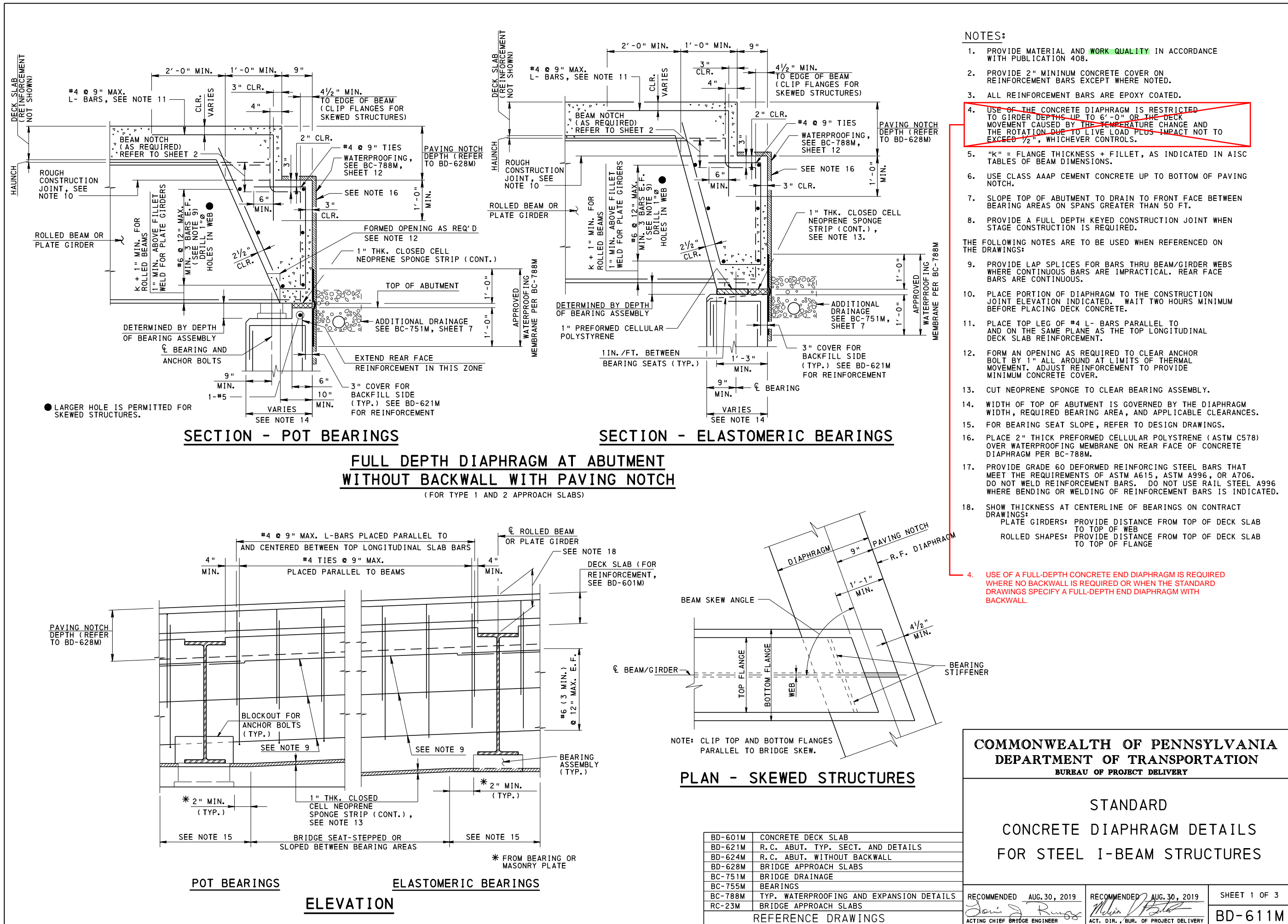
RECOMMENDED OCT. 7, 2024

*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

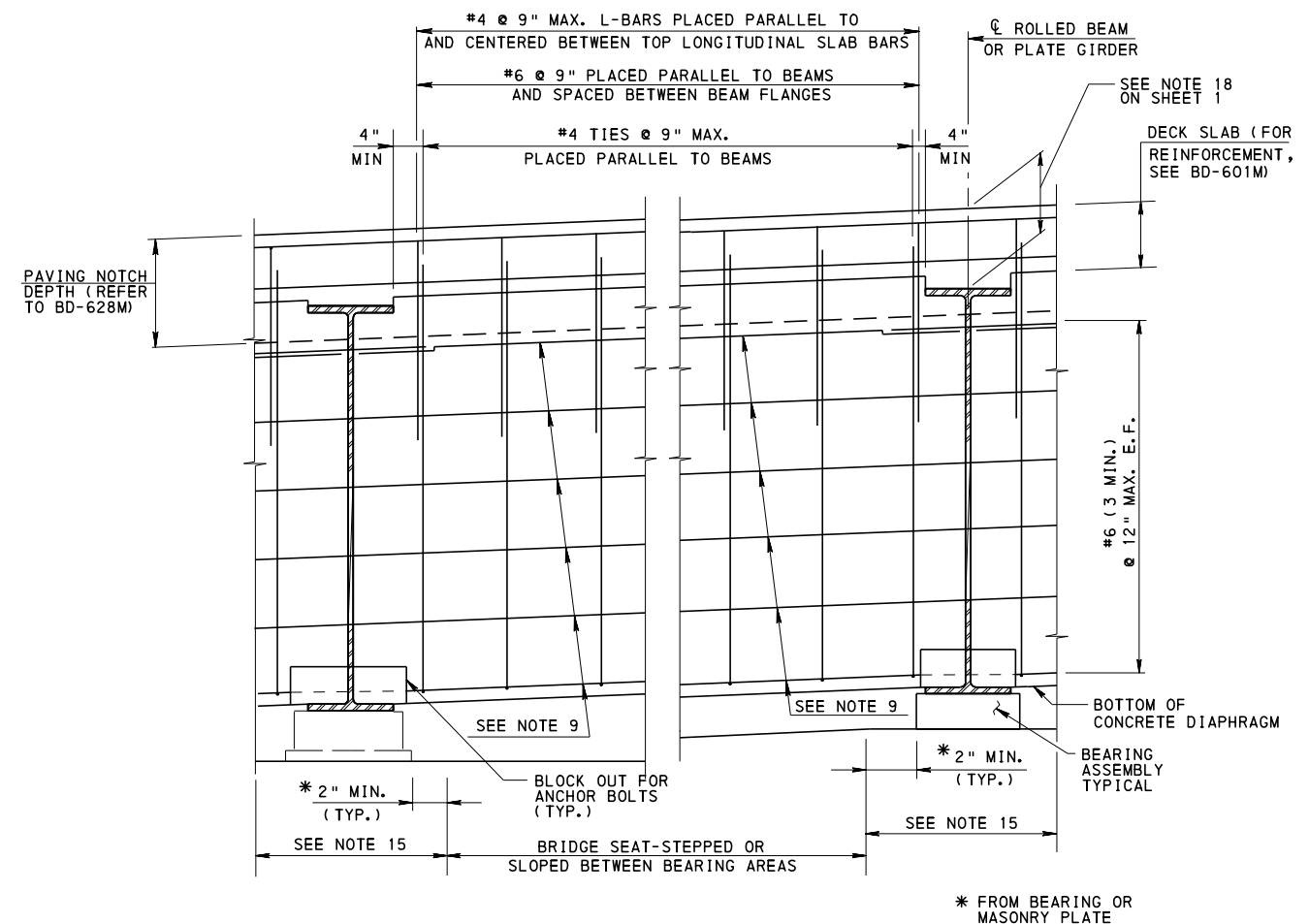
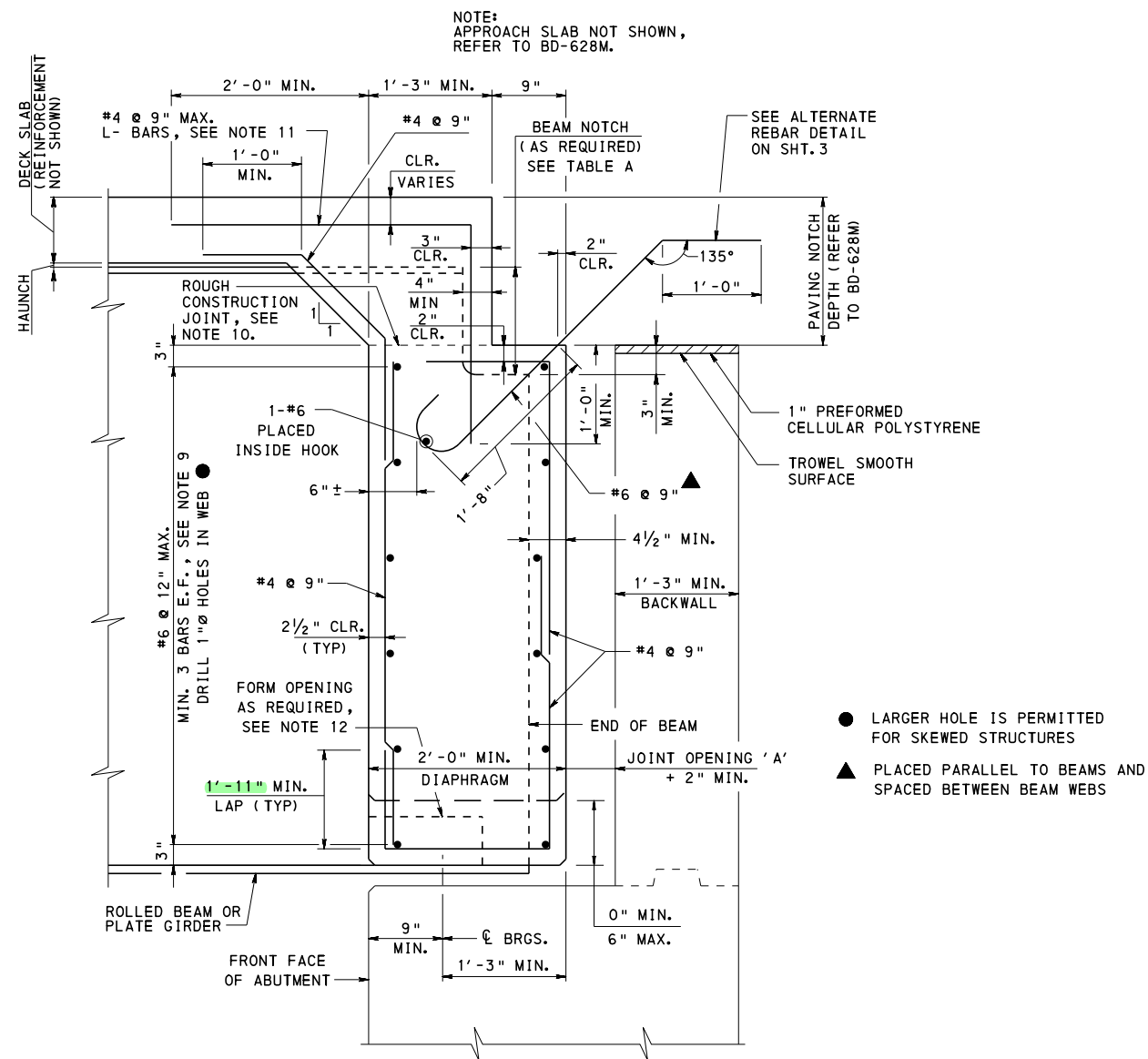
SHEET 11 OF 11

BD-610M

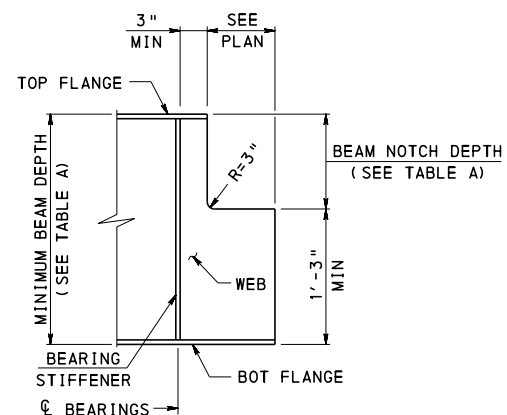
CHANGE 2  
e-Notification No. 85,  
dated May 2, 2023







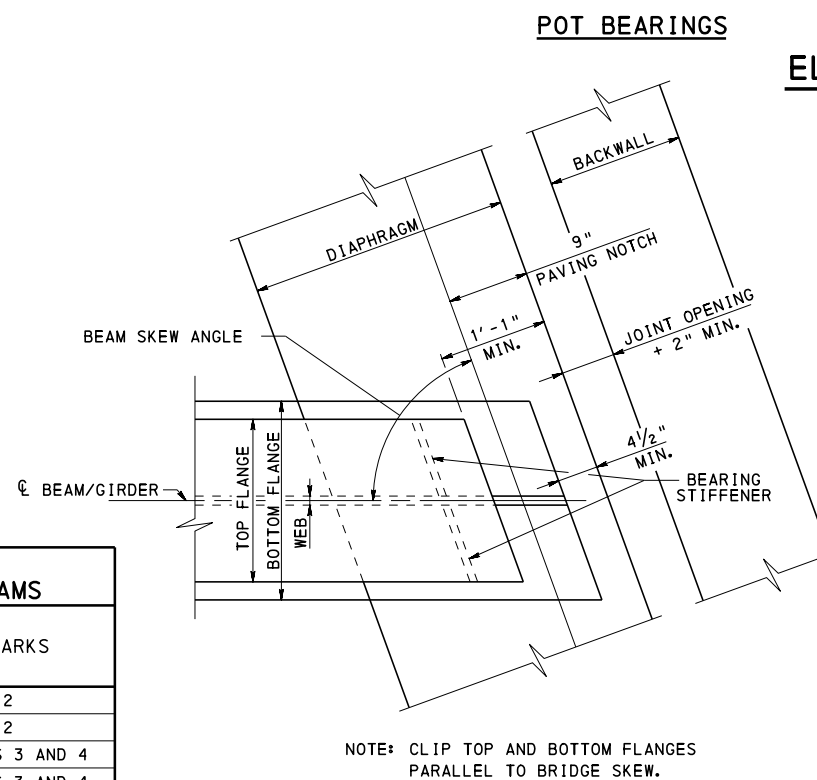
### DIAPHRAGM AT ABUTMENT WITH BACKWALL FOR TYPE 3 APPROACH SLABS



APPROACH SLAB TYPE (SEE NOTE 1)	BEAM NOTCH DEPTH	MINIMUM BEAM DEPTH	REMARKS
1	10½" "	2' - 1½" "	SEE NOTE 2
2	1' - 3½" "	2' - 6½" "	SEE NOTE 2
3	1' - 0½" "	3' - 4" "	SEE NOTES 3 AND 4
4	1' - 0½" "	3' - 4" "	SEE NOTES 3 AND 4
RC-23M	10½" "	N/A	SEE NOTE 5

**BEAM NOTCH NOTES**

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. SUPPORT APPROACH SLAB ON ABUTMENT FOR BEAM DEPTHS LESS THAN SHOWN.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. TYPE 3 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 40". USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
5. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.



NOTES:

1. FOR NOTES, SEE SHEET 1.

## PLAN - SKEWED STRUCTURES

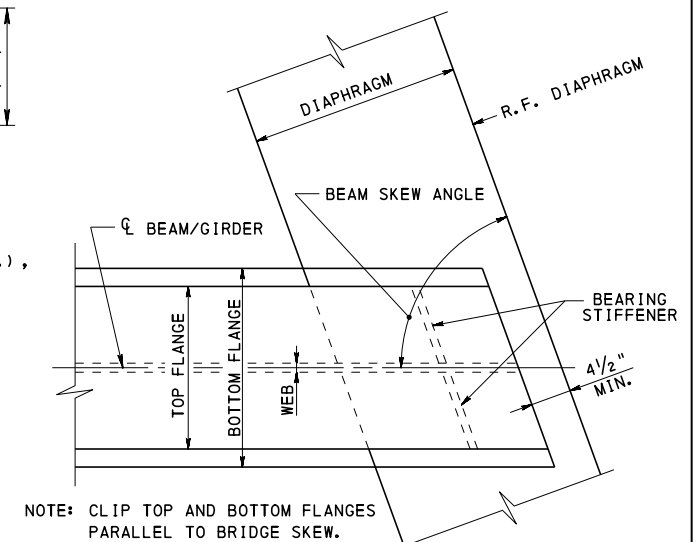
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

# STANDARD CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES

RECOMMENDED AUG. 30, 2019 <i>James J. Ruggie</i> ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 <i>Michael J. Bate</i> ACT. DIR. - BUR. OF PROJECT DELIVERY	SHEET 2 OF 3  BD-611M
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## SECTION - POT BEARINGS

**SECTION - ELASTOMERIC BEARINGS**

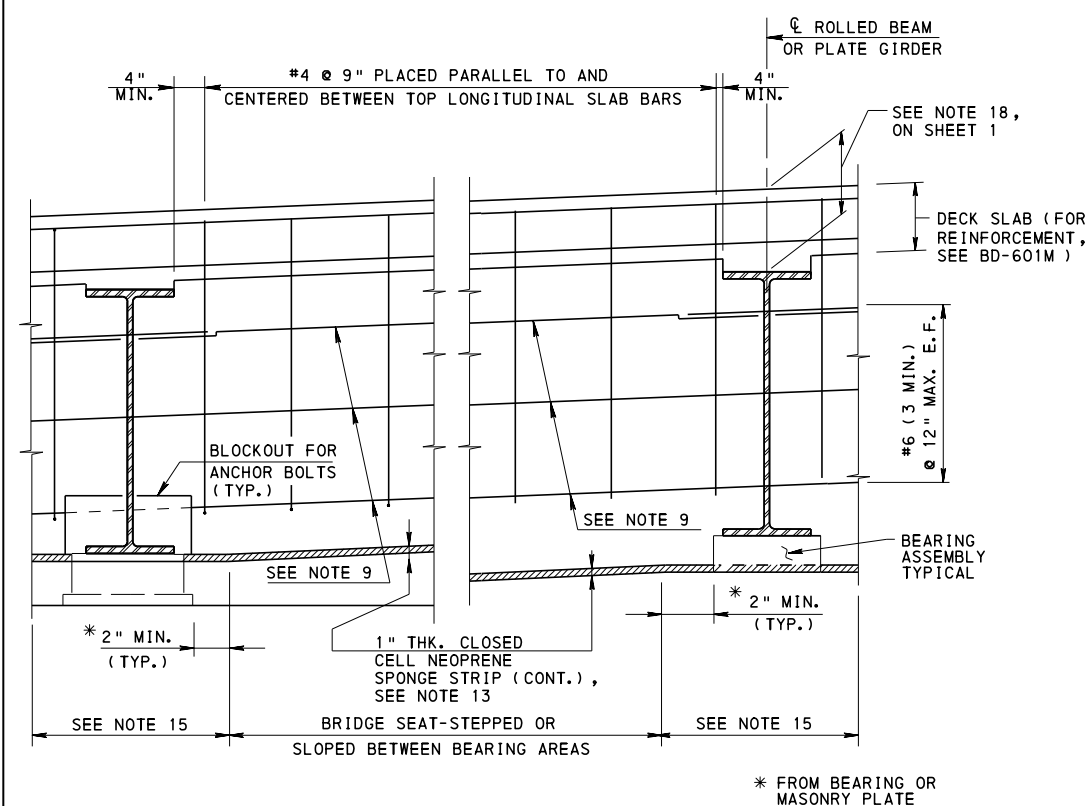


## PLAN - SKEWED STRUCTURES

NOTES:

1. FOR NOTES, SEE SHEET 1.

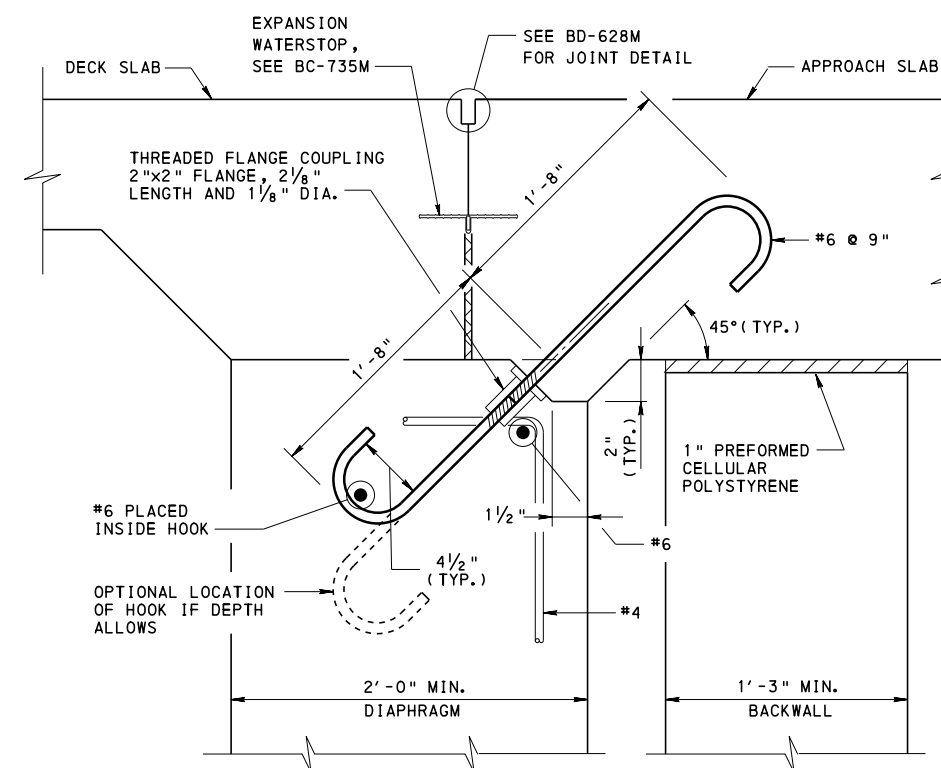
FULL DEPTH DIAPHRAGM AT ABUTMENT  
WITHOUT BACKWALL AND PAVING NOTCH



## POT BEARINGS

ELASTOMERIC BEARINGS

## ELEVATION



### ALTERNATE REBAR DETAIL

END OF SPREAD BOX BEAM TO MATCH NOTCH SHOWN ABOVE FOR THIS ALTERNATE.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

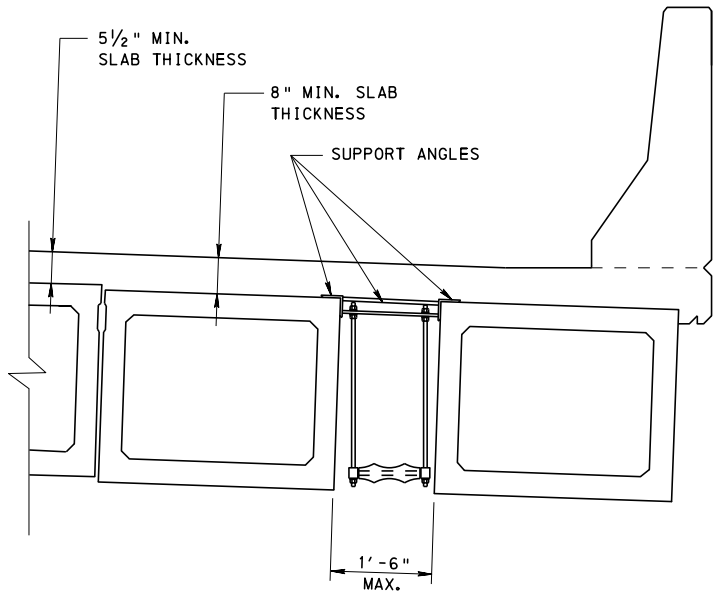
# STANDARD CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES

RECOMMENDED AUG. 30, 2019  
*Joris J. Runyon*  
 ACTING CHIEF BRIDGE ENGINEER

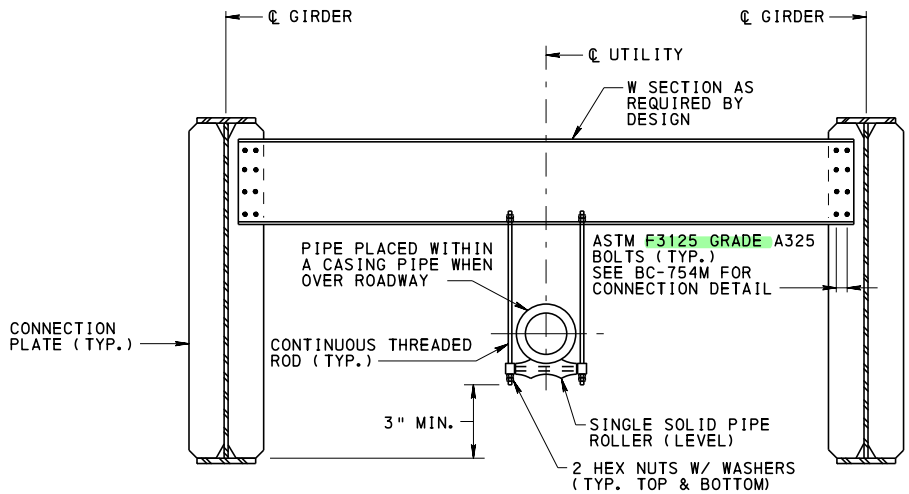
RECOMMENDED AUG. 30, 2019  
*Melvin D. Butler*  
 ACT. DIR. - BUR. OF PROJECT DELIVERY

SHEET 3 OF 3

BD-611M



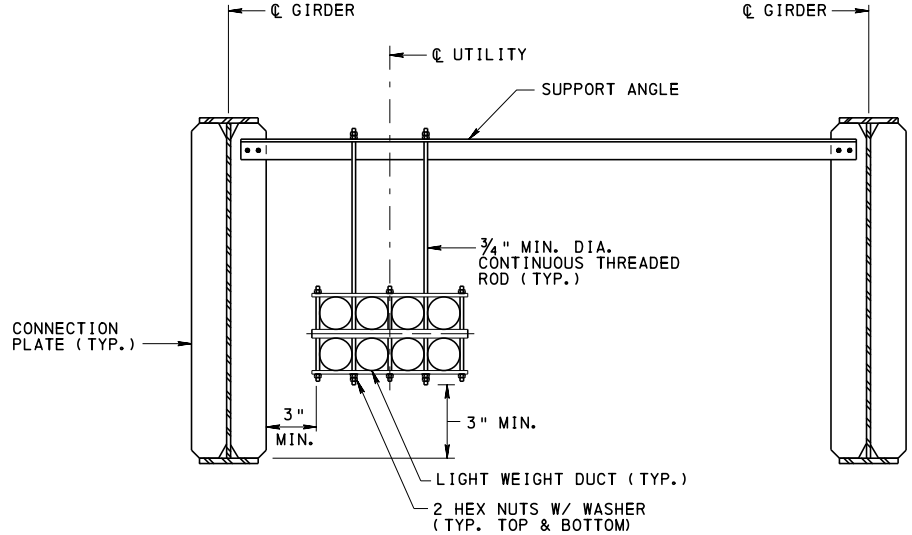
LOCATION OF UTILITIES  
ON ADJACENT BOX BRIDGES



WATER OR GAS LINE SUPPORT DETAIL  
N. T. S.

NOTES:

1. ALL COMPONENTS FOR SUPPORTS MUST BE DESIGNED DURING FINAL PLAN PREPARATION.
2. SHOP DRAWINGS OF SUPPORTS MUST BE PROVIDED AND APPROVED PRIOR TO CONSTRUCTION.
3. GALVANIZE ALL HANGERS, SUPPORTS AND ASSOCIATED HARDWARE. IN ADDITION, FOR STEEL BRIDGES PAINT ALL FABRICATED STEEL WITH ZINC RICH PRIMER AND APPLY FINISH COAT TO MATCH BEAM COLOR.
4. VERTICAL POSITION OF UTILITIES MUST BE SET TO PROVIDE AT LEAST 3" CLEARANCE TO BOTTOM OF BEAMS FROM UTILITY OR ITS CASING. IN ADDITION, MAINTAIN AT LEAST 1" CLEARANCE FROM UTILITY TO TOP OR BOTTOM HORIZONTAL REBARS IN END DIAPHRAGM.



UTILITY SUPPORT DETAIL  
N. T. S.

SPECIAL RESTRICTIONS AND NOTES FOR:  
LOCATION OF PIPES CARRYING CHEMICALS  
OR HEAT RADIATING GASES OR FLUIDS &  
OF CONDUITS CARRYING ELECTRICAL POWER:

NOT ACCEPTABLE:

1. EMBEDMENT OF SUCH PIPES IN P/S ADJACENT BOX BEAMS.
2. EMBEDMENT OF SUCH PIPES IN CURBS & PARAPETS UNLESS SPECIAL PROVISIONS (TO BE APPROVED BY THE BRIDGE ENGINEER) ARE TO BE MADE TO PERMIT DISSIPATION OF THE DEVELOPING HEAT.

ACCEPTABLE:

1. BETWEEN BEAMS ON SPREAD BEAM BRIDGES (I OR BOX).
2. UNDER DIVISOR, IF IN EXISTENCE.
3. ON COMPOSITE ADJACENT BOXES WHEN SPREAD UP TO 1'-6". IN THIS CASE SLAB THICKNESS BETWEEN BEAMS DESIGNED PER BD-601M. ALSO SPECIAL PROVISIONS (TO BE APPROVED BY THE BRIDGE ENGINEER) ARE TO BE MADE TO PERMIT DISSIPATION OF THE DEVELOPING HEAT.

SPECIAL REQUIREMENTS FOR FLUID CARRYING PIPES:

1. STEEL CASING REQUIRED IN SPANS OVER ROADWAYS OR WALKWAYS.

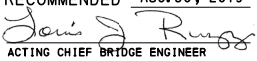
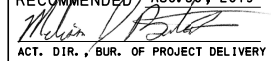
DESIGN INSTRUCTIONS:

1. FURNISH COMPUTATIONS FOR ADJACENT BEAMS WHEN UTILITY LOAD IS LOCATED BETWEEN BEAMS AND IS MORE THAN 5 lb/ft.
2. FURNISH COMPUTATIONS IN ANY CASE FOR ADJACENT BEAMS WHEN UTILITY IS SUSPENDED FROM OVERHANGING SLAB OR DIVISOR (INCLUDE HORIZONTAL ACCIDENTAL IMPACT ON RAILING AND PARAPET).
3. STRUCTURES WITH CATHODIC PROTECTION REQUIRE SPECIAL DETAILS AND APPROVAL OF BRIDGE ENGINEER.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

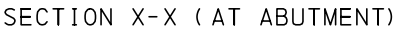
STANDARD  
UTILITY ATTACHMENT  
TO SUPERSTRUCTURE

BD-601M	CONCRETE DECK SLAB
BC-754M	STEEL DIAPHRAGMS
REFERENCE DRAWINGS	

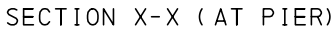
RECOMMENDED	AUG. 30, 2019	RECOMMENDED	AUG. 30, 2019
			
ACTING CHIEF BRIDGE ENGINEER		ACT. DIR., BUR. OF PROJECT DELIVERY	

SHEET 1 OF 3
BD-612M






FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN  
ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



LEGEND:

E.F. DENOTES EACH FACE  
 PREFORMED CELLULAR POLYSTYRENE  
 \* SPLAY OR CUT AS NEEDED TO ACCOMMODATE UTILITY

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

STANDARD  
UTILITY ATTACHMENT  
TO SUPERSTRUCTURE

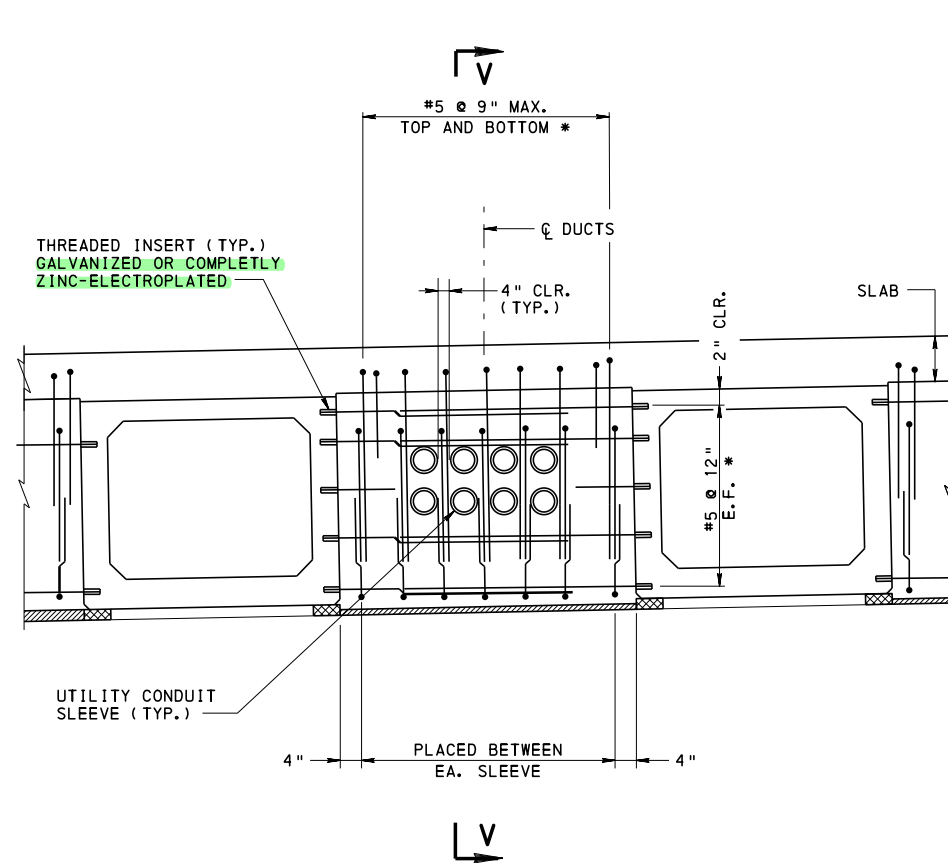
RECOMMENDED AUG. 30, 2019  
*Doris J. Rung*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Melvin D. Butler*  
 ACT. DIR., BUR. OF PROJECT DELIVER

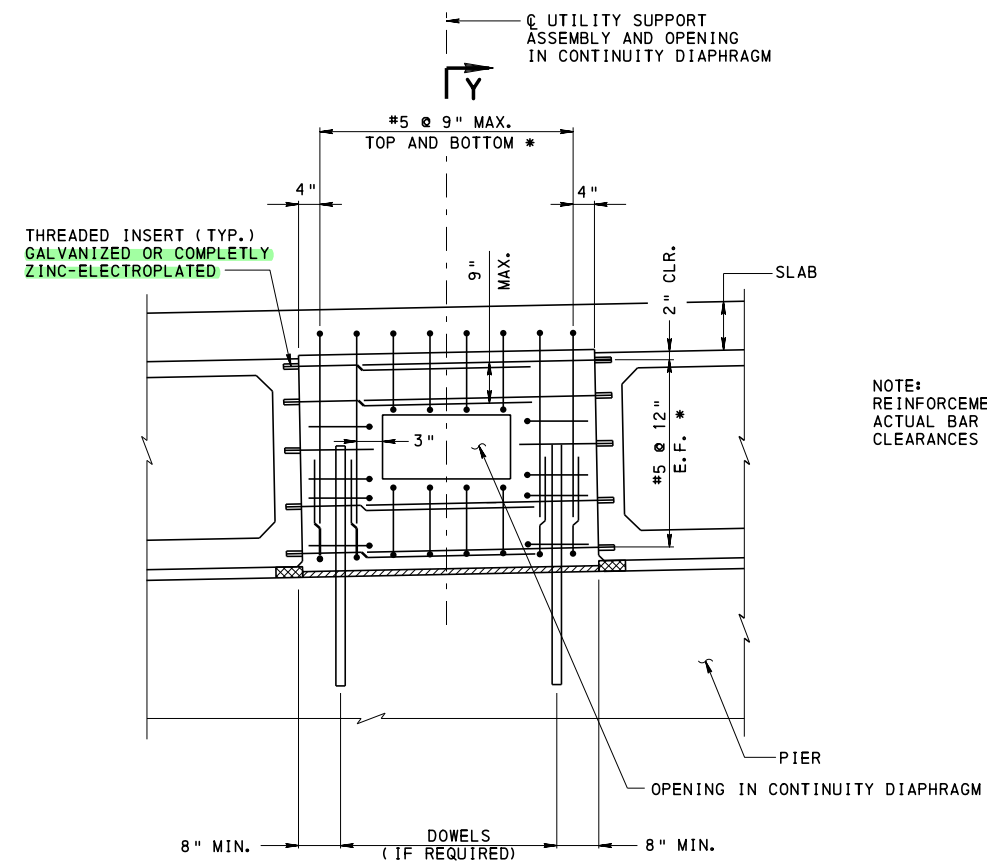
SHEET 2 OF 3

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BD-612M

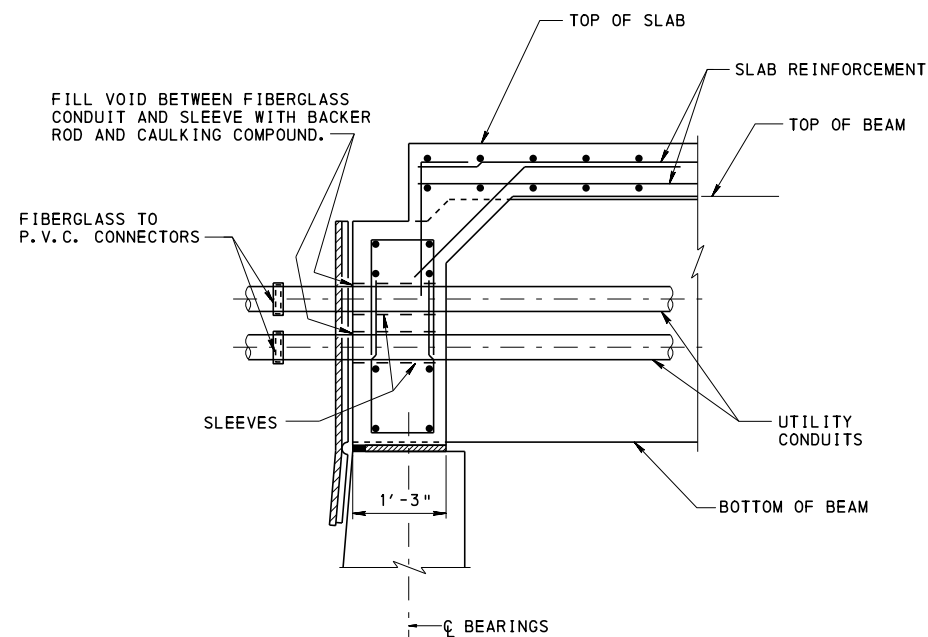


**END DIAPHRAGM W/MULTIPLE SLEEVES  
FOR UTILITY CONDUITS**  
(SLAB REINFORCEMENT NOT SHOWN FOR CLARITY)

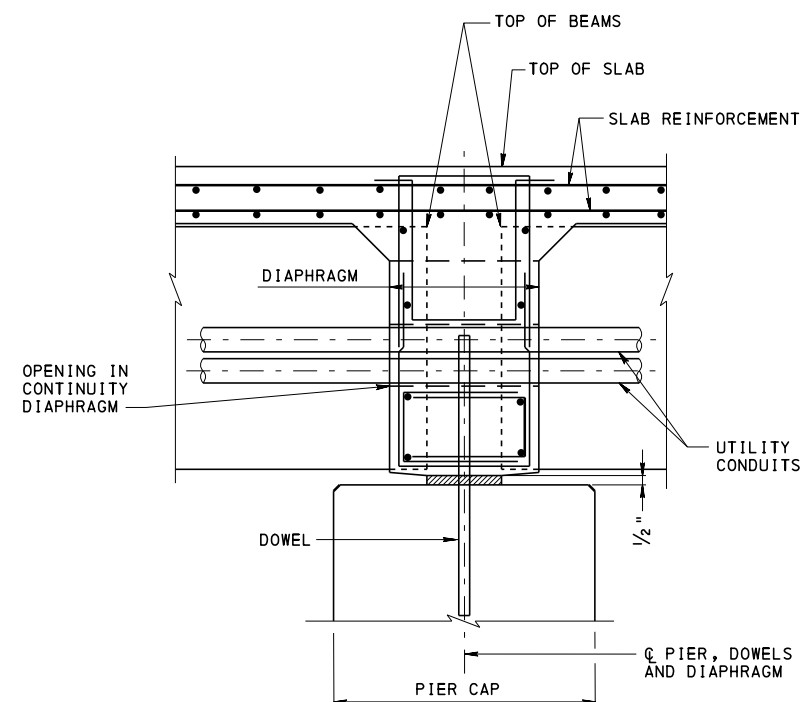


**PIER DIAPHRAGM OPENING  
FOR UTILITY CONDUITS**  
(SLAB REINFORCEMENT NOT SHOWN FOR CLARITY)

NOTE:  
REINFORCEMENT CONFIGURATIONS SHOWN ARE MINIMUMS.  
ACTUAL BAR SIZES AND SPACING MUST BE DESIGNED.  
CLEARANCES SHOWN ARE MINIMUMS.



**SECTION V-V**  
FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN  
ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



**SECTION Y-Y**

- LEGEND:**
- E.F. DENOTES EACH FACE
  - PREFORMED CELLULAR POLYSTYRENE
  - \* SPLAY OR CUT AS NEEDED TO ACCOMMODATE UTILITY

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
UTILITY ATTACHMENT  
TO SUPERSTRUCTURE**

CHANGE 5

DESIGN METHODOLOGY:

1. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DOCUMENTS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL DESIGN INFORMATION. BEARING DESIGN DRAWINGS SHOULD INCLUDE, AS A MINIMUM, BEARING LOCATION PLAN, LOAD TABLE, TABLE OF DIMENSIONS FOR TYPE AND SIZE (LOAD) OF BEARING(S) SELECTED, REFERENCE TO BC-756M AND ANY OTHER DETAILS NECESSARY FOR THE COMPLETION OF SHOP DRAWINGS AND FABRICATION BY THE CONTRACTOR.
2. THE INFORMATION SHOWN IN THIS STANDARD AND BC-756M MAY BE USED FOR BEARING DESIGNS BY EITHER AASHTO STANDARD SPECIFICATIONS UTILIZING SERVICE LOADS OR AASHTO LRFD SPECIFICATIONS UTILIZING SERVICE AND EXTREME EVENT LIMIT STATE LOAD COMBINATIONS AS MODIFIED BY DM-4 AND HEREIN.
3. DIVIDE THE HORIZONTAL SEISMIC LOADS, DERIVED FROM EITHER SPECIFICATION, BY 1.5 PER AASHTO (1992) STANDARD SPECIFICATION, DIVISION 1-A, SECTION 7.1.
4. A TOTAL DESIGN ROTATION OF 0.03 RADIAN (INCLUDING 0.02 RADIAN OF CONSTRUCTION TOLERANCE) WAS USED FOR THIS STANDARD.
5. GUIDED AND NON-GUIDED BEARINGS ARE DESIGNED FOR A TOTAL LONGITUDINAL MOVEMENT OF 3" (PLUS 1" OF CONSTRUCTION TOLERANCE IN EACH DIRECTION). ADDITIONAL LONGITUDINAL MOVEMENT CAN BE ACCOMMODATED BY INCREASING THE LENGTH OF THE SOLE PLATE, STAINLESS STEEL, GUIDE BARS, AND GUIDE PLATE.
6. NON-GUIDED BEARINGS ARE DESIGNED FOR A TOTAL TRANSVERSE MOVEMENT OF 0.5" (PLUS 0.75" OF CONSTRUCTION TOLERANCE IN EACH DIRECTION). ADDITIONAL TRANSVERSE MOVEMENT CAN BE ACCOMMODATED BY INCREASING APPROPRIATE COMPONENT DIMENSIONS.
7. WELDED CONNECTIONS ARE DESIGNED USING ALLOWABLE STRESS DESIGN.

POT DESIGN:

1. THE THICKNESS OF THE POT WALL OF THE FIXED AND GUIDED BEARINGS WAS CALCULATED USING AASHTO (1998) LRFD EQUATION 14.7.4.7-1 AND SECTION C14.7.4.6.
2. THE THICKNESS OF THE POT WALL OF THE NON-GUIDED BEARINGS ARE DESIGNED FOR A NOMINAL HORIZONTAL LOAD EQUAL TO 10% OF THE DESIGN VERTICAL CAPACITY (P<sub>r</sub>), AND USING AASHTO (1998) LRFD EQUATION 14.7.4.6-5 (Pr=10%P<sub>r</sub>) AND SECTION C14.7.4.6.
3. THE THICKNESS OF THE POT BASE WAS CALCULATED USING AASHTO (1998) LRFD EQUATIONS 14.7.4.6-3 AND 14.7.4.6-4.

PISTON DESIGN:

1. THE HEIGHT OF THE PISTON RIM WAS CALCULATED USING AASHTO (1998) LRFD EQUATIONS 14.7.4.7-2 AND 14.7.4.7-3 ALONG WITH SECTION C14.7.4.7.
2. THE DIAMETER OF THE PISTON WAS CALCULATED USING AASHTO (1998) LRFD EQUATION 14.7.4.7-4 AND USING A MAXIMUM CLEARANCE OF 0.04" BETWEEN THE PISTON AND THE POT AND A DESIGN ROTATION OF 0.03 RADIAN.

MASONRY PLATE DESIGN:

1. THE MASONRY PLATE WAS DESIGNED ASSUMING IT WILL BE PLACED NORMAL TO THE BEAM/GIRDER CENTERLINE. OTHER ORIENTATIONS BETWEEN THE MASONRY PLATE AND THE BEAM/GIRDER CENTERLINE ARE PERMITTED. HOWEVER, THE ENGINEER IS REQUIRED TO CHECK ALL GEOMETRY TO ENSURE THAT ALL CLEARANCE REQUIREMENTS ARE SATISFIED.
2. THE MASONRY PLATE THICKNESS (A) HAS BEEN DESIGNED FOR BENDING IN THE FOLLOWING MANNER: THE PRESSURE DUE TO THE BEARING REACTION IS ASSUMED TO DISTRIBUTE EVENLY OVER THE ENTIRE MASONRY PLATE. THE MINIMUM PLATE THICKNESS IS THEN DESIGNED BY MODELING THE MASONRY PLATE AS A CANTILEVER BEAM WITH A CANTILEVER LENGTH EQUAL TO THE LONGEST PERPENDICULAR DISTANCE BETWEEN THE EDGE OF THE MASONRY PLATE AND EDGE OF THE POT PLATE.

SOLE PLATE DESIGN:

1. THE SOLE PLATE THICKNESS (H) HAS BEEN DESIGNED FOR BENDING IN THE FOLLOWING MANNER: CIRCULAR PTFE IS ASSUMED AS AN EQUIVALENT SQUARE AREA. THE PRESSURE IS THEN ASSUMED TO DISTRIBUTE FROM THE PTFE THROUGH THE PLATE AT A 1:1.5 SLOPE. THE MINIMUM PLATE THICKNESS IS THEN DESIGNED BY MODELING THE SOLE PLATE AS A CANTILEVER BEAM. THE CANTILEVER BEAM LENGTH ASSUMED IS THE MINIMUM OF THE FOLLOWING DIMENSIONS:
  - THE LARGEST DISTANCE FROM THE EDGE OF DISTRIBUTED PRESSURE AREA TO THE EDGE OF THE PTFE'S (OR PISTON'S) ASSUMED EQUIVALENT SQUARE AREA.
  - THE LARGEST DISTANCE FROM THE EDGE OF THE SOLE PLATE TO THE EDGE OF THE PTFE'S (OR PISTON'S) ASSUMED EQUIVALENT SQUARE AREA.
2. THE SOLE PLATE THICKNESS GIVEN IN COLUMN "H" IS THE MINIMUM THICKNESS. ANY ADDITIONAL THICKNESS, "I", REQUIRED TO ACCOMMODATE THE BEVEL MUST BE ADDED TO THE OVERALL BEARING HEIGHT GIVEN IN COLUMN "PP".
3. A MINIMUM SOLE PLATE THICKNESS OF 0.8125" WAS USED FOR THIS STANDARD.

INSTRUCTIONS FOR USING DESIGN TABLES:

1. CALCULATE THE MINIMUM AND MAXIMUM VERTICAL DESIGN LOAD REACTIONS PER BEARING AS FOLLOWS:

LRFD SPECIFICATIONS

- USE THE SERVICE I AND EXTREME EVENT I LIMIT STATES.
- COMPUTE THE MINIMUM REACTION LOADS BY INCLUDING THE MINIMUM VALUE OF PERMANENT LOADS AND THE LOADS THAT PRODUCE UPLIFT.

STANDARD SPECIFICATIONS

- USE ALL SERVICE LOAD GROUPS.
- REDUCE LOADS BY THE PERCENT INCREASE IN ALLOWABLE STRESS AS PERMITTED BY AASHTO.
- THE PERCENT INCREASE IN ALLOWABLE STRESS, AS DEFINED BY AASHTO, SHOULD NOT BE USED FOR THE CALCULATION OF THE MINIMUM VERTICAL DESIGN LOAD.
- COMPUTE THE MINIMUM REACTION LOADS BY INCLUDING THE MINIMUM VALUE OF PERMANENT LOADS AND THE LOADS THAT PRODUCE UPLIFT.

2. FOR FIXED AND GUIDED BEARING CALCULATE THE MAXIMUM HORIZONTAL DESIGN LOAD PER BEARING AS FOLLOWS:

LRFD SPECIFICATIONS

- USE THE SERVICE I AND EXTREME EVENT I LIMIT STATES.
- DIVIDE THE EXTREME EVENT I LIMIT STATE LOADS BY 1.50.
- FOR FIXED BEARINGS COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT VECTOR SUM OF THE HORIZONTAL LOADS FOR EACH LIMIT STATE.
- FOR GUIDED BEARINGS, COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT SUM OF THE HORIZONTAL LOADS FOR EACH LIMIT STATE APPLIED NORMAL TO THE ORIENTATION OF THE GUIDE BAR.

STANDARD SPECIFICATIONS

- USE ALL SERVICE LOAD GROUPS.
- REDUCE LOADS BY THE PERCENT INCREASE IN ALLOWABLE STRESS AS PERMITTED BY AASHTO.
- DIVIDE THE GROUP VII LOADS BY 1.50.
- FOR FIXED BEARINGS COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT VECTOR SUM OF THE HORIZONTAL LOADS FOR EACH LOAD GROUP.
- FOR GUIDED BEARINGS, COMPUTE THE MAXIMUM HORIZONTAL DESIGN LOAD AS THE RESULTANT SUM OF THE HORIZONTAL LOADS FOR EACH LOAD GROUP APPLIED NORMAL TO THE ORIENTATION OF THE GUIDE BAR.

INSTRUCTIONS BELOW ARE APPLICABLE TO BOTH THE AASHTO LRFD SPECIFICATIONS AND STANDARD SPECIFICATIONS

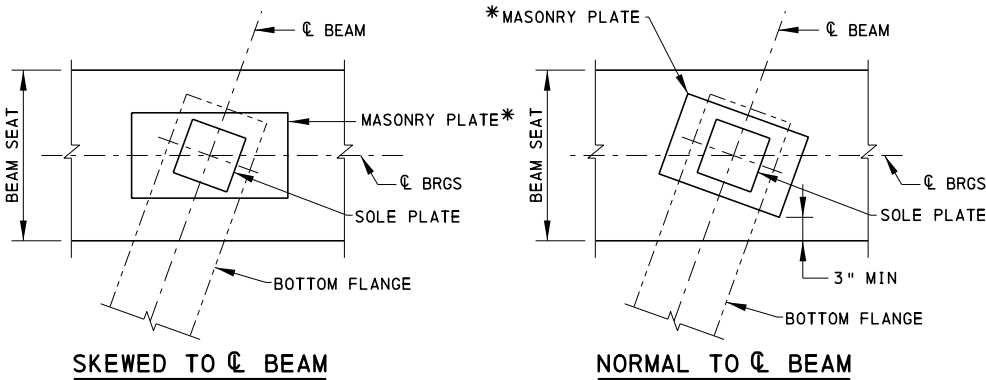
3. DETERMINE THE CONTROLLING MINIMUM AND MAXIMUM VERTICAL DESIGN LOAD REACTIONS AND THE MAXIMUM HORIZONTAL DESIGN LOAD. THESE ARE THE DESIGN LOADS TO BE USED WITH THE DESIGN TABLES. IF THE MAXIMUM DESIGN LOAD IS GREATER THAN 1500 KIPS THESE DESIGN STANDARDS ARE NOT APPLICABLE.
4. CALCULATE THE MAXIMUM GIRDER END ROTATION ABOUT EACH AXIS DUE TO MAXIMUM LIVE LOAD PLUS IMPACT AS WELL AS ALL PERMANENT LOADS AND GEOMETRIC CONSTRAINTS SUCH AS ROADWAY GEOMETRY AND CAMBER. ALL OR MOST OF THE ROTATION DUE TO PERMANENT LOADS AND GEOMETRY MAY BE ACCOMMODATED BY BEVELING THE SOLE PLATE. INCLUDE THE ROTATIONS NOT ACCOMMODATED BY THE BEVELED SOLE PLATE IN THE DESIGN ROTATION. COMPUTE THE VECTOR RESULTANT SUM OF THE TRANSVERSE AND LONGITUDINAL ROTATIONS AND ADD 0.02 RADIAN FOR CONSTRUCTION TOLERANCE. IF THE TOTAL ROTATION INCLUDING THE CONSTRUCTION TOLERANCE EXCEEDS 0.03 RADIAN, THE DESIGN TABLES ARE NOT APPLICABLE. COMPUTE ROTATIONS USING THE SERVICE I LIMIT STATE FOR LRFD DESIGNS. COMPUTE ROTATIONS USING APPLICABLE SERVICE LOAD GROUPS FOR DESIGNS USING STANDARD SPECIFICATIONS.
5. FOR FIXED AND GUIDED BEARINGS, COMPUTE THE RATIO OF THE MAXIMUM HORIZONTAL DESIGN LOAD TO THE MAXIMUM VERTICAL DESIGN LOAD (H/V)<sub>DES</sub> ON THE BEARING. FOR (H/V)<sub>DES</sub> RATIOS LESS THAN OR EQUAL TO 0.10, USE THE 10% HORIZONTAL LOAD TABLES. FOR (H/V)<sub>DES</sub> RATIOS GREATER THAN 0.10 AND LESS THAN OR EQUAL TO 0.30, USE THE 30% HORIZONTAL LOAD TABLES.

NOTE THAT IT IS ACCEPTABLE TO USE BEARINGS WITH VERTICAL LOAD CAPACITIES GREATER THAN THE MAXIMUM VERTICAL DESIGN LOAD TO PROVIDE A GREATER HORIZONTAL LOAD CAPACITY. THIS PROCEDURE MAY BE USED FOR THE SELECTION OF MORE ECONOMICAL BEARINGS OR TO ACHIEVE A SATISFACTORY DESIGN WHERE THE PRELIMINARY BEARING SELECTION DOES NOT SATISFY THE (H/V)<sub>DES</sub> RATIO CRITERIA OF 0.30.

6. CHOOSE THE APPROPRIATE DESIGN TABLE. TABLES ARE DIVIDED BASED ON BEARING TYPE AND H/V RATIOS.
7. SELECT A PRELIMINARY BEARING SIZE FROM THE DESIGN TABLES WITH A LOAD CAPACITY EQUAL TO OR EXCEEDING THE DESIGN LOAD IN BOTH THE HORIZONTAL AND VERTICAL DIRECTIONS.
8. COMPUTE THE RATIO OF THE MINIMUM VERTICAL DESIGN LOAD TO VERTICAL LOAD CAPACITY OF THE BEARING. IF THIS RATIO IS LESS THAN 0.20, THE DESIGN TABLES ARE NOT APPLICABLE.
9. FOR GUIDED AND NON-GUIDED BEARINGS, CALCULATE THE TOTAL LONGITUDINAL MOVEMENT (NOT INCLUDING THE 1" CONSTRUCTION TOLERANCE IN EACH DIRECTION). IF THE TOTAL LONGITUDINAL MOVEMENT IS GREATER THAN 3", INCREASE THE FOLLOWING DIMENSIONS AN AMOUNT EQUAL TO THE TOTAL LONGITUDINAL MOVEMENT MINUS 3"
  - SOLE PLATE: "J"
  - STAINLESS STEEL PLATES: "LL" AND "NN"
  - GUIDE BARS: "CC"
10. ONCE ALL DESIGN LOAD CRITERIA ARE SATISFIED, THE BEARING DIMENSIONS SHOWN IN THE DESIGN TABLES FOR THE INDIVIDUAL BEARING MAY BE USED.
11. DESIGN THE CONNECTION OF THE SOLE PLATE TO THE GIRDER IN ACCORDANCE WITH THE SCHEMATICS OF BC-756M AND THE AASHTO BRIDGE DESIGN SPECIFICATIONS. ALL TABULATED SOLE PLATE DIMENSIONS ARE MINIMUMS.

INSTRUCTIONS FOR USING DESIGN TABLES CON'T:

12. WHERE THE CENTERLINE OF THE MASONRY PLATE IS NOT PARALLEL TO THE CENTERLINE OF THE BEAM AND SOLE PLATE, COMPUTE CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE AND GUIDE BARS. IF REQUIRED, TO PROVIDE NECESSARY CLEARANCES, RESIZE THE FOLLOWING MASONRY PLATE DIMENSIONS:
  - MASONRY PLATE WIDTH: "B"
  - MASONRY PLATE LENGTH: "C"
  - MASONRY PLATE THICKNESS: "A"
  - ANCHOR BOLT LOCATION: "D"
13. CHECK OVERALL GEOMETRY AND VERIFY THAT ALL OTHER DESIGN REQUIREMENTS ARE SATISFIED. RECOMPUTE THE BEARING HEIGHT, "PP", WHEN BEVELED SOLE PLATES ARE USED AND/OR THE MASONRY PLATE THICKNESS IS INCREASED.
14. CHECK THAT ANCHOR BOLTS DO NOT INTERFERE WITH PIER OR ABUTMENT REINFORCEMENT, AND THAT THE BEARING ASSEMBLY MEETS ALL CLEARANCE REQUIREMENTS RELATIVE TO ITS PLACEMENT ON THE SUBSTRUCTURE AND CONNECTION TO THE SUPERSTRUCTURE.



SOLE AND MASONRY PLATE ORIENTATION OPTIONS

\*- TO FACILITATE FUTURE REPLACEMENT, CONSIDER SIZING MASONRY PLATE AND LOCATING ANCHOR BOLTS SO THAT THE BOLTS ARE NOT BENEATH THE GIRDER FLANGE.

INDEX OF SHEETS	
SHEET NO.	SHEET TITLE
1	DESIGN METHODOLOGY
2	ILLUSTRATIVE DESIGN EXAMPLE
3	EXAMPLE BEARING LOCATION PLAN AND LOAD TABLE
4	FIXED - 10% AND 30% HORIZONTAL LOAD (DESIGN TABLES)
5	NON-GUIDED (DESIGN TABLE)
6	GUIDED - 10% HORIZONTAL LOAD (DESIGN TABLE)
7	GUIDED - 30% HORIZONTAL LOAD (DESIGN TABLE)

STANDARD ABBREVIATIONS:

HLMR - HIGH LOAD MULTI-ROTATIONAL  
DIA. - DIAMETER  
I.D. - INSIDE DIAMETER  
Ø - DIAMETER  
PTFE - POLYTETRAFLUOROETHYLENE  
G.P. = GUIDE PLATE  
G.B. = GUIDE BAR

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
HIGH LOAD MULTI-ROTATIONAL  
POT BEARINGS  
DESIGN METHODOLOGY

		RECOMMENDED NOV. 23, 2022	RECOMMENDED NOV. 23, 2022	SHEET 1 OF 7
BC-756M	HIGH LOAD MUTI ROTATIONAL POT BEARINGS	<i>L. W. Gray</i> CHIEF BRIDGE ENGINEER	<i>Gavin E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMINISTRATION	BD-613M
REFERENCE DRAWINGS				

GUIDED POT BEARING DESIGN EXAMPLE  
LRFD SPECIFICATIONS

AASHTO LRFD LIMIT STATES	DESIGN LOADS (KIPS)										
	VERTICAL								HORIZONTAL		
	DL		LL+I		WIND		TOTAL		TRANSVERSE	LONGITUDINAL	RESOLUTION
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
SERVICE I	200	220	-5	124	-7	20	188	364	44	0	44
EXTREME EVENT I	180	250	0	0	0	0	180	250	46	0	46/1.5=30.7

PARAMETERS:

DESIGN LOADS: SEE BEARING SCHEDULE  
SKEW ANGLE: 70 DEGREES  
SERVICE LOAD ROTATION: 0.007 RADIAN  
TOTAL LONGITUDINAL MOVEMENT: 2.70" (2 X CONTRACTION OF 1.35")

DESIGN:

- DETERMINE CONTROLLING DESIGN LOADS (SEE TABLE):  
VERTICAL LOADS:  
MAXIMUM: 364 KIPS  
MINIMUM: 180 KIPS  
  
HORIZONTAL LOAD: 44 KIPS
- CHECK ROTATIONAL CAPACITY:  
  
SERVICE ROTATION = 0.007 RADIAN  
CONSTRUCTION ROTATION TOLERANCE = 0.02 RADIAN  
DESIGN ROTATION = 0.007 + 0.02 = 0.027 RADIAN < 0.03 OK  
TO USE DESIGN TABLES
- SELECT APPROPRIATE LOAD TABLE:  
  
DESIGN HORIZONTAL LOAD/DESIGN VERTICAL LOAD = 44/364 = 12%  
TRY 30% LOAD TABLES
- SELECT PRELIMINARY BEARING SIZE:  
  
REQUIRED VERTICAL LOAD CAPACITY = 364 KIPS  
REQUIRED HORIZONTAL LOAD CAPACITY = 44  
TRY 400 KIP BEARING > 364 OK  
HORIZONTAL LOAD CAPACITY 120 > 44 OK  
  
ALTERNATIVELY, A 450 KIP BEARING FROM THE 10% LOAD TABLE COULD BE  
SELECTED SINCE THE HORIZONTAL CAPACITY IS LISTED AS 45 KIPS WHICH IS > THAN  
THE 44 KIP DESIGN LOAD.
- CHECK 20% VERTICAL LOAD CRITERION  
  
VERTICAL CAPACITY = 400 KIPS  
MINIMUM VERTICAL LOAD = 180 KIPS  
MINIMUM VERTICAL DESIGN LOAD / VERTICAL CAPACITY = 180/400 = 0.45 > 0.20 OK
- CHECK ALTERNATIVE DESIGN(USING 10% DESIGN TABLE):  
  
VERTICAL CAPACITY = 450 KIPS  
MINIMUM VERTICAL DESIGN LOAD /VERTICAL CAPACITY = 180/450 = 0.33 > 0.20 OK  
  
ALTHOUGH BOTH BEARINGS SATISFY THE LOAD CHECKS, ONE MAY BE MORE APPROPRIATE  
FOR A PARTICULAR APPLICATION. SELECT MOST APPROPRIATE BEARING.
- CHECK MOVEMENT CAPACITY:  
TOTAL MOVEMENT = 2 X ONE-WAY MOVEMENT = 2 X 1.35" = 2.70" < 3.0" OK
- ONCE ALL DESIGN LOAD CRITERIA ARE SATISFIED, THE BEARING DIMENSIONS SHOWN  
IN THE DESIGN TABLES FOR THE INDIVIDUAL BEARING MAY BE USED.
- DESIGN THE CONNECTION OF THE SOLE PLATE TO THE GIRDER IN ACCORDANCE  
WITH THE SCHEMATICS OF BC-756M AND THE AASHTO BRIDGE DESIGN  
SPECIFICATIONS. ALL TABULATED SOLE PLATE DIMENSIONS ARE MINIMUMS.
- IF THE CENTERLINE OF THE MASONRY PLATE IS NOT PARALLEL TO THE CENTERLINE  
OF THE BEAM AND SOLE PLATE, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND  
THE SOLE PLATE AND GUIDE BARS MUST BE CHECKED. IF REQUIRED TO PROVIDE  
NECESSARY CLEARANCES, RESIZE THE FOLLOWING MASONRY PLATE DIMENSIONS:  
  
MASONRY PLATE WIDTH: "B"  
MASONRY PLATE LENGTH: "C"  
MASONRY PLATE THICKNESS: "A"  
ANCHOR BOLT LOCATION: "D"
- CHECK OVERALL GEOMETRY AND VERIFY THAT ALL OTHER DESIGN REQUIREMENTS ARE  
SATISFIED. RECOMPUTE THE BEARING HEIGHT, "PP", WHEN BEVELED SOLE PLATES  
ARE USED AND/OR THE MASONRY PLATE THICKNESS IS INCREASED.
- CHECK THAT ANCHOR BOLTS DO NOT INTERFERE WITH PIER OR ABUTMENT  
REINFORCEMENT, AND THAT THE BEARING ASSEMBLY MEETS ALL CLEARANCE  
REQUIREMENTS RELATIVE TO ITS PLACEMENT ON THE SUBSTRUCTURE AND CONNECTION  
TO THE SUPERSTRUCTURE.

GUIDED POT BEARING DESIGN EXAMPLE  
STANDARD SPECIFICATIONS - SERVICE LOAD DESIGN

AASHTO SERVICE LOAD GROUP	DESIGN LOADS (KIPS)										
	VERTICAL								HORIZONTAL		
	DL		LL+I		WIND		TOTAL		TRANSVERSE	LONGITUDINAL	RESOLUTION
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
1	200	220	-5	124	-	-	195	344	0	0	0
2	200	220	-	-	-7	20	193	240/1.25=192	38	0	38/1.25=30.4
3	200	220	-5	124	-2	6	193	350/1.25=280	22	0	22/1.25=17.6
4	200	220	-5	124	-	-	195	344/1.25=275.2	0	0	0
5	200	220	-	-	-7	20	193	240/1.4=171.4	38	0	38/1.4=27.1
6	200	220	-5	124	-2	6	193	350/1.4=250	22	0	22/1.4=15.7
7	200	220	-	-	-	-	200	220/1.5=146.7	46	0	46/1.5=30.7

PARAMETERS:

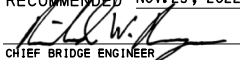
DESIGN LOADS: SEE BEARING SCHEDULE  
SKEW ANGLE: 70 DEGREES  
SERVICE LOAD ROTATION: 0.007 RADIAN  
TOTAL LONGITUDINAL MOVEMENT: 2.70" (2 X CONTRACTION OF 1.35")


DESIGN:

- DETERMINE CONTROLLING DESIGN LOADS(SEE TABLE):  
VERTICAL LOADS:  
MAXIMUM: 344 KIPS  
MINIMUM: 193 KIPS  
  
HORIZONTAL LOAD: 30.7 KIPS
- CHECK ROTATIONAL CAPACITY:  
  
SERVICE ROTATION = 0.007 RADIAN  
CONSTRUCTION ROTATION TOLERANCE = 0.02 RADIAN  
DESIGN ROTATION = 0.007 + 0.02 = 0.027 RADIAN < 0.03 OK  
TO USE DESIGN TABLES
- SELECT APPROPRIATE LOAD TABLE:  
  
DESIGN HORIZONTAL LOAD/DESIGN VERTICAL LOAD = 30.7/344 = 8.9%  
USE 10% LOAD TABLES
- SELECT PRELIMINARY BEARING SIZE:  
  
REQUIRED VERTICAL LOAD CAPACITY = 344 KIPS  
REQUIRED HORIZONTAL LOAD CAPACITY = 30.7 KIPS  
TRY 350 KIP BEARING > 344 OK  
HORIZONTAL LOAD CAPACITY 35 > 30.7 OK
- CHECK 20% VERTICAL LOAD CRITERION  
  
VERTICAL CAPACITY = 350 KIPS  
MINIMUM VERTICAL DESIGN LOAD / VERTICAL CAPACITY = 193/350 = 0.55 > 0.20 OK
- CHECK MOVEMENT CAPACITY:  
TOTAL LONGITUDINAL MOVEMENT = 2 X ONE-WAY MOVEMENT = 2 X 1.35" = 2.70" < 3.0" OK
- ONCE ALL DESIGN LOAD CRITERIA ARE SATISFIED, THE BEARING DIMENSIONS SHOWN  
IN THE DESIGN TABLES FOR THE INDIVIDUAL BEARING MAY BE USED.
- DESIGN THE CONNECTION OF THE SOLE PLATE TO THE GIRDER IN ACCORDANCE  
WITH THE SCHEMATICS OF BC-756M AND THE AASHTO BRIDGE DESIGN  
SPECIFICATIONS. ALL TABULATED SOLE PLATE DIMENSIONS ARE MINIMUMS.
- IF THE CENTERLINE OF THE MASONRY PLATE IS NOT PARALLEL TO THE CENTERLINE  
OF THE BEAM AND SOLE PLATE, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND  
THE SOLE PLATE AND GUIDE BARS MUST BE CHECKED. IF REQUIRED TO PROVIDE  
NECESSARY CLEARANCES, RESIZE THE FOLLOWING MASONRY PLATE DIMENSIONS:  
  
MASONRY PLATE WIDTH: "B"  
MASONRY PLATE LENGTH: "C"  
MASONRY PLATE THICKNESS: "A"  
ANCHOR BOLT LOCATION: "D"
- CHECK OVERALL GEOMETRY AND VERIFY THAT ALL OTHER DESIGN REQUIREMENTS ARE  
SATISFIED. RECOMPUTE THE BEARING HEIGHT, "PP", WHEN BEVELED SOLE PLATES  
ARE USED AND/OR THE MASONRY PLATE THICKNESS IS INCREASED.
- CHECK THAT ANCHOR BOLTS DO NOT INTERFERE WITH PIER OR ABUTMENT  
REINFORCEMENT, AND THAT THE BEARING ASSEMBLY MEETS ALL CLEARANCE  
REQUIREMENTS RELATIVE TO ITS PLACEMENT ON THE SUBSTRUCTURE AND CONNECTION  
TO THE SUPERSTRUCTURE.

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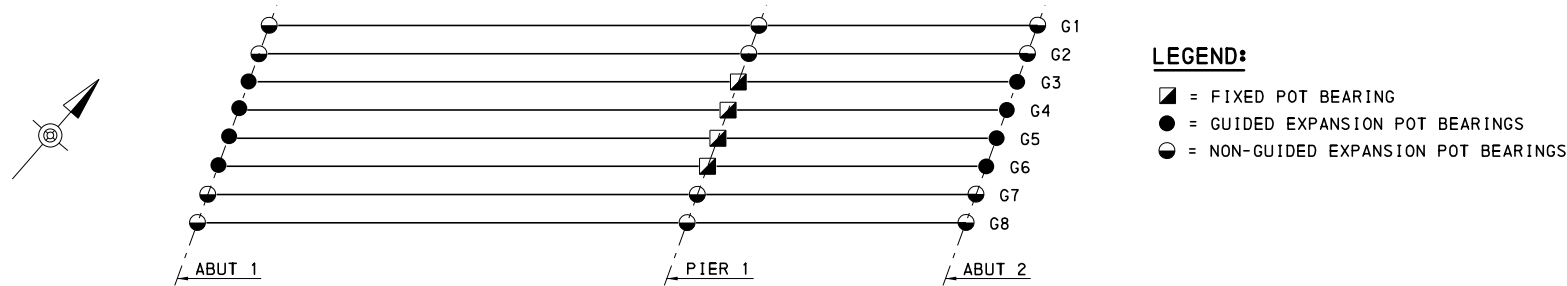
STANDARD  
HIGH LOAD MULTI-ROTATIONAL  
POT BEARINGS  
ILLUSTRATIVE DESIGN EXAMPLE

RECOMMENDED NOV. 23, 2022  
  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
  
CHIEF ENGINEER, HIGHWAY ADMIN

SHEET 2 OF 7

BD-613M



SCHMATIC POT BEARING LOCATION PLAN

FACTORED LOADS (kips)													BEARING SIZE REQUIRED		NUMBER OF BEARINGS REQUIRED
LOCATION	BEARING TYPE *	LIMIT STATE	VERTICAL						HORIZONTAL			MAXIMUM MOVEMENT (ONE-WAY) (INCHES)	VERTICAL LOAD (kips)	HORIZONTAL LOAD (kips)	
			DL		LL+I		TOTAL		TRANSVERSE	LONGITUDINAL	RESOLUTION				
			MIN	MAX	MIN	MAX	MIN	MAX							
ABUT 1	GUIDED EXP	SER I	124.0	177.7	-6.1	128.6	118.0	306.2	24.8	0	24.8	2.29 "	350	105	4
		EXT I	155.0	227.8	0	0	155.0	227.8	77.4	0	77.4/1.5 = 51.60				
	NON-GUIDED EXP	SER I	124.1	211.5	-6.1	128.6	118.1	340.1	0	0	0	2.29 "	350	35	4
		EXT I	155.2	270.1	0	0	155.2	270.1	0	0	0				
PIER	FIX	SER I	313.5	366.4	0	253.7	313.5	620.0	39.9	39.6	56.2	0 "	750	225	4
		EXT I	391.8	471.2	0	0	391.8	471.2	161.5	278.3	326.8/1.5 = 217.9				
	NON-GUIDED EXP	SER I	317.7	446.6	0	253.7	317.7	700.2	0	0	0	0 "	750	75	4
		EXT I	397.2	571.5	0	0	397.2	571.5	0	0	0				
ABUT 2	GUIDED EXP	SER I	100.9	131.9	-33.4	110.8	67.5	242.7	15.2	0	15.2	1.70 "	300	30	4
		EXT I	63.7	117.4	0	0	63.7	117.4	39.5	0	39.5/1.5 = 26.3				
	NON-GUIDED EXP	SER I	100.0	138.2	-33.4	110.8	66.6	249.1	0	0	0	1.70 "	250	25	4
		EXT I	62.5	137.8	0	0	62.5	137.8	0	0	0				

\* SEE BC-756M FOR DETAILS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
HIGH LOAD MULTI-ROTATIONAL  
POT BEARINGS  
EXAMPLE BEARING LOCATION PLAN  
AND LOAD TABLE

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 3 OF 7

BD-613M

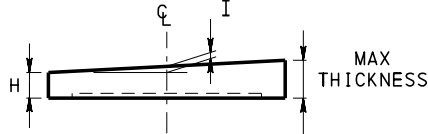
DESIGN TABLES FOR FIXED POT BEARINGS ( 10% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE▲						ANCHOR BOLT		SOLE PLATE▲			POT							NEOPRENE DISC			PISTON				BEARING * HEIGHT
			A	B	C	D	E	F	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	
200	20	0.03	1½ "	11 ⅞ "	19 ⅜ "	7 ⅞ "	3 ⅞ "	-	4	1¼ "	⅜ "	PER DESIGN ( BEVELED SOLE PLATE)	10 ⅜ "	10 ⅜ "	2 ⅞ "	10 ⅜ "	1½ "	9 ⅞ "	¼ "	¾ "	1 "	8 ⅞ "	⅜ "	1 ⅞ "	8.835	5 ⅞ "	¼ "	5 ⅞ "
250	25	0.03	1½ "	13 ⅞ "	20 ⅝ "	8 ⅞ "	4 ⅝ "	-	4	1¼ "	⅜ "		11 ⅞ "	11 ⅝ "	2 ⅞ "	11 ⅞ "	1 ⅞ "	⅝ "	¼ "	⅞ "	1 "	9 ⅞ "	⅜ "	1 ⅞ "	9.835	5 ⅞ "	¼ "	5 ⅜ "
300	30	0.03	1½ "	14 "	21½ "	8½ "	4 ¾ "	-	4	1¼ "	⅜ "		12½ "	12½ "	2 ⅝ "	12½ "	1¾ "	9 ⅞ "	¼ "	⅞ "	1 ⅞ "	10¾ "	⅜ "	1¼ "	10.710	3 ⅞ "	¼ "	5 ⅝ "
350	35	0.03	1½ "	15¼ "	22 ⅝ "	9 ⅞ "	5 ⅜ "	-	4	1¼ "	⅜ "		13 ⅝ "	13 ⅜ "	2 ⅞ "	13 ⅝ "	1 ⅞ "	9 ⅞ "	¼ "	1 "	1¼ "	11 ⅝ "	⅜ "	1¼ "	11.585	3 ⅞ "	¼ "	5½ "
400	40	0.03	1 ⅝ "	15 ⅞ "	23 ⅜ "	9 ⅞ "	5 ⅞ "	-	4	1¼ "	⅜ "		14 ⅞ "	14 ⅜ "	2 ⅞ "	14 ⅜ "	1 ⅝ "	⅝ "	¼ "	1 "	1¼ "	12 ⅜ "	⅜ "	1¼ "	12.335	3 ⅞ "	¼ "	5 ⅞ "
450	45	0.03	1 ⅝ "	16 ⅞ "	24 ⅜ "	9 ⅝ "	6 ⅜ "	-	4	1¼ "	⅜ "		15 ⅜ "	15 ⅜ "	2 ¾ "	15 ⅜ "	2 ⅞ "	⅞ "	¼ "	1 ⅞ "	1 ⅜ "	13 ⅞ "	⅜ "	1 ⅜ "	13.085	7 ⅞ "	¼ "	6 "
500	50	0.03	1 ⅝ "	17½ "	25 "	10¼ "	6½ "	-	4	1¼ "	⅜ "		16 "	16 "	2 ⅜ "	16 "	2 ⅞ "	⅞ "	¼ "	1 ⅞ "	1 ⅜ "	13¾ "	⅜ "	1 ⅜ "	13.710	7 ⅞ "	¼ "	6 "
550	55	0.03	1 ⅝ "	18½ "	26 "	10¾ "	7 "	-	4	1¼ "	⅜ "		17 "	17 "	3 ⅞ "	17 "	2¼ "	⅝ "	¼ "	1¼ "	1½ "	14½ "	⅜ "	1½ "	14.460	7 ⅞ "	¼ "	6½ "
600	60	0.03	1 ⅝ "	19 ⅞ "	26 ⅝ "	11 ⅞ "	7 ⅞ "	-	4	1¼ "	⅜ "		17 ⅞ "	17 ⅝ "	3 ⅞ "	17 ⅝ "	2 ⅞ "	¾ "	¼ "	1¼ "	1 ⅝ "	15 ⅞ "	⅜ "	1½ "	15.085	½ "	¼ "	6 ⅞ "
650	65	0.03	1 ⅝ "	21¼ "	27¼ "	11 ⅜ "	8 ⅜ "	-	4	1¼ "	⅜ "		18¼ "	18¼ "	3 ⅞ "	18¼ "	2 ⅞ "	¾ "	¼ "	1¼ "	1 ⅝ "	15¾ "	⅜ "	1½ "	15.710	½ "	¼ "	6 ⅞ "
700	70	0.03	1 ⅝ "	22½ "	28 "	11¾ "	9 "	-	4	1¼ "	⅜ "		19 "	19 "	3 ⅞ "	19 "	2½ "	⅝ "	¼ "	1 ⅜ "	1 ⅝ "	16¼ "	⅜ "	1½ "	16.210	½ "	¼ "	6 ⅝ "
750	75	0.03	1 ⅝ "	23¾ "	28 ⅝ "	12 ⅞ "	9 ⅝ "	-	4	1¼ "	⅜ "		19 ⅝ "	19 ⅝ "	3 ⅞ "	19 ⅝ "	2 ⅝ "	⅝ "	¼ "	1 ⅜ "	1¾ "	16 ⅞ "	⅜ "	1 ⅝ "	16.835	½ "	¼ "	6¾ "
800	80	0.03	1 ⅝ "	24 ⅞ "	29 ⅜ "	12 ⅞ "	10 ⅜ "	-	4	1¼ "	⅜ "		20 ⅜ "	20 ⅜ "	3 ⅞ "	20 ⅜ "	2 ⅞ "	1 "	¼ "	1½ "	1¾ "	17 ⅜ "	⅜ "	1 ⅝ "	17.335	9 ⅞ "	¼ "	6 ⅝ "
850	85	0.03	1 ⅝ "	26 ⅞ "	29 ⅞ "	12 ⅞ "	10 ⅜ "	-	4	1¼ "	⅜ "		20 ⅞ "	20 ⅞ "	3 ⅞ "	20 ⅞ "	2 ⅜ "	⅞ "	¼ "	1½ "	1 ⅞ "	17 ⅜ "	⅜ "	1 ⅝ "	17.835	9 ⅞ "	¼ "	6 ⅝ "
900	90	0.03	1 ⅞ "	26 ⅞ "	31 ⅞ "	13 ⅝ "	10 ⅞ "	-	4	1½ "	⅜ "		21 ⅜ "	21 ⅜ "	3 ⅞ "	21 ⅜ "	2 ⅜ "	⅞ "	¼ "	1½ "	1 ⅞ "	18 ⅜ "	⅜ "	1 ⅝ "	18.335	9 ⅞ "	¼ "	7 ⅞ "
950	95	0.03	1 ⅞ "	27 "	32 ⅝ "	13 ⅞ "	10 ⅞ "	-	4	1½ "	⅜ "		22 ⅞ "	22 ⅞ "	3 ⅝ "	22 ⅞ "	3 "	⅝ "	¼ "	1 ⅝ "	2 "	18 ⅞ "	½ "	1¾ "	18.835	9 ⅞ "	¼ "	7½ "
1000	100	0.03	1 ⅞ "	28 ⅞ "	33 ⅞ "	13 ⅝ "	11 ⅞ "	-	4	1½ "	⅜ "		22 ⅝ "	22 ⅝ "	3 ⅝ "	22 ⅝ "	3 "	⅝ "	¼ "	1 ⅝ "	2 "	19 ⅜ "	½ "	1¾ "	19.335	5 ⅞ "	¼ "	7 ⅞ "
1100	110	0.03	1 ⅞ "	30¼ "	34 ⅞ "	14 ⅞ "	12½ "	-	4	1½ "	⅜ "		23 ⅝ "	23 ⅝ "	4 ⅜ "	23 ⅝ "	3 ⅞ "	1 "	¼ "	1 ⅝ "	2 ⅞ "	20 ⅜ "	⅜ "	1¾ "	20.335	5 ⅞ "	¼ "	7 ⅞ "
1200	120	0.03	1 ⅞ "	32 ⅞ "	35¼ "	15 "	13 ⅞ "	-	4	1½ "	⅜ "		24¾ "	24¾ "	4 ⅞ "	24¾ "	3 ⅞ "	1 "	¼ "	1¾ "	2½ "	21¼ "	½ "	1 ⅞ "	21.210	⅞ "	¼ "	7 ⅜ "
1300	130	0.03	2 "	33 ⅞ "	37¾ "	15 ⅞ "	13 ⅝ "	-	4	1¾ "	⅜ "		25¾ "	25¾ "	4 ⅞ "	25¾ "	3 ⅜ "	1 ⅞ "	¼ "	1 ⅞ "	2¼ "	22 "	½ "	1 ⅞ "	21.960	⅞ "	¼ "	8 ⅞ "
1400	140	0.03	2 "	35 ⅞ "	38 ⅝ "	16 ⅞ "	14 ⅜ "	-	4	1¾ "	⅜ "		26 ⅞ "	26 ⅞ "	4 ⅞ "	26 ⅞ "	3½ "	1 ⅞ "	¼ "	1 ⅞ "	2 ⅜ "	22 ⅞ "	½ "	2 "	22.835	⅞ "	¼ "	8½ "
1500	150	0.03	2 "	37¼ "	39 ⅝ "	16 ⅜ "	15 ⅝ "	-	4	1¾ "	⅜ "		27 ⅞ "	27 ⅞ "	4 ⅞ "	27 ⅞ "	3 ⅞ "	1 ⅞ "	¼ "	2 "	2 ⅜ "	23 ⅝ "	½ "	2 "	23.585	¾ "	¼ "	8 ⅞ "

DESIGN TABLES FOR FIXED POT BEARINGS ( 30% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲			POT						NEOPRENE DISC			PISTON				BEARING * HEIGHT		
			A	B	C	D	E	F	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W		X	PP
200	60	0.03	1 ⅜ "	12 ⅞ "	20 ⅜ "	7 ⅞ "	4 ⅜ "	-	4	1 ¼ "	⅜ "	PER DESIGN ( BEVELED SOLE PLATE)	11 ⅜ "	11 ⅜ "	2 ¼ "	11 ⅜ "	1 ⅝ "	⅝ "	¼ "	1 ¼ "	1 "	8 ⅞ "	⅜ "	1 ⅞ "	1 ⅞ "	8.835	⅝ "	¼ "	5 ⅞ "
250	75	0.03	1 ⅜ "	14 ⅞ "	21 ⅝ "	8 ⅞ "	4 ⅜ "	-	4	1 ¼ "	⅜ "		12 ⅝ "	12 ⅝ "	2 ⅜ "	12 ⅝ "	1 ⅝ "	⅞ "	¼ "	1 ⅜ "	1 "	9 ⅞ "	⅜ "	1 ¼ "	9.835	⅝ "	¼ "	5 ⅞ "	
300	90	0.03	1 ⅝ "	15 ¼ "	24 ¼ "	9 ½ "	5 "	-	4	1 ½ "	⅜ "		13 ¾ "	13 ¾ "	2 ⅞ "	13 ¾ "	1 ⅜ "	⅝ "	¼ "	1 ½ "	1 ⅞ "	10 ¾ "	⅜ "	1 ⅜ "	10.710	7 ⅞ "	¼ "	5 ⅞ "	
350	105	0.03	1 ⅝ "	16 ⅜ "	25 ⅜ "	10 ⅞ "	5 ⅞ "	-	4	1 ½ "	⅜ "		14 ⅞ "	14 ⅞ "	2 ⅞ "	14 ⅞ "	2 "	⅞ "	¼ "	1 ⅝ "	1 ¼ "	11 ⅝ "	⅜ "	1 ⅜ "	11.585	7 ⅞ "	¼ "	5 ¾ "	
400	120	0.03	1 ⅝ "	17 ⅜ "	26 ⅜ "	10 ⅞ "	6 ⅞ "	-	4	1 ½ "	⅜ "		15 ⅞ "	15 ⅞ "	2 ⅞ "	15 ⅞ "	2 ⅞ "	⅝ "	¼ "	1 ¾ "	1 ¼ "	12 ⅜ "	⅜ "	1 ½ "	12.335	½ "	¼ "	5 ⅝ "	
450	135	0.03	1 ⅞ "	18 ⅜ "	28 ⅞ "	11 ⅞ "	6 ⅜ "	-	4	1 ¾ "	⅜ "		16 ⅞ "	16 ⅞ "	2 ⅝ "	16 ⅞ "	2 ¼ "	⅞ "	¼ "	1 ⅞ "	1 ⅜ "	13 ⅞ "	⅜ "	1 ½ "	13.085	½ "	¼ "	6 ⅜ "	
500	150	0.03	1 ⅞ "	19 ¼ "	29 ¾ "	11 ⅞ "	6 ⅝ "	-	4	1 ¾ "	⅜ "		17 ¾ "	17 ¾ "	2 ⅝ "	17 ¾ "	2 ¼ "	⅞ "	¼ "	2 "	1 ⅜ "	13 ¾ "	⅜ "	1 ½ "	13.710	9 ⅞ "	⅝ "	6 ⅜ "	
550	165	0.03	1 ⅞ "	20 ¼ "	30 ½ "	12 ¼ "	7 ⅞ "	-	4	1 ¾ "	⅜ "		18 ½ "	18 ½ "	3 ⅞ "	18 ½ "	2 ⅞ "	¾ "	¼ "	2 "	1 ½ "	14 ½ "	⅜ "	1 ⅝ "	14.460	9 ⅞ "	⅝ "	6 ⅞ "	
600	180	0.03	2 ⅞ "	20 ⅞ "	32 ⅞ "	13 ⅞ "	7 ⅞ "	-	4	2 "	⅜ "		19 ⅜ "	19 ⅜ "	3 ⅞ "	19 ⅜ "	2 ⅞ "	⅞ "	¼ "	2 ⅞ "	1 ⅝ "	15 ⅞ "	⅜ "	1 ⅝ "	15.085	5 ⅞ "	⅝ "	7 ⅜ "	
650	195	0.03	2 ⅞ "	21 ¾ "	33 ¾ "	13 ½ "	7 ½ "	-	4	2 "	⅜ "		20 ¼ "	20 ¼ "	3 ⅞ "	20 ¼ "	2 ⅝ "	⅞ "	¼ "	2 ¼ "	1 ⅝ "	15 ¾ "	⅜ "	1 ¾ "	15.710	5 ⅞ "	⅝ "	7 ¼ "	
700	210	0.03	2 ⅞ "	22 ½ "	34 ¼ "	13 ¾ "	7 ⅞ "	-	4	2 "	⅜ "		20 ¾ "	20 ¾ "	3 ⅞ "	20 ¾ "	2 ⅝ "	⅞ "	¼ "	2 ¼ "	1 ⅝ "	16 ¼ "	⅜ "	1 ¾ "	16.210	⅞ "	⅝ "	7 ¼ "	
750	225	0.03	2 ⅞ "	23 ⅝ "	35 ⅞ "	14 ⅜ "	8 ⅞ "	-	4	2 "	⅜ "		21 ⅝ "	21 ⅝ "	3 ⅞ "	21 ⅝ "	2 ⅜ "	⅞ "	¼ "	2 ⅜ "	1 ¾ "	16 ⅞ "	⅜ "	1 ⅞ "	16.835	⅞ "	⅝ "	7 ⅞ "	
800	240	0.03	2 "	24 "	34 ⅜ "	14 ⅞ "	9 "	-	6	1 ¾ "	⅜ "		22 ⅜ "	22 ⅜ "	3 ⅞ "	22 ⅜ "	2 ⅜ "	⅞ "	¼ "	2 ½ "	1 ¾ "	17 ⅜ "	⅜ "	1 ⅞ "	17.335	⅞ "	⅜ "	7 ⅞ "	
850	255	0.03	1 ⅝ "	24 ½ "	34 ⅞ "	14 ⅞ "	9 ¼ "	-	6	1 ¾ "	⅜ "		22 ⅞ "	22 ⅞ "	3 ⅝ "	22 ⅞ "	3 "	⅝ "	⅝ "	2 ½ "	1 ⅞ "	17 ⅞ "	⅜ "	2 "	17.835	⅞ "	⅜ "	7 ⅞ "	
900	270	0.03	2 ⅜ "	25 ¼ "	37 ⅞ "	15 ⅞ "	9 ¼ "	-	6	2 "	⅜ "		23 ⅝ "	23 ⅝ "	3 ⅝ "	23 ⅝ "	3 "	⅝ "	⅝ "	2 ⅝ "	1 ⅞ "	18 ⅜ "	⅜ "	2 "	18.335	¾ "	⅜ "	7 ⅝ "	
950	285	0.03	2 ⅜ "	25 ⅞ "	37 ⅝ "	15 ⅞ "	9 ⅞ "	-	6	2 "	⅜ "		24 ⅞ "	24 ⅞ "	4 ⅞ "	24 ⅞ "	3 ⅞ "	1 "	⅝ "	2 ⅝ "	2 "	18 ⅞ "	½ "	2 "	18.835	¾ "	⅜ "	8 ⅞ "	
1000	300	0.03	2 ⅜ "	26 ⅝ "	38 ⅜ "	15 ⅜ "	9 ⅝ "	-	6	2 "	⅜ "		24 ⅞ "	24 ⅞ "	4 ⅞ "	24 ⅞ "	3 ⅞ "	1 "	⅝ "	2 ¾ "	2 "	19 ⅜ "	½ "	2 ⅞ "	19.335	¾ "	⅜ "	8 ¼ "	
1100	330	0.03	2 ⅜ "	28 ⅝ "	39 ⅝ "	16 ⅞ "	10 ⅝ "	-	6	2 "	⅜ "		26 ⅞ "	26 ⅞ "	4 ⅞ "	26 ⅞ "	3 ⅜ "	1 ⅞ "	⅝ "	2 ⅞ "	2 ⅞ "	20 ⅜ "	½ "	2 ⅞ "	20.335	⅝ "	7 ⅞ "	8 ⅞ "	
1200	360	0.03	2 ⅝ "	29 ⅞ "	40 ¾ "	17 "	11 ⅞ "	5 "	8	2 "	⅜ "		27 ¼ "	27 ¼ "	4 ⅞ "	27 ¼ "	3 ⅞ "	1 "	⅝ "	3 "	2 ⅞ "	21 ¼ "	½ "	2 ¼ "	21.210	7 ⅞ "	7 ⅞ "	8 ⅝ "	
1300	390	0.03	2 ¼ "	30 ¼ "	41 ¾ "	17 ½ "	11 ¾ "	5 ⅞ "	8	2 "	⅜ "		28 ¼ "	28 ¼ "	4 ⅝ "	28 ¼ "	3 ⅞ "	1 ⅞ "	⅜ "	3 ⅞ "	2 ¼ "	22 "	½ "	2 ⅜ "	21.960	7 ⅞ "	7 ⅞ "	8 ⅞ "	
1400	420	0.03	2 ¼ "	31 ½ "	42 ⅞ "	18 ⅞ "	12 ⅜ "	5 ¼ "	8	2 "	⅜ "		29 ⅞ "	29 ⅜ "	4 ⅝ "	29 ⅜ "	3 ¾ "	1 ⅞ "	⅜ "	3 ¼ "	2 ⅜ "	22 ⅞ "	½ "	2 ⅜ "	22.835	⅝ "	7 ⅞ "	9 ⅞ "	
1500	450	0.03	2 ¼ "	33 "	43 ⅞ "	18 ⅞ "	13 ⅞ "	5 ½ "	8	2 "	⅜ "		30 ⅜ "	30 ⅜ "	4 ⅝ "	30 ⅜ "	3 ⅜ "	1 ⅞ "	⅜ "	3 ⅜ "	2 ⅜ "	23 ⅝ "	½ "	2 ½ "	23.585	⅝ "	½ "	9 ⅜ "	

▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTRESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.



BEVELED SOLE PLATE DETAIL

\*- BEARING HEIGHT INCLUDES ⅞ " BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDINGLY.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
HIGH LOAD MULTI-ROTATIONAL  
POT BEARINGS - FIXED

RECOMMENDED NOV. 23, 2022  
*L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

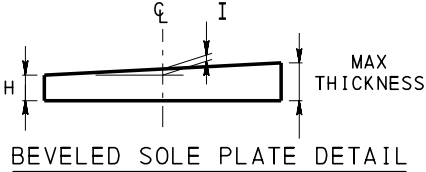
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DESIGN TABLES FOR NON-GUIDED POT BEARINGS

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲					ANCHOR BOLT		SOLE PLATE ▲				POT						NEOPRENE DISC			PISTON			PTFE	STAINLESS STEEL		BEARING * HEIGHT
			A	B	C	D	E	QTY.	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	HH	LL	MM	PP
200	20	0.03	1 1/2 "	11 7/8 "	19 7/8 "	7 11/16 "	3 11/16 "	4	1 1/4 "	13/16 "	PER DESIGN ( BEVELED SOLE PLATE )	13 7/8 "	10 7/8 "	2 1/16 "	10 3/8 "	1 1/2 "	9/16 "	1/4 "	3/4 "	1 "	8 7/8 "	3/8 "	13/16 "	8.835	5/16 "	8 5/8 "	13 5/8 "	10 5/8 "	5 "
250	25	0.03	1 1/2 "	13 1/8 "	20 7/8 "	8 3/16 "	4 5/16 "	4	1 1/4 "	13/16 "		14 7/8 "	11 7/8 "	2 3/16 "	11 3/8 "	1 9/16 "	5/8 "	1/4 "	3/4 "	1 "	9 7/8 "	3/8 "	15/16 "	9.835	5/16 "	9 5/8 "	14 5/8 "	11 5/8 "	5 3/16 "
300	30	0.03	1 5/8 "	13 3/4 "	21 3/4 "	8 5/8 "	4 5/8 "	4	1 1/4 "	13/16 "		15 3/4 "	12 3/4 "	2 5/16 "	12 1/4 "	1 3/4 "	9/16 "	1/4 "	3/4 "	1 1/8 "	10 3/4 "	3/8 "	15/16 "	10.710	3/8 "	10 1/2 "	15 1/2 "	12 1/2 "	5 3/8 "
350	35	0.03	1 5/8 "	14 5/8 "	22 3/8 "	9 1/16 "	5 1/16 "	4	1 1/4 "	13/16 "		16 3/8 "	13 3/8 "	2 3/8 "	13 1/8 "	1 7/8 "	1/2 "	1/4 "	3/4 "	1 1/4 "	11 5/8 "	3/8 "	1 1/16 "	11.585	3/8 "	11 3/8 "	16 3/8 "	13 3/8 "	5 9/16 "
400	40	0.03	1 5/8 "	16 "	23 3/8 "	9 7/16 "	5 3/4 "	4	1 1/4 "	13/16 "		17 3/8 "	14 3/8 "	2 5/8 "	13 7/8 "	1 15/16 "	11/16 "	1/4 "	3/4 "	1 1/4 "	12 3/8 "	3/8 "	1 1/16 "	12.335	3/8 "	12 1/8 "	17 7/8 "	14 1/8 "	5 3/4 "
450	45	0.03	1 3/4 "	16 1/8 "	24 1/8 "	9 13/16 "	5 13/16 "	4	1 1/4 "	13/16 "		18 1/8 "	15 1/8 "	2 13/16 "	14 3/8 "	2 1/16 "	3/4 "	1/4 "	3/4 "	1 3/8 "	13 1/8 "	3/8 "	1 1/16 "	13.085	7/16 "	12 7/8 "	17 7/8 "	14 7/8 "	6 1/16 "
500	50	0.03	1 3/4 "	17 3/8 "	24 3/4 "	10 1/8 "	6 1/16 "	4	1 1/4 "	13/16 "		18 3/4 "	15 3/4 "	2 7/8 "	15 1/4 "	2 3/16 "	11/16 "	1/4 "	3/4 "	1 3/8 "	13 3/4 "	3/8 "	1 3/16 "	13.710	7/16 "	13 1/2 "	18 1/2 "	15 1/2 "	6 1/8 "
550	55	0.03	1 3/4 "	18 7/8 "	25 1/2 "	10 1/2 "	7 3/16 "	4	1 1/4 "	13/16 "		19 1/2 "	16 1/2 "	3 1/8 "	16 "	2 1/4 "	7/8 "	1/4 "	3/4 "	1 1/2 "	14 1/2 "	3/8 "	1 3/16 "	14.460	7/16 "	14 1/4 "	19 1/4 "	16 1/4 "	6 7/16 "
600	60	0.03	1 3/4 "	20 1/4 "	26 1/8 "	10 13/16 "	7 7/8 "	4	1 1/4 "	13/16 "		20 1/8 "	17 1/8 "	3 3/16 "	16 5/8 "	2 7/16 "	3/4 "	1/4 "	3/4 "	1 5/8 "	15 1/8 "	3/8 "	1 3/16 "	15.085	1/2 "	14 7/8 "	19 7/8 "	16 7/8 "	6 1/16 "
650	65	0.03	1 3/4 "	21 5/8 "	26 3/4 "	11 1/8 "	8 9/16 "	4	1 1/4 "	13/16 "		20 3/4 "	17 3/4 "	3 3/16 "	17 1/4 "	2 7/16 "	11/16 "	1/4 "	3/4 "	1 5/8 "	15 3/4 "	3/8 "	1 5/16 "	15.710	1/2 "	15 1/2 "	20 1/2 "	17 1/2 "	6 1/2 "
700	70	0.03	1 3/4 "	23 1/8 "	27 1/4 "	11 3/8 "	9 9/16 "	4	1 1/4 "	13/16 "		21 1/4 "	18 1/4 "	3 1/16 "	17 3/4 "	2 1/2 "	15/16 "	1/4 "	3/4 "	1 5/8 "	16 1/4 "	3/8 "	1 5/16 "	16.210	1/2 "	16 "	21 "	18 "	6 3/4 "
750	75	0.03	1 3/4 "	24 3/8 "	27 7/8 "	11 11/16 "	9 15/16 "	4	1 1/4 "	13/16 "		21 7/8 "	18 7/8 "	3 1/16 "	18 3/8 "	2 5/8 "	13/16 "	1/4 "	3/4 "	1 3/4 "	16 7/8 "	3/8 "	1 5/16 "	16.835	1/2 "	16 5/8 "	21 5/8 "	18 5/8 "	6 3/4 "
800	80	0.03	1 3/4 "	25 3/4 "	28 3/8 "	11 15/16 "	10 5/8 "	4	1 1/4 "	13/16 "		22 3/8 "	19 3/8 "	3 3/4 "	18 7/8 "	2 11/16 "	11/16 "	1/4 "	3/4 "	1 3/4 "	17 3/8 "	3/8 "	1 5/16 "	17.335	3/8 "	17 1/8 "	22 1/8 "	19 1/8 "	7 "
850	85	0.03	1 3/4 "	27 "	28 7/8 "	12 3/16 "	11 1/4 "	4	1 1/4 "	13/16 "		22 7/8 "	19 7/8 "	3 11/16 "	19 3/8 "	2 13/16 "	7/8 "	1/4 "	3/4 "	1 7/8 "	17 7/8 "	3/8 "	1 7/16 "	17.835	9/16 "	17 5/8 "	22 5/8 "	19 5/8 "	7 1/16 "
900	90	0.03	1 7/8 "	27 3/8 "	30 3/8 "	12 13/16 "	11 1/16 "	4	1 1/2 "	13/16 "		23 3/8 "	20 3/8 "	3 11/16 "	19 7/8 "	2 13/16 "	7/8 "	1/4 "	3/4 "	1 7/8 "	18 3/8 "	3/8 "	1 7/16 "	18.335	9/16 "	18 1/8 "	23 1/8 "	20 1/8 "	7 3/16 "
950	95	0.03	1 7/8 "	28 1/2 "	31 3/8 "	13 1/16 "	11 5/8 "	4	1 1/2 "	13/16 "		23 7/8 "	20 7/8 "	3 15/16 "	20 3/8 "	3 "	15/16 "	1/4 "	3/4 "	2 "	18 7/8 "	1/2 "	1 7/16 "	18.835	9/16 "	18 5/8 "	23 5/8 "	20 5/8 "	7 3/8 "
1000	100	0.03	1 7/8 "	29 1/2 "	31 7/8 "	13 3/16 "	12 1/8 "	4	1 1/2 "	13/16 "	24 3/8 "	21 3/8 "	3 15/16 "	20 7/8 "	3 "	15/16 "	1/4 "	3/4 "	2 "	19 3/8 "	1/2 "	1 7/16 "	19.335	5/8 "	19 1/8 "	24 1/8 "	21 1/8 "	7 3/8 "	
1100	110	0.03	1 7/8 "	31 1/2 "	32 7/8 "	13 13/16 "	13 1/8 "	4	1 1/2 "	13/16 "	25 3/8 "	22 3/8 "	4 1/4 "	21 7/8 "	3 3/16 "	1 1/16 "	1/4 "	3/4 "	2 1/8 "	20 3/8 "	1/2 "	1 9/16 "	20.335	5/8 "	20 1/8 "	25 1/8 "	22 1/8 "	7 3/4 "	
1200	120	0.03	1 7/8 "	33 1/2 "	33 3/4 "	14 1/4 "	14 1/8 "	4	1 1/2 "	13/16 "	26 1/4 "	23 1/4 "	4 1/8 "	22 3/4 "	3 3/16 "	15/16 "	1/4 "	3/4 "	2 1/8 "	21 1/4 "	1/2 "	1 9/16 "	21.210	11/16 "	21 "	26 "	23 "	7 5/8 "	
1300	130	0.03	2 1/8 "	34 3/8 "	36 "	15 "	14 3/16 "	4	1 3/4 "	13/16 "	27 "	24 "	4 1/16 "	23 1/2 "	3 3/8 "	1 1/16 "	1/4 "	3/4 "	2 1/4 "	22 "	1/2 "	1 11/16 "	21.960	11/16 "	21 3/4 "	26 3/4 "	23 3/4 "	8 1/4 "	
1400	140	0.03	2 1/8 "	36 1/4 "	36 7/8 "	15 1/16 "	15 1/8 "	4	1 3/4 "	13/16 "	27 7/8 "	24 7/8 "	4 5/8 "	24 3/8 "	3 1/2 "	1 1/8 "	1/4 "	3/4 "	2 3/8 "	22 7/8 "	1/2 "	1 11/16 "	22.835	11/16 "	22 5/8 "	27 5/8 "	24 5/8 "	8 7/16 "	
1500	150	0.03	2 1/4 "	38 "	38 "	16 "	16 "	4	1 3/4 "	13/16 "	28 3/8 "	25 5/8 "	4 11/16 "	25 1/8 "	3 9/16 "	1 1/8 "	1/4 "	3/4 "	2 3/8 "	23 3/8 "	1/2 "	1 11/16 "	23.585	3/4 "	23 3/8 "	28 3/8 "	25 3/8 "	8 9/16 "	

▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTRESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. LOCATE TAPPED SCREWS OUTSIDE THE PERIMETER OF THE FILLET WELD TOE THAT CONNECTS THE 13 GAUGE STAINLESS STEEL TO THE SOLE PLATE. IF THE BOLT PATTERN FALLS OUTSIDE THE LIMITS OF THE EMBEDDED PLATE, HLMR POT BEARINGS SHALL NOT BE USED. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.



\*- BEARING HEIGHT INCLUDES 1/8" BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDININGLY.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
HIGH LOAD MULTI-ROTATIONAL  
POT BEARINGS - NON-GUIDED

RECOMMENDED NOV. 23, 2022  
*L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gray E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 5 OF 7

BD-613M

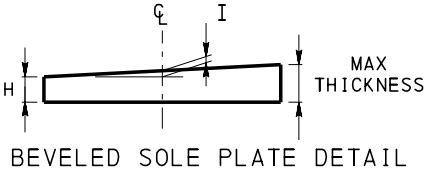


DESIGN TABLES FOR GUIDED POT BEARINGS ( 10% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲	POT								NEOPRENE DISC				PISTON				GUIDE PLATE	
			A	B	C	D	E	F	QTY.	G		H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
200	20	0.03	1 7⁄8 "	11 7⁄8 "	23 3⁄8 "	9 11⁄16 "	3 11⁄16 "	-	4	1 1⁄4 "	13⁄16 "	PER DESIGN ( BEVELED SOLE PLATE )	15 1⁄4 "	14 7⁄8 "	2 "	10 3⁄8 "	1 1⁄2 "	1⁄2 "	1⁄4 "	3⁄4 "	1 "	8 7⁄8 "	3⁄8 "	1 1⁄8 "	8.835	5⁄16 "	1⁄4 "	1 1⁄16 "	10 3⁄8 "
250	25	0.03	2 "	13 1⁄8 "	25 3⁄8 "	10 7⁄16 "	4 5⁄16 "	-	4	1 1⁄4 "	13⁄16 "		16 1⁄2 "	16 3⁄8 "	2 3⁄16 "	11 5⁄8 "	1 9⁄16 "	5⁄8 "	1⁄4 "	7⁄8 "	1 "	9 7⁄8 "	3⁄8 "	1 1⁄4 "	9.835	5⁄16 "	1⁄4 "	1 1⁄4 "	11 5⁄8 "
300	30	0.03	2 "	14 3⁄4 "	26 1⁄4 "	10 3⁄8 "	5 1⁄8 "	-	4	1 1⁄4 "	13⁄16 "		17 3⁄8 "	17 1⁄4 "	2 5⁄16 "	12 1⁄2 "	1 3⁄4 "	9⁄16 "	1⁄4 "	7⁄8 "	1 1⁄8 "	10 3⁄4 "	3⁄8 "	1 1⁄4 "	10.710	3⁄8 "	1⁄4 "	1 1⁄4 "	12 1⁄2 "
350	35	0.03	2 1⁄8 "	15 1⁄8 "	27 5⁄8 "	11 1⁄16 "	5 5⁄16 "	-	4	1 1⁄4 "	13⁄16 "		18 1⁄2 "	18 5⁄8 "	2 3⁄8 "	13 5⁄8 "	1 7⁄8 "	1⁄2 "	1⁄4 "	1 "	1 1⁄4 "	11 5⁄8 "	3⁄8 "	1 3⁄8 "	11.585	3⁄8 "	1⁄4 "	1 3⁄8 "	13 5⁄8 "
400	40	0.03	2 1⁄8 "	16 3⁄4 "	28 3⁄8 "	11 15⁄16 "	6 1⁄8 "	-	4	1 1⁄4 "	13⁄16 "		19 1⁄4 "	19 3⁄8 "	2 9⁄16 "	14 3⁄8 "	1 15⁄16 "	5⁄8 "	1⁄4 "	1 "	1 1⁄4 "	12 3⁄8 "	3⁄8 "	1 3⁄8 "	12.335	3⁄8 "	1⁄4 "	1 3⁄8 "	14 3⁄8 "
450	45	0.03	2 1⁄4 "	16 7⁄8 "	29 5⁄8 "	12 3⁄16 "	6 3⁄16 "	-	4	1 1⁄4 "	13⁄16 "		20 1⁄4 "	20 3⁄8 "	2 13⁄16 "	15 3⁄8 "	2 1⁄8 "	11⁄16 "	1⁄4 "	1 1⁄8 "	1 3⁄8 "	13 1⁄8 "	3⁄8 "	1 1⁄2 "	13.085	7⁄16 "	1⁄4 "	1 1⁄2 "	15 3⁄8 "
500	50	0.03	2 1⁄4 "	18 1⁄8 "	30 1⁄4 "	12 7⁄8 "	6 13⁄16 "	-	4	1 1⁄4 "	13⁄16 "		20 3⁄8 "	21 1⁄4 "	2 13⁄16 "	16 "	2 1⁄8 "	11⁄16 "	1⁄4 "	1 1⁄8 "	1 3⁄8 "	13 3⁄4 "	3⁄8 "	1 1⁄2 "	13.710	7⁄16 "	1⁄4 "	1 1⁄2 "	16 "
550	55	0.03	2 3⁄8 "	18 1⁄2 "	31 1⁄4 "	13 3⁄8 "	7 "	-	4	1 1⁄4 "	13⁄16 "		21 7⁄8 "	22 1⁄4 "	3 1⁄8 "	17 "	2 1⁄4 "	7⁄8 "	1⁄4 "	1 1⁄4 "	1 1⁄2 "	14 1⁄2 "	3⁄8 "	1 1⁄2 "	14.460	7⁄16 "	1⁄4 "	1 1⁄2 "	17 "
600	60	0.03	2 3⁄8 "	19 1⁄8 "	32 1⁄8 "	13 13⁄16 "	7 5⁄16 "	-	4	1 1⁄4 "	13⁄16 "		22 1⁄2 "	23 1⁄8 "	3 3⁄16 "	17 5⁄8 "	2 7⁄16 "	3⁄4 "	1⁄4 "	1 1⁄4 "	1 5⁄8 "	15 1⁄8 "	3⁄8 "	1 5⁄8 "	15.085	1⁄2 "	1⁄4 "	1 5⁄8 "	17 5⁄8 "
650	65	0.03	2 1⁄2 "	19 3⁄4 "	32 3⁄4 "	14 1⁄8 "	7 5⁄8 "	-	4	1 1⁄4 "	13⁄16 "		23 1⁄8 "	23 3⁄4 "	3 1⁄8 "	18 1⁄4 "	2 7⁄16 "	11⁄16 "	1⁄4 "	1 1⁄4 "	1 5⁄8 "	15 3⁄4 "	3⁄8 "	1 5⁄8 "	15.710	1⁄2 "	1⁄4 "	1 5⁄8 "	18 1⁄4 "
700	70	0.03	2 1⁄2 "	20 1⁄2 "	33 1⁄2 "	14 1⁄2 "	8 "	-	4	1 1⁄4 "	13⁄16 "		23 7⁄8 "	24 1⁄2 "	3 7⁄16 "	19 "	2 7⁄16 "	15⁄16 "	1⁄4 "	1 3⁄8 "	1 5⁄8 "	16 1⁄4 "	3⁄8 "	1 5⁄8 "	16.210	1⁄2 "	1⁄4 "	1 5⁄8 "	19 "
750	75	0.03	2 1⁄2 "	21 1⁄8 "	34 3⁄8 "	14 15⁄16 "	8 5⁄16 "	-	4	1 1⁄4 "	13⁄16 "		24 1⁄2 "	25 3⁄8 "	3 1⁄16 "	19 5⁄8 "	2 5⁄8 "	13⁄16 "	1⁄4 "	1 3⁄8 "	1 5⁄8 "	16 7⁄8 "	3⁄8 "	1 5⁄8 "	16.835	9⁄16 "	1⁄4 "	1 3⁄4 "	19 5⁄8 "
800	80	0.03	2 1⁄2 "	21 7⁄8 "	35 1⁄8 "	15 5⁄16 "	8 11⁄16 "	-	4	1 1⁄4 "	13⁄16 "		25 1⁄2 "	26 1⁄8 "	3 3⁄4 "	20 3⁄8 "	2 11⁄16 "	1 1⁄16 "	1⁄4 "	1 1⁄2 "	1 3⁄4 "	17 3⁄8 "	3⁄8 "	1 3⁄4 "	17.335	9⁄16 "	1⁄4 "	1 3⁄4 "	20 3⁄8 "
850	85	0.03	2 1⁄2 "	22 3⁄4 "	35 5⁄8 "	15 3⁄4 "	9 1⁄8 "	-	4	1 1⁄4 "	13⁄16 "		25 3⁄4 "	26 3⁄8 "	3 9⁄16 "	20 7⁄8 "	2 11⁄16 "	7⁄8 "	1⁄4 "	1 1⁄2 "	1 7⁄8 "	17 7⁄8 "	3⁄8 "	1 3⁄4 "	17.835	9⁄16 "	1⁄4 "	1 3⁄4 "	20 7⁄8 "
900	90	0.03	2 3⁄4 "	22 7⁄8 "	37 5⁄8 "	16 3⁄16 "	8 3⁄16 "	-	4	1 1⁄2 "	13⁄16 "		26 1⁄4 "	27 1⁄8 "	3 11⁄16 "	21 3⁄8 "	2 13⁄16 "	7⁄8 "	1⁄4 "	1 1⁄2 "	1 7⁄8 "	18 3⁄8 "	3⁄8 "	1 3⁄4 "	18.335	9⁄16 "	1⁄4 "	1 3⁄4 "	21 3⁄8 "
950	95	0.03	2 3⁄4 "	24 1⁄4 "	38 5⁄8 "	16 11⁄16 "	9 1⁄2 "	-	4	1 1⁄2 "	13⁄16 "		27 "	28 1⁄8 "	3 15⁄16 "	22 1⁄8 "	3 "	15⁄16 "	1⁄4 "	1 5⁄8 "	2 "	18 7⁄8 "	1⁄2 "	1 3⁄4 "	18.835	5⁄8 "	1⁄4 "	1 7⁄8 "	22 1⁄8 "
1000	100	0.03	2 3⁄4 "	25 1⁄8 "	39 1⁄8 "	16 15⁄16 "	9 15⁄16 "	-	4	1 1⁄2 "	13⁄16 "		27 1⁄2 "	28 5⁄8 "	3 15⁄16 "	22 5⁄8 "	3 "	15⁄16 "	1⁄4 "	1 5⁄8 "	2 "	19 3⁄8 "	1⁄2 "	1 7⁄8 "	19.335	5⁄8 "	1⁄4 "	1 7⁄8 "	22 5⁄8 "
1100	110	0.03	2 3⁄4 "	27 "	40 1⁄8 "	17 7⁄16 "	10 3⁄8 "	-	4	1 1⁄2 "	13⁄16 "		28 1⁄2 "	29 5⁄8 "	4 3⁄16 "	23 5⁄8 "	3 3⁄16 "	1 "	1⁄4 "	1 5⁄8 "	2 1⁄8 "	20 3⁄8 "	1⁄2 "	1 7⁄8 "	20.335	5⁄8 "	1⁄4 "	1 7⁄8 "	23 5⁄8 "
1200	120	0.03	3 "	27 1⁄8 "	41 5⁄8 "	18 3⁄16 "	10 15⁄16 "	-	4	1 1⁄2 "	13⁄16 "		29 3⁄8 "	31 1⁄8 "	4 9⁄16 "	24 3⁄4 "	3 3⁄16 "	1 1⁄8 "	1⁄4 "	1 5⁄8 "	2 1⁄8 "	21 1⁄4 "	1⁄2 "	1 7⁄8 "	21.210	11⁄16 "	1⁄4 "	2 "	24 3⁄4 "
1300	130	0.03	3 1⁄4 "	27 7⁄8 "	44 1⁄8 "	19 1⁄16 "	10 15⁄16 "	-	4	1 3⁄4 "	13⁄16 "		30 5⁄8 "	32 1⁄8 "	4 9⁄16 "	25 3⁄4 "	3 3⁄8 "	1 3⁄16 "	1⁄4 "	1 7⁄8 "	2 1⁄4 "	22 "	1⁄2 "	2 "	21.960	11⁄16 "	1⁄4 "	2 "	25 3⁄4 "
1400	140	0.03	3 1⁄4 "	29 1⁄2 "	45 1⁄4 "	19 5⁄8 "	11 3⁄4 "	-	4	1 3⁄4 "	13⁄16 "		31 1⁄2 "	33 1⁄4 "	4 9⁄16 "	26 5⁄8 "	3 1⁄2 "	1 1⁄16 "	1⁄4 "	1 7⁄8 "	2 3⁄8 "	22 7⁄8 "	1⁄2 "	2 "	22.835	11⁄16 "	1⁄4 "	2 1⁄8 "	26 5⁄8 "
1500	150	0.03	3 1⁄4 "	31 1⁄8 "	46 1⁄4 "	20 1⁄8 "	12 3⁄16 "	-	4	1 3⁄4 "	13⁄16 "		32 1⁄2 "	34 1⁄4 "	4 13⁄16 "	27 5⁄8 "	3 3⁄16 "	1 1⁄4 "	1⁄4 "	2 "	2 3⁄8 "	23 5⁄8 "	1⁄2 "	2 1⁄8 "	23.585	3⁄4 "	1⁄4 "	2 1⁄8 "	27 5⁄8 "

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VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	GUIDE BARS							PTFE				STAINLESS STEEL				BEARING * HEIGHT
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	
200	20	1 3/8 "	1 3/8 "	15 1/4 "	5/16 "	7/16 "	5/16 "	5.434	7 3/8 "	3/16 "	5/8 "	10 1/8 "	15 1/8 "	8 5/8 "	15 1/8 "	7/8 "	6 7/16 "
250	25	1 1/2 "	1 1/2 "	16 1/2 "	5/16 "	7/16 "	5/16 "	6.059	8 1/2 "	3/16 "	3/4 "	11 3/8 "	16 3/8 "	9 1/2 "	16 3/8 "	1 "	7 "
300	30	1 1/2 "	1 1/2 "	17 3/8 "	5/16 "	7/16 "	5/16 "	6.496	9 3/8 "	3/16 "	3/4 "	12 1/4 "	17 1/4 "	10 3/8 "	17 1/4 "	1 "	7 1/16 "
350	35	1 5/8 "	1 5/8 "	18 1/2 "	5/16 "	7/16 "	5/16 "	7.059	10 1/8 "	3/16 "	7/8 "	13 3/8 "	18 3/8 "	11 1/8 "	18 3/8 "	1 1/8 "	7 1/2 "
400	40	1 5/8 "	1 5/8 "	19 1/4 "	5/16 "	7/16 "	5/16 "	7.434	10 3/4 "	3/16 "	7/8 "	14 1/8 "	19 1/8 "	11 3/4 "	19 1/8 "	1 1/8 "	7 5/8 "
450	45	1 3/4 "	1 3/4 "	20 1/4 "	5/16 "	7/16 "	5/16 "	7.934	11 3/8 "	3/16 "	1 "	15 1/8 "	20 1/8 "	12 3/8 "	20 1/8 "	1 1/4 "	8 3/16 "
500	50	1 3/4 "	1 3/4 "	20 7/8 "	5/16 "	7/16 "	5/16 "	8.246	12 "	3/16 "	1 "	15 3/4 "	20 3/4 "	13 "	20 3/4 "	1 1/4 "	8 3/16 "
550	55	1 3/4 "	1 3/4 "	21 7/8 "	5/16 "	7/16 "	5/16 "	8.746	12 5/8 "	3/16 "	1 "	16 3/4 "	21 3/4 "	13 5/8 "	21 3/4 "	1 1/4 "	8 5/8 "
600	60	1 7/8 "	1 7/8 "	22 1/2 "	5/16 "	7/16 "	5/16 "	9.059	13 1/8 "	3/16 "	1 1/8 "	17 3/8 "	22 3/8 "	14 1/8 "	22 3/8 "	1 3/8 "	8 7/8 "
650	65	1 7/8 "	1 7/8 "	23 1/8 "	5/16 "	7/16 "	5/16 "	9.371	13 3/4 "	3/16 "	1 1/8 "	18 "	23 "	14 3/4 "	23 "	1 3/8 "	8 15/16 "
700	70	1 7/8 "	1 7/8 "	23 7/8 "	5/16 "	7/16 "	5/16 "	9.746	14 1/4 "	3/16 "	1 1/8 "	18 3/4 "	23 3/4 "	15 1/4 "	23 3/4 "	1 3/8 "	9 3/16 "
750	75	2 "	2 "	24 1/2 "	5/16 "	7/16 "	5/16 "	10.059	14 3/4 "	3/16 "	1 1/4 "	19 3/8 "	24 3/8 "	15 3/4 "	24 3/8 "	1 1/2 "	9 5/16 "
800	80	2 "	2 "	25 1/4 "	5/16 "	7/16 "	5/16 "	10.434	15 1/4 "	3/16 "	1 1/4 "	20 1/8 "	25 1/8 "	16 1/4 "	25 1/8 "	1 1/2 "	9 11/16 "
850	85	2 "	2 "	25 3/4 "	5/16 "	7/16 "	5/16 "	10.684	15 5/8 "	3/16 "	1 1/4 "	20 5/8 "	25 5/8 "	16 5/8 "	25 5/8 "	1 1/2 "	9 5/8 "
900	90	2 "	2 "	26 1/4 "	5/16 "	7/16 "	5/16 "	10.934	16 1/8 "	3/16 "	1 1/4 "	21 1/8 "	26 1/8 "	17 1/8 "	26 1/8 "	1 1/2 "	9 1/8 "
950	95	2 1/8 "	2 1/8 "	27 "	5/16 "	7/16 "	5/16 "	11.309	16 1/2 "	3/16 "	1 3/8 "	21 7/8 "	26 7/8 "	17 1/2 "	26 7/8 "	1 5/8 "	10 3/16 "
1000	100	2 1/8 "	2 1/8 "	27 1/2 "	5/16 "	7/16 "	5/16 "	11.559	17 "	3/16 "	1 3/8 "	22 3/8 "	27 3/8 "	18 "	27 3/8 "	1 5/8 "	10 5/16 "
1100	110	2 1/8 "	2 1/8 "	28 1/2 "	5/16 "	7/16 "	5/16 "	12.059	17 3/4 "	3/16 "	1 3/8 "	23 3/8 "	28 3/8 "	18 3/4 "	28 3/8 "	1 5/8 "	10 1/2 "
1200	120	2 1/4 "	2 1/4 "	29 3/8 "	5/16 "	7/16 "	5/16 "	12.652	18 5/8 "	1/4 "	1 1/2 "	24 1/2 "	29 1/2 "	19 3/8 "	29 1/2 "	1 3/4 "	11 "
1300	130	2 1/4 "	2 1/4 "	30 3/8 "	5/16 "	7/16 "	5/16 "	13.152	19 3/8 "	1/4 "	1 1/2 "	25 1/2 "	30 1/2 "	20 3/8 "	30 1/2 "	1 3/4 "	11 1/16 "
1400	140	2 3/8 "	2 3/8 "	31 1/2 "	5/16 "	7/16 "	5/16 "	13.590	20 1/8 "	1/4 "	1 5/8 "	26 3/8 "	31 3/8 "	21 1/8 "	31 3/8 "	1 7/8 "	11 11/16 "
1500	150	2 3/8 "	2 3/8 "	32 1/2 "	5/16 "	7/16 "	5/16 "	14.090	20 3/4 "	1/4 "	1 5/8 "	27 3/8 "	32 3/8 "	21 3/4 "	32 3/8 "	1 7/8 "	12 "



\* - BEARING HEIGHT INCLUDES 1/8 " BEDDING MATERIAL. EFFECTS OF BEVELED SOLE PLATE ARE NOT INCLUDED. IF BEVELED SOLE PLATE IS USED CALCULATE INCREASED BEARING HEIGHT ACCORDINGLY.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
HIGH LOAD MULTI-ROTATIONAL  
POT BEARINGS - GUIDED  
10% HORIZONTAL LOAD

RECOMMENDED NOV. 23, 2022  
*L. L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 6 OF 7

BD-613M

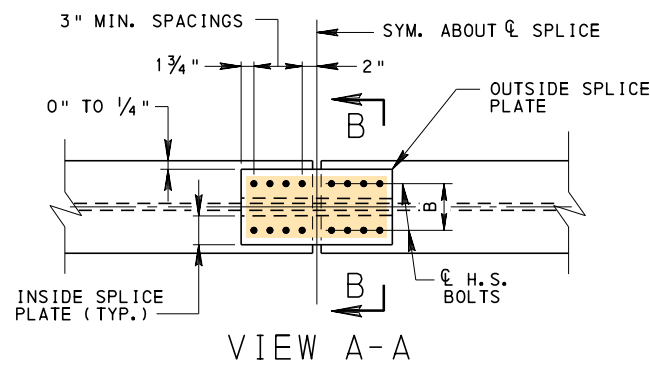
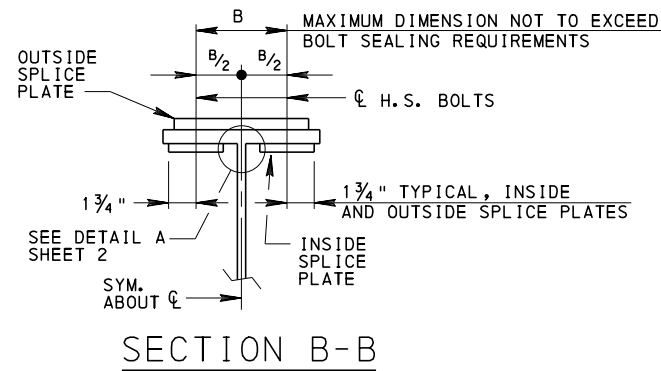
DESIGN TABLES FOR GUIDED POT BEARINGS (30% HORIZONTAL LOAD)

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	ROTATION (RADS.)	MASONRY PLATE ▲						ANCHOR BOLT		SOLE PLATE ▲	POT								NEOPRENE DISC			PISTON				GUIDE PLATE		
			A	B	C	D	E	F	QTY.	G		H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
200	60	0.03	2 "	12 7⁄8 "	26 3⁄8 "	11 3⁄16 "	4 3⁄16 "	-	4	1 1⁄4 "	3⁄16 "	PER DESIGN ( BEVELED SOLE PLATE )	16 1⁄4 "	17 7⁄8 "	2 3⁄16 "	11 3⁄8 "	1 5⁄8 "	9⁄16 "	1⁄4 "	1 1⁄4 "	1 "	8 7⁄8 "	3⁄8 "	1 1⁄4 "	8.835	3⁄8 "	1⁄4 "	2 1⁄8 "	11 3⁄8 "
250	75	0.03	2 1⁄8 "	14 1⁄8 "	28 5⁄8 "	12 1⁄16 "	4 13⁄16 "	-	4	1 1⁄4 "	3⁄16 "		17 1⁄2 "	19 5⁄8 "	2 3⁄16 "	12 5⁄8 "	1 11⁄16 "	1⁄2 "	1⁄4 "	1 3⁄8 "	1 "	9 7⁄8 "	3⁄8 "	1 3⁄8 "	9.835	7⁄16 "	1⁄4 "	2 3⁄8 "	12 5⁄8 "
300	90	0.03	2 3⁄8 "	15 1⁄4 "	31 1⁄2 "	13 1⁄8 "	5 "	-	4	1 1⁄2 "	3⁄16 "		18 5⁄8 "	21 "	2 7⁄16 "	13 3⁄4 "	1 13⁄16 "	5⁄8 "	1⁄4 "	1 1⁄2 "	1 1⁄8 "	10 3⁄4 "	3⁄8 "	1 3⁄8 "	10.710	7⁄16 "	1⁄4 "	2 1⁄2 "	13 3⁄4 "
350	105	0.03	2 3⁄8 "	16 3⁄4 "	32 7⁄8 "	13 13⁄16 "	5 3⁄4 "	-	4	1 1⁄2 "	3⁄16 "		19 3⁄4 "	23 3⁄8 "	2 9⁄16 "	14 7⁄8 "	2 "	9⁄16 "	1⁄4 "	1 5⁄8 "	1 1⁄4 "	11 5⁄8 "	3⁄8 "	1 1⁄2 "	11.585	1⁄2 "	1⁄4 "	2 5⁄8 "	14 7⁄8 "
400	120	0.03	2 1⁄2 "	17 3⁄8 "	34 1⁄4 "	14 1⁄2 "	6 1⁄16 "	-	4	1 1⁄2 "	3⁄16 "		20 3⁄4 "	23 3⁄4 "	2 3⁄4 "	15 7⁄8 "	2 1⁄8 "	5⁄8 "	1⁄4 "	1 3⁄4 "	1 1⁄4 "	12 3⁄8 "	3⁄8 "	1 1⁄2 "	12.335	1⁄2 "	1⁄4 "	2 3⁄4 "	15 7⁄8 "
450	135	0.03	2 3⁄4 "	18 3⁄8 "	37 "	15 1⁄2 "	6 3⁄16 "	-	4	1 3⁄4 "	5⁄16 "		21 3⁄4 "	25 "	2 7⁄8 "	16 7⁄8 "	2 3⁄16 "	11⁄16 "	1⁄4 "	1 7⁄8 "	1 3⁄8 "	13 1⁄8 "	3⁄8 "	1 5⁄8 "	13.085	9⁄16 "	1⁄4 "	2 7⁄8 "	16 7⁄8 "
500	150	0.03	2 3⁄4 "	19 7⁄8 "	38 1⁄4 "	16 1⁄8 "	6 15⁄16 "	-	4	1 3⁄4 "	5⁄16 "		22 5⁄8 "	26 1⁄4 "	2 15⁄16 "	17 3⁄4 "	2 1⁄4 "	11⁄16 "	1⁄4 "	2 "	1 3⁄8 "	13 3⁄4 "	3⁄8 "	1 5⁄8 "	13.710	9⁄16 "	5⁄16 "	3 "	17 3⁄4 "
550	165	0.03	3 "	20 "	39 1⁄4 "	16 5⁄8 "	7 "	-	4	1 3⁄4 "	1 1⁄16 "		23 3⁄8 "	27 1⁄4 "	3 3⁄16 "	18 1⁄2 "	2 7⁄16 "	3⁄4 "	1⁄4 "	2 "	1 1⁄2 "	14 1⁄2 "	3⁄8 "	1 5⁄8 "	14.460	5⁄8 "	5⁄16 "	3 1⁄8 "	18 1⁄2 "
600	180	0.03	3 1⁄4 "	20 7⁄8 "	41 7⁄8 "	17 9⁄16 "	7 1⁄16 "	-	4	2 "	1 1⁄16 "		24 1⁄4 "	28 3⁄8 "	3 7⁄16 "	19 3⁄8 "	2 9⁄16 "	7⁄8 "	1⁄4 "	2 1⁄8 "	1 5⁄8 "	15 1⁄8 "	3⁄8 "	1 7⁄8 "	15.085	5⁄8 "	5⁄16 "	3 1⁄8 "	19 3⁄8 "
650	195	0.03	3 1⁄4 "	21 3⁄4 "	43 1⁄8 "	18 3⁄16 "	7 1⁄2 "	-	4	2 "	1 3⁄16 "		25 1⁄8 "	29 5⁄8 "	3 7⁄16 "	20 1⁄4 "	2 5⁄8 "	13⁄16 "	1⁄4 "	2 1⁄4 "	1 5⁄8 "	15 3⁄4 "	3⁄8 "	1 7⁄8 "	15.710	5⁄8 "	5⁄16 "	3 3⁄8 "	20 1⁄4 "
700	210	0.03	3 1⁄4 "	22 1⁄4 "	43 7⁄8 "	18 9⁄16 "	7 3⁄4 "	-	4	2 "	1 3⁄16 "		25 5⁄8 "	30 3⁄8 "	3 7⁄16 "	20 3⁄4 "	2 5⁄8 "	13⁄16 "	1⁄4 "	2 1⁄4 "	1 5⁄8 "	16 1⁄4 "	3⁄8 "	2 "	16.210	11⁄16 "	5⁄16 "	3 3⁄8 "	20 3⁄4 "
750	225	0.03	3 1⁄4 "	23 5⁄8 "	45 "	19 1⁄8 "	8 1⁄16 "	-	4	2 "	1 3⁄16 "		26 1⁄2 "	31 1⁄2 "	3 11⁄16 "	21 5⁄8 "	2 13⁄16 "	7⁄8 "	1⁄4 "	2 3⁄8 "	1 3⁄4 "	16 7⁄8 "	3⁄8 "	2 "	16.835	11⁄16 "	3⁄8 "	3 5⁄8 "	21 5⁄8 "
800	240	0.03	3 1⁄4 "	24 "	44 5⁄8 "	19 5⁄16 "	9 "	-	6	1 3⁄4 "	1 5⁄16 "		27 1⁄4 "	32 5⁄8 "	3 11⁄16 "	22 3⁄8 "	2 13⁄16 "	7⁄8 "	5⁄16 "	2 1⁄2 "	1 3⁄4 "	17 3⁄8 "	3⁄8 "	2 1⁄8 "	17.335	11⁄16 "	3⁄8 "	3 5⁄8 "	22 3⁄8 "
850	255	0.03	3 1⁄4 "	24 1⁄2 "	45 1⁄8 "	19 9⁄16 "	9 1⁄4 "	-	6	1 3⁄4 "	1 5⁄16 "		27 3⁄4 "	33 1⁄8 "	3 15⁄16 "	22 7⁄8 "	3 "	15⁄16 "	5⁄16 "	2 1⁄2 "	1 7⁄8 "	17 7⁄8 "	3⁄8 "	2 1⁄8 "	17.835	3⁄4 "	3⁄8 "	3 5⁄8 "	22 7⁄8 "
900	270	0.03	3 1⁄2 "	25 1⁄4 "	47 5⁄8 "	20 7⁄16 "	9 1⁄4 "	-	6	2 "	1 5⁄16 "		28 1⁄2 "	34 1⁄8 "	3 15⁄16 "	23 5⁄8 "	3 "	15⁄16 "	5⁄16 "	2 5⁄8 "	1 7⁄8 "	18 3⁄8 "	3⁄8 "	2 1⁄8 "	18.335	3⁄4 "	3⁄8 "	3 7⁄8 "	23 5⁄8 "
950	285	0.03	3 1⁄2 "	26 1⁄2 "	48 1⁄2 "	20 7⁄8 "	9 7⁄8 "	-	6	2 "	1 7⁄16 "		29 "	35 "	4 1⁄16 "	24 1⁄8 "	3 3⁄16 "	15⁄16 "	5⁄16 "	2 5⁄8 "	2 "	18 7⁄8 "	1⁄2 "	2 1⁄4 "	18.835	13⁄16 "	3⁄8 "	3 7⁄8 "	24 1⁄8 "
1000	300	0.03	3 1⁄2 "	28 1⁄8 "	49 5⁄8 "	21 7⁄16 "	10 11⁄16 "	-	6	2 "	1 7⁄16 "		29 3⁄4 "	36 1⁄8 "	4 1⁄16 "	24 7⁄8 "	3 3⁄16 "	7⁄8 "	5⁄16 "	2 3⁄4 "	2 "	19 3⁄8 "	1⁄2 "	2 1⁄4 "	19.335	13⁄16 "	3⁄8 "	4 1⁄8 "	24 7⁄8 "
1100	330	0.03	3 11⁄16 "	28 1⁄8 "	51 1⁄8 "	22 3⁄16 "	10 11⁄16 "	-	6	2 "	1 9⁄16 "		31 "	37 5⁄8 "	4 5⁄16 "	26 1⁄8 "	3 3⁄8 "	7⁄8 "	5⁄16 "	2 7⁄8 "	2 1⁄8 "	20 3⁄8 "	1⁄2 "	2 1⁄4 "	20.335	13⁄16 "	7⁄16 "	4 1⁄8 "	26 1⁄8 "
1200	360	0.03	3 11⁄16 "	29 1⁄2 "	52 5⁄8 "	22 15⁄16 "	11 3⁄8 "	3 11⁄16 "	8	2 "	1 9⁄16 "		32 1⁄8 "	39 1⁄8 "	4 7⁄16 "	27 1⁄4 "	3 7⁄16 "	1 "	3⁄8 "	3 "	2 1⁄8 "	21 1⁄4 "	1⁄2 "	2 1⁄4 "	21.210	7⁄8 "	7⁄16 "	4 3⁄8 "	27 1⁄4 "
1300	390	0.03	3 15⁄16 "	30 1⁄4 "	54 1⁄8 "	23 11⁄16 "	11 3⁄4 "	3 7⁄8 "	8	2 "	1 11⁄16 "		33 3⁄8 "	40 5⁄8 "	4 7⁄8 "	28 1⁄4 "	3 5⁄8 "	1 1⁄4 "	3⁄8 "	3 1⁄8 "	2 1⁄4 "	22 "	1⁄2 "	2 1⁄2 "	21.960	15⁄16 "	7⁄16 "	4 9⁄16 "	28 1⁄4 "
1400	420	0.03	3 15⁄16 "	31 1⁄2 "	55 5⁄8 "	24 7⁄16 "	12 3⁄8 "	4 1⁄16 "	8	2 "	1 11⁄16 "		34 1⁄4 "	42 1⁄8 "	4 13⁄16 "	29 3⁄8 "	3 3⁄4 "	1 1⁄16 "	3⁄8 "	3 1⁄4 "	2 3⁄8 "	22 7⁄8 "	1⁄2 "	2 1⁄2 "	22.835	15⁄16 "	1⁄2 "	4 13⁄16 "	29 3⁄8 "
1500	450	0.03	3 15⁄16 "	33 3⁄8 "	56 7⁄8 "	25 1⁄16 "	13 5⁄16 "	4 1⁄4 "	8	2 "	1 13⁄16 "		35 1⁄4 "	43 3⁄8 "	5 1⁄4 "	30 3⁄8 "	3 13⁄16 "	1 7⁄16 "	3⁄8 "	3 3⁄8 "	2 3⁄8 "	23 5⁄8 "	1⁄2 "	2 5⁄8 "	23.585	1 "	1⁄2 "	4 13⁄16 "	30 3⁄8 "

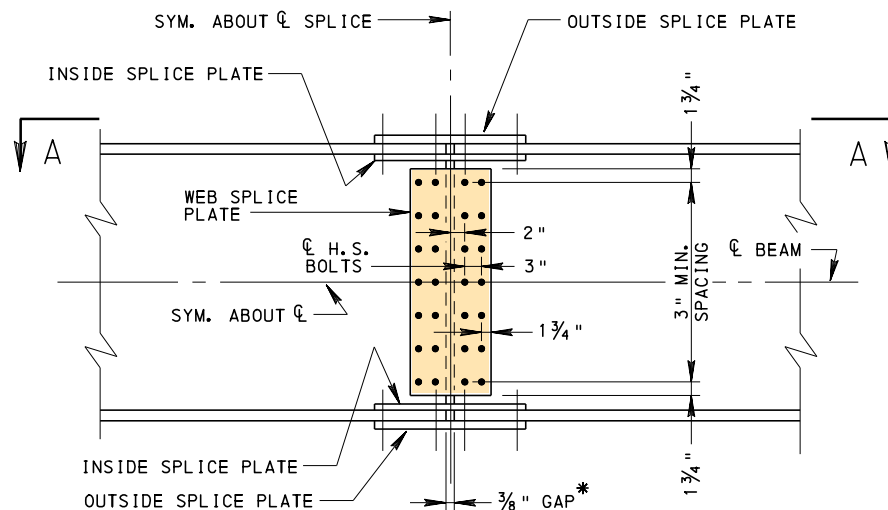
▲ - THE INDICATED SOLE PLATE DIMENSIONS "J" AND "K" MUST BE INCREASED TO ACCOMMODATE THE TAPPED SCREW CONNECTION FOR PRESTRESSED CONCRETE BEAMS SHOWN ON BC-756M, SHEET 6 OF 6. LOCATE TAPPED SCREWS OUTSIDE THE PERIMETER OF THE FILLET WELD TOE THAT CONNECTS THE 13 GAUGE STAINLESS STEEL TO THE SOLE PLATE. IF THE BOLT PATTERN FALLS OUTSIDE THE LIMITS OF THE EMBEDDED PLATE, HLMP POT BEARINGS SHALL NOT BE USED. DUE TO THE INCREASED SOLE PLATE DIMENSIONS, CLEARANCES BETWEEN THE TOP OF ANCHOR BOLTS AND THE SOLE PLATE MUST BE CHECKED. THE MASONRY PLATE AND ANCHOR BOLT LOCATIONS MAY NEED TO BE ADJUSTED IN ACCORDANCE WITH THE INSTRUCTIONS FOR USING DESIGN TABLES, NOTE 12 ON SHEET 1 OF 7.

VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	GUIDE BARS							PTFE				STAINLESS STEEL				BEARING HEIGHT*
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	
200	60	2 3⁄8 "	2 3⁄8 "	16 1⁄4 "	5⁄16 "	1⁄2 "	5⁄16 "	5.934	7 5⁄8 "	3⁄16 "	1 5⁄8 "	11 1⁄8 "	16 1⁄8 "	8 5⁄8 "	16 1⁄8 "	1 7⁄8 "	7 13⁄16 "
250	75	2 5⁄8 "	2 5⁄8 "	17 1⁄2 "	5⁄16 "	1⁄2 "	5⁄16 "	6.559	8 1⁄2 "	3⁄16 "	1 7⁄8 "	12 3⁄8 "	17 3⁄8 "	9 1⁄2 "	17 3⁄8 "	2 1⁄8 "	8 1⁄4 "
300	90	2 3⁄4 "	2 3⁄4 "	18 5⁄8 "	5⁄16 "	1⁄2 "	5⁄16 "	7.121	9 3⁄8 "	3⁄16 "	2 "	13 1⁄2 "	18 1⁄2 "	10 3⁄8 "	18 1⁄2 "	2 1⁄4 "	8 7⁄8 "
350	105	2 7⁄8 "	2 7⁄8 "	19 3⁄4 "	5⁄16 "	7⁄16 "	5⁄16 "	7.684	10 1⁄8 "	3⁄16 "	2 1⁄8 "	14 5⁄8 "	19 5⁄8 "	11 1⁄8 "	19 5⁄8 "	2 3⁄8 "	9 3⁄16 "
400	120	3 "	3 "	20 3⁄4 "	3⁄8 "	1⁄2 "	3⁄8 "	8.184	10 3⁄4 "	3⁄16 "	2 1⁄4 "	15 5⁄8 "	20 5⁄8 "	11 3⁄4 "	20 5⁄8 "	2 1⁄2 "	9 1⁄2 "
450	135	3 1⁄8 "	3 1⁄8 "	21 3⁄4 "	3⁄8 "	1⁄2 "	3⁄8 "	8.684	11 3⁄8 "	3⁄16 "	2 3⁄8 "	16 5⁄8 "	21 5⁄8 "	12 3⁄8 "	21 5⁄8 "	2 5⁄8 "	10 9⁄16 "
500	150	3 1⁄4 "	3 1⁄4 "	22 5⁄8 "	7⁄16 "	3⁄16 "	7⁄16 "	9.121	12 "	3⁄16 "	2 1⁄2 "	17 1⁄2 "	22 1⁄2 "	13 "	22 1⁄2 "	2 3⁄4 "	10 3⁄8 "
550	165	3 3⁄8 "	3 3⁄8 "	23 3⁄8 "	7⁄16 "	3⁄16 "	7⁄16 "	9.496	12 5⁄8 "	3⁄16 "	2 5⁄8 "	18 1⁄4 "	23 1⁄4 "	13 5⁄8 "	23 1⁄4 "	2 7⁄8 "	11 1⁄16 "
600	180	3 1⁄2 "	3 1⁄2 "	24 1⁄4 "	7⁄16 "	3⁄16 "	7⁄16 "	9.934	13 1⁄8 "	3⁄16 "	2 3⁄4 "	19 1⁄8 "	24 1⁄8 "	14 1⁄8 "	24 1⁄8 "	3 "	11 13⁄16 "
650	195	3 5⁄8 "	3 5⁄8 "	25 1⁄8 "	1⁄2 "	5⁄8 "	1⁄2 "	10.371	13 3⁄4 "	3⁄16 "	3 7⁄8 "	20 "	25 "	14 3⁄4 "	25 "	3 1⁄8 "	12 1⁄8 "
700	210	3 3⁄4 "	3 3⁄4 "	25 5⁄8 "	1⁄2 "	5⁄8 "	1⁄2 "	10.621	14 1⁄4 "	3⁄16 "	3 "	20 1⁄2 "	25 1⁄2 "	15 1⁄4 "	25 1⁄2 "	3 1⁄4 "	12 1⁄4 "
750	225	3 7⁄8 "	3 7⁄8 "	26 1⁄2 "	1⁄2 "	5⁄8 "	1⁄2 "	11.059	14 3⁄4 "	3⁄16 "	3 1⁄8 "	21 3⁄8 "	26 3⁄8 "	15 3⁄4 "	26 3⁄8 "	3 3⁄8 "	12 5⁄8 "
800	240	4 "	4 "	27 1⁄4 "	9⁄16 "	11⁄16 "	9⁄16 "	11.434	15 1⁄4 "	3⁄16 "	3 1⁄4 "	22 1⁄8 "	27 1⁄8 "	16 1⁄4 "	27 1⁄8 "	3 1⁄2 "	12 7⁄8 "
850	255	4 "	4 "	27 3⁄4 "	9⁄16 "	11⁄16 "	9⁄16 "	11.684	15 5⁄8 "	3⁄16 "	3 1⁄4 "	22 5⁄8 "	27 5⁄8 "	16 5⁄8 "	27 5⁄8 "	3 1⁄2 "	13 1⁄16 "
900	270	4 1⁄8 "	4 1⁄8 "	28 1⁄2 "	9⁄16 "	11⁄16 "	9⁄16 "	12.059	16 1⁄8 "	3⁄16 "	3 3⁄8 "	23 3⁄8 "	28 3⁄8 "	17 1⁄8 "	28 3⁄8 "	3 5⁄8 "	13 3⁄16 "
950	285	4 1⁄4 "	4 1⁄4 "	29 "	5⁄8 "	3⁄4 "	5⁄8 "	12.309	16 1⁄2 "	3⁄16 "	3 1⁄2 "	23 7⁄8 "	28 7⁄8 "	17 1⁄2 "	28 7⁄8 "	3 3⁄4 "	13 15⁄16 "
1000	300	4 3⁄8 "	4 3⁄8 "	29 3⁄4 "	5⁄8 "	3⁄4 "	5⁄8 "	12.715	17 "	1⁄4 "	3 5⁄8 "	24 5⁄8 "	29 5⁄8 "	18 "	29 5⁄8 "	3 7⁄8 "	14 1⁄8 "
1100	330	4 1⁄2 "	4 1⁄2 "	31 "	5⁄8 "	3⁄4 "	5⁄8 "	13.340	17 3⁄4 "	1⁄4 "	3 3⁄4 "	25 7⁄8 "	30 7⁄8 "	18 3⁄4 "	30 7⁄8 "	4 "	14 1⁄2 "
1200	360	4 5⁄8 "	4 5⁄8 "	32 1⁄8 "	11⁄16 "	13⁄16 "	11⁄16 "	13.902	18 5⁄8 "	1⁄4 "	3 7⁄8 "	27 "	32 "	19 5⁄8 "	32 "	4 1⁄8 "	14 7⁄8 "
1300	390	4 7⁄8 "	4 7⁄8 "	33 1⁄8 "	11⁄16 "	13⁄16 "	11⁄16 "	14.402	19 3⁄8 "	1⁄4 "	4 1⁄8 "	28 "	33 "	20 3⁄8 "	33 "	4 3⁄8 "	16 1⁄16 "
1400	420	5 "	5 "	34 1⁄4 "	3⁄4 "	7⁄8 "	3⁄4 "	14.965	20 1⁄8 "	1⁄4 "	4 1⁄4 "	29 1⁄8 "	34 1⁄8 "	21 1⁄8 "	34 1⁄8 "	4 1⁄2 "	16 3⁄16 "
1500	450	5 1⁄8 "	5 1⁄8 "	35 1⁄4 "	3⁄4 "	7⁄8 "	3⁄4 "	15.465	20 3⁄4 "	1⁄4 "	4 3⁄8 "	30 1⁄8 "	35 1⁄8 "	21 3⁄4 "	35 1⁄8 "	4 5⁄8 "	16 13⁄16 "

CHANGE 5



FLANGE SPLICE DETAIL - TYPE 1



\* USE  $\frac{3}{8}$ " GAP FOR DESIGN, DETAIL AS  $\frac{1}{4}$ " GAP ON DRAWINGS.

## GENERAL NOTES:

- DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.
- DETAILS SHOWN ARE FOR  $\frac{7}{8}$ " DIAMETER HIGH STRENGTH BOLTS.
- BOLT SPACINGS SHOWN ARE PREFERRED MINIMUMS.
- EDGE DISTANCES SHOWN ARE MINIMUMS BASED ON SHEARED OR GAS CUT EDGES PLUS AN ADDITIONAL  $\frac{1}{4}$ " CLEARANCE IN ACCORDANCE WITH STRUCTURAL COMMITTEE FOR ECONOMICAL FABRICATION DETAIL. THIS WILL PROVIDE A TOLERANCE FOR PUNCHING, DRILLING AND REAMING.
- FOR THE MINIMUM EDGE DISTANCES, THE BEARING CAPACITY OF THE WEB PLATE, ESPECIALLY THIN WEB PLATES, MAY BE SIGNIFICANTLY LESS THAN THE BOLT SHEAR CAPACITY RESULTING IN THE PLATE BEARING CAPACITY CONTROLLING THE DESIGN. THE DESIGNER SHOULD ADJUST THE WEB EDGE DISTANCES, INCREASING THE PLATE BEARING CAPACITY, TO MINIMIZE THE NUMBER OF GAGE LINES OF WEB BOLTS. THE DESIGNER SHOULD INCREASE THE WEB EDGE DISTANCE TO OBTAIN A DESIGN WITH THE TYPICAL 2 OR 3 ROWS OF WEB SPLICE BOLTS.
- DESIGNER TO VERIFY INSTALLATION CLEARANCES AS ILLUSTRATED IN AISC MANUAL OF STEEL CONSTRUCTION.
- DESIGNER TO INDICATE WHETHER OR NOT THE BOLTS ARE DESIGNED FOR THREADS EXCLUDED FROM SHEAR PLANE.
- DESIGN THE TENSION FLANGE, COMPRESSION FLANGE AND WEB SPLICES (PLATES AND BOLTS) IN ACCORDANCE WITH AASHTO LRFD ARTICLE 6.13.6.1 AND DM-4 ARTICLE 6.13.6.1.
- CHECK GIRDER CAPACITY AT THE SPLICE FOR REDUCTION DUE TO BOLTS HOLES IN THE TENSION FLANGE USING THE EFFECTIVE AREA,  $A_e$ , AS DEFINED IN AASHTO LRFD ARTICLE 6.13.6.1.3b.  
  
THIS GIRDER CAPACITY CHECK IS CRITICAL FOR SINGLE SPAN STRUCTURES AND CONTINUOUS STRUCTURES WITH SPLICES IN HIGH MOMENT REGIONS.  
  
IN CASES THAT A SIGNIFICANT REDUCTION IN FLANGE CAPACITY OCCURS DUE TO EFFECTIVE AREA, CONSIDER A STAGGERED BOLT PATTERN.
- THE EFFECTIVE COMPRESSION FLANGE AREA SHALL BE TAKEN EQUAL TO THE GROSS AREA OF THE COMPRESSION FLANGE.
- DESIGNER TO VERIFY THAT BOLT SPACINGS FOR FLANGE SPLICES AND WEB SPLICES DO NOT EXCEED BOLT SEALING REQUIREMENTS.
- OFFSET DECK JOINTS A MINIMUM 3'-0" FROM STEEL FIELD GIRDER SPLICES.
- FOR BOLT DIAMETER EQUAL OR GREATER THAN 1", THE HOLE DIAMETER SHALL BE  $\frac{1}{8}$ " PLUS DIAMETER OF BOLT. ALSO, ADJUST EDGE DISTANCE, CENTER TO CENTER BOLT SPACINGS, CLEARANCES, ETC.

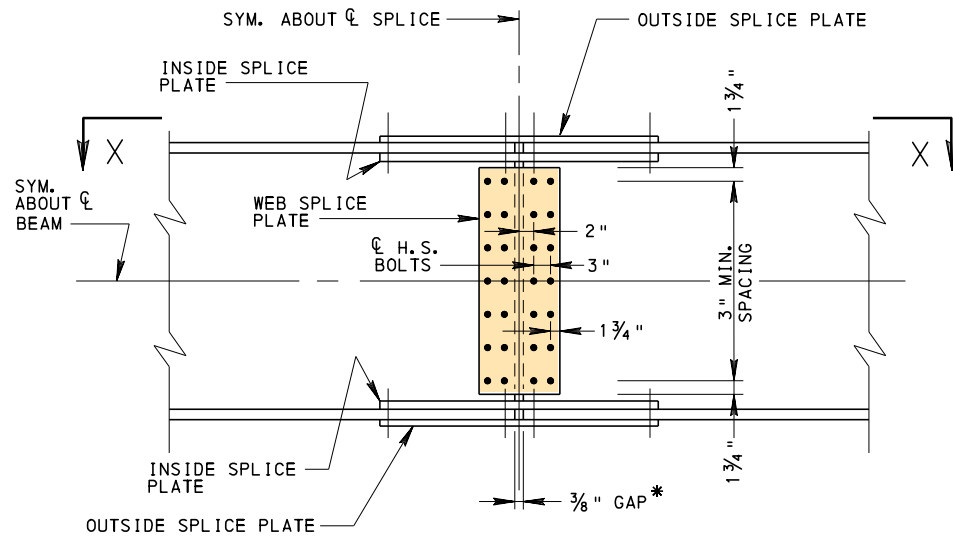
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
FIELD SPLICE

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

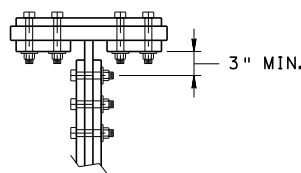
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 2  
BD-616M

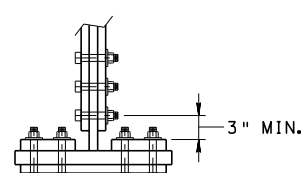


**WEB SPLICE DETAIL**

\* USE  $\frac{3}{8}$ " GAP FOR DESIGN, DETAIL AS  $\frac{1}{4}$ " GAP ON DRAWINGS.

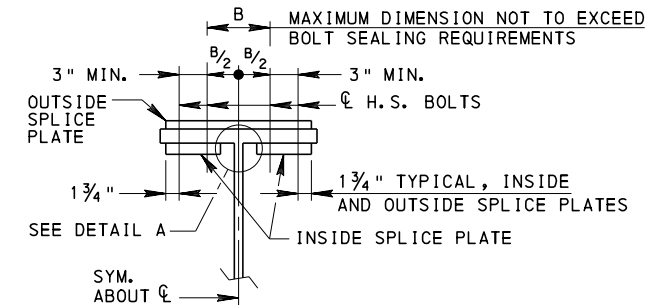


**TOP FLANGE**

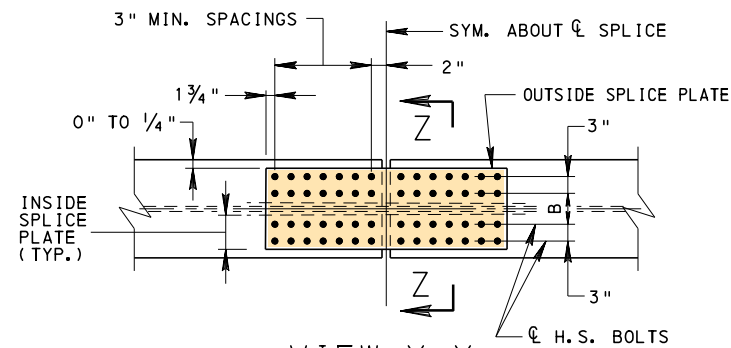


**BOTTOM FLANGE**

**$\frac{7}{8}$ " DIAMETER BOLT ENTERING AND TIGHTENING CLEARANCES**

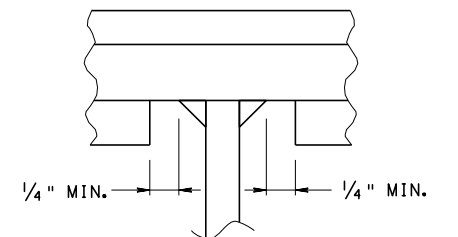


**SECTION Z-Z**

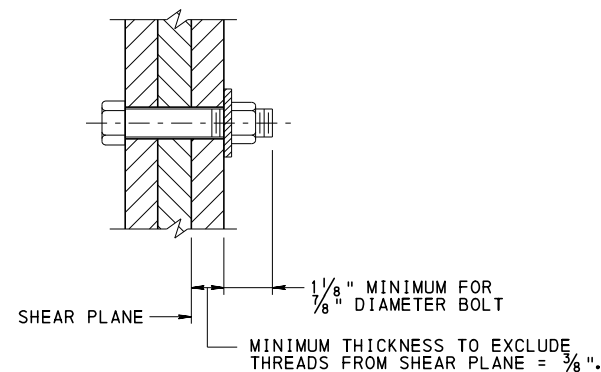


**VIEW X-X**

**FLANGE SPLICE DETAIL - TYPE 2**



**DETAIL A**



**BOLT SHEAR PLANE**

MINIMUM PLATE THICKNESS IS  $\frac{3}{8}$ ".

NOTE:  
BASED ON  $1\frac{1}{2}$ " THREAD LENGTH  
FOR  $\frac{7}{8}$ " DIAMETER BOLT

NOTE:  
SEE SHEET 1 FOR GENERAL NOTES.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

**STANDARD  
FIELD SPLICE**

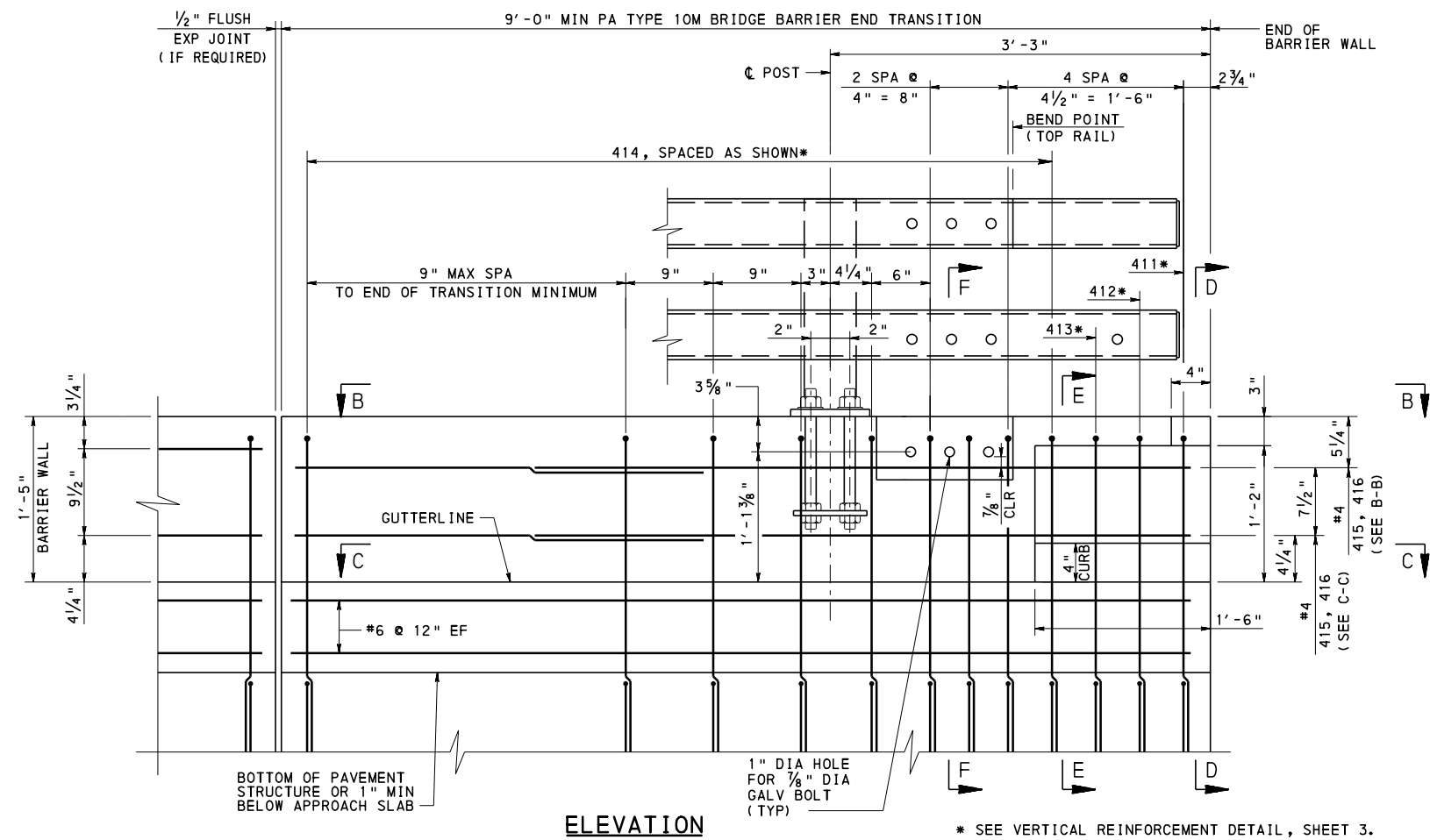
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 2 OF 2  
BD-616M



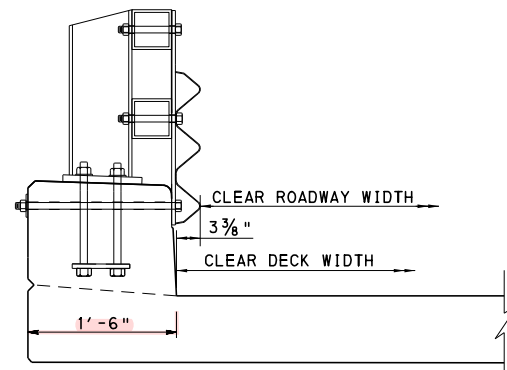




**PA TYPE 10M BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION**

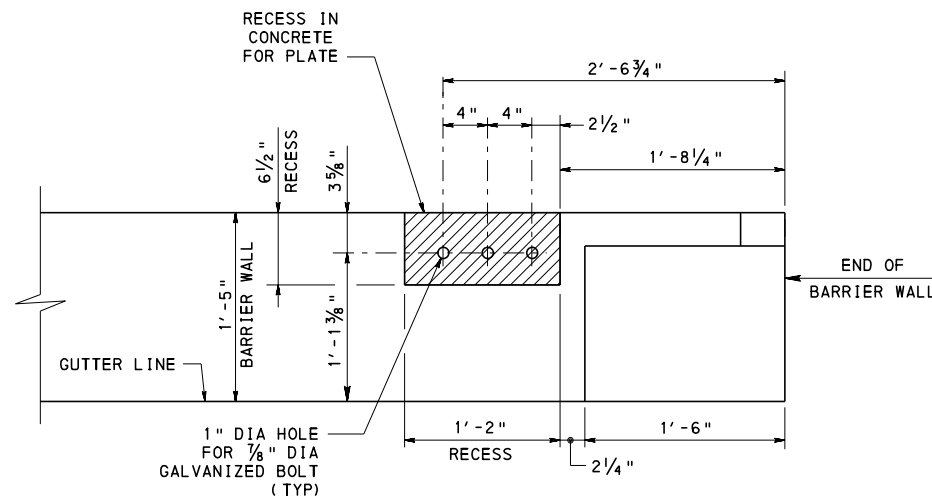
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)  
(GUIDE RAIL, CONNECTION PLATE ASSEMBLY AND BOLTS OMITTED FOR CLARITY)

\* SEE VERTICAL REINFORCEMENT DETAIL, SHEET 3.  
\*\* REINFORCEMENT DETAILING SHOWN REPRESENTS A  
CONDITION WHERE AN EXPANSION JOINT IS NOT PRESENT.



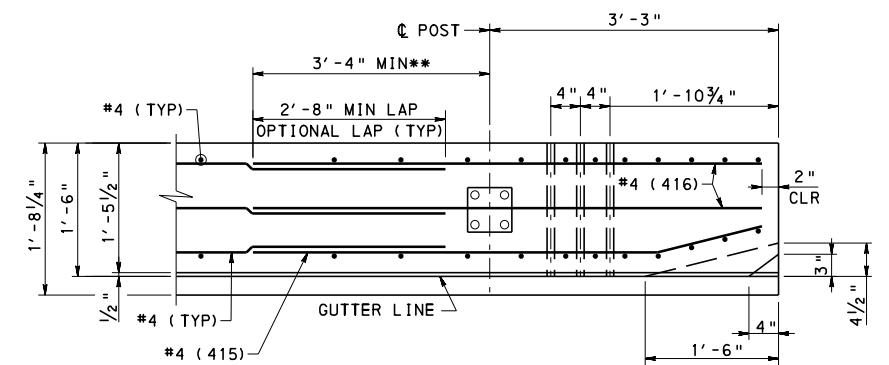
**CLEAR ROADWAY WIDTH DETAIL**

(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)  
CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3 3/8" MINIMUM  
TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH.

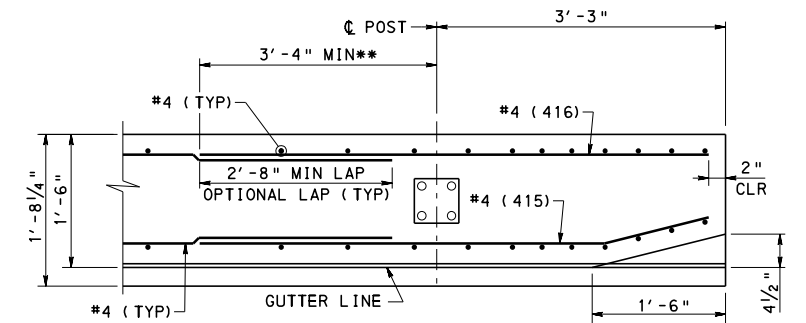


**THRIE-BEAM GUIDE RAIL  
RECESS AND BOLT HOLE DETAIL**

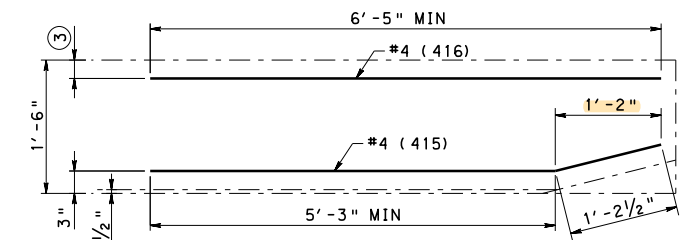
(WITHOUT CURB SHOWN, WITH CURB SIMILAR)



**SECTION B-B**



**SECTION C-C**



**HORIZONTAL REINFORCEMENT**  
(SEE NOTE 2)

**NOTES:**

1. FOR SECTION D-D, E-E AND F-F LOCATION, SEE SHEET 3.
2. DIMENSION FROM FACE OF BARRIER TO BAR IS  
MEASURED TO OUTSIDE FACE OF REINFORCEMENT BAR.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

**LEGEND:**

- ③ 2 1/2" CLR FOR SAFETY WING,  
3 3/8" CLR FOR U-WING.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

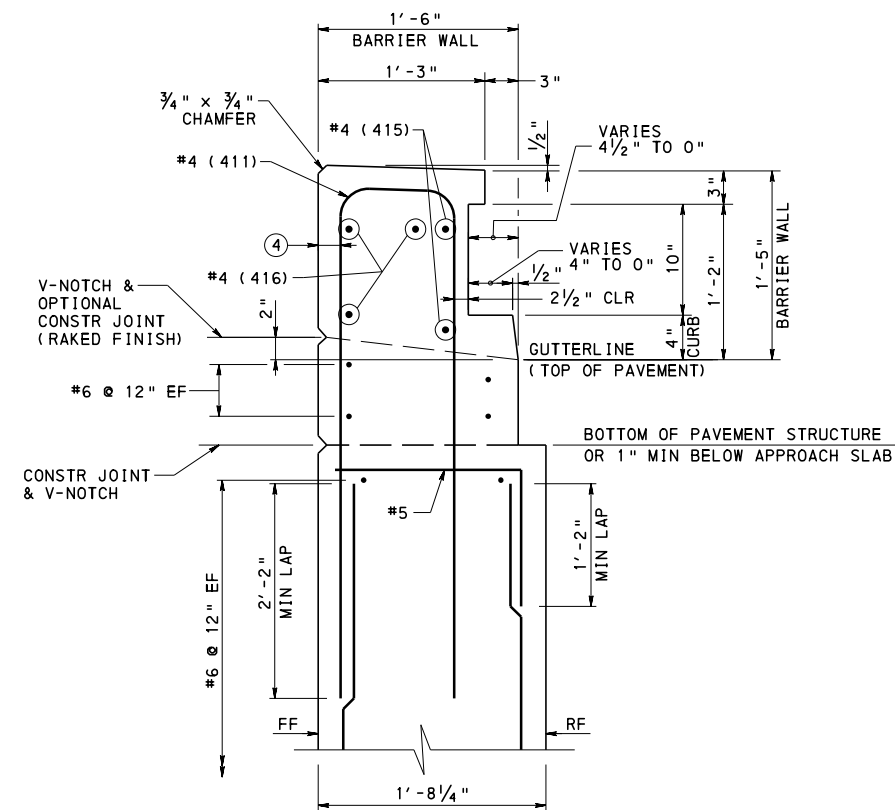
**STANDARD**

**PA TYPE 10M BRIDGE BARRIER  
END OF BARRIER DETAILS  
WITH THRIE-BEAM CONNECTION - 1**

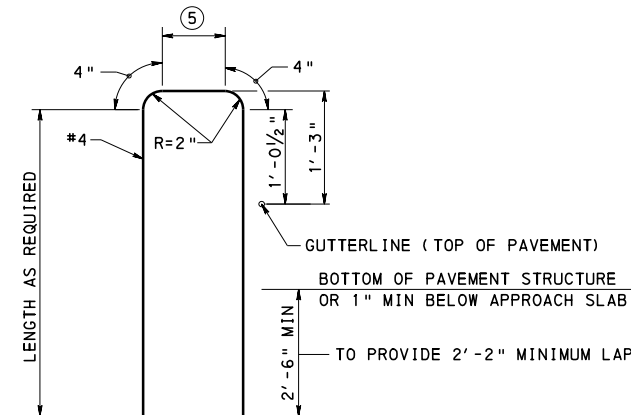
RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

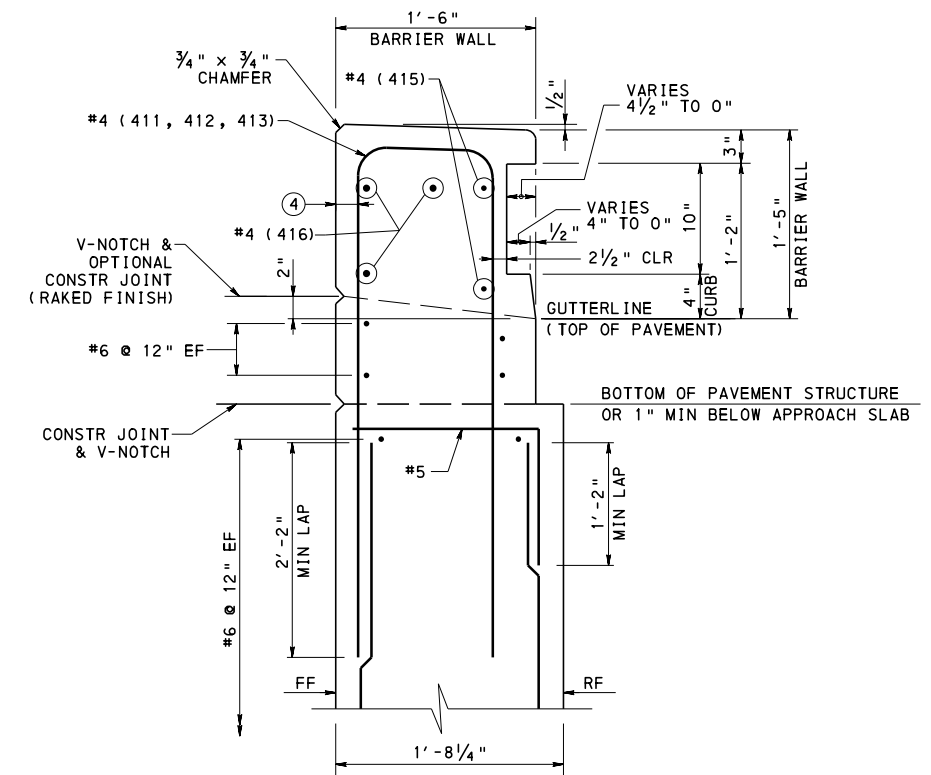
SHEET 2 OF 10  
BD-617M



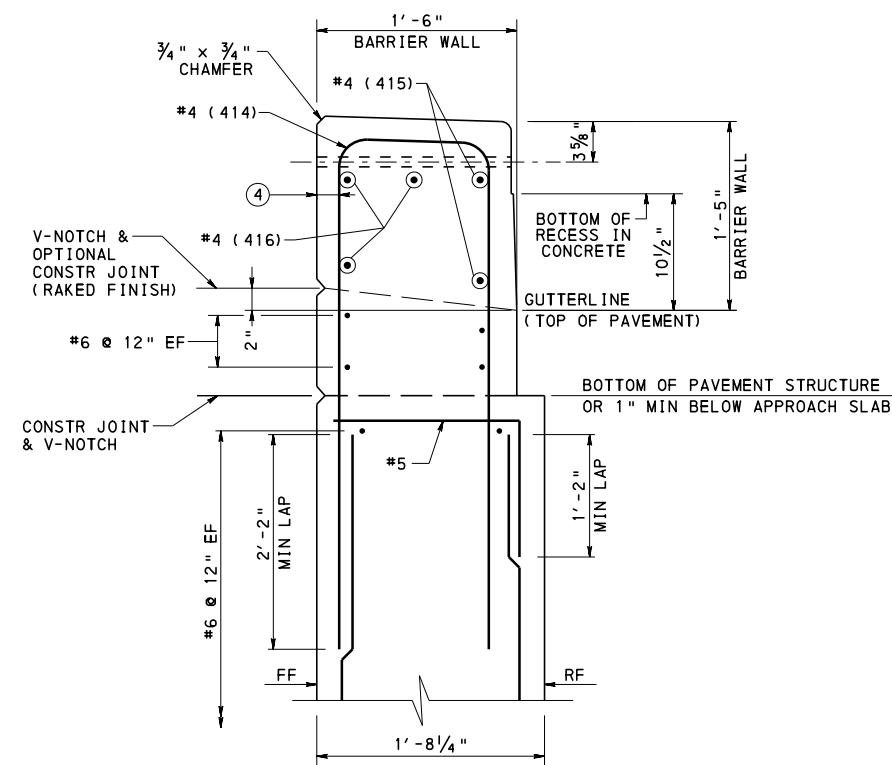
**SECTION D-D (6)**  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



**VERTICAL  
REINFORCEMENT**



**SECTION E-E (6)**  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



**SECTION F-F (6)**

**LEGEND:**

- (4) 2" CLR FOR SAFETY WINGS,  
2 5/8" CLR FOR U-WINGS.
- (5) FOR SAFETY WINGS:  
4 3/4" (411)  
5 3/4" (412)  
6 7/8" (413)  
8 1/2" (414)  
FOR U-WINGS:  
4 1/8" (411)  
5 1/8" (412)  
6 1/4" (413)  
7 7/8" (414)
- (6) REINFORCEMENT AND INFORMATION SHOWN  
FOR SAFETY WINGS. REINFORCEMENT IN U-WING  
BELOW 1'-6" WIDTH IS AS BY DESIGN.

**NOTES:**

1. FOR SECTION D-D, E-E AND F-F LOCATION, SEE SHEET 2.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION**

**BUREAU OF BRIDGE**

**STANDARD**

**PA TYPE 10M BRIDGE BARRIER  
END OF BARRIER DETAILS  
WITH THRIE-BEAM CONNECTION - 2**

RECOMMENDED OCT. 7, 2024

*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

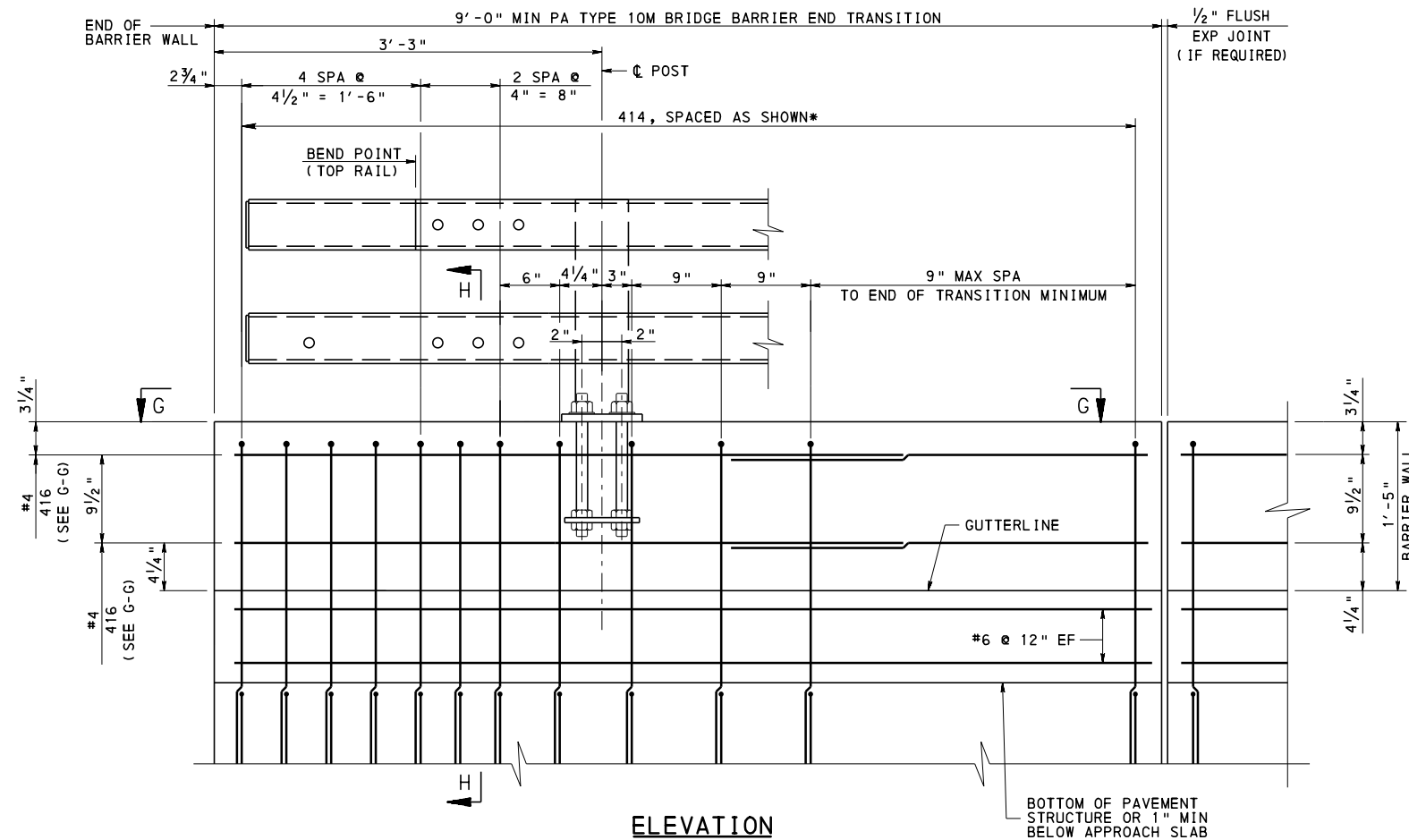
RECOMMENDED OCT. 7, 2024

*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 10

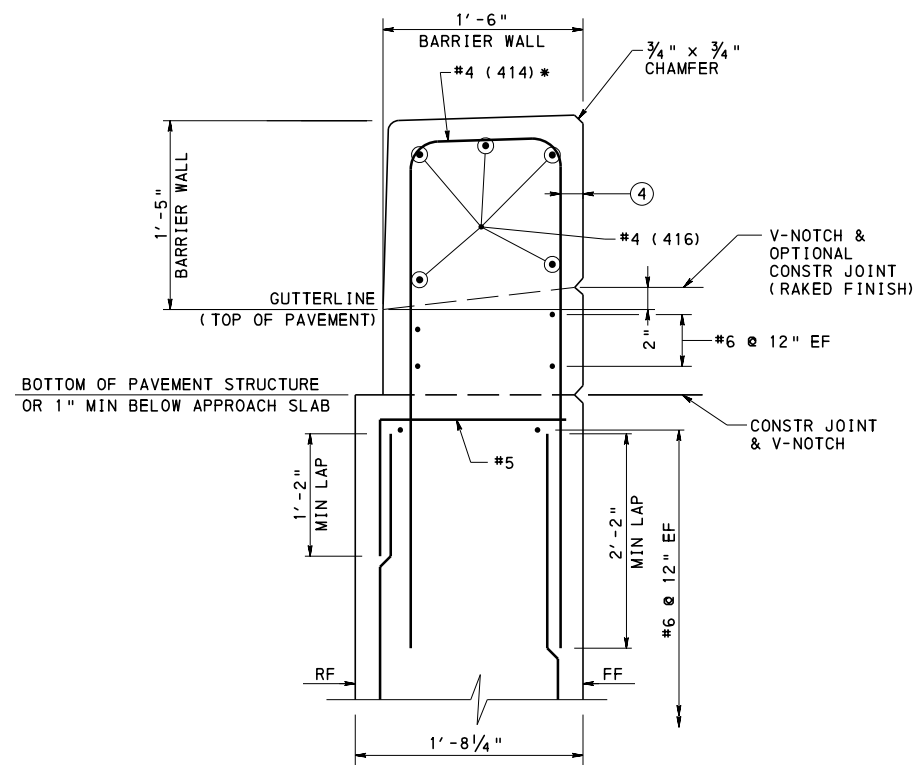
**BD-617M**



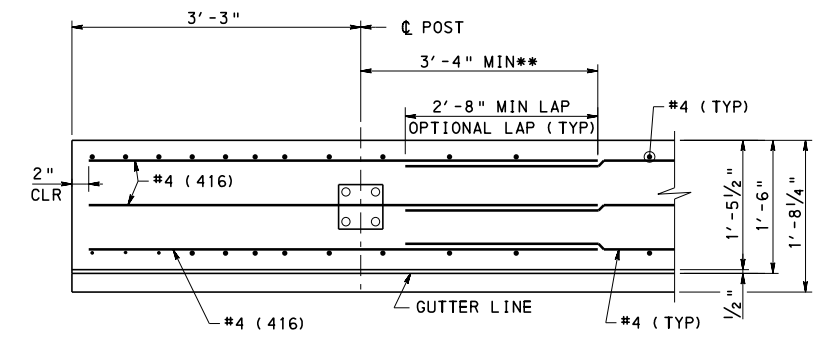


**PA TYPE 10M BARRIER END TRANSITION  
WITH W-BEAM CONNECTION**

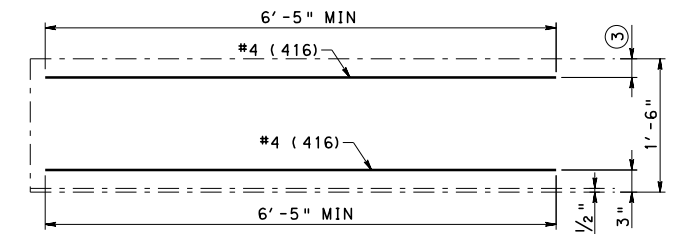
(GUIDE RAIL, CONNECTION PLATE ASSEMBLY AND BOLTS OMITTED FOR CLARITY)



**SECTION H-H ⑥**



**SECTION G-G**



**HORIZONTAL REINFORCEMENT**  
(SEE NOTE 1)

**NOTES:**

1. DIMENSION FROM FACE OF BARRIER TO BAR IS MEASURED TO OUTSIDE FACE OF REINFORCEMENT BAR.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

**LEGEND:**

- ③ 2 1/2" CLR FOR SAFETY WING, 3/8" CLR FOR U-WING.
- ④ 2" CLR FOR SAFETY WINGS, 2 5/8" CLR FOR U-WINGS.
- ⑥ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WINGS. REINFORCEMENT IN U-WING BELOW 1'-6" WIDTH IS AS BY DESIGN.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

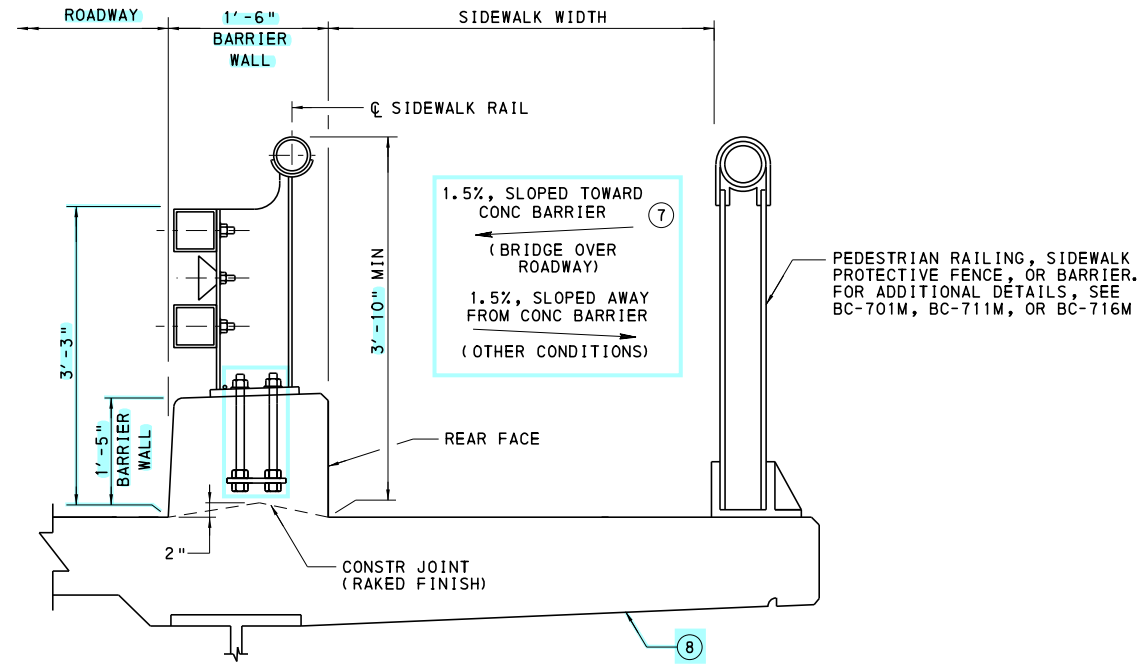
**STANDARD**

**PA TYPE 10M BRIDGE BARRIER  
END OF BARRIER DETAILS  
WITH W-BEAM CONNECTION**

RECOMMENDED OCT. 7, 2024  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

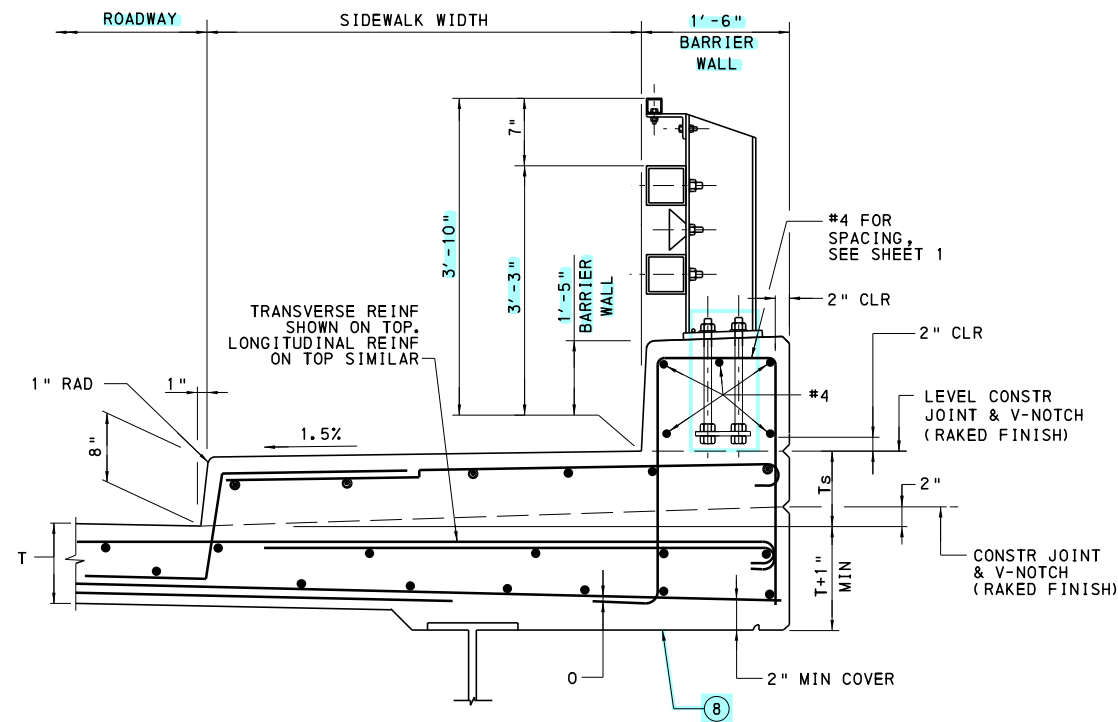
RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 4 OF 10  
**BD-617M**



### TYPICAL SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M)



### ALTERNATE SIDEWALK DETAIL

(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)

### LEGEND:

- ⑦ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN THE SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.
- ⑧ UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.

### NOTES:

- 1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BARRIER NOT SHOWN, SEE SHEET 1.
- 2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

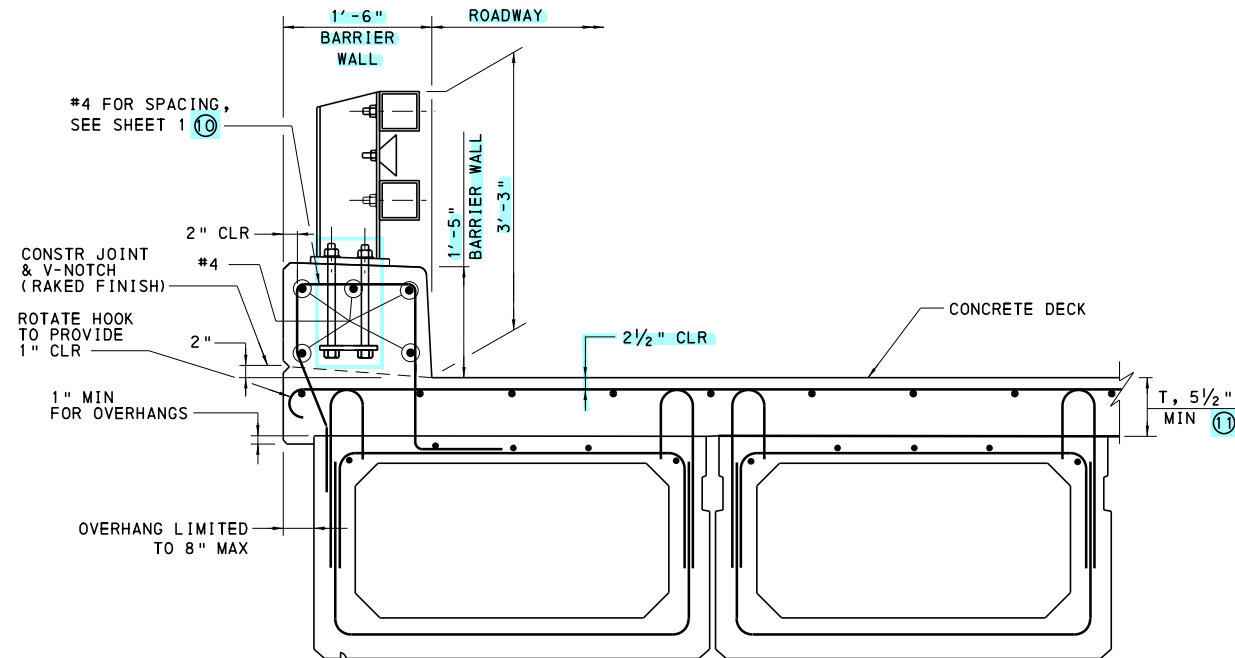
PA TYPE 10M BRIDGE BARRIER  
SIDEWALK DETAILS

RECOMMENDED OCT. 7, 2024  
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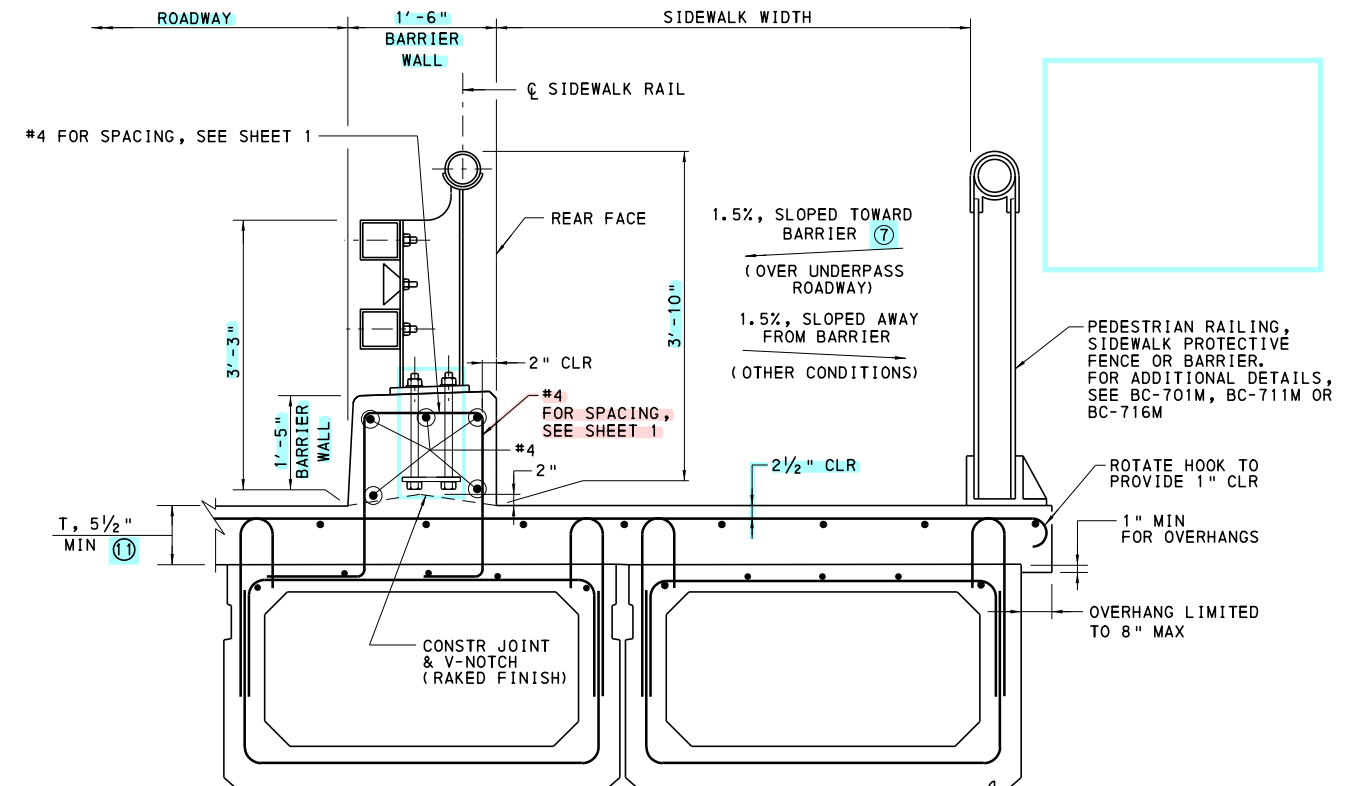
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*Gavin E. Gray*  
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SHEET 5 OF 10

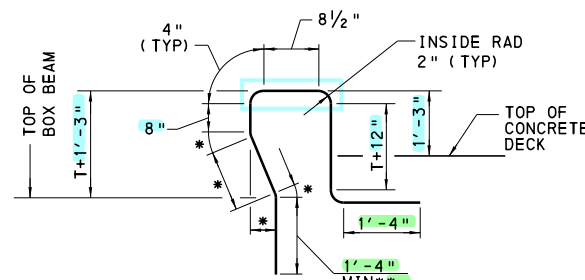
BD-617M



36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING BARRIER

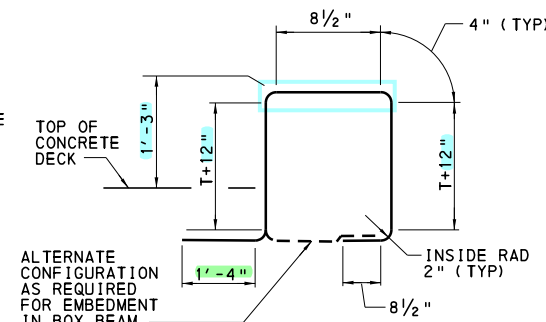


36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING TYPICAL SIDEWALK ⑨



\* VARIES WITH DECK SLAB THICKNESS, T, AND OVERHANG. DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK.  
\*\* OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM.

VERTICAL REINFORCEMENT



VERTICAL REINFORCEMENT

NOTE: FOR REINFORCEMENT BAR NOTES SEE SHEET 1.

# LEGEND:

- ⑦ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIER OR WITH TYPE 2 SCUPPERS IN THE SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAINS AS PER BC-751M.
- ⑨ USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED TO BE ADJUSTED TO ACCOMMODATE THIS CONDITION.
- ⑩ BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.
- ⑪ INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.

# NOTES:

- FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BARRIER NOT SHOWN, SEE SHEET 1.
- FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

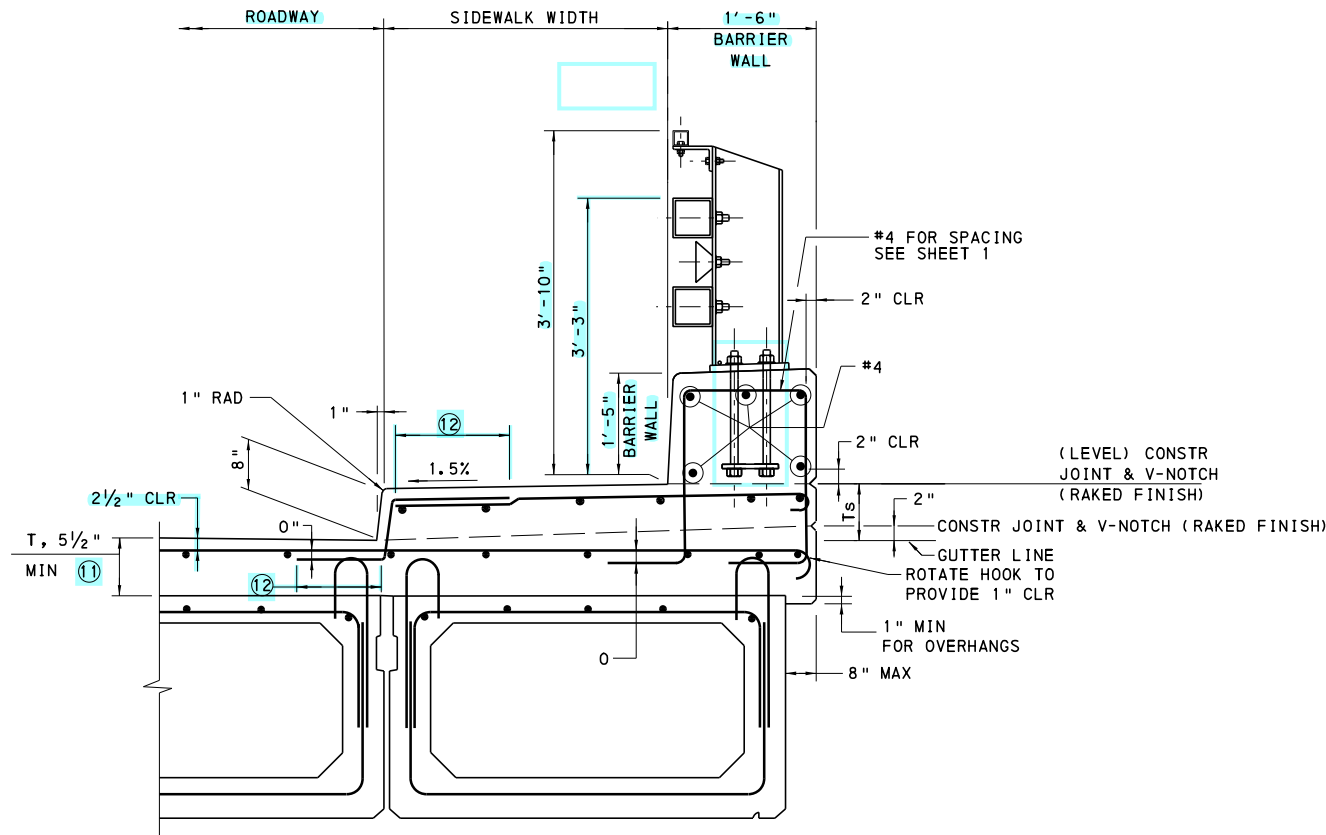
STANDARD

PA TYPE 10M BRIDGE BARRIER  
ADJACENT BOX BEAM DETAILS - 1

RECOMMENDED OCT. 7, 2024  
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CHIEF BRIDGE ENGINEER

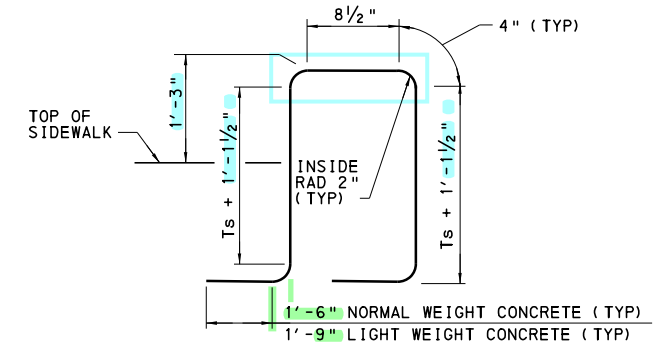
RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 10  
BD-617M



**36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING ALTERNATE SIDEWALK**

FOR GEOMETRIC AND REINFORCEMENT DETAILS  
OF THE SIDEWALK, SEE BD-601M.



**VERTICAL REINFORCEMENT**  
FOR REINFORCEMENT BAR NOTES, SEE SHEET 1

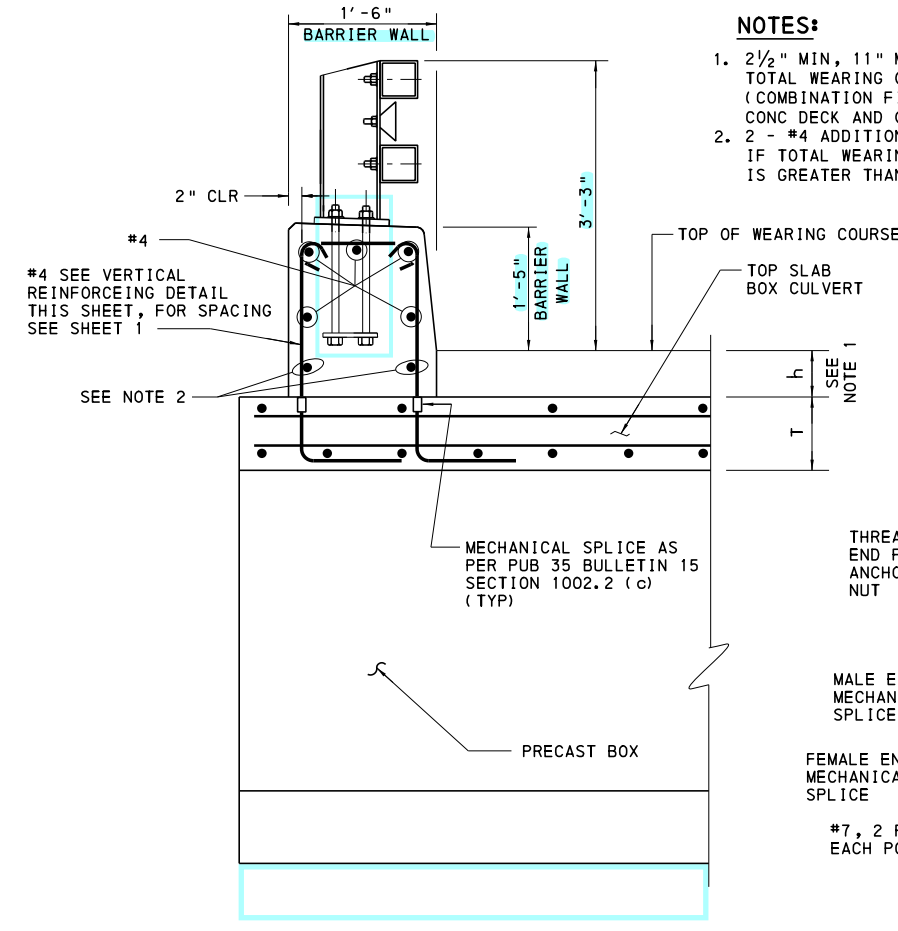
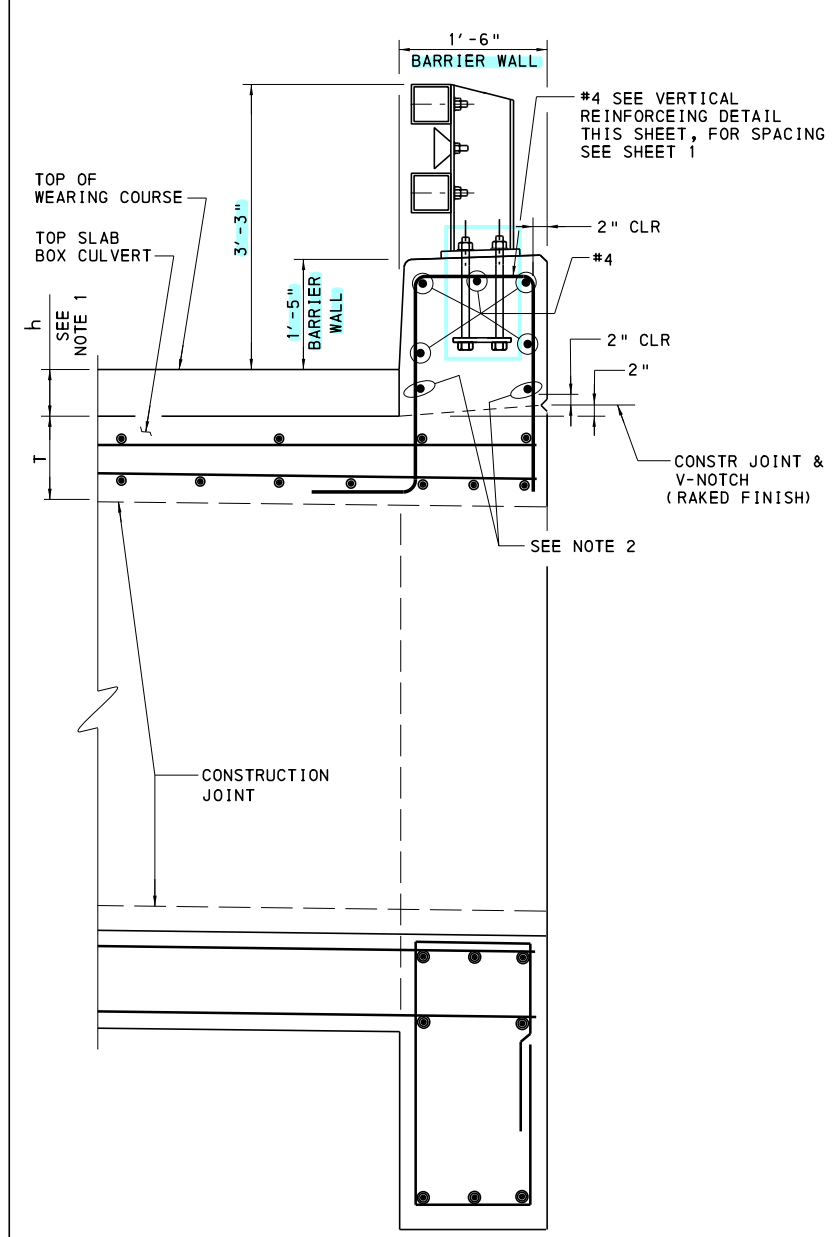
**NOTES:**

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BARRIER NOT SHOWN, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

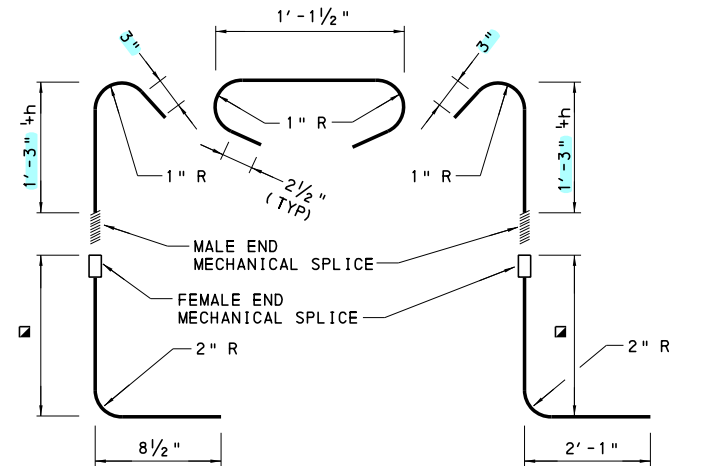
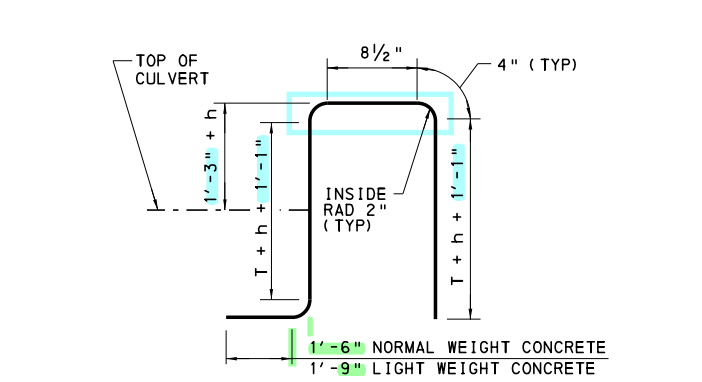
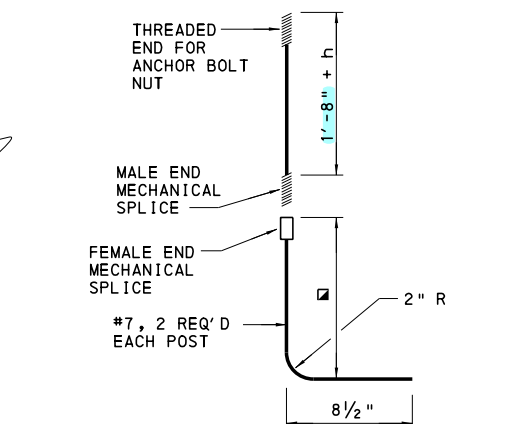
**LEGEND:**

- ① INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.
- ② FOR DIMENSIONS, SEE BD-601M, SHEET 4.

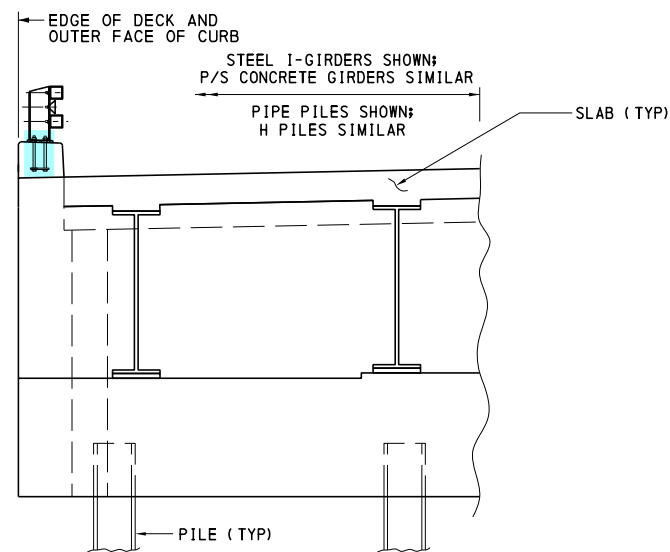
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD		
PA TYPE 10M BRIDGE BARRIER ADJACENT BOX BEAM DETAILS - 2		
RECOMMENDED OCT. 7, 2024 <i>Karin D. Lange</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Gavin E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 7 OF 10 BD-617M



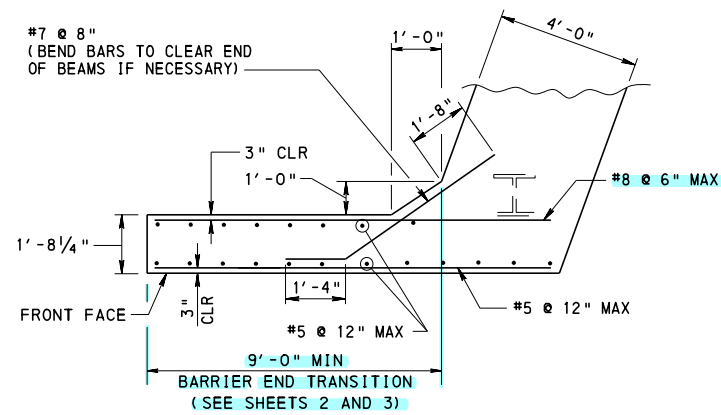
- NOTES:**
1. 2 1/2" MIN, 11" MAX TOTAL WEARING COURSE THICKNESS (h) (COMBINATION FILL OR 5" MIN REINF CONC DECK AND OVERLAY)
  2. 2 - #4 ADDITIONAL BARS REQUIRED IF TOTAL WEARING COURSE THICKNESS (h) IS GREATER THAN 6"



- NOTES:**
1. FOR RC CULVERT DETAILS, SEE BD-632M.
  2. FOR POST AND REINFORCEMENT BAR SPACING, SEE SHEET 1.
  3. FOR ADDITIONAL NOTES, SEE SHEET 1.

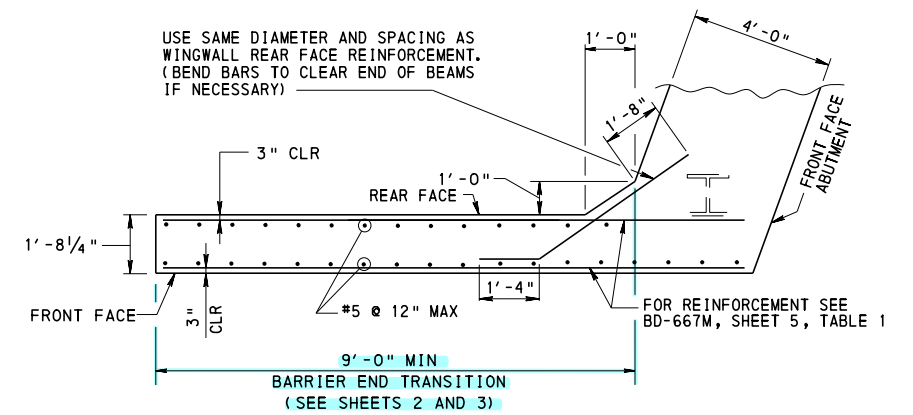


TYPICAL ELEVATION

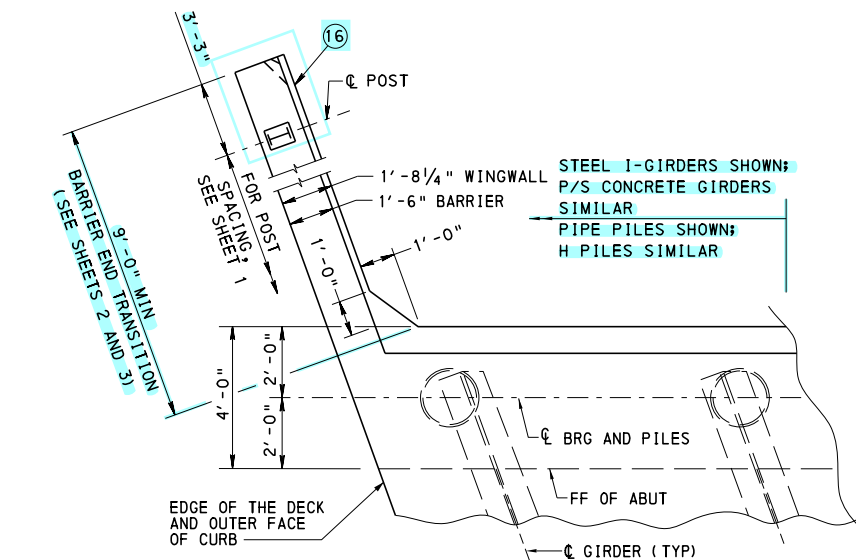


SECTION J-J

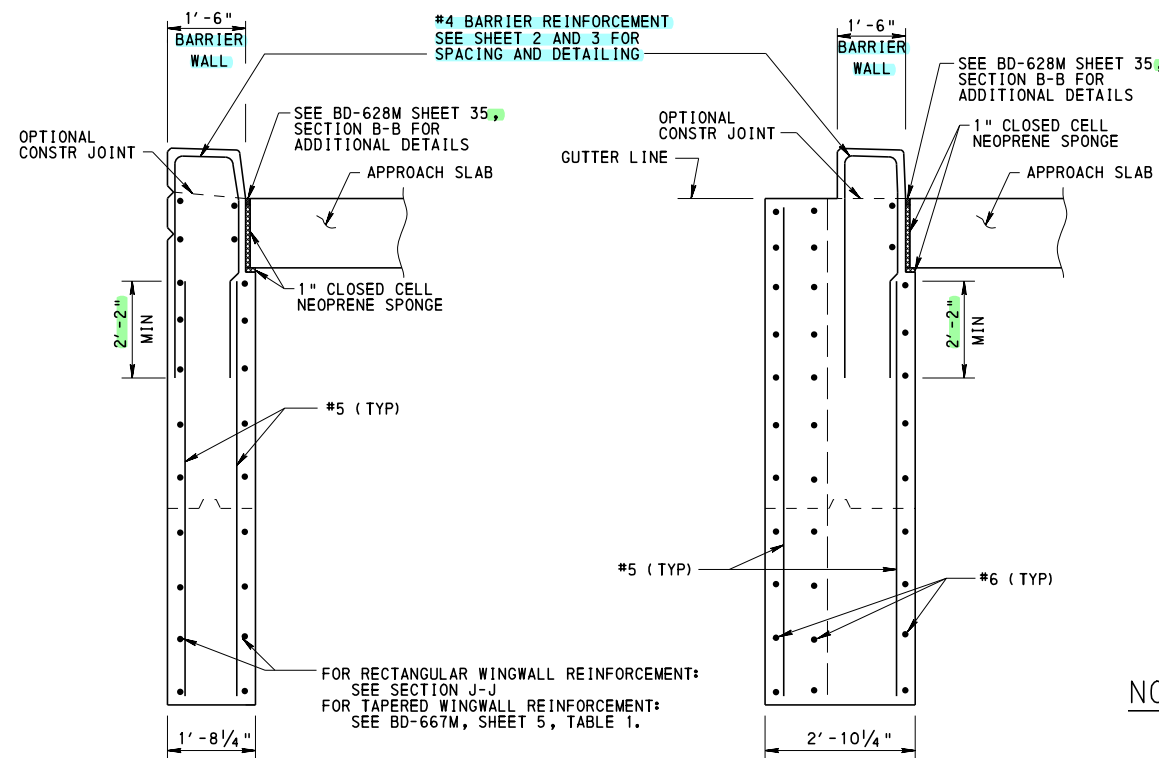
SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS J-J AND L-L.



SECTION L-L  
(FOR REINFORCEMENT NOT SHOWN  
SEE BD-667M, SHEET 4)



TYPICAL PLAN



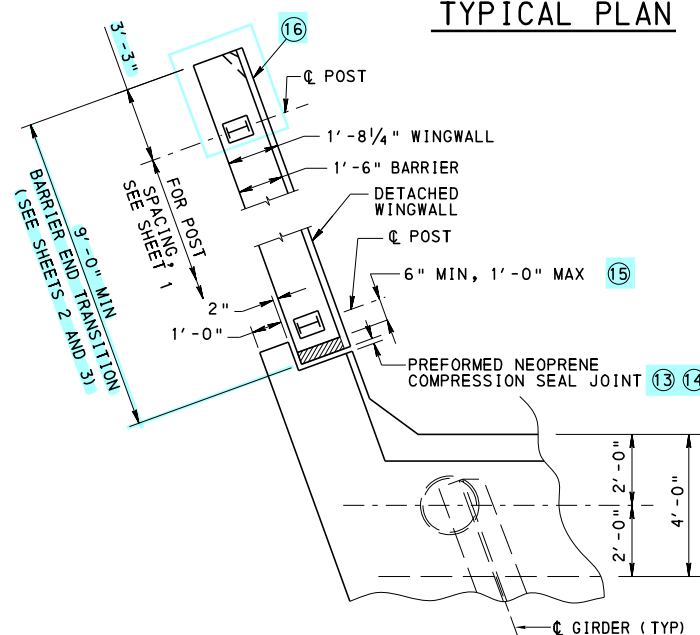
SECTION K-K

(RECTANGULAR OR TAPERED WING)

SECTION N-N

(DETACHED WING)

SEE BD-667M SHEET 5 FOR LOCATION OF SECTIONS K-K AND N-N.



DETACHED WINGWALL PLAN

(FOR DIMENSIONS AND CALL OUTS  
NOT SHOWN, SEE TYPICAL PLAN)

LEGEND:

- ⑬ FOR DETAILS OF THE PREFORMED NEOPRENE COMPRESSION SEAL JOINT AND SLIDING PLATE, SEE BD-667M, SHEETS 5 AND 6.
- ⑭ FOR DETAILS OF THE BENT PLATE ON CONCRETE CURB, SEE BC-709M.
- ⑮ CL POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR CL POST TO EDGE OF FIXED END OF SLIDING PLATE.
- ⑯ SECTION SHOWN WITHOUT CURB, WITH CURB FOLLOW DETAILS ON SHEETS 2 AND 3.

NOTES:

- 1. SEE BD-667M FOR ALL OTHER INTEGRAL ABUTMENT DETAILS.
- 2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

PA TYPE 10M BRIDGE BARRIER  
INTEGRAL ABUTMENT DETAILS

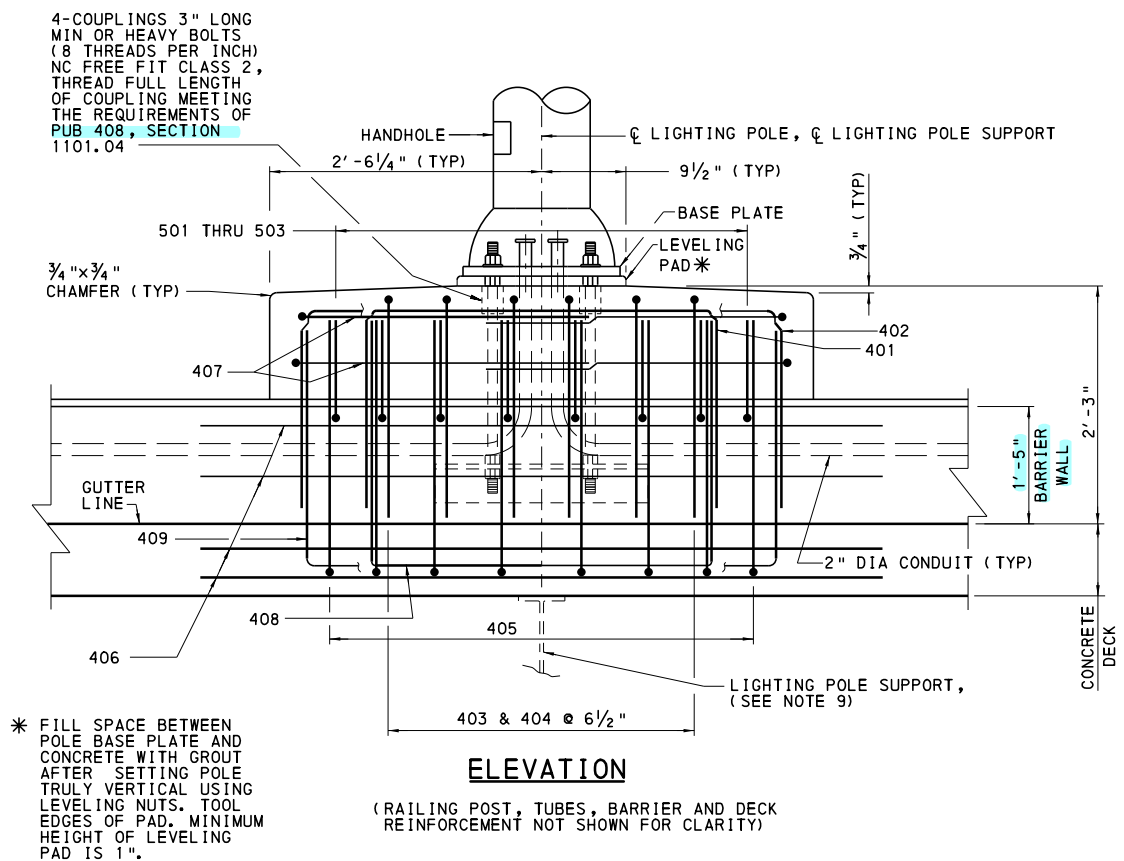
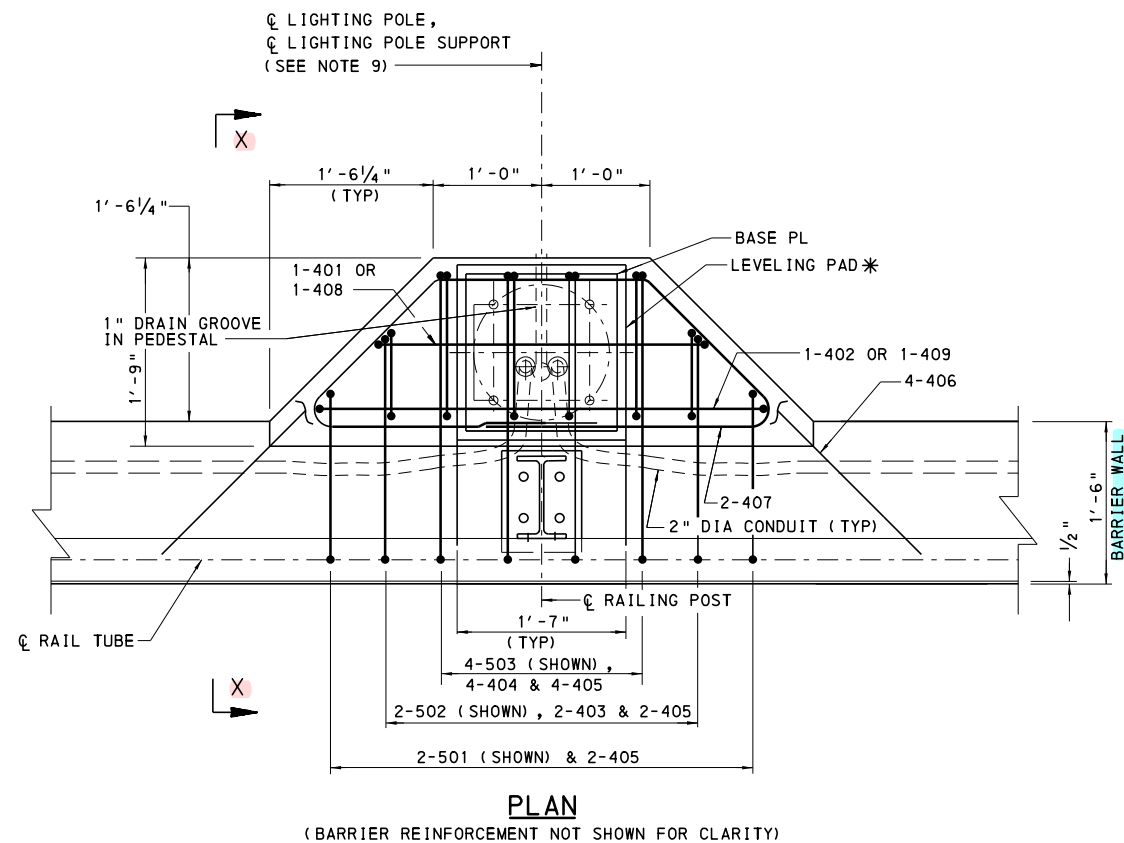
RECOMMENDED OCT. 7, 2024  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 9 OF 10

BD-617M





## NOTES:

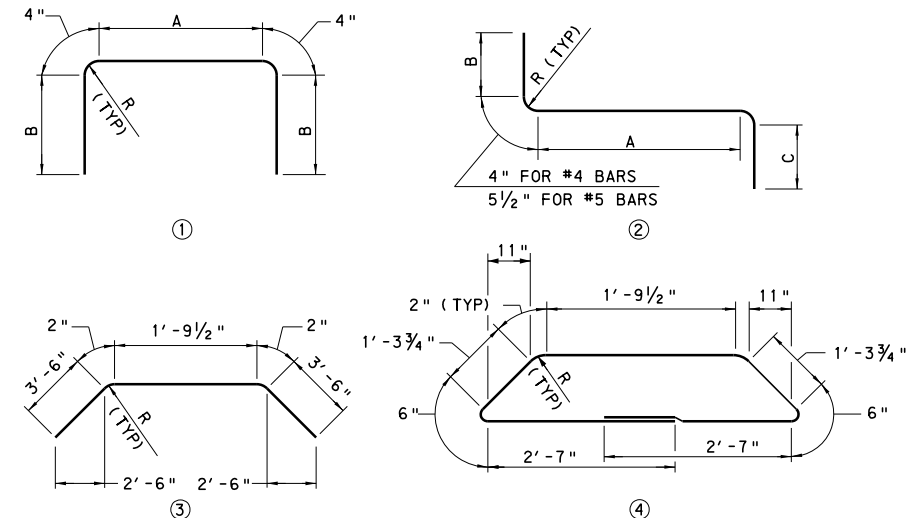
1. PROVIDE MATERIALS AND **PERFORM WORK** IN ACCORDANCE WITH PUBLICATION 408.
2. SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER, TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
3. SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
4. CONFORM ANCHOR MATERIALS AS SPECIFIED IN PUBLICATION 408, SECTION 1101.04. ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.
5. SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
6. PROVIDE 2" CLEAR ON ALL REINFORCEMENT UNLESS NOTED.
7. PROVIDE A MINIMUM OF 2 1/2" CONCRETE COVER FOR CONDUIT.
8. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
9. PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. REFER TO BD-655M FOR ABUTMENT DETAILS AND BD-658M FOR PIER DETAILS TO HELP DEVELOP LIGHT POLE SUPPORT DETAIL. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM.
10. FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.

## PROVISIONS FOR FUTURE LIGHTING

MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA	ANCHOR BOLT DIAMETER
50'-0" MAX	15"	1"

## REINFORCEMENT TABLE

MARK	SIZE	LENGTH	NUMBER	TYPE	A	B	C
401	4	6'-6"	1	1	2'-7"	1'-7 1/2"	-----
402	4	7'-5"	1	1	3'-6"	1'-7 1/2"	-----
403	4	4'-5"	2	1	5"	1'-8"	-----
404	4	4'-11"	4	1	11"	1'-8"	-----
405	4	5'-2 1/2"	8	2	2'-7 1/2"	2'-3"	0"
406	4	9'-1 1/2"	4	3	-----	-----	-----
407	4	10'-11"	2	4	-----	-----	-----
408	4	7'-9"	1	1	2'-7"	2'-3"	-----
409	4	8'-8"	1	1	3'-6"	2'-3"	-----
501	5	3'-6 1/2"	2	2	1'-0"	9"	10 1/2"
502	5	4'-0 1/2"	2	2	1'-6"	9"	10 1/2"
503	5	4'-6"	4	2	1'-11 1/2"	9"	10 1/2"



## REINFORCEMENT DETAILS

## REINFORCEMENT BAR NOTES

1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. **EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).**
3. RADIUS, R=2", FOR #4 BARS AND R=3" FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF BRIDGE

STANDARD

PA TYPE 10M BRIDGE BARRIER  
LIGHTING POLE ANCHORAGE DETAILS

RECOMMENDED OCT. 7, 2024

*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

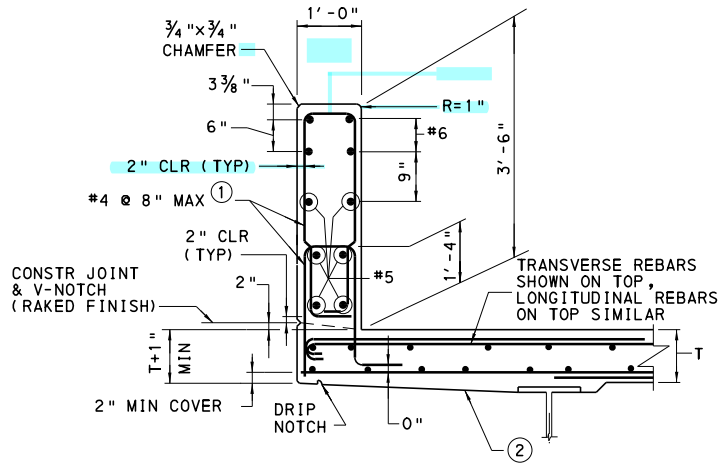
RECOMMENDED OCT. 7, 2024

*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

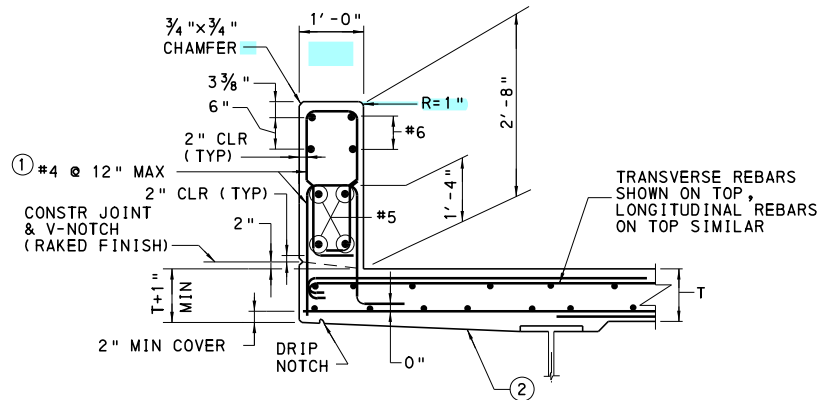
SHEET 10 OF 10

BD-617M

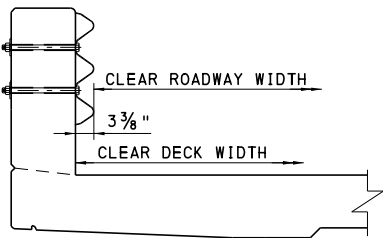
- CHANGE 2
- CHANGE 3
- CHANGE 7



42" VERTICAL WALL  
CONCRETE BARRIER DETAIL  
(FOR REINFORCEMENT IN DECK  
SLAB, SEE BD-601M)

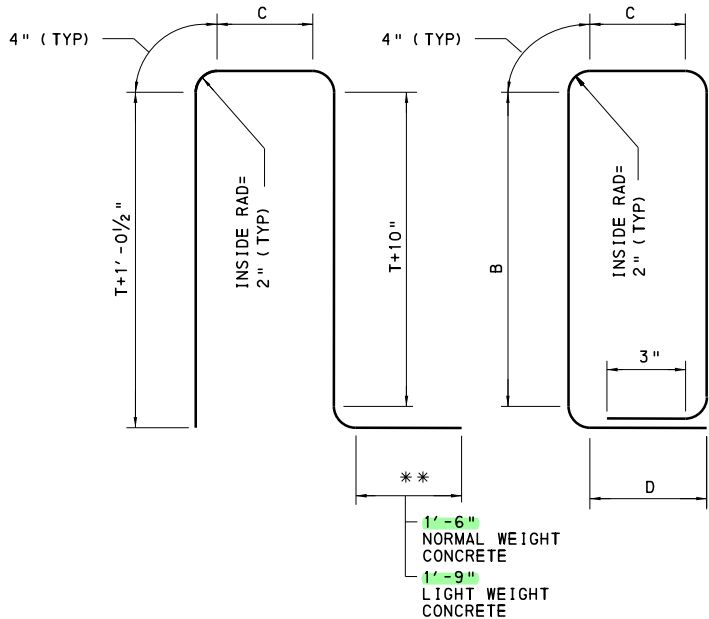


32" VERTICAL WALL  
CONCRETE BARRIER DETAIL  
(FOR REINFORCEMENT IN DECK  
SLAB, SEE BD-601M)



CLEAR ROADWAY WIDTH DETAIL

(THRIE-BEAM GUIDE RAIL SHOWN, W-BEAM GUIDE RAIL SIMILAR)  
CLEAR DECK WIDTH INCLUDES CLEAR ROADWAY WIDTH PLUS 3/4" MINIMUM  
TO ACCOUNT FOR THE THRIE-BEAM OR W-BEAM TERMINAL CONNECTOR WIDTH.



VERTICAL REINFORCEMENT

(SEE TABLE 1 FOR DIMENSIONS B, C, D)

\*\* WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE,  
SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO  
PROVIDE NECESSARY DIMENSIONS.

TABLE 1 VERTICAL REINFORCEMENT DIMENSIONS			
	B	C	D
42" VERTICAL WALL CONCRETE BARRIER	2' - 7"	3"	5 1/2"
32" VERTICAL WALL CONCRETE BARRIER	1' - 9"	3"	5 1/2"

REINFORCEMENT BAR NOTES

- REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- RADIUS, R=2, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1 (c).

BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER - P/S CONCRETE I-BEAM AND BOX BEAM BRIDGES
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
BC-701M	PROTECTIVE FENCE
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

VERTICAL WALL CONCRETE BARRIER  
MISCELLANEOUS DETAILS

RECOMMENDED OCT. 7, 2024  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 12

BD-618M

LEGEND:

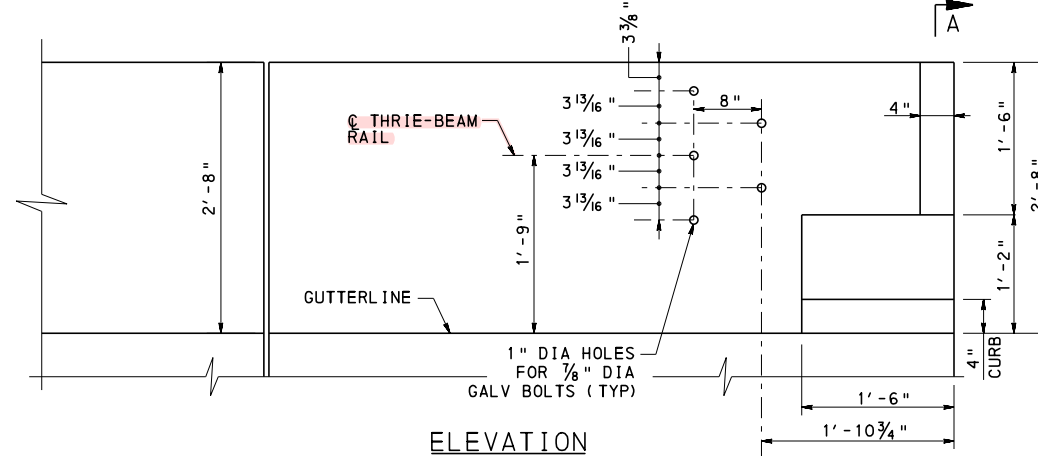
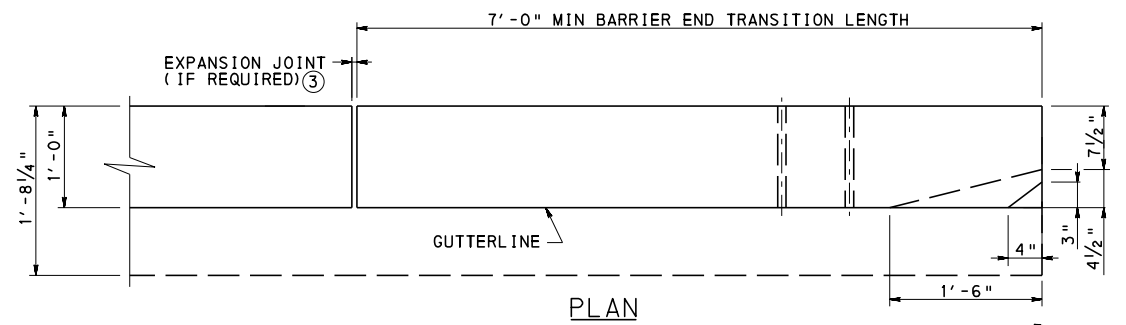
- WITHIN 10 FT ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON SHEETS 2-9.
- UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.

NOTES:

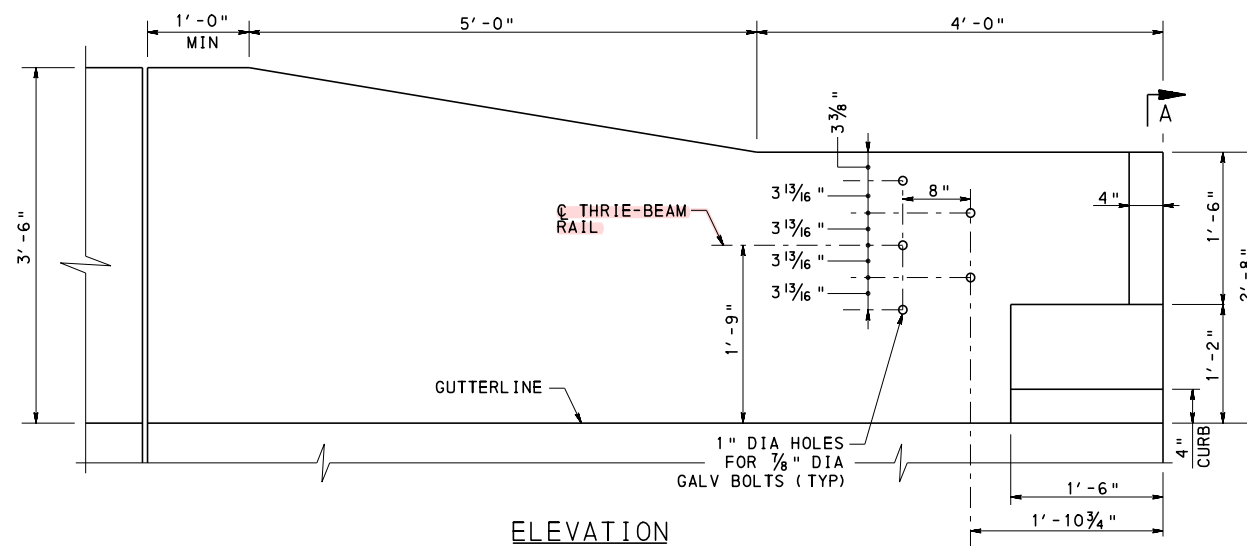
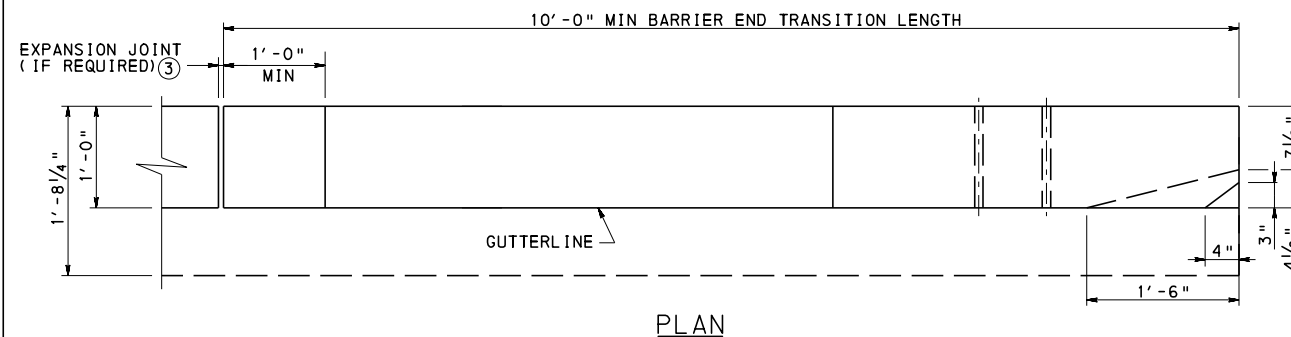
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
- THE 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-5. THE 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE HEIGHT OF THE BARRIER BELOW 42".
- THE 32" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-3.
- FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF VERTICAL WALL CONCRETE BARRIERS ARE AS FOLLOWS:
  - 42" VERTICAL CONCRETE WALL 530 LB/FT
  - 32" VERTICAL CONCRETE WALL 400 LB/FT
  - SIDEWALK VERTICAL CONCRETE WALL 530 LB/FT
  - RAISED SIDEWALK VERTICAL CONCRETE WALL 540 LB/FT
- FOR DETAILS OF THE 42" AND 32" VERTICAL WALL CONCRETE BARRIER ON SUBSTRUCTURE UNITS, SEE THE APPROPRIATE SUBSTRUCTURE DETAILS IN BD-622M AND BD-624M.
- ON UNDIVIDED HIGHWAYS WITH TWO-WAY TRAFFIC, PROVIDE END TRANSITIONS THAT CONNECT TO A THRIE-BEAM GUIDE RAIL.
- ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS, PROVIDE APPROACH END TRANSITIONS THAT CONNECT TO A THRIE-BEAM GUIDE RAIL AND PROVIDE TRAILING END TRANSITIONS THAT CONNECT TO A W-BEAM GUIDE RAIL IF WARRANTED BY THE LENGTH OF NEED OR OTHER OBSTRUCTIONS.
- END CHAMFERS, ON THE BARRIER, ARE NOT REQUIRED ON THE TRAILING END OF THE BARRIER ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL.

CONTRACT DRAWING NOTE:

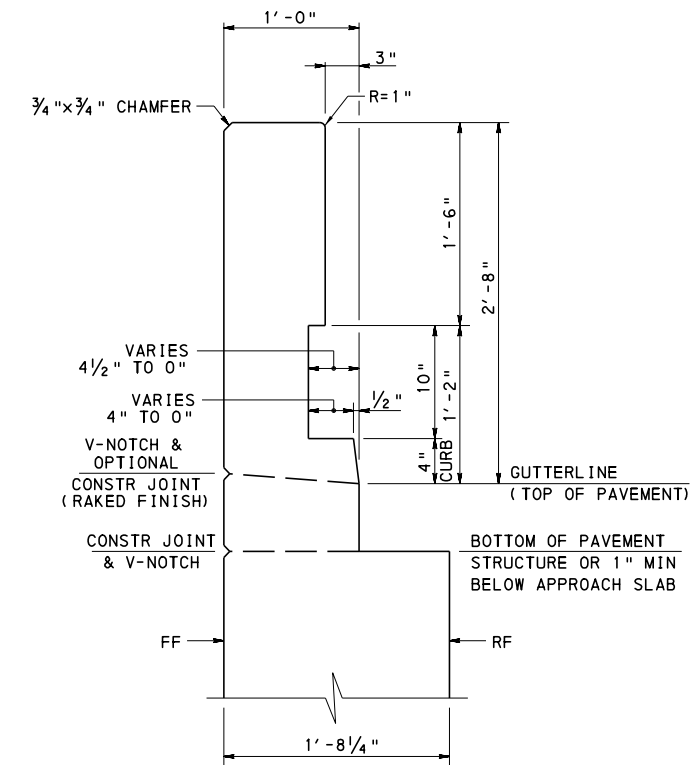
- THE FOLLOWING NOTE IS TO BE PLACED ON THE CONTRACT DRAWINGS WHEN THE 42" VERTICAL WALL CONCRETE BARRIER IS USED: THE 42" VERTICAL WALL CONCRETE BARRIER IS DESIGNATED AS MASH TL-4 WHEN AN OVERLAY IS PLACED ON THE STRUCTURE AND REDUCES THE BARRIER HEIGHT BELOW 42".



32" VERTICAL WALL CONCRETE BARRIER  
END TRANSITION WITH THRIE-BEAM CONNECTION  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



42" VERTICAL WALL CONCRETE BARRIER  
END TRANSITION WITH THRIE-BEAM CONNECTION  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



SECTION A-A

# LEGEND:

- ③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

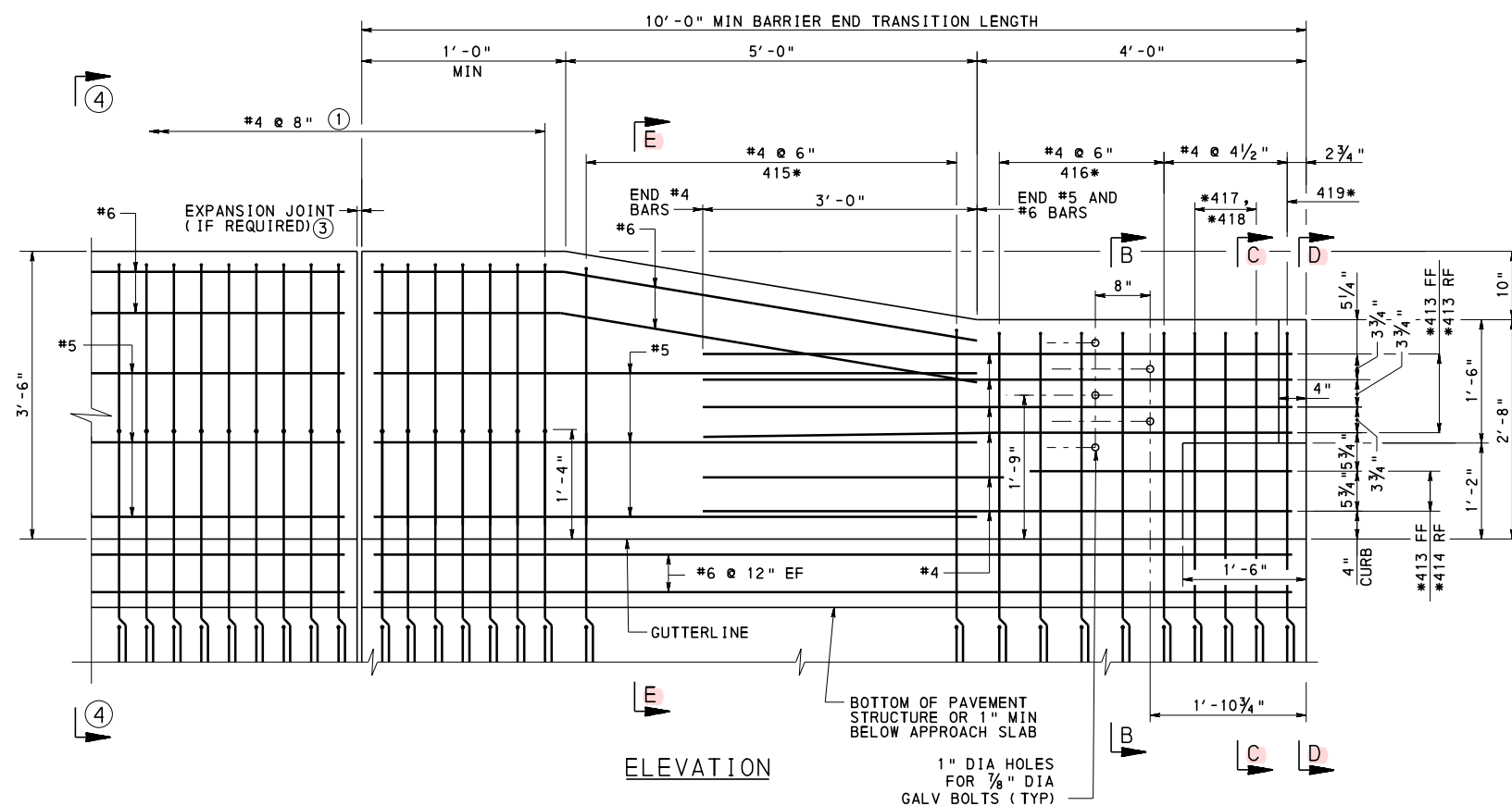
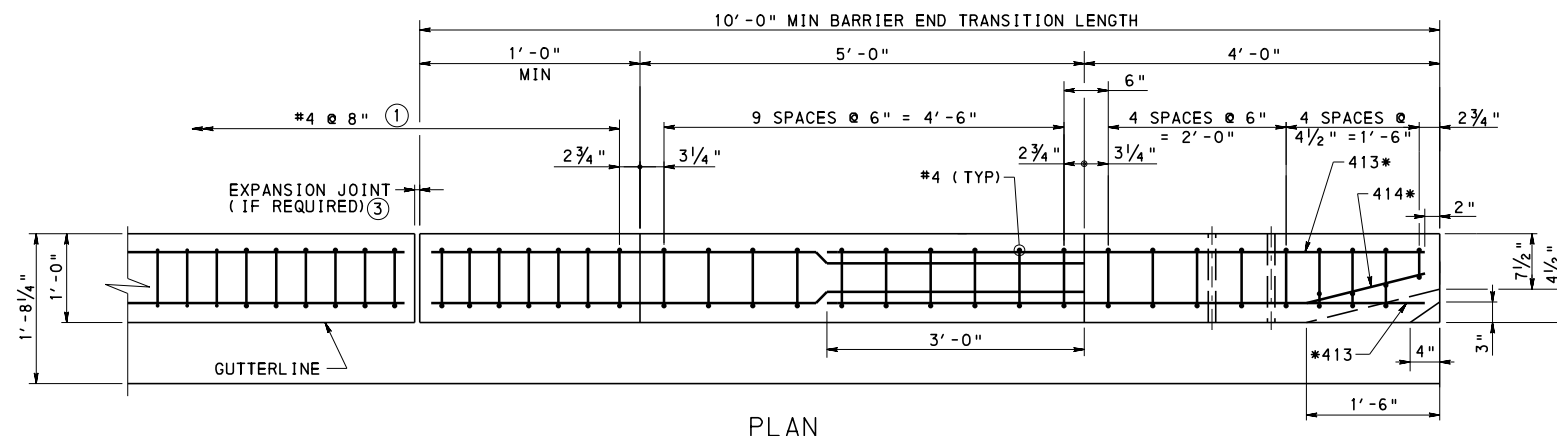
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
VERTICAL WALL CONCRETE BARRIER  
BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION - 1

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

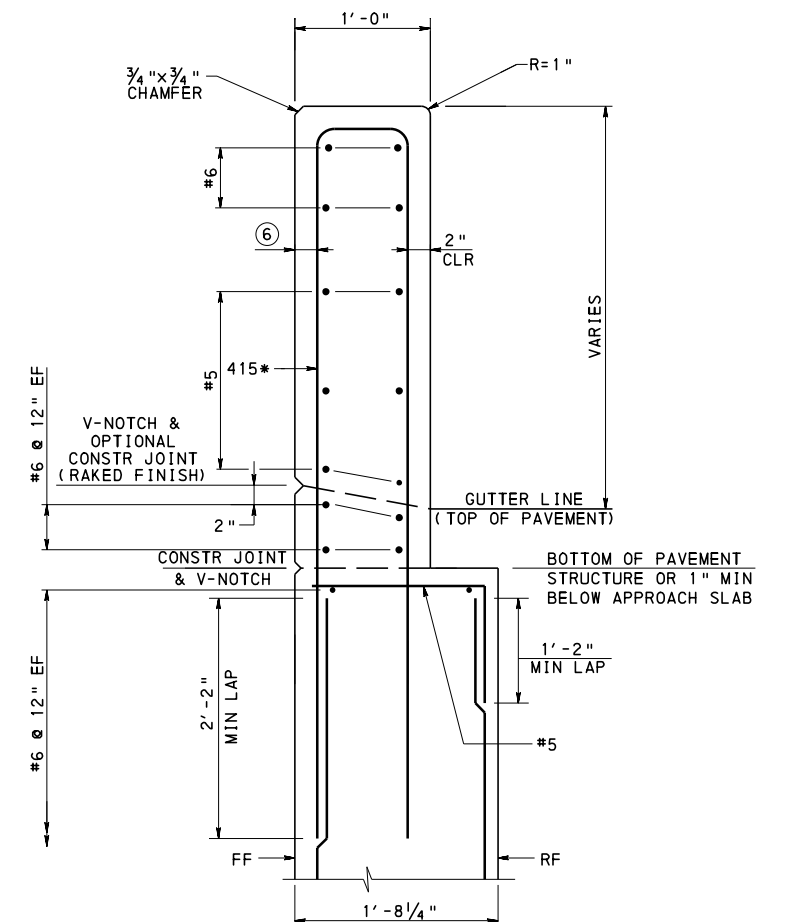
RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 12  
BD-618M



42" VERTICAL WALL CONCRETE BARRIER  
END TRANSITION WITH THRIE-BEAM CONNECTION  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

\* SEE REINFORCEMENT DETAILS, SHEETS 5 & 6.



SECTION E-E

#### LEGEND:

- ① WITHIN 10 FT ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON SHEETS 2-9.
- ③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".
- ④ SEE 42" VERTICAL WALL CONCRETE BARRIER DETAIL, SHEET 1.
- ⑥ 2" CLR FOR SAFETY WINGS, 2 5/8" CLR FOR U-WINGS.
- ⑦ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1'-0" WIDTH IS AS REQUIRED PER DESIGN.

#### NOTES:

1. FOR ADDITIONAL BARRIER END TRANSITION DETAILS AND REINFORCEMENT, SEE BD-622M AND BD-624M.
2. FOR SECTION B-B, C-C AND D-D, SEE SHEET 5.

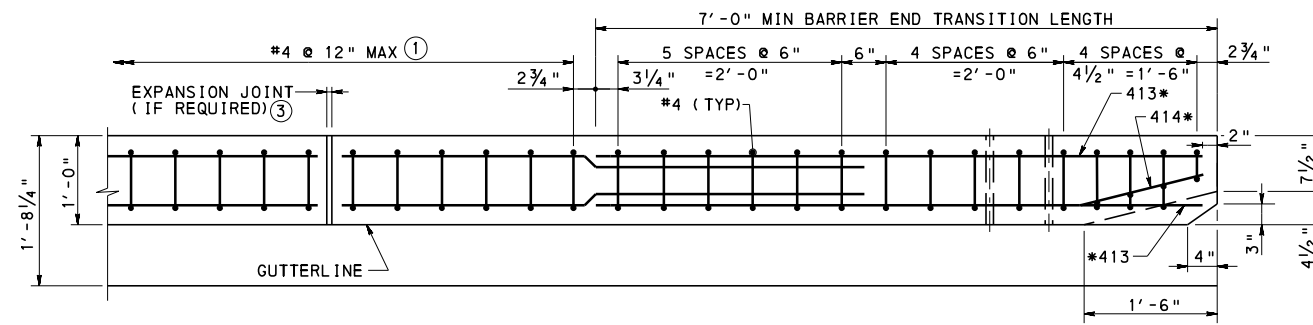
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
VERTICAL WALL CONCRETE BARRIER  
BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION - 2

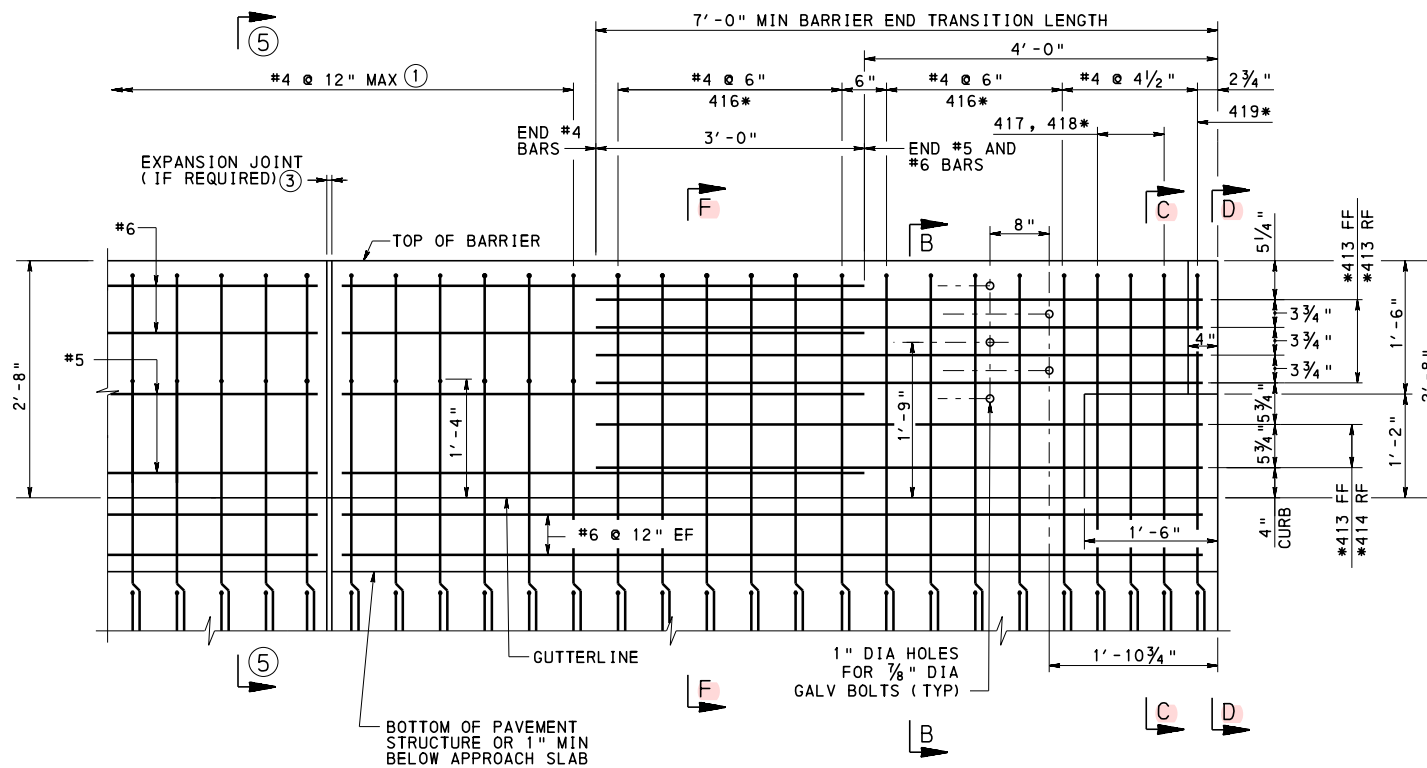
RECOMMENDED OCT. 7, 2024  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 12  
BD-618M



PLAN



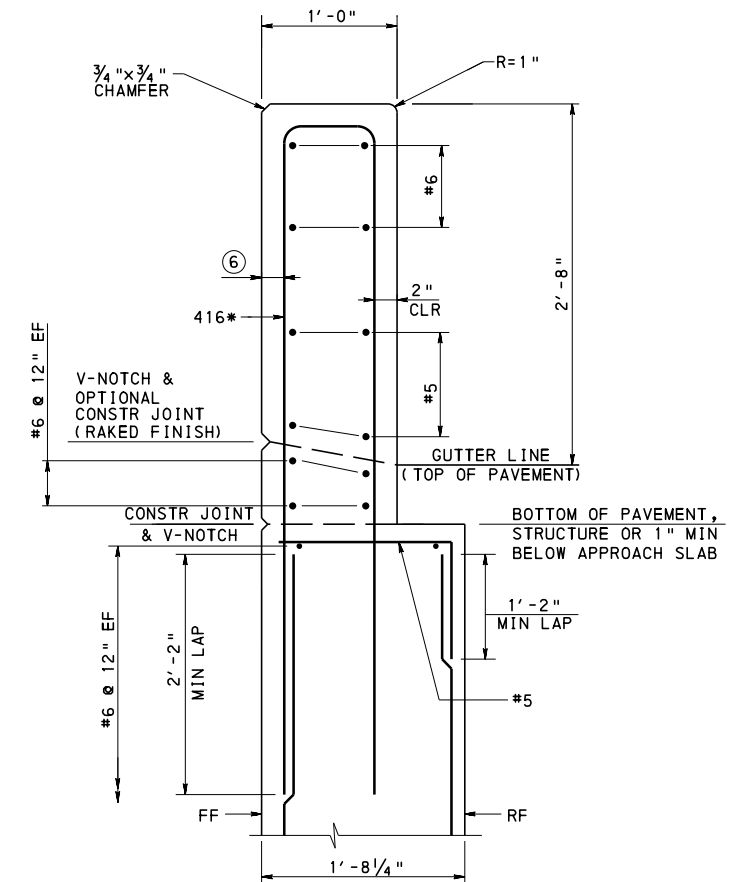
ELEVATION

# 32" VERTICAL WALL CONCRETE BARRIER END TRANSITION WITH THRIE-BEAM CONNECTION (WITH CURB SHOWN, WITHOUT CURB SIMILAR)

\* SEE REINFORCEMENT DETAILS, SHEETS 5 & 6.

## NOTES:

- FOR ADDITIONAL BARRIER END TRANSITION DETAILS AND REINFORCEMENT, SEE BD-622M AND BD-624M.
- FOR SECTION B-B, C-C AND D-D, SEE SHEET 5.



SECTION F-F

NOTE: #4 LONGITUDINAL BARS IN THE BARRIER ARE NOT SHOWN FOR CLARITY.

## LEGEND:

- WITHIN 10 FT ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON SHEETS 2-9.
- EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".
- SEE 32" VERTICAL WALL CONCRETE BARRIER DETAIL, SHEET 1.
- 2" CLR FOR SAFETY WINGS, 2 5/8" CLR FOR U-WINGS.
- REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1'-0" WIDTH IS AS REQUIRED PER DESIGN.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

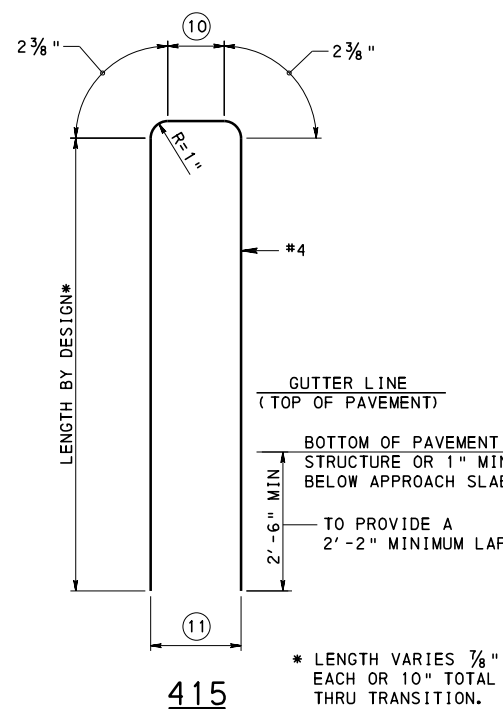
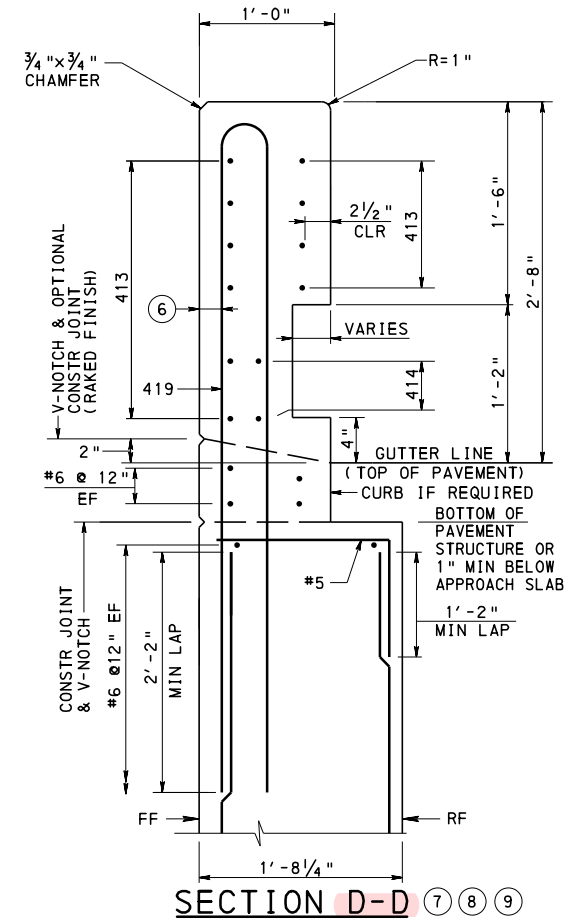
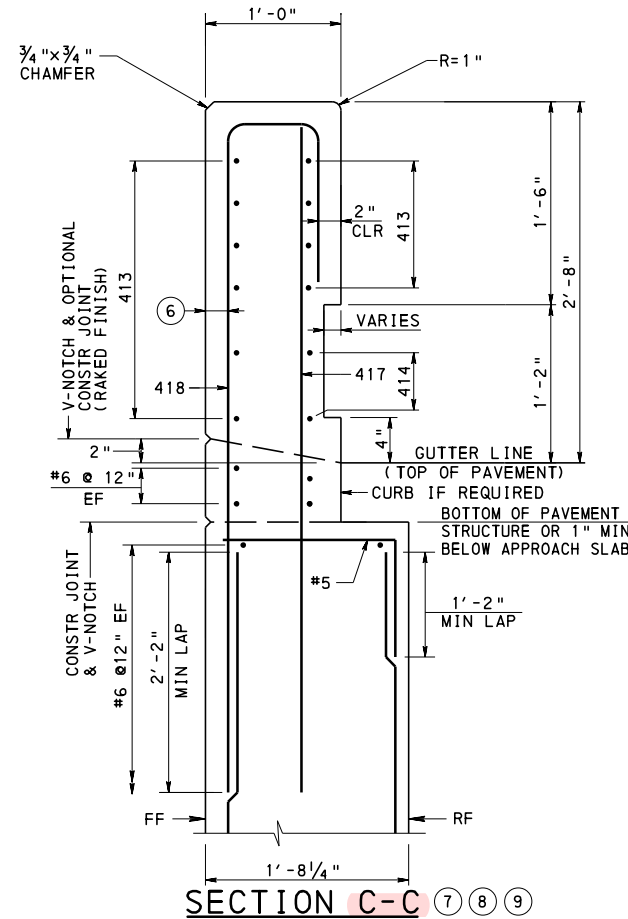
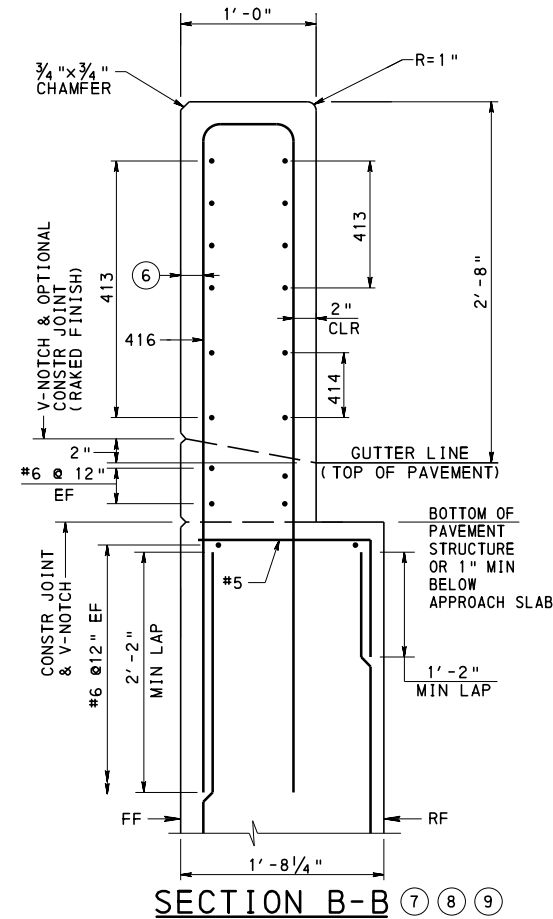
STANDARD  
VERTICAL WALL CONCRETE BARRIER  
BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION - 3

RECOMMENDED OCT. 7, 2024  
Chief Bridge Engineer

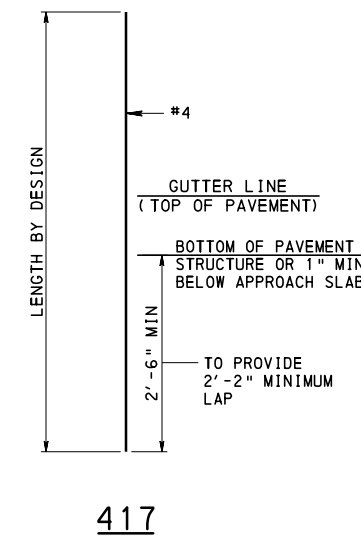
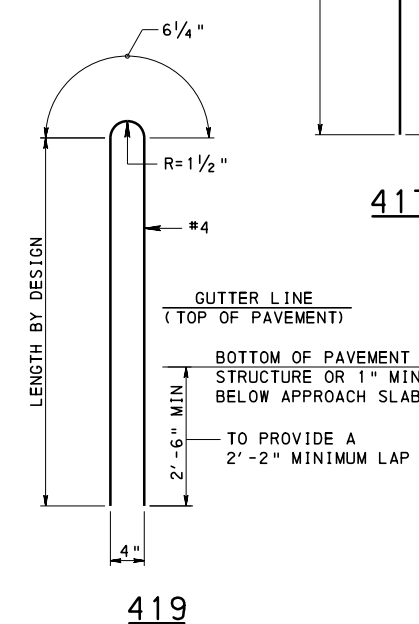
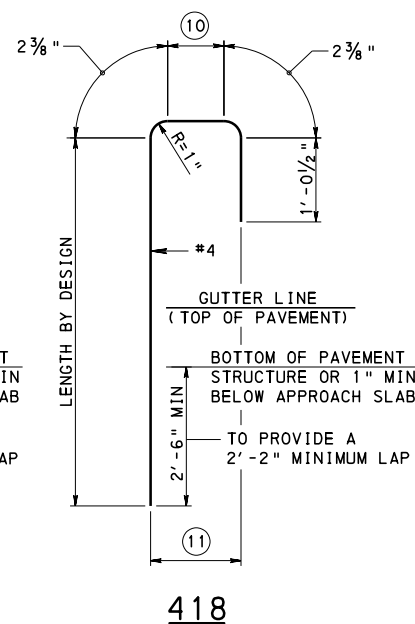
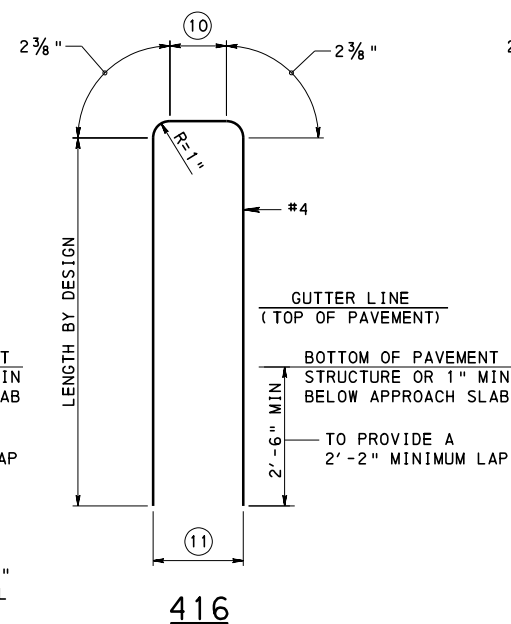
RECOMMENDED OCT. 7, 2024  
Chief Engineer, Highway Admin.

SHEET 4 OF 12

BD-618M



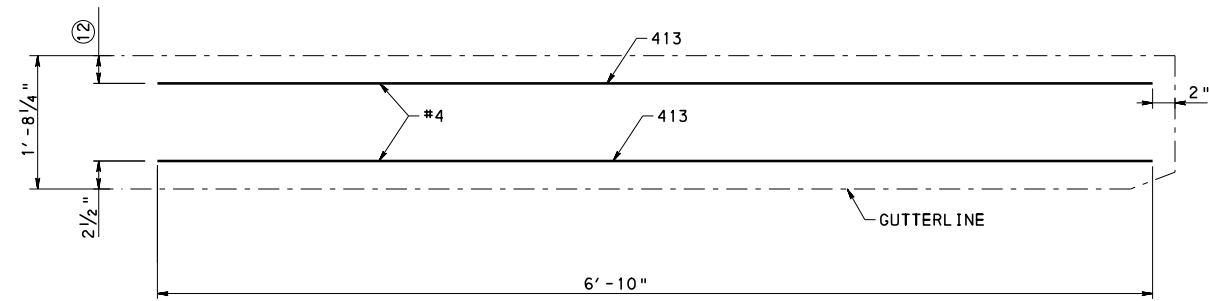
\* LENGTH VARIES 7/8" EACH OR 10" TOTAL THRU TRANSITION.



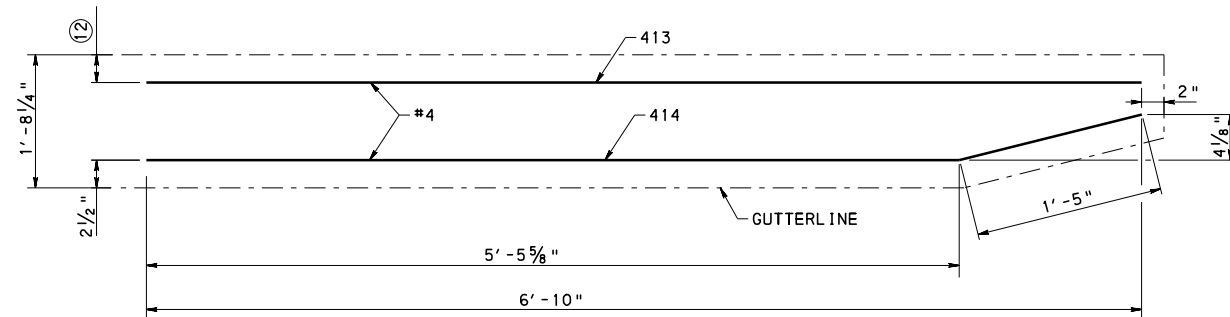
# LEGEND:

- ⑥ 2" CLR FOR SAFETY WINGS.  
2 5/8" CLR FOR U-WINGS.
- ⑦ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WINGS.  
REINFORCEMENT IN U-WING BELOW 1'-0" WIDTH IS AS REQUIRED PER DESIGN.
- ⑧ TYPICAL SECTIONS SHOWN WITH CURB, WITHOUT CURB SIMILAR.
- ⑨ FOR DETAILS OF THE BARRIER SUPPORT WALLS, SEE BD-622M AND BD-624M, SHEET 2.
- ⑩ 5" FOR SAFETY WINGS.  
4 3/8" FOR U-WINGS.
- ⑪ 8" FOR SAFETY WINGS.  
7 3/8" FOR U-WINGS.





PLAN  
413



PLAN  
414

LEGEND:

- ⑫ 2 1/2" CLR FOR SAFETY WINGS.  
3 1/8" CLR FOR U-WINGS.

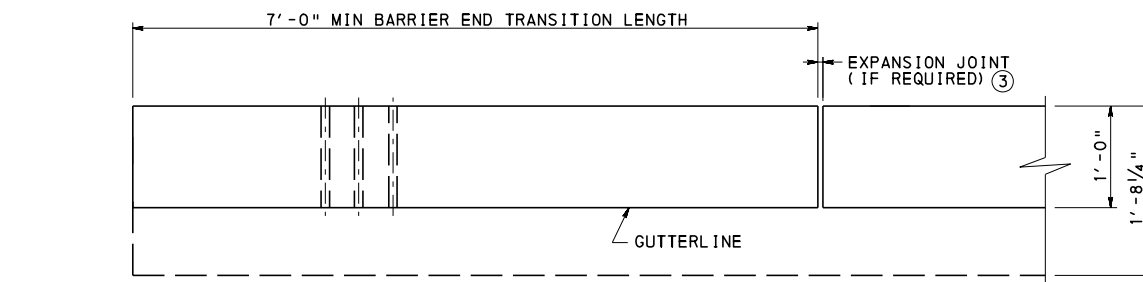
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
VERTICAL WALL CONCRETE BARRIER  
END TRANSITION REINFORCEMENT  
WITH THRIE-BEAM CONNECTION - 2

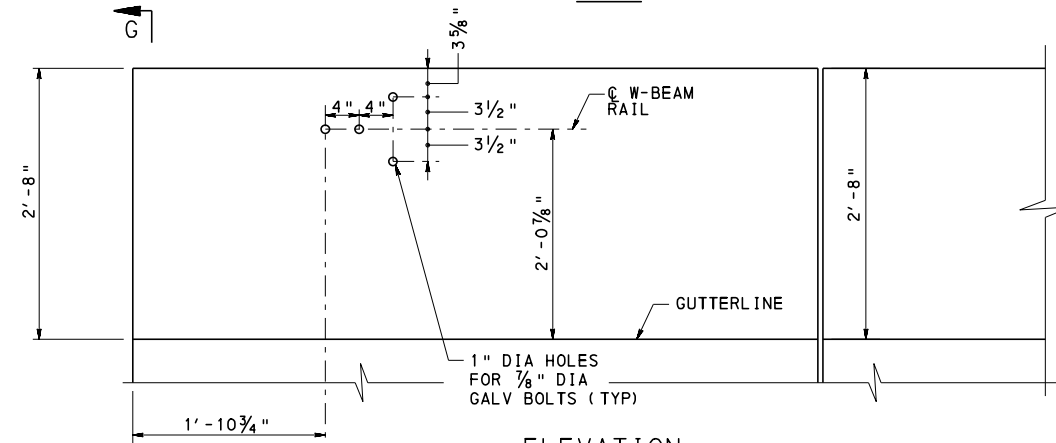
RECOMMENDED OCT. 7, 2024  
*Kevin J. Senger*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 12  
BD-618M

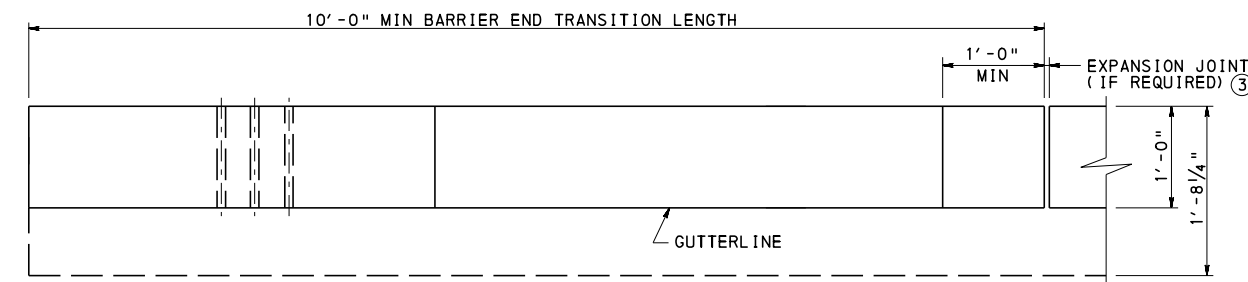


PLAN

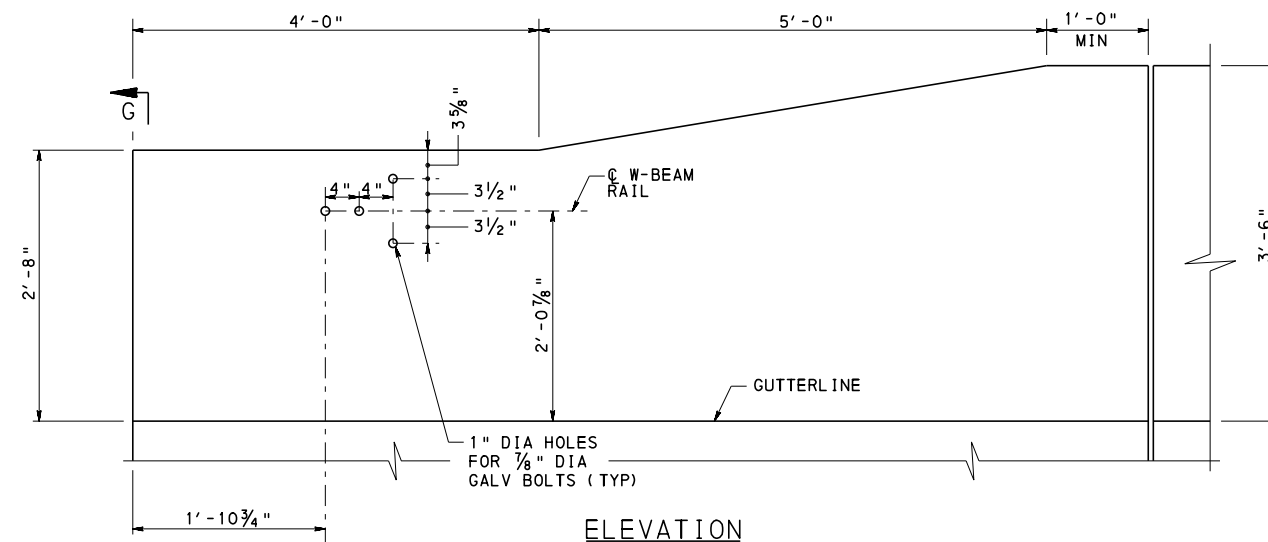


ELEVATION

32" VERTICAL WALL CONCRETE BARRIER  
TRAILING END TRANSITION WITH W-BEAM CONNECTION

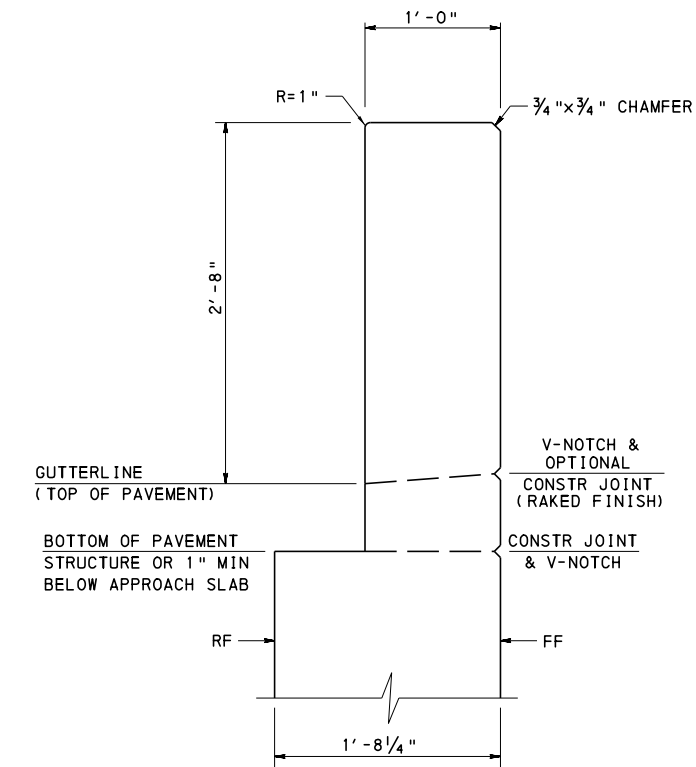


PLAN



ELEVATION

42" VERTICAL WALL CONCRETE BARRIER  
TRAILING END TRANSITION WITH W-BEAM CONNECTION



SECTION G-G

# LEGEND:

- ③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

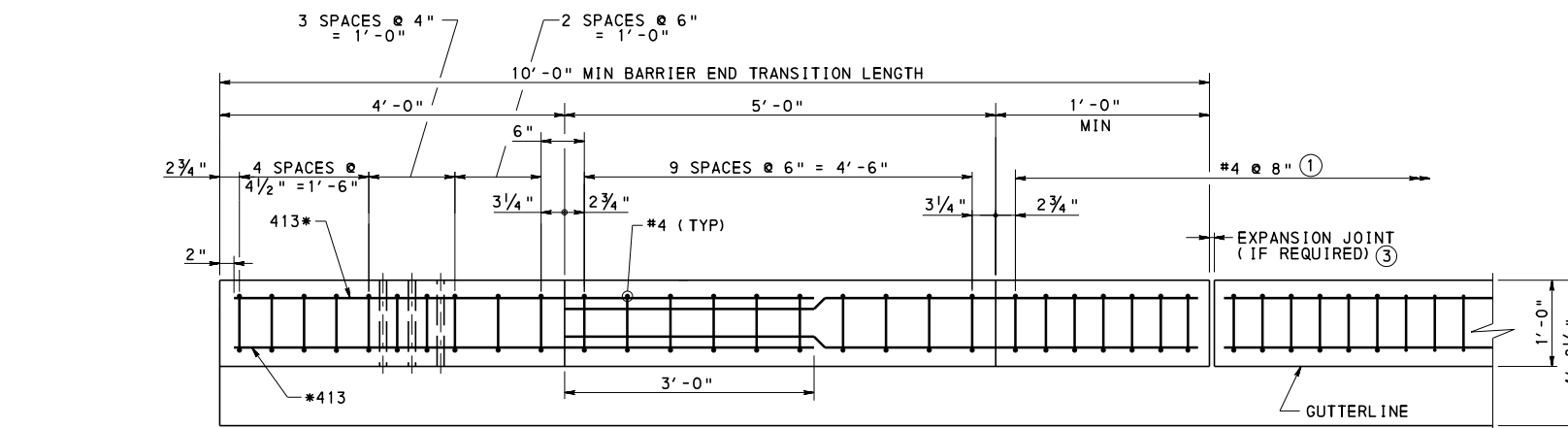
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
VERTICAL WALL CONCRETE BARRIER  
BARRIER END TRANSITION  
WITH W-BEAM CONNECTION - 1

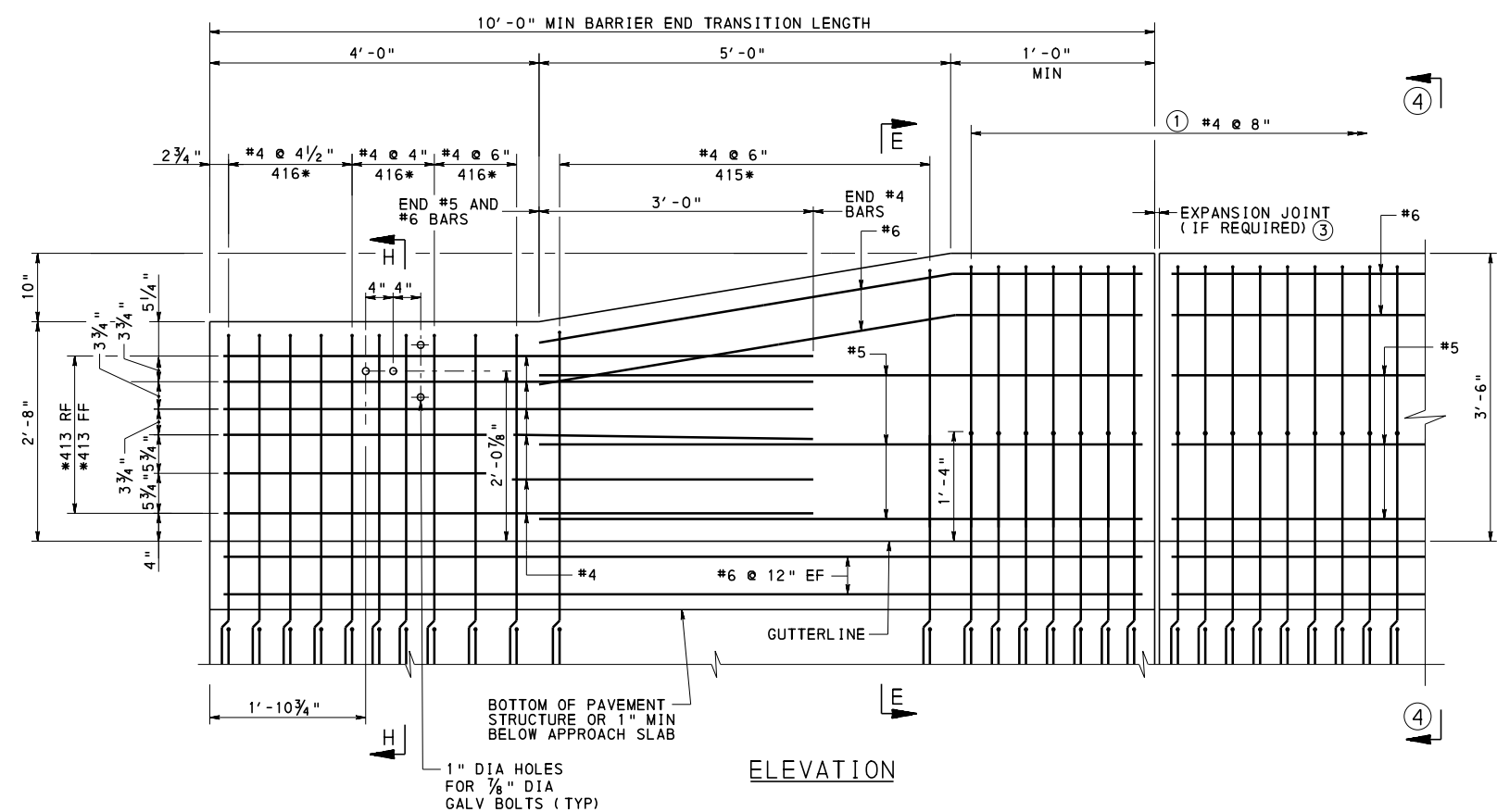
RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 7 OF 12  
BD-618M



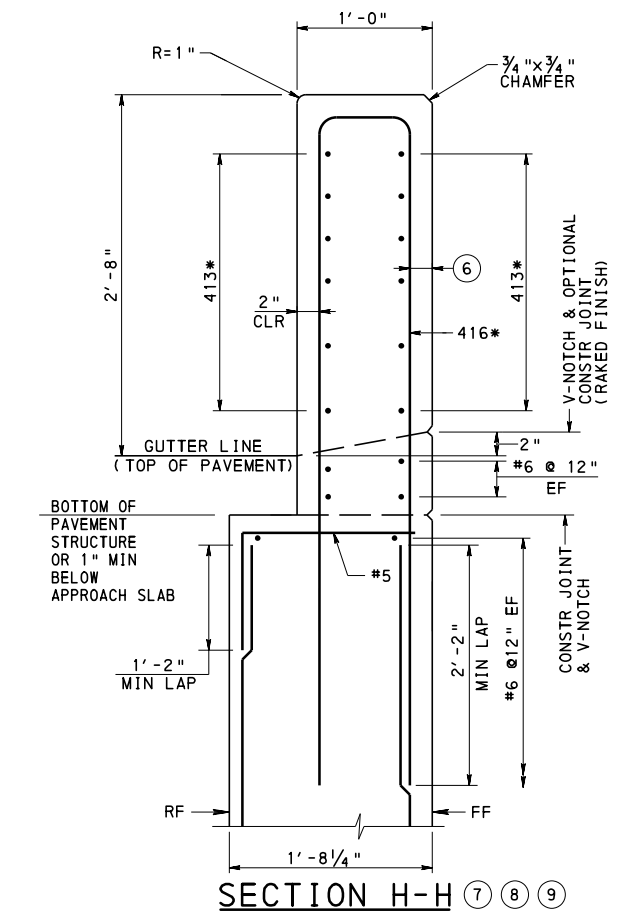
PLAN



ELEVATION

42" VERTICAL WALL CONCRETE BARRIER  
TRAILING END TRANSITION WITH W-BEAM CONNECTION

\* SEE REINFORCEMENT DETAILS, SHEETS 5 & 6.



SECTION H-H ⑦ ⑧ ⑨

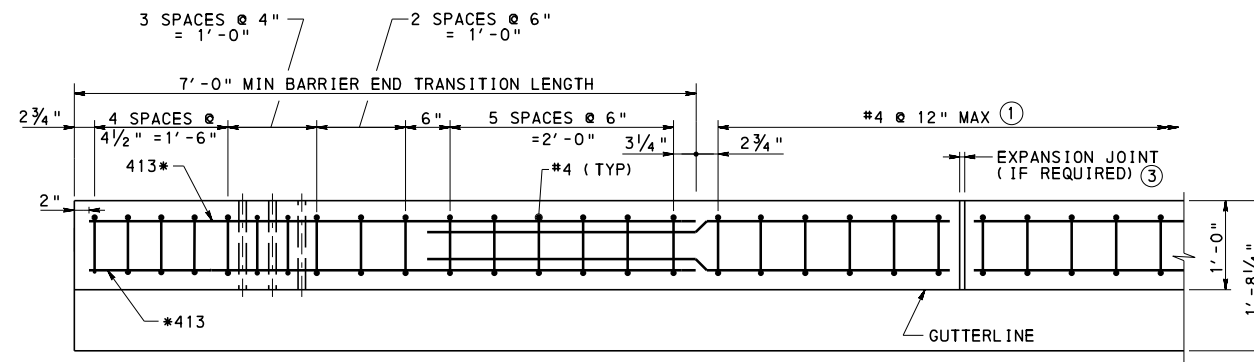
LEGEND:

- ① WITHIN 10 FT ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON SHEETS 2-9.
- ③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".
- ④ SEE 42" VERTICAL WALL CONCRETE BARRIER DETAIL, SHEET 1.
- ⑥ 2" CLR FOR SAFETY WINGS, 2 5/8" CLR FOR U-WINGS.
- ⑦ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1'-0" WIDTH IS AS REQUIRED PER DESIGN.
- ⑧ TYPICAL SECTIONS SHOWN WITH CURB, WITHOUT CURB SIMILAR.
- ⑨ FOR DETAILS OF THE BARRIER SUPPORT WALLS, SEE BD-622M AND BD-624M, SHEET 2.

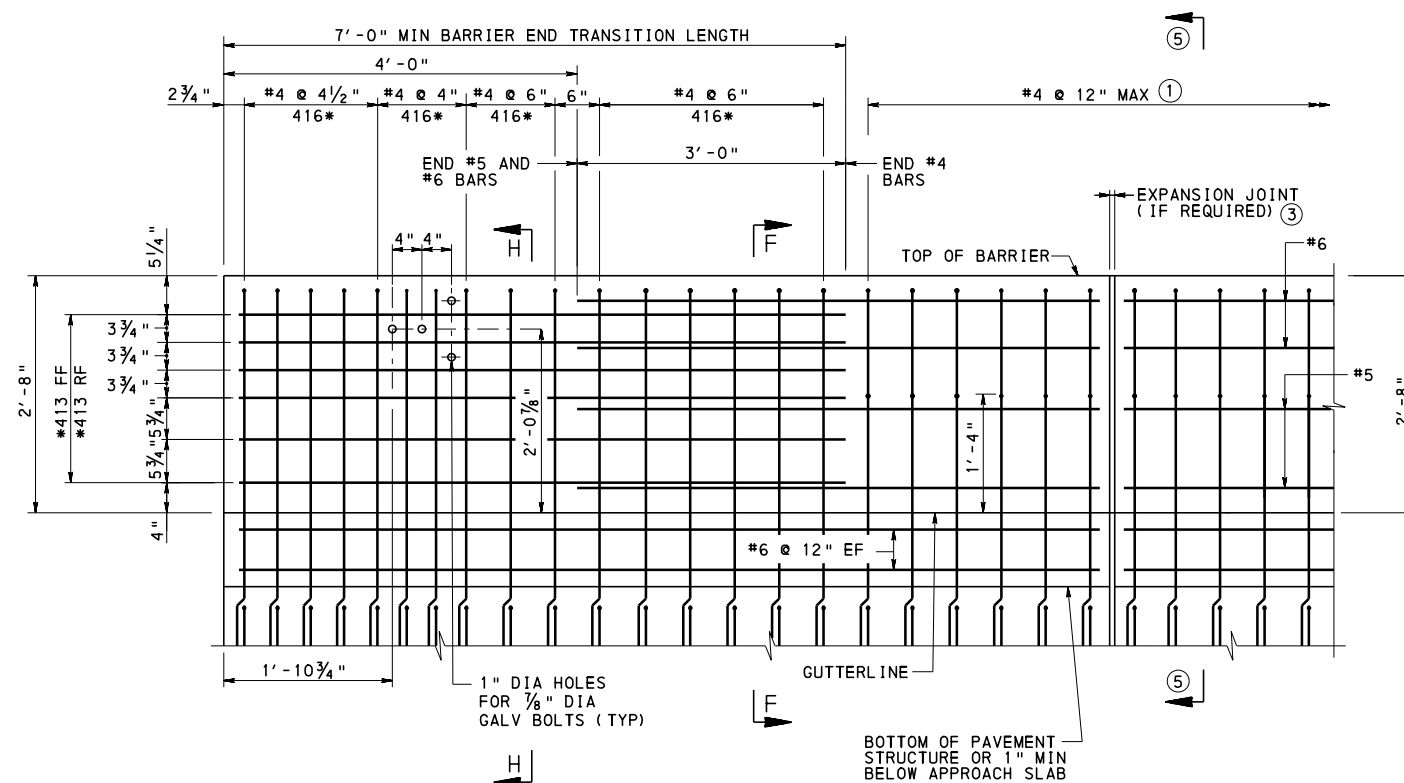
NOTES:

1. FOR ADDITIONAL BARRIER END TRANSITION DETAILS AND REINFORCEMENT, SEE BD-622M AND BD-624M.
2. FOR SECTION E-E, SEE SHEET 3.

<p align="center"><b>COMMONWEALTH OF PENNSYLVANIA</b> <b>DEPARTMENT OF TRANSPORTATION</b> BUREAU OF BRIDGE</p>		
<p align="center">STANDARD VERTICAL WALL CONCRETE BARRIER BARRIER END TRANSITION WITH W-BEAM CONNECTION - 2</p>		
<p>RECOMMENDED OCT. 7, 2024</p> <p><i>Kevin J. Lange</i> CHIEF BRIDGE ENGINEER</p>	<p>RECOMMENDED OCT. 7, 2024</p> <p><i>Glenn E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.</p>	<p>SHEET 8 OF 12</p> <p align="center"><b>BD-618M</b></p>



PLAN



ELEVATION

\* SEE REINFORCEMENT DETAILS, SHEETS 5 & 6.

# 32" VERTICAL WALL CONCRETE BARRIER TRAILING END TRANSITION WITH W-BEAM CONNECTION

## NOTES:

1. FOR ADDITIONAL BARRIER END TRANSITION DETAILS AND REINFORCEMENT, SEE BD-622M AND BD-624M.
2. FOR SECTION F-F, SEE SHEET 4.
2. FOR SECTION H-H, SEE SHEET 8.

## LEGEND:

- ① WITHIN 10 FT ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON SHEETS 2-9.
- ③ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".
- ⑤ SEE 32" VERTICAL WALL CONCRETE BARRIER DETAIL, SHEET 1.
- ⑥ 2" CLR FOR SAFETY WINGS, 2 5/8" CLR FOR U-WINGS.
- ⑦ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW 1'-0" WIDTH IS AS REQUIRED PER DESIGN.

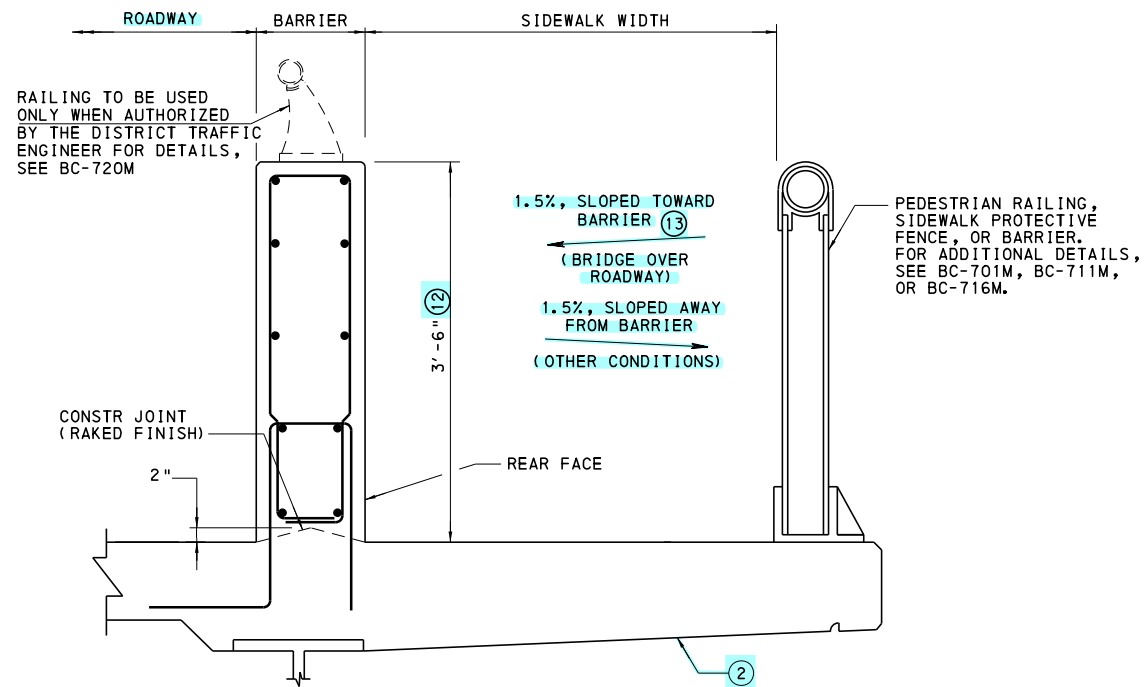
COMMONWEALTH OF PENNSYLVANIA  
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BUREAU OF BRIDGE

STANDARD  
VERTICAL WALL CONCRETE BARRIER  
BARRIER END TRANSITION  
WITH W-BEAM CONNECTION - 3

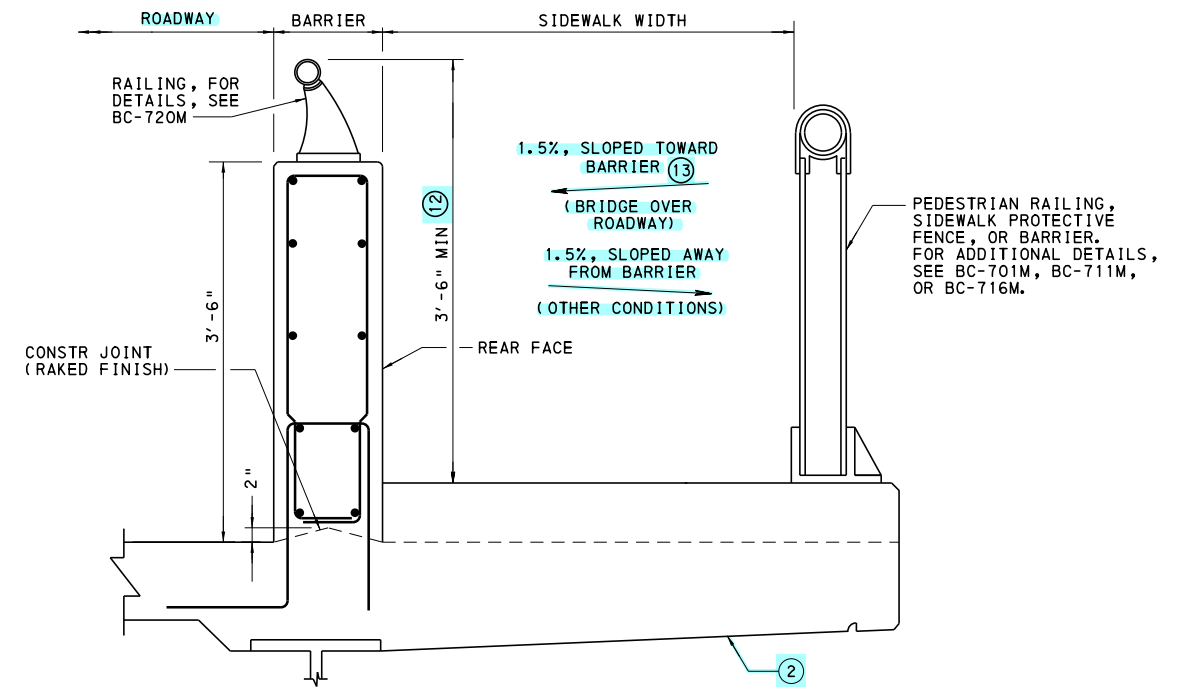
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SHEET 9 OF 12  
BD-618M



**TYPICAL SIDEWALK DETAIL**  
(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M.)



**RAISED SIDEWALK DETAIL**  
(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M.)

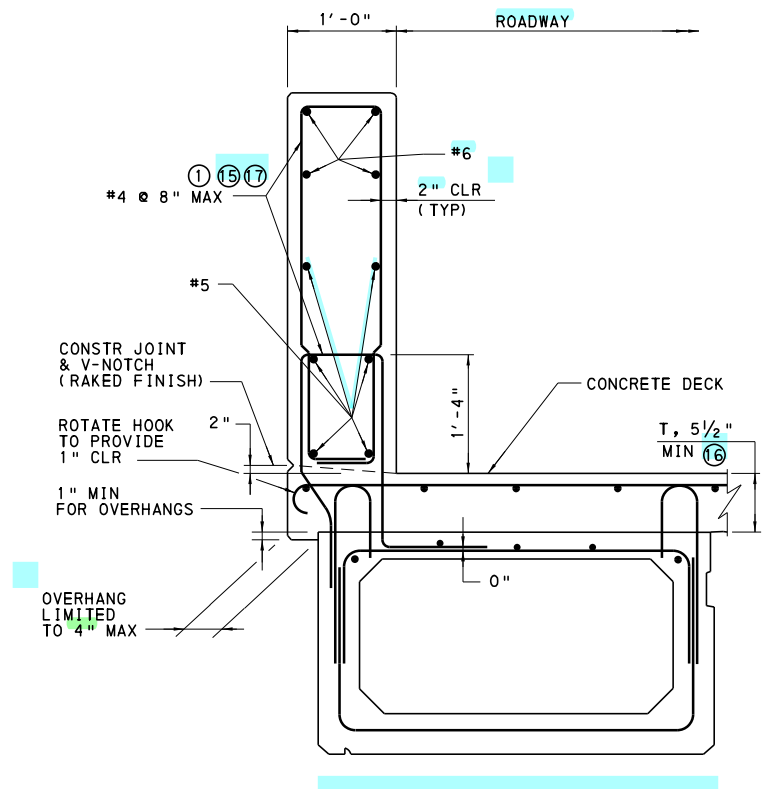
**LEGEND:**

- ② UNDERSIDE OF DECK MAY BE CONSTRUCTED LEVEL.
- ⑫ 42" VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32" VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF THE BARRIER AND RAILING MUST BE 3'-6" MINIMUM ON SIDEWALK SIDE OF RAILING.
- ⑬ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.

**NOTES:**

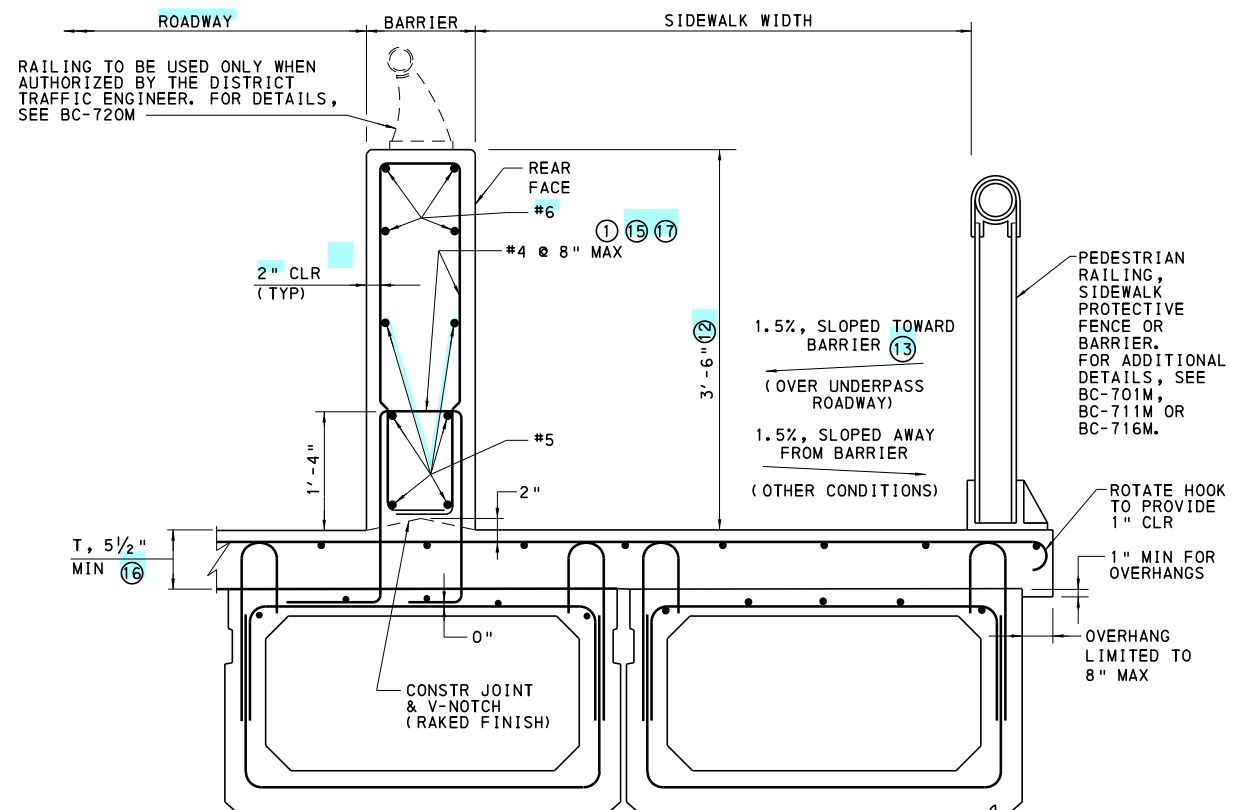
- 1. FOR VERTICAL WALL BARRIER DETAILS AT ALTERNATE SIDEWALK, SEE BD-601M.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD		
VERTICAL WALL CONCRETE BARRIER SIDEWALK DETAILS		
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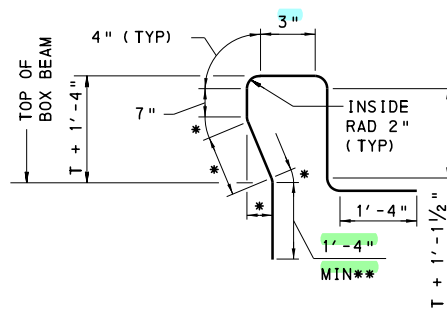


36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING BARRIER

(42" VERTICAL WALL CONCRETE BARRIER SHOWN, 32" VERTICAL WALL CONCRETE BARRIER SIMILAR)



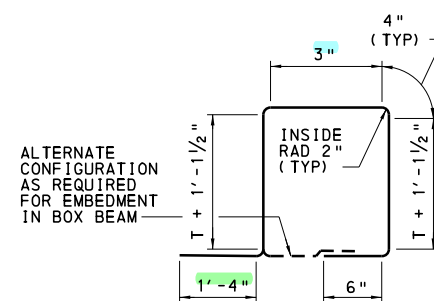
36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING TYPICAL SIDEWALK  
(RAISED SIDEWALK DETAIL SIMILAR)



\* VARIES WITH DECK SLAB THICKNESS, T, AND OVERHANG. DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK.

\*\* OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM

VERTICAL REINFORCEMENT



ALTERNATE CONFIGURATION AS REQUIRED FOR EMBEDMENT IN BOX BEAM

VERTICAL REINFORCEMENT

# LEGEND:

- ① WITHIN 10 FT ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCING BARS TO HALF THE SPACING SHOWN. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS ON SHEETS 2-9.
- ② 42" VERTICAL WALL CONCRETE BARRIER SHOWN. IF 32" VERTICAL WALL CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF BARRIER AND RAILING MUST BE 3'-6" MIN ON SIDEWALK SIDE OF RAILING.
- ③ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONCRETE BARRIERS OR WITH TYPE 2 SCUPPERS IN SIDEWALK SLAB. WHERE CURB DRAINS ARE USED, SET SIDEWALK ELEVATION AT THE REAR FACE OF THE BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 AND S7 BARS. BEVEL DRAIN PER BC-751M.
- ④ USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED TO BE ADJUSTED TO ACCOMMODATE THIS CONDITION.
- ⑤ BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.
- ⑥ INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.
- ⑦ FOR 32" VERTICAL WALL CONCRETE BARRIER USE #4 @ 12".

## NOTES:

1. FOR VERTICAL WALL CONCRETE BARRIER DETAILS AT 36" AND 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK, SEE BD-661M.

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VERTICAL WALL  
CONCRETE BARRIER  
ADJACENT BOX BEAM DETAILS

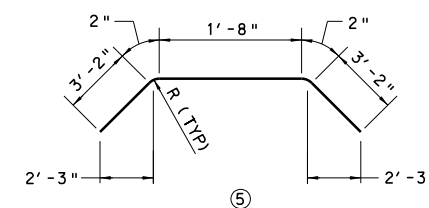
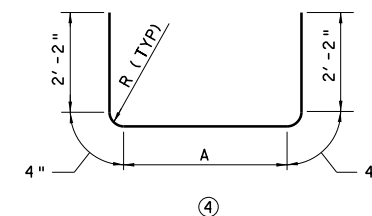
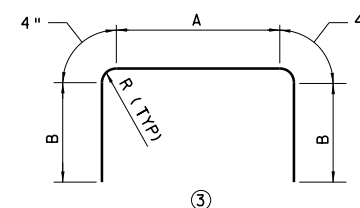
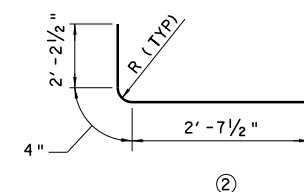
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SHEET 11 OF 12  
BD-618M

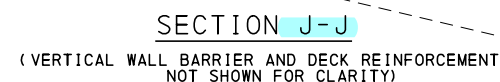


1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 7091(c).
3. RADIUS,  $R=2"$ , IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.



NOTES:

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
2. SET ANCHOR BOLTS ACCURATELY BY THE TEMPLATE FURNISHED BY THE MANUFACTURER TO THE CORRECT ELEVATION AND ALIGNMENT AND SECURELY BRACE AGAINST DISPLACEMENT BEFORE THE SURROUNDING CONCRETE IS PLACED. ANCHOR BOLT DIAMETER AS REQUIRED BY LIGHTING POLE MANUFACTURER. (FOR FUTURE LIGHTING PROVISIONS, SEE CHART ON THIS SHEET.)
3. SEAL CONDUIT AND PROTECT THREADS FOR FUTURE LIGHTING INSTALLATIONS.
4. CONFORM ANCHOR MATERIALS AS SPECIFIED IN PUBLICATION 408, SECTION 1101.04. ANCHOR ANGLES ARE PERMITTED TO BE GALVANIZED.
5. SET LIGHTING POLES TRULY VERTICAL WITH BASES LEVEL USING LEVELING NUTS.
6. PROVIDE 2" CLEAR ON ALL REINFORCEMENT EXCEPT AS NOTED.
7. PROVIDE A MINIMUM OF 2½" CONCRETE COVER FOR CONDUIT.
8. CONTINUE NORMAL BARRIER REINFORCEMENT THROUGH THICKENED PORTION OF BARRIER.
9. PREFERRED LOCATION FOR LIGHTING POLES IS AT PIERS AND ABUTMENTS. REFER TO BD-655M FOR ABUTMENT DETAILS AND BD-655M FOR PIER DETAILS TO HELP DEVELOP LIGHT POLE SUPPORT DETAIL. LIGHTING POLE SUPPORT, IF NEEDED, TO BE DESIGNED BY THE ENGINEER TO DISTRIBUTE LOAD TO BOTH FASCIA AND FIRST INTERIOR BEAM.
10. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE VERTICAL WALL, CONCRETE BARRIER NOT SHOWN, SEE SHEET 1.
11. FOR LIGHTING POLE LOCATIONS WITHIN A SPAN, THE LUMINAIRE DEFLECTION MUST BE EVALUATED FOR DYNAMIC EFFECTS.




\* FILL SPACE BETWEEN POLE BASE PLATE AND CONCRETE WITH GROUT AFTER SETTING POLE TRULY VERTICAL USING LEVELING NUTS. TOOL EDGES OF PAD. MINIMUM HEIGHT OF LEVELING PAD IS 1".

PROVISIONS FOR FUTURE LIGHTING		
MOUNTING HEIGHT	ANCHOR BOLT CIRCLE DIA	ANCHOR BOLT DIAMETER
50' - 0" MAX	15"	1"

MARK	SIZE	LENGTH		NUMBER	TYPE	A	B	
		42" VERTICAL WALL CONCRETE BARRIER	32" VERTICAL WALL CONCRETE BARRIER				42" VERTICAL WALL CONCRETE BARRIER	32" VERTICAL WALL CONCRETE BARRIER
401	4	4' - 9½ "	3' - 11½ "	2	1	10½ "	2' - 11½ "	2' - 1½ "
402	4	5' - 4 "	4' - 6 "	2	1	1' - 5 "	2' - 11½ "	2' - 1½ "
403	4	5' - 11 "	5' - 1 "	4	1	2' - 0 "	2' - 11½ "	2' - 1½ "
404	4	5' - 2 "	5' - 2 "	8	2	---	---	---
405	4	9' - 0 "	7' - 4 "	1	3	2' - 6 "	2' - 11 "	2' - 1 "
406	4	7' - 6 "	7' - 6 "	1	4	2' - 6 "	---	---
407	4	10' - 2 "	8' - 6 "	1	3	3' - 8 "	2' - 11 "	2' - 1 "
408	4	8' - 8 "	8' - 8 "	1	4	3' - 8 "	---	---
409	4	8' - 4 "	8' - 4 "	7	5	---	---	---

COMMONWEALTH OF PENNSYLVANIA  
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BUREAU OF BRIDGE

STANDARD  
VERTICAL WALL  
CONCRETE BARRIER  
LIGHTING POLE ANCHORAGE DETAILS

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SHEET 12 OF 12  
BD-618M

NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS  
(THIS STANDARD IS ONLY APPLICABLE FOR BRIDGES DESIGNED WITH A REFINED METHOD OF ANALYSIS)

1. DESIGN SPECIFICATIONS

- a) AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (AASHTO LRFD ).
- b) PENNDOT DESIGN MANUAL , PART 4 (PENNDOT DM4 ).
- c) PENNDOT SPECIFICATIONS, PUBLICATION 408 (PUB 408 ).

2. REFERENCES

- a) AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, ANSI/AISC 360-10, JULY 7, 2016 (AISC SPEC ).
- b) FEDERAL HIGHWAY ADMINISTRATION, STEEL BRIDGE DESIGN HANDBOOK, VOLUME 13, BRACING SYSTEM DESIGN, PUBLICATION NO. FHWA-HIF-16-002=VOL 13, DECEMBER 2015 (FHWA SBDH).

c) NATIONAL STEEL BRIDGE ALLIANCE, SKEWED AND CURVED STEEL I-GIRDER BRIDGE FIT, AUGUST 2016.

3. DETAILING REQUIREMENTS

- a) GIRDERS SHALL BE DESIGNED AND DETAILED SUCH THAT THE GIRDER WEBS ARE VERTICAL (PLUMB ) AS SPECIFIED IN THE TABLES BELOW.

DEFINITIONS:

NLF = NO LOAD FIT. GIRDER WEBS VERTICAL (PLUMB ) UNDER NO LOAD CONDITIONS (I.E. , WHEN TEMPORARY SHORING IS PROVIDED TO ACHIEVE OR APPROXIMATE ZERO VERTICAL DEFLECTIONS )

SDLF = STEEL DEAD LOAD FIT. GIRDER WEBS VERTICAL (PLUMB ) WHEN STEEL DEAD LOADS ARE APPLIED (WEIGHT OF STRUCTURAL STEEL ) BUT PRIOR TO DECK PLACEMENT. IF TEMPORARY SHORING WAS USED, SDLF IMPLIES GIRDER WEBS VERTICAL (PLUMB ) WITH ALL TEMPORARY SHORING REMOVED.

TDLF = TOTAL DEAD LOAD FIT. GIRDER WEBS VERTICAL (PLUMB ) AFTER ALL DEAD LOADS ARE APPLIED (INCLUDING WEIGHT OF STEEL , WEIGHT OF DECK SLAB AND WEIGHT OF SUPERIMPOSED DEAD LOADS, BUT NOT INCLUDING FUTURE WEARING SURFACE ).

L = ACTUAL SPAN LENGTH, BEARING TO BEARING ALONG THE CENTERLINE OF THE GIRDER.

R<sub>s</sub>= RADIUS OF CURVATURE AT BRIDGE CENTERLINE.

I = SKEW INDEX, SEE NOTE 7 OF THIS STANDARD FOR DEFINITION.

RECOMMENDED FIT CONDITIONS FOR STRAIGHT I-GIRDER BRIDGES  
(INCLUDING CURVED BRIDGES WITH L/R IN ALL SPANS LESS THAN 0.03 +/-)<sup>1</sup>

NON-SKEWED BRIDGES AND SKEWED BRIDGES WITH SKEW ≥ 70 DEGREES +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
ANY SPAN LENGTH	ANY		NONE

SKEWED BRIDGES WITH SKEW < 70 DEGREES +/- AND I <sub>s</sub> ≤ 0.30 +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
ANY SPAN LENGTH	TDLF OR SDLF		NLF

SKEWED BRIDGES WITH SKEW < 70 DEGREES +/- AND I <sub>s</sub> > 0.30 +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
SPAN LENGTHS ≤ 200 FEET	SDLF	TDLF	NLF
SPAN LENGTHS > 200 FEET	SDLF		TDLF & NLF

RECOMMENDED FIT CONDITIONS FOR HORIZONTALLY CURVED I-GIRDER BRIDGES  
[(L/R)<sub>MAX</sub> ≥ 0.03 +/-]<sup>1</sup>

BRIDGES WITH RADIAL OR SKEWED SUPPORTS			
	RECOMMENDED	ACCEPTABLE	AVOID
LARGE SPAN LENGTHS > 250 FEET +/- AND (L/R) <sub>MAX</sub> ≥ 0.2	NLF <sup>2</sup>	SDLF	TDLF
ALL OTHER CASES	SDLF	NLF	TDLF

1 FOR THE VARIOUS RECOMMENDED FIT CONDITIONS PRESENTED IN THE TABLES ABOVE, THE SPAN LENGTH, SKEW, AND CURVATURE LIMITS SHOULD BE CONSIDERED APPROXIMATE GUIDELINES AND SHOULD BE EVALUATED IN THE FULL CONTEXT OF THE GEOMETRIC AND STRUCTURAL COMPLEXITY OF THE GIVEN BRIDGE. THE RECOMMENDATION OF SDLF FOR CASES IDENTIFIED IN THE TABLE ABOVE FOR HORIZONTALLY CURVED BRIDGES IS BASED ON MANY YEARS OF PRACTICE AND RECENT RESEARCH RESULTS. IN PRACTICE, THE USE OF SDLF HAS BEEN ALMOST UNIVERSAL FOR CURVED I-BRIDGES WITH (L/R)<sub>MAX</sub> < 0.2. THE RECOMMENDATION TRANSITIONS TO NLF ABOVE THE LIMIT BASED ON A STUDY OF THESE TYPES OF BRIDGES WHICH SHOWS LOCKED-IN LACK-OF-FIT FORCES CAN BECOME SIGNIFICANT IN BRIDGES WITH LONGER SPANS AND SMALLER RADII. NLF MATCHES THE NORMAL ANALYSIS METHODS USED IN THE DESIGN AND WILL PROVIDE A BETTER MATCH BETWEEN PREDICTED FORCES AND DISPLACEMENTS THAN SDLF WHEN THE STEEL DEAD LOAD DISPLACEMENTS BECOME LARGE.

2 THE RECOMMENDATION TO USE NLF DETAILING DOES NOT NECESSARILY IMPLY THE NEED TO USE TEMPORARY SHORING, NOR DOES THE USE OF SDLF OR TDLF DETAILING IMPLY THAT TEMPORARY SHORING CANNOT BE USED. AS DISCUSSED IN THE DESIGN AND ANALYSIS SECTION OF DM-4 SECTION 6, APPENDIX E6, THE CHOICE OF DETAILING METHOD AFFECTS THE NATURE AND MAGNITUDE OF THE BRIDGE'S INTERNAL DEAD LOAD FORCES AND OF THE "FIT-UP" FORCES WHICH THE ERECTOR MAY NEED TO APPLY TO ASSEMBLE THE STRUCTURAL STEEL. THE NATURE AND MAGNITUDE OF THESE FORCES ARE ALSO INFLUENCED BY THE USE OF TEMPORARY SHORING. BRIDGES ERECTED WITHOUT TEMPORARY SHORING CAN BE DETAILED FOR NLF AND SUCCESSFULLY ERECTED IF THE FIT-UP FORCES ARE MANAGEABLE. LIKEWISE, BRIDGES WHICH ARE TO BE ERECTED USING SOME FORM OF TEMPORARY SHORING CAN BE DETAILED FOR SDLF OR TDLF AND SUCCESSFULLY ERECTED IF THE FIT-UP FORCES ARE MANAGEABLE.

- b) WHERE THE MAXIMUM OUT-OF-PLANE GIRDER ROTATIONS DUE TO ALL DEAD LOADS, EXCLUDING FUTURE WEARING SURFACE EXCEEDS 0.005 RADIAN, PROVIDE A TABLE IN THE CONSTRUCTION DRAWINGS SHOWING THE TOTAL DEAD LOAD OUT-OF-PLANE GIRDER ROTATIONS AT THE GIRDER TENTH POINTS AND AT EACH DIAPHRAGM CONNECTION LOCATION. PROVIDE ROTATION VALUES FOR EACH GIRDER.

4. USAGE AND ORIENTATION OF DIAPHRAGMS

- a) FOR STRAIGHT BRIDGES, PLACE INTERMEDIATE DIAPHRAGMS PARALLEL TO THE SKEW AND IN CONTIGUOUS LINES FOR SKEW ANGLES OF 70° TO 90°. FOR SKEWS LESS THAN 70°, PLACE DIAPHRAGMS NORMAL TO THE GIRDER, EITHER IN CONTIGUOUS LINES OR IN A STAGGERED ARRANGEMENT. THE USE OF A STAGGERED ARRANGEMENT TYPICALLY RESULTS IN LOWER DIAPHRAGM FORCES, BUT MAY INCREASE GIRDER FLANGE LATERAL BENDING MOMENTS. IN SEVERELY SKEWED, VERY WIDE BRIDGES (BRIDGES WITH A HIGH SKEW INDEX, I<sub>s</sub> ), OMITTING SELECT DIAPHRAGMS (WITHOUT COMPROMISING THE BRACING OF GIRDERS ) TYPICALLY RESULTS IN A MORE ECONOMICAL DESIGN.
- b) FOR STRAIGHT BRIDGES, PIER DIAPHRAGMS (DIAPHRAGMS AT INTERMEDIATE BEARINGS ) MAY BE OMITTED IF PROVISIONS ARE MADE TO TRANSMIT HORIZONTAL SUPERSTRUCTURE FORCES INTO THE BEARINGS, AND AN ACCEPTABLE METHOD FOR JACKING THE GIRDERS FOR FUTURE BEARING REPLACEMENT IS INCORPORATED INTO THE DESIGN. IF PIER DIAPHRAGMS ARE USED, ORIENT CROSS FRAMES PARALLEL TO THE SKEW FOR SKEW ANGLES OF 70° TO 90°, OR NORMAL TO THE GIRDER FOR SKEW ANGLES LESS THAN 70°.
- c) FOR CURVED GIRDER BRIDGES WITH RADIAL SUPPORTS, PLACE INTERMEDIATE AND PIER DIAPHRAGMS RADIAL TO THE GIRDERS AND IN CONTIGUOUS LINES.
- d) FOR CURVED GIRDER BRIDGES WITH SKEWED SUPPORTS, GENERALLY PLACE INTERMEDIATE DIAPHRAGMS RADIAL TO THE GIRDERS AND IN CONTIGUOUS LINES.
- e) WHEN DIAPHRAGMS ARE PLACED RADIAL TO THE GIRDER IN CURVED AND/OR SKEWED BRIDGES, IT MAY BE ADVANTAGEOUS IN THE IMMEDIATE VICINITY OF THE SKEWED SUPPORTS TO OMIT DIAPHRAGMS THAT WOULD OTHERWISE FRAME DIRECTLY INTO THE SUPPORT; RESUME PLACEMENT OF CONTIGUOUS RADIAL DIAPHRAGMS IN THE NEXT ADJACENT BAY. GENERALLY PLACE PIER DIAPHRAGMS PARALLEL TO THE SKEW FOR SKEW ANGLES OF 70° TO 90°, OR NORMAL TO THE GIRDER FOR SKEWS LESS THAN 70°.
- f) FOR CASES OF UNUSUALLY COMPLEX FRAMING AND/OR SEVERE GEOMETRY, SUBMIT A PROPOSED FRAMING PLAN TO THE BUREAU OF PROJECT DELIVERY, BRIDGE DESIGN AND TECHNOLOGY DIVISION FOR REVIEW PRIOR TO BEGINNING FINAL DESIGN.
- g) END DIAPHRAGMS ARE REQUIRED AT THE ENDS OF GIRDERS TO SUPPORT THE EDGE OF DECK AND THE EXPANSION JOINTS.
- h) END DIAPHRAGMS SHOULD BE DESIGNED TO ACCOMODATE JACKING OF THE GIRDERS FOR BEARING REPLACEMENT UNLESS OTHER ACCEPTABLE PROVISIONS FOR JACKING ARE INCORPORATED INTO THE DESIGN.
- i) PLACE END DIAPHRAGMS APPROXIMATELY PARALLEL TO THE CENTERLINE OF BEARINGS. POSITION END DIAPHRAGM CONNECTION COMPONENTS SO AS TO CREATE MINIMUM OFFSET FROM THE CENTERLINE OF BEARINGS. DIAPHRAGM CONNECTION PLATE MAY BE PLACED BEHIND THE BEARING STIFFENER TO MINIMIZE THE OFFSET.
- j) COORDINATE BEARING STIFFENER AND CONNECTION PLATE LOCATIONS WITH DETAILS OF BEARING TO GIRDER CONNECTIONS.
- k) FOR SKEWED CONNECTIONS, THE DESIGNER SHOULD VERIFY THE PRACTICALITY OF BENT CONNECTION PLATE GEOMETRY. REFER TO SECTION 1105.03(1) OF PENNDOT PUB 408 FOR MINIMUM BEND RADIUS.
- l) THE DIAPHRAGM CONNECTION PLATE DETAILS SHOWN ARE VALID FOR SKEW ANGLES 25° TO 90°. PROVIDE SPECIAL DETAILS FOR SKEW ANGLES LESS THAN 25°.
- m) PROVIDE CONNECTION PLATES ON THE OUTSIDE FACE OF FASCIA GIRDERS AT INTERMEDIATE DIAPHRAGM LOCATIONS FOR TWO AND THREE GIRDER SYSTEMS.

5. SELECTION OF DIAPHRAGM TYPE

DIAPHRAGM TYPES SHOULD BE SELECTED BASED ON THE FOLLOWING GUIDELINES. SPECIAL CONDITIONS (VARIABLE SKEW, VARIABLE GIRDER SPACING, ETC.) MAY WARRANT A DEPARTURE FROM THESE GUIDELINES.

INTERMEDIATE DIAPHRAGMS

- TYPE X: TYPE X DIAPHRAGMS SHOULD BE USED IN CASES WHERE THE RATIO OF GIRDER SPACING (S) TO GIRDER DEPTH "D" IS 1.0 OR LESS (S/D ≤ 1.0 ).
- TYPE K: TYPE K DIAPHRAGMS SHOULD BE USED IN CASES WHERE THE RATIO OF GIRDER SPACING "S" TO GIRDER DEPTH "D" IS 1.5 OR GREATER (S/D ≥ 1.5 ).
- IN CASES WHERE THE RATIO OF GIRDER SPACING "S" TO GIRDER DEPTH "D" IS BETWEEN 1.0 AND 1.5, EITHER TYPE X OR TYPE K DIAPHRAGMS MAY BE USED. SECONDARY CONSIDERATIONS INCLUDE:
  - i. ACHIEVING A GENERAL EFFICIENT ANGLE BETWEEN DIAPHRAGM DIAGONAL AND HORIZONTAL (CHORD ) MEMBERS AS CLOSE TO 45° AS POSSIBLE.
  - ii. MINIMIZING SHOP HANDLING OF DIAPHRAGMS BY USING TYPE K DIAPHRAGMS WHICH DO NOT NEED TO BE REMOVED FROM THEIR FABRICATION JIG AND INVERTED TO WELD THE SECOND DIAGONAL.
- SOLID PLATE: SOLID PLATE DIAPHRAGMS SHOULD BE USED WHEN REQUIRED TO ADDRESS HIGH DIAPHRAGM FORCE EFFECTS AND/OR IN CASES WHERE GIRDERS ARE TIGHTLY SPACED AND LARGE DIAGONAL AND HORIZONTAL (CHORD ) MEMBERS WOULD OTHERWISE BE REQUIRED FOR A TYPE X DIAPHRAGM.

\* NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS, CONTINUED ON SHEET 2 \*

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CROSS FRAME AND SOLID PLATE  
DIAPHRAGMS FOR STEEL BEAM/GIRDER  
BRIDGES DESIGNED  
WITH REFINED METHODS OF ANALYSIS

BC-753M	STEEL GIRDER DETAILS
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDERS ONLY )
REFERENCE DRAWINGS	

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*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 5

BD-619M

NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS ( CONTINUED FROM SHEET 1 )

5. SELECTION OF DIAPHRAGM TYPE ( CONTINUED FROM SHEET 1 )

END DIAPHRAGMS

- TYPE K: TYPE K DIAPHRAGMS ARE TYPICALLY THE MOST ECONOMICAL DESIGN AND SHOULD BE USED IN CASES WHERE GIRDER JACKING FOR BEARING REMOVAL IS PROVIDED AT A LOCATION OTHER THAN THE END DIAPHRAGM.
- TYPE K INVERTED: TYPE K INVERTED DIAPHRAGMS SHOULD BE USED IN CASES WHERE JACKING FOR BEARING REMOVAL OCCURS AT THE END DIAPHRAGM AND JACKING LOADS DO NOT REQUIRE A SOLID PLATE DIAPHRAGM. THE USE OF TYPE K INVERTED DIAPHRAGMS FACILITATES PASSAGE OF LARGER UTILITIES THROUGH THE DIAPHRAGM.
- SOLID PLATE: SOLID PLATE DIAPHRAGMS SHOULD BE USED IN CASES WHERE NECESSARY TO ADDRESS HIGH DIAPHRAGM FORCE EFFECTS FROM A REFINED ANALYSIS AND/OR IN CASES WHERE JACKING FORCES FOR BEARING REMOVAL EXCEED THE LIMITATIONS OF A TYPE K INVERTED DIAPHRAGM.

6. SELECTION OF DIAPHRAGM MEMBERS

SELECT THE MOST ECONOMICAL DIAPHRAGM MEMBERS WHICH MEET DESIGN STRENGTH AND DETAILING REQUIREMENTS. IT IS GENERALLY DESIRABLE TO REASONABLY MINIMIZE THE NUMBER OF DIFFERENT TYPES **AND SIZES** OF MEMBERS USED IN A GIVEN DESIGN, BUT IT IS ACCEPTABLE TO USE DIFFERENT MEMBER SIZES IN CASES WHERE A LIMITED NUMBER OF DIAPHRAGMS HAVE SIGNIFICANTLY HIGHER DESIGN LOADS THAN OTHER DIAPHRAGMS IN THE SAME BRIDGE.

THE MOST COMMON TYPES OF DIAPHRAGM MEMBERS FOR TYPE X, TYPE K AND TYPE K INVERTED DIAPHRAGMS ARE LISTED BELOW.

- ANGLE SECTIONS: THE MOST ECONOMICAL DIAPHRAGM MEMBERS ARE TYPICALLY SINGLE ANGLE SECTIONS ( AISC "L" SHAPES ). EQUAL LEG ANGLES SHOULD BE USED. UNEQUAL LEG ANGLES SHOULD NOT BE USED. DOUBLE ANGLES ARE GENERALLY MORE EXPENSIVE TO FABRICATE THAN WT SECTIONS SINCE MORE HANDLING, SPECIAL COATINGS AND SOME REVERSE-SIDE WELDING ARE TYPICALLY REQUIRED.
  - WT SECTIONS: WHEN DESIGN FORCE EFFECTS EXCEED THE CAPACITY OF ANGLE SECTIONS, WT SECTIONS ( AISC "WT" SHAPES ) MAY BE USED. WT SECTIONS ARE FABRICATED BY CUTTING W SECTIONS ( AISC WIDE FLANGE, OR "W" SHAPES ) IN HALF LONGITUDINALLY, WHICH ADDS SIGNIFICANT FABRICATION AND STRAIGHTENING COSTS.
  - W SECTIONS: IN SPECIAL CASES WIDE FLANGE W SECTIONS ( AISC WIDE FLANGE, OR "W", SHAPES ) MAY BE USED, ESPECIALLY FOR END DIAPHRAGMS. JUSTIFICATION FOR THE USE OF W SECTIONS INCLUDES THE POTENTIAL FOR HIGH ORTHOGONAL FORCES ( SUCH AS JACKING FORCES ) CAUSING BENDING OF THE MEMBER, OR UNUSUALLY HIGH AXIAL FORCE EFFECTS. THE FLANGES OF W SECTIONS MAY REQUIRE COPING TO ALLOW FOR CONNECTION TO GUSSET PLATES.
- THE MOST COMMON TYPES OF DIAPHRAGM MEMBERS FOR SOLID PLATE DIAPHRAGMS ARE LISTED BELOW.
- CHANNEL SECTIONS: CHANNEL SECTIONS ( AISC "C" AND "MC" SHAPES ) MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES OF SHALLOW GIRDER DEPTH. CHANNEL SECTIONS ARE TYPICALLY REASONABLY ECONOMICAL IF A COMMONLY ROLLED AND WIDELY AVAILABLE SIZE IS USED.
  - BENT PLATES: COLD BENT PLATES MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES OF SHALLOW GIRDER DEPTH. BENT PLATES MAY BE MORE ECONOMICAL THAN CHANNEL SECTIONS IN CASES WHERE A COMMONLY ROLLED AND WIDELY AVAILABLE CHANNEL SECTION IS NOT AVAILABLE IN THE REQUIRED SIZE. **REFER TO PUB 408 SECTION 1105.03(f) FOR MINIMUM BEND RADIUS.**
  - W SECTIONS: W SECTIONS ( AISC WIDE FLANGE, OR "W", SHAPES ) MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES WHERE A CHANNEL SECTION OF THE REQUIRED SIZE IS NOT AVAILABLE ( SUCH AS CASES OF DEEPER GIRDERS ). THE FLANGES OF W SECTIONS MAY REQUIRE COPING TO ALLOW FOR CONNECTION TO STIFFENERS IF GUSSET PLATES ARE NOT USED. THE USE OF EXCESSIVELY HEAVY W SECTIONS IS DISCOURAGED DUE TO POOR ECONOMY IN DIAPHRAGM APPLICATIONS AND HIGH COST/LIMITED AVAILABILITY.
  - WELDED PLATE GIRDERS: WELDED PLATE GIRDERS MAY BE USED FOR SOLID PLATE DIAPHRAGMS IN CASES WHERE AN ECONOMICAL W SECTION IS NOT AVAILABLE. THE FLANGES OF PLATE GIRDERS MAY REQUIRE COPING TO ALLOW FOR CONNECTION TO STIFFENERS IF GUSSET PLATES ARE NOT USED. IF WELDED PLATE GIRDERS WILL BE SUBJECT TO JACKING LOADS FOR BEARING REPLACEMENT, THE NEED FOR JACKING STIFFENERS SHOULD BE INVESTIGATED.

7. CHARACTERIZATION OF STRAIGHT BRIDGES BY SKEW INDEX

STRAIGHT GIRDER BRIDGES SHOULD BE CATEGORIZED BY SKEW INDEX. THE SKEW INDEX, "I<sub>s</sub>" IS CALCULATED AS FOLLOWS:

I<sub>s</sub>= W<sub>6</sub>/ ( L<sub>s</sub>TAN ( Ø<sub>p</sub> ) )

WHERE:

W<sub>6</sub>= BRIDGE WIDTH PERPENDICULAR TO THE CENTERLINE, FASCIA GIRDER TO FASCIA GIRDER ( FT )

Ø<sub>p</sub>= THE SMALLER ANGLE BETWEEN THE HIGHWAY CENTERLINE ( OR A TANGENT THERETO ) AND A LINE PARALLEL TO THE CENTERLINE OF THE SUPPORT ( 90 DEGREES = NONSKEWED ).

L<sub>s</sub>= SPAN LENGTH ( FT )

IN CASES OF MULTIPLE SPAN UNITS, THE LARGEST SKEW INDEX OF ALL THE SPANS SHALL BE USED TO CHARACTERIZE THE UNIT.

CURVED GIRDER BRIDGES CANNOT BE CHARACTERIZED BY SKEW INDEX AT THIS TIME.

8. LEVEL OF REFINED ANALYSIS

a) REFINED ANALYSIS: REFINED ANALYSIS TYPICALLY CONSISTS OF 3D ANALYSIS, OR MAY CONSIST OF AN ENHANCED 2D ANALYSIS IF THE 2D ANALYSIS INCLUDES BOTH OF THE FOLLOWING FEATURES:

i. CONSIDERATION OF WARPING STIFFNESS WHEN MODELING THE TORSIONAL STIFFNESS OF I-SHAPED GIRDERS.

ii. A COMPLETE REPRESENTATION OF THE STIFFNESS OF DIAPHRAGMS BY MEANS OF A SHEAR-DEFORMABLE BEAM ELEMENT ( TIMOSHENKO BEAM ) AND IN ACCORDANCE WITH THE REFINED ANALYSIS REQUIREMENTS OF DM-4 SECTION 4.6.3

REFINED ANALYSIS IS GENERALLY REQUIRED FOR STRAIGHT GIRDER BRIDGES WITH SKEW INDEX GREATER THAN 0.30 ( I<sub>s</sub>>0.30 ) AND SKEW ANGLE < 70 DEGREES.

REFINED ANALYSIS IS REQUIRED FOR ALL CURVED GIRDER BRIDGES.

REFINED ANALYSIS IS REQUIRED FOR KINKED GIRDER BRIDGES MEETING THE DEFINITION OF CURVED GIRDERS AS OUTLINED IN DM-4 SECTION 4.6.1.2.1.

9. DETERMINATION OF DESIGN LOADS

a) LIMIT STATES AND LOAD FACTORS:

- ALL APPLICABLE LIMIT STATES, AS IDENTIFIED IN SECTION 3 OF THE AASHTO LRFD, SHALL BE INVESTIGATED AS PART OF THE DIAPHRAGM DESIGN. LOAD FACTORS FOR THE LOAD COMBINATIONS FOR EACH LIMIT STATE SHALL BE AS PRESENTED IN SECTION 3 OF THE AASHTO LRFD, WITH THE FOLLOWING ADDITIONS:

- BOTH THE STRENGTH AND STIFFNESS REQUIREMENTS FOR STABILITY BRACING ( AS SPECIFIED IN THE AISC SPEC APPENDIX 6.3 AND/OR THE FHWA SBDH, VOL. 13 ) MUST BE SATISFIED.

- THE STIFFNESS REQUIREMENT ( AS PRESENTED IN THE FHWA SBDH, VOL. 13 ) IS:

B<sub>T</sub> = ( 2.4 L M<sub>f</sub><sup>2</sup> ) / ( Ø n E I<sub>eff</sub> C<sub>bb</sub><sup>2</sup> )

- THE STRENGTH REQUIREMENT ( AS PRESENTED IN THE FHWA SBDH, VOL. 13 ) IS:

M<sub>br</sub> = ( 0.005 L<sub>b</sub> L M<sub>f</sub><sup>2</sup> ) / ( n E I<sub>eff</sub> C<sub>bb</sub><sup>2</sup> h<sub>o</sub> )

- SEE PENNDOT DM-4, APPENDIX E6P, SECTION E6.5P FOR BASIC DEFINITION OF ALL VARIABLES. SEE BELOW FOR ADDITIONAL DEFINITION OF THE ULTIMATE MOMENT ( M<sub>f</sub> ).

- THE ULTIMATE MOMENT ( M<sub>f</sub> ) USED TO CALCULATE STABILITY BRACING STRENGTH AND STIFFNESS REQUIREMENTS ( IN ACCORDANCE WITH THE PROVISIONS OF THE AISC SPEC APPENDIX 6.3 AND/OR THE FHWA SBDH VOL. 13 ) SHOULD BE BASED ON THE FOLLOWING LOAD COMBINATIONS FOR THE GIVEN LIMIT STATE UNDER INVESTIGATION:

- STRENGTH I, FINAL CONDITION, COMPOSITE, NEGATIVE MOMENT REGIONS: 1.25 DC + 1.5 DW + 1.75 LL
- STRENGTH I, CONSTRUCTION CONDITION, NONCOMPOSITE, POSITIVE OR NEGATIVE MOMENT REGIONS: 1.25 DC + 1.25 DW + 1.5 CONSTRUCTION LOADS ( INCLUDING DYNAMIC EFFECTS IF APPLICABLE )
- STRENGTH III, FINAL CONDITION, COMPOSITE, NEGATIVE MOMENT REGIONS: 1.25 DC + 1.5 DW + 0 LL + **1.00** WS
- STRENGTH III, CONSTRUCTION CONDITION, NONCOMPOSITE, POSITIVE OR NEGATIVE MOMENT REGIONS: 1.25 DC + 1.25 DW + **1.00** WS + 1.25 CONSTRUCTION LOADS ( DC IS DEAD LOAD OF STEEL ONLY )
- STRENGTH V, FINAL CONDITION, COMPOSITE, NEGATIVE MOMENT REGIONS: 1.25 DC + 1.5 DW + 1.35 LL + **1.00** WS + 1.0 WL
- SPECIAL STEEL CONSTRUCTION **LOAD COMBINATION**: 1.4 DC + 1.4 CONSTRUCTION LOADS ( INCLUDING DYNAMIC EFFECTS IF APPLICABLE )

- IN THE ABOVE-LISTED **LOAD COMBINATIONS**, THE STRENGTH I, CONSTRUCTION CONDITION **LOAD COMBINATION** SHOULD INCLUDE NO WIND LOADING, BUT FULL CONSTRUCTION LOADS ASSOCIATED WITH DECK PLACEMENT, INCLUDING CONSIDERATION OF CONSTRUCTION LIVE LOADS AND DYNAMIC EFFECTS AS APPLICABLE.

- IN THE ABOVE-LISTED **LOAD COMBINATIONS**, THE STRENGTH III, CONSTRUCTION CONDITION **LOAD COMBINATION** SHOULD INCLUDE WIND LOADING AND REDUCED CONSTRUCTION LOADS ( SUCH AS WEIGHT OF STATIC CONSTRUCTION EQUIPMENT AND STORED MATERIALS WITH NO CONSTRUCTION LIVE LOAD ). THE STRENGTH III, CONSTRUCTION CONDITION, NEED NOT BE CHECKED FOR DECK PLACEMENT CONDITIONS ( THE STRENGTH I LIMIT STATE COVERS THIS CONDITION ).

- IN THE ABOVE-LISTED **LOAD COMBIATIONS**, FOR CONSTRUCTION CONDITION **LOAD COMBINATIONS**, DW SHOULD ONLY INCLUDE ANY APPLICABLE UTILITY LOADS, BUT NOT FUTURE WEARING SURFACE LOADING.

- **IN THE ABOVE-LISTED LOAD COMBINATIONS, USE THE APPROPRIATE WIND VELOCITY FOR THE GIVEN LOAD COMBINATION. REFER TO AASHTO LRFD SECTION 3.8.**

- ONCE THE STABILITY BRACING FORCES HAVE BEEN CALCULATED USING THESE APPROPRIATELY FACTORED ULTIMATE MOMENT ( M<sub>f</sub> ) VALUES, THEY SHOULD BE MULTIPLIED BY A 1.0 LOAD FACTOR FOR COMBINATION WITH OTHER FORCE EFFECTS IN THE APPROPRIATE **LOAD COMBINATIONS** WHEN EVALUATING BRACING STRENGTH AND STIFFNESS REQUIREMENTS.

b) GRAVITY LOAD ( DEAD LOAD AND LIVE LOAD ) EFFECTS:

FOR BRIDGES WITH SKEW INDEX LESS THAN 0.30 ( I<sub>s</sub><0.30 ) WHERE SIMPLIFIED ANALYSIS METHODS ARE USED, THE EFFECTS OF GRAVITY LOADS MAY BE NEGLECTED WHEN DETERMINING DIAPHRAGM DESIGN LOADS.

FOR BRIDGES WITH SKEW INDEX GREATER THAN 0.30 ( I<sub>s</sub>>0.30 ) WHERE REFINED ANALYSIS METHODS ARE USED, DIAPHRAGM GRAVITY LOAD EFFECTS SHOULD BE DETERMINED FROM THE REFINED ANALYSIS.

c) WIND LOAD EFFECTS:

WIND LOAD EFFECTS SHOULD BE INCLUDED IN THE CALCULATION OF DIAPHRAGM DESIGN FORCES. APPROPRIATE WIND PRESSURES AND ASSOCIATED FACTORS SHOULD BE CALCULATED FOLLOWING THE GUIDANCE IN SECTION 3 OF THE AASHTO LRFD. WIND PRESSURE APPLIED TO THE FASCIA GIRDER CAN BE APPORTIONED AS FOLLOWS:

- WIND PRESSURE ON TOP 50% OF THE DEPTH OF THE FASCIA GIRDER CAN BE APPORTIONED TO THE TOP FLANGE AND CAN BE ASSUMED TO BE TRANSFERRED DIRECTLY INTO THE DECK.

- WIND PRESSURE ON THE BOTTOM 50% OF THE DEPTH OF FASCIA GIRDER CAN BE APPORTIONED TO THE BOTTOM FLANGE. THE BOTTOM FLANGE CAN BE ASSUMED TO TRANSFER THE RESULTING WIND LOAD TO INDIVIDUAL INTERMEDIATE DIAPHRAGMS BY MEANS OF FLANGE LATERAL BENDING. THE LOAD IN EACH INTERMEDIATE DIAPHRAGM CAN BE DETERMINED BY MEANS OF A TRIBUTARY SPAN ASSUMPTION. THE DIAPHRAGMS SHOULD BE DESIGNED TO TRANSFER THIS LOAD INTO THE DECK.

- THE RESULTING WIND LOAD IN THE DECK CAN BE ASSUMED TO BE TRANSFERRED BY AND THROUGH THE DECK TO THE PIER AND END DIAPHRAGMS, THE PIER AND END DIAPHRAGMS SHOULD BE DESIGNED TO TRANSFER THE RESULTING WIND LOAD FROM THE DECK TO THE BEARINGS.

\* NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS, CONTINUED ON SHEET 3 \*

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CROSS FRAME AND SOLID PLATE  
DIAPHRAGMS FOR STEEL BEAM/GIRDER  
BRIDGES DESIGNED  
WITH REFINED METHODS OF ANALYSIS

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 5

BD-619M



NOTES FOR DESIGNING AND DETAILING DIAPHRAGMS (CONTINUED FROM SHEET 2)

9. DETERMINATION OF DESIGN LOADS (CONTINUED FROM SHEET 2 )

d) FATIGUE LOADING EFFECTS:

A DETAILED ANALYSIS OF FATIGUE LOADING IS NOT REQUIRED FOR THE DESIGN OF DIAPHRAGMS IN BRIDGES WITH A SKEW INDEX LESS THAN 0.30 (I<sub>s</sub>< 0.30 ) WHERE A REFINED ANALYSIS IS NOT PERFORMED. INSTEAD THE LENGTH OF LONGITUDINAL FILLET WELDS CONNECTING DIAPHRAGM CHORD AND DIAGONAL MEMBERS TO GUSSET PLATES SHALL NOT BE LESS THAN 4". THE MINIMUM WELD SIZE REQUIREMENTS OF THE AASHTO LRFD SHALL BE MET.

FOR CURVED GIRDER BRIDGES OR BRIDGES WITH A SKEW INDEX GREATER THAN 0.30 (I<sub>s</sub>> 0.30 ) A REFINED ANALYSIS IS REQUIRED AND SHALL INCLUDE DETERMINATION OF FATIGUE STRESS RANGES IN THE DIAPHRAGM MEMBERS. FOLLOW THE GUIDANCE PROVIDED IN THE COMMENTARY OF THE AASHTO LRFD (C6.6.1.2.1 ) , REGARDING THE DETERMINATION OF FATIGUE STRESS RANGES WHEN COMPUTED USING A REFINED ANALYSIS.

e) STABILITY BRACING FORCES:

STABILITY BRACING STRENGTH AND STIFFNESS REQUIREMENTS SHOULD BE SATISFIED, IN ACCORDANCE WITH THE AISC SPEC (APPENDIX 6.3 ) AND THE FHWA SBDH (VOL 13 ). STABILITY BRACING FORCES SHOULD BE COMBINED WITH OTHER LOADS AS SPECIFIED ABOVE IN THIS STANDARD.

STABILITY BRACING FORCES SHOULD BE CALCULATED FOR DIAPHRAGMS BRACING TOP FLANGES IN POSITIVE MOMENT REGIONS. THE MAXIMUM POSITIVE MOMENT AND ASSOCIATED DIAPHRAGM SPACING ( IN THE VICINITY OF THE MAXIMUM POSITIVE MOMENT LOCATION ) SHOULD BE USED TO CALCULATE STABILITY BRACING FORCES. ONLY NON-COMPOSITE DEAD LOAD EFFECTS SHOULD BE CONSIDERED IN CALCULATING STABILITY BRACING FORCES FOR DIAPHRAGMS IN THE POSITIVE MOMENT REGION; ONCE THE DECK IS CURED, THE TOP FLANGE IN COMPRESSION IS CONTINUOUSLY BRACED BY THE DECK.

STABILITY BRACING FORCES SHOULD BE CALCULATED FOR DIAPHRAGMS BRACING BOTTOM FLANGES IN NEGATIVE MOMENT REGIONS ( IN MULTIPLE SPAN CONTINUOUS BRIDGES ). THE ULTIMATE NEGATIVE MOMENT AT THE LOCATION OF THE FIRST DIAPHRAGM AWAY FROM THE PIER SHOULD BE USED TO CALCULATE STABILITY BRACING FORCES.

IF DIAPHRAGM SPACING IS DIFFERENT IN THE POSITIVE AND NEGATIVE MOMENT REGIONS, THE DIAPHRAGM SPACING IN EACH REGION SHOULD BE USED FOR CALCULATION OF STABILITY BRACING FORCES IN THAT PARTICULAR REGION.

10. DETAILED DESIGN PROCEDURES FOR TYPE X AND TYPE K INTERMEDIATE DIAPHRAGMS

a) DESIGN OF TOP CHORD, BOTTOM CHORD, AND DIAGONALS IN TYPE X AND TYPE K DIAPHRAGMS.

● STRENGTH DESIGN: STRENGTH DESIGN SHALL BE PERFORMED IN ACCORDANCE WITH THE APPROPRIATE AASHTO LRFD PROVISIONS (SECTION 6 ). FOR ANGLE SECTIONS (AISC "L" SHAPES ) THE EFFECTIVE SLENDERNESS RATIO METHOD IN THE AASHTO LRFD (SECTION 6.9.4.4 ) SHALL BE USED. FOR OTHER SECTIONS SUCH AS WT, W, AND CHANNEL SECTIONS (AISC "WT", "WIDE FLANGE", "C", AND "MC" SHAPES ) , THE DESIGN SHALL CONSIDER BOTH AXIAL LOAD AND FLEXURE DUE TO THE ECCENTRICITY OF CONNECTIONS (BEAM-COLUMN INTERACTION) , AND SHALL CONSIDER SECOND-ORDER MOMENT AMPLIFICATION IN THE CASE OF COMPRESSION LOADING IN ACCORDANCE WITH THE AASHTO LRFD (SECTION 6.9.2.2 ) .

● FATIGUE DESIGN: EVALUATE FATIGUE OF THE BASE METAL IN THE CONNECTION OF DIAPHRAGM MEMBERS TO GUSSET PLATES USING LONGITUDINAL WELDS AS A CATEGORY E<sub>1</sub> DETAIL, AS SPECIFIED IN THE AASHTO LRFD (TABLE 6.6.1.2.3.-1 ) . FOR INTERSTATE AND NATIONAL HIGHWAY SYSTEM (NHS) BRIDGES, DESIGN DIAPHRAGMS FOR THE FATIGUE I **LOAD COMBINATION** AS DEFINED IN THE AASHTO LRFD. FOR OTHER BRIDGES, DESIGN DIAPHRAGMS FOR THE FATIGUE II **LOAD COMBINATION** AS DEFINED IN THE AASHTO LRFD; DESIGNED FOR A 100-YEAR SERVICE LIFE.

● THE EFFECTIVE LENGTH OF TOP CHORD, BOTTOM CHORD AND DIAGONAL MEMBERS SHALL BE DETERMINED IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF THE AASHTO LRFD. FOR DIAGONAL MEMBERS IN TYPE X DIAPHRAGMS WHICH ARE CONNECTED AT THEIR POINTS OF INTERSECTION, SEE SECTION 2.7 OF THE FHWA SBDH, VOL. 13, FOR PROVISIONS REGARDING THE USE OF 0.5L IN EFFECTIVE LENGTH CALCULATIONS.

b) DESIGN OF GUSSET PLATES

GUSSET PLATES SHALL BE DESIGNED IN ACCORDANCE WITH THE APPROPRIATE PROVISIONS OF THE AASHTO LRFD (SECTION 6.14.2.8) , ADDRESSING TENSION, COMPRESSION AND SHEAR AS APPLICABLE.

c) DESIGN OF WELDED CONNECTION OF DIAPHRAGM MEMBERS TO GUSSET PLATES

THE WELDED CONNECTION OF DIAPHRAGM MEMBERS (TOP CHORD, BOTTOM CHORD, DIAGONALS ) TO THE GUSSET PLATES SHOULD BE DESIGNED IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6 ) .

d) DESIGN OF BOLTED CONNECTION OF GUSSET PLATES TO CONNECTION PLATES AND/OR BEARING STIFFENERS

● THE BOLTED CONNECTIONS OF GUSSET PLATES TO CONNECTION PLATES AND/OR BEARING STIFFENERS SHOULD BE DESIGNED IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6 ) . IN-PLANE ECCENTRICITY OF LOADING APPLIED TO THE BOLT GROUP (RESULTANT OF LOAD NOT ACTING THROUGH THE **CENTROID** OF THE BOLT GROUP ) SHALL BE CONSIDERED.

● ALL APPLICABLE COMBINATIONS OF TENSION AND COMPRESSION LOADS IN INDIVIDUAL MEMBERS SHOULD BE CONSIDERED; EITHER INVESTIGATE ALL TRUE CONCURRENT COMBINATIONS OF LOADS, OR DESIGN FOR CONSERVATIVE ENVELOPING COMBINATIONS OF THE MAXIMUM COMPRESSION AND TENSION FORCES IN EACH MEMBER CONNECTED TO THE GUSSET PLATE.

● INVESTIGATE SHEAR IN THE BOLTS AND BEARING IN THE CONNECTED MATERIALS (BOTH THE GUSSET PLATE AND THE CONNECTION PLATE OR BEARING STIFFENER) UNDER ALL APPLICABLE STRENGTH **LOAD COMBINATIONS**. INVESTIGATE SLIP OF BOLTED CONNECTIONS UNDER THE SERVICE II **LOAD COMBINATION**.

● USE 7/8" DIAMETER ASTM **F3125 GRADE** A325 BOLTS WHENEVER POSSIBLE. 1" DIAMETER ASTM **F3125 GRADE** A325 BOLTS MAY BE USED IN SITUATIONS WHERE THE USE OF 7/8" DIAMETER BOLTS WOULD RESULT IN AN EXCESSIVE NUMBER OF BOLTS IN THE CONNECTION. THE USE OF ASTM **F3125 GRADE** A325 BOLTS LARGER THAN 1" DIAMETER, OR THE USE OF ANY SIZE ASTM **F3125 GRADE** 490 BOLTS, REQUIRES APPROVAL FROM THE CHIEF BRIDGE ENGINEER.

● DESIGN BOLTED CONNECTIONS ASSUMING A CLASS B CONSTANT SURFACE SLIP RESISTANCE. **USE CLASS C SLIP RESISTANCE FOR GALVANIZED BOLTS. (SEE NOTE 14(e) OF THIS STANDARD).**

● BOLT SPACINGS, END DISTANCES, AND EDGE DISTANCES SHOULD MEET AASHTO LRFD REQUIREMENTS.

● USE STANDARD SIZE HOLES. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" IN DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" IN DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8" .

● THE USE OF OVERSIZE HOLES OR SLOTTED HOLES REQUIRES APPROVAL FROM THE CHIEF BRIDGE ENGINEER.

● CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE CHECKED.

e) DESIGN OF CONNECTION PLATES

THE WELDS CONNECTING THE CONNECTION PLATE (OR BEARING STIFFENER ) TO THE GIRDER WEB AND FLANGES SHOULD BE DESIGNED WITH ADEQUATE STRENGTH TO TRANSMIT THE DIAPHRAGM FORCES INTO THE GIRDERS. INVESTIGATE THE STRENGTH OF THE WELDED CONNECTIONS IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6 ) .

11. DETAILED DESIGN PROCEDURES FOR TYPE K AND TYPE K INVERTED PIER AND END DIAPHRAGMS

a) IN GENERAL , DESIGN TYPE K AND TYPE K INVERTED END DIAPHRAGMS FOLLOWING THE GUIDANCE PRESENTED IN NOTE 10 OF THIS STANDARD FOR DESIGN OF TYPE X AND TYPE K INTERMEDIATE DIAPHRAGMS, EXCEPT AS SPECIFICALLY MODIFIED BELOW.

b) IN SITUATIONS WHERE TYPE K INVERTED END DIAPHRAGMS ARE USED AND THE TOP CHORD ACTS TO STRENGTHEN AND STIFFEN THE EDGE OF THE DECK AT EXPANSION JOINTS, THE DIAPHRAGM TOP CHORD IS TYPICALLY A CHANNEL OR W SECTION (AISC "C", "MC", OR WIDE FLANGE SHAPE ). THE DIAPHRAGM TOP CHORD IN THIS SITUATION IS TYPICALLY MADE TO ACT IN A COMPOSITE FASHION WITH THE DECK VIA THE USE OF SHEAR CONNECTORS.

c) THE DIAPHRAGM TOP CHORD SHOULD BE DESIGNED TO CARRY A PORTION OF THE DEAD LOAD OF THE WET CONCRETE DECK AS WELL AS WHEEL LOADS APPLIED TO THE DECK , IN ADDITION TO ANY **GLOBAL (SYSTEM) DEAD, LIVE, AND WIND LOAD EFFECTS**. THE DIAPHRAGM TOP CHORD MAY BE TREATED AS EITHER A TWO SPAN CONTINUOUS BEAM (SIMPLY SUPPORTED AT ITS ENDS, CONTINUOUS OVER THE POINT OF CONNECTION TO THE DIAGONALS ) , OR AS TWO SIMPLE SPANS (SIMPLY SUPPORTED AT ITS ENDS AND AT THE POINT OF CONNECTION TO THE DIAGONALS ) .

d) THE DIAGONALS SHOULD BE DESIGNED TO CARRY DEAD LOAD AND LIVE LOAD REACTIONS FROM THE DIAPHRAGM TOP CHORD'S ACTION AS A BEAM STIFFENING AND STRENGTHENING THE EDGE OF THE DECK AT EXPANSION JOINTS, IN ADDITION TO ANY **GLOBAL (SYSTEM) DEAD, LIVE, AND WIND LOAD EFFECTS**.

e) THE CONNECTION PLATES FOR PIER AND END DIAPHRAGMS TYPICALLY ALSO FUNCTION AS BEARING STIFFENERS AND SHOULD BE DESIGNED FOR BOTH DIAPHRAGM LOADS AND BEARING REACTIONS, FOLLOWING THE APPROPRIATE PROVISIONS OF THE AASHTO LRFD (SECTIONS 6.9.2.1 , 6.10.11.2 AND 6.13.3.2 ) .

12. DETAILED DESIGN PROCEDURES FOR SOLID PLATE INTERMEDIATE OR PIER AND END DIAPHRAGMS

a) TYPICALLY, SOLID PLATE INTERMEDIATE DIAPHRAGMS ARE DESIGNED FOR THEIR APPROPRIATE STRENGTH LIMIT STATE DESIGN LOAD EFFECTS IN A MANNER SIMILAR TO THE DESIGN OF OTHER STEEL GIRDERS OR BEAMS, IN ACCORDANCE WITH THE AASHTO LRFD (SECTION 6 ) .

b) IF SOLID PLATE PIER OR END DIAPHRAGMS WILL BE SUBJECTED TO JACKING LOADS FOR BEARING REPLACEMENT, BEARING STIFFENERS SHOULD BE DESIGNED AND PROVIDED, UNLESS IT CAN BE CLEARLY SHOWN BY CALCULATION THAT THE UNSTIFFENED WEB HAS SUFFICIENT AXIAL (BUCKLING ) , WEB LOCAL YIELDING, AND WEB CRIPPLING CAPACITY, FOLLOWING THE APPROPRIATE PROVISIONS OF THE AASHTO LRFD (SECTION 6 ) .

c) SOLID PLATE INTERMEDIATE OR PIER AND END DIAPHRAGMS ARE TYPICALLY CONNECTED TO STIFFENERS VIA BOLTED CONNECTIONS. THESE BOLTED CONNECTIONS SHOULD BE DESIGNED IN ACCORDANCE WITH THE PROVISIONS OF THE AASHTO LRFD (SECTION 6 ) . ECCENTRICITY OF LOADING APPLIED TO THE BOLT GROUP SHALL BE CONSIDERED. INVESTIGATE SHEAR IN THE BOLTS AND BEARING IN THE CONNECTED MATERIALS (BOTH THE SOLID PLATE DIAPHRAGM'S WEB AND THE CONNECTION PLATE OR BEARING STIFFENER ) UNDER ALL APPLICABLE STRENGTH LIMIT STATES. INVESTIGATE SLIP OF BOLTED CONNECTIONS UNDER THE SERVICE II LIMIT STATE.

d) IN SITUATIONS WHERE THE SPAN TO DEPTH RATIO OF SOLID PLATE DIAPHRAGMS IS LESS THAN OR EQUAL TO 4.0, SHEAR DEFORMATIONS MUST BE CONSIDERED WHEN EVALUATING THE STRENGTH ADEQUACY OF THE DIAPHRAGM.

13. BEARING DESIGN

a) DESIGN BEARINGS TO ACCOMMODATE APPLICABLE VERTICAL LOAD DEMANDS, HORIZONTAL LOAD DEMANDS, HORIZONTAL MOVEMENT DEMANDS, AND ROTATIONAL DEMANDS, AS APPROPRIATE. CONSIDER THE CONCURRENT COMBINATIONS OF THESE DEMANDS AT EACH STAGE OF CONSTRUCTION (INCLUDING PRIOR TO DECK PLACEMENT) AND UNDER FINAL CONDITIONS.

b) WHEN EVALUATING THE ROTATIONAL DEMAND ON BEARINGS FOR CURVED OR SKEWED STEEL GIRDER BRIDGES, CONSIDER BOTH THE MAJOR AXIS BENDING ROTATION OF THE GIRDER (ROTATION ABOUT THE TRANSVERSE AXIS OF THE GIRDER ) AND GIRDER LAYOVER (ROTATION ABOUT THE LONGITUDINAL AXIS OF THE GIRDER ) .

c) WHEN EVALUATING GIRDER LAYOVER ROTATIONAL DEMANDS ON BEARINGS AT SKEWED SUPPORTS (FOR EITHER CURVED OR STRAIGHT GIRDER BRIDGES ) , CONSIDER THE EFFECTS OF THE CHOSEN DETAILING METHOD (NLF, SDLF, TDLF ) ON THE VALUES OF THE GIRDER LAYOVER ROTATIONAL DEMANDS. THE CHOSEN DETAILING METHOD AFFECTS THE MAGNITUDE AND DIRECTION OF GIRDER LAYOVER AT VARIOUS STAGES OF CONSTRUCTION (I.E., DURING GIRDER ERECTION, WITH ALL STEEL ERECTED PRIOR TO DECK PLACEMENT, AFTER DECK PLACEMENT, ETC.).

d) IF BEARINGS CANNOT BE ECONOMICALLY DESIGNED TO ACCOMMODATE ALL ROTATIONAL DEMANDS UNDER ALL LOADING CONDITIONS (DURING ALL STAGES OF CONSTRUCTION AND UNDER FINAL CONDITIONS ) , CONSIDER THE USE OF SOLE PLATES BEVELED BOTH TRANSVERSELY AND LONGITUDINALLY, OR REQUIRING THE BLOCKING OF GIRDERS DURING CONSTRUCTION (I.E., THE SUPPORT OF GIRDERS ON TEMPORARY BLOCKING ) . BASE BEARING DESIGN DECISIONS ON THE GOAL OF ACHIEVING A BALANCE OF ECONOMY, CONSTRUCTABILITY, AND LONG TERM SERVICEABILITY CRITERIA.

14. NOTES TO BE SHOWN ON THE CONSTRUCTION DRAWINGS

a) PROVIDE MATERIALS AND **WORK QUALITY** IN ACCORDANCE WITH PUBLICATION 408 AND AASHTO/AWS D1.5 SPECIFICATIONS.

b) DEVELOP SHOP DRAWINGS AND ERECTION PROCEDURES THAT DETAIL ALL WEBS VERTICAL UNDER (SPECIFY THE APPROPRIATE LOADING CONDITION, AS INDICATED IN NOTE 3.d OF THIS STANDARD, I.E., NO LOAD FIT (NLF ) , STEEL DEAD LOAD FIT (SDLF ) OR TOTAL DEAD LOAD FIT (TDLF ) ) CONDITION.

c) USE STANDARD SIZE HOLES FOR ALL BOLTS.

d) USE (INDICATE 7/8" OR AS SPECIFIED IN THE DESIGN AND PLANS ) DIAMETER ASTM **F3125 GRADE** A325 BOLTS HAVING AN UNTHREADED SHANK OF SUFFICIENT LENGTH TO NOT ALLOW ANY THREADS TO EXIST IN THE PLANE BETWEEN THE TWO CONNECTED PARTS (SHEAR PLANE ) .

e) FURNISH PAINT THAT HAS BEEN QUALIFIED AS CLASS B IN ACCORDANCE WITH SECTION 6.13.2.8 OF AASHTO LRFD SPECIFICATION. (INCLUDE THIS NOTE FOR PAINTED BRIDGES AND WEATHERING STEEL BRIDGES )

f) BLAST CLEAN THE FAYING SURFACES OF SPLICES AND CONNECTIONS OF ALL STRUCTURAL ELEMENTS IN ACCORDANCE WITH PUBLICATION 408 SECTION 1060.3(b)3. REBLAST UNPAINTED ELEMENTS THAT REMAIN UNASSEMBLED FOR A PERIOD OF 12 MONTHS OR MORE FOLLOWING THE INITIAL CLEANING. (INCLUDE THIS NOTE FOR WEATHERING STEEL BRIDGES ONLY )

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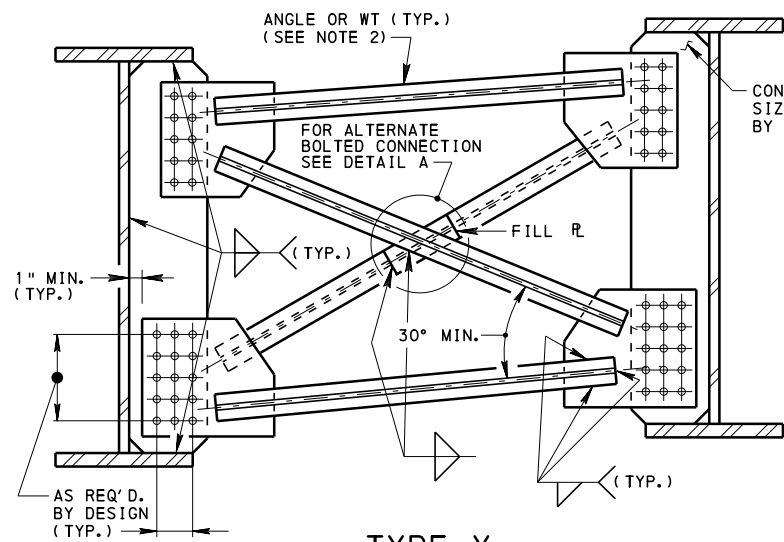
STANDARD  
CROSS FRAME AND SOLID PLATE  
DIAPHRAGMS FOR STEEL BEAM/GIRDER  
BRIDGES DESIGNED  
WITH REFINED METHODS OF ANALYSIS

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

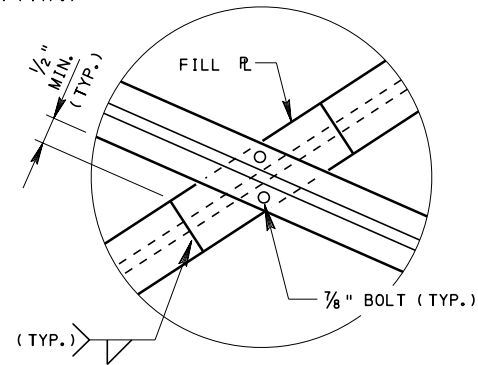
RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 5

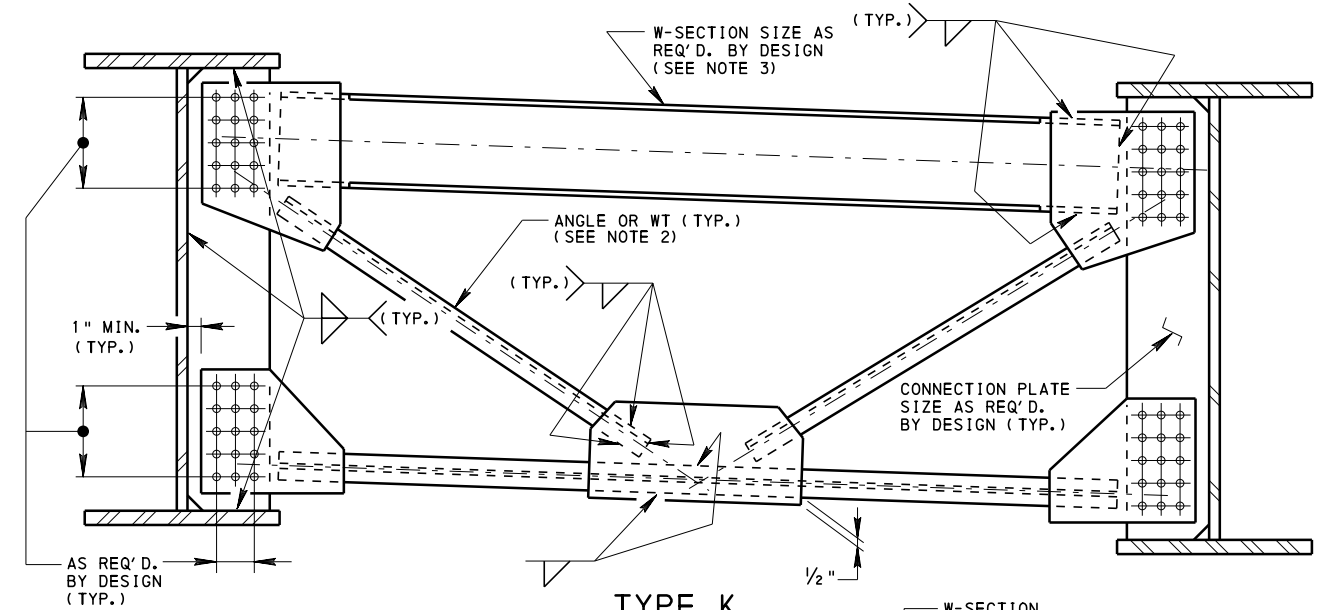
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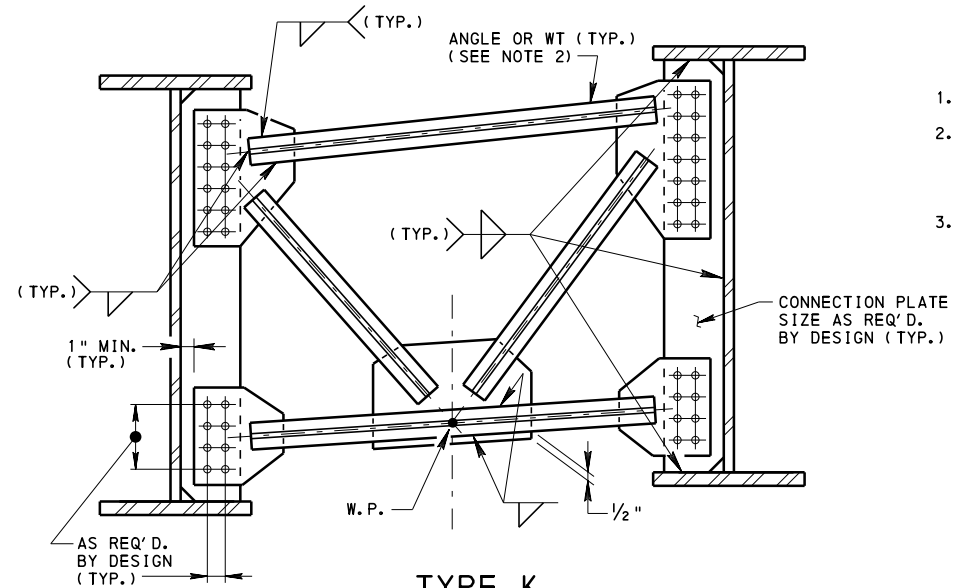
TYPE X



DETAIL A



TYPE K



TYPE K

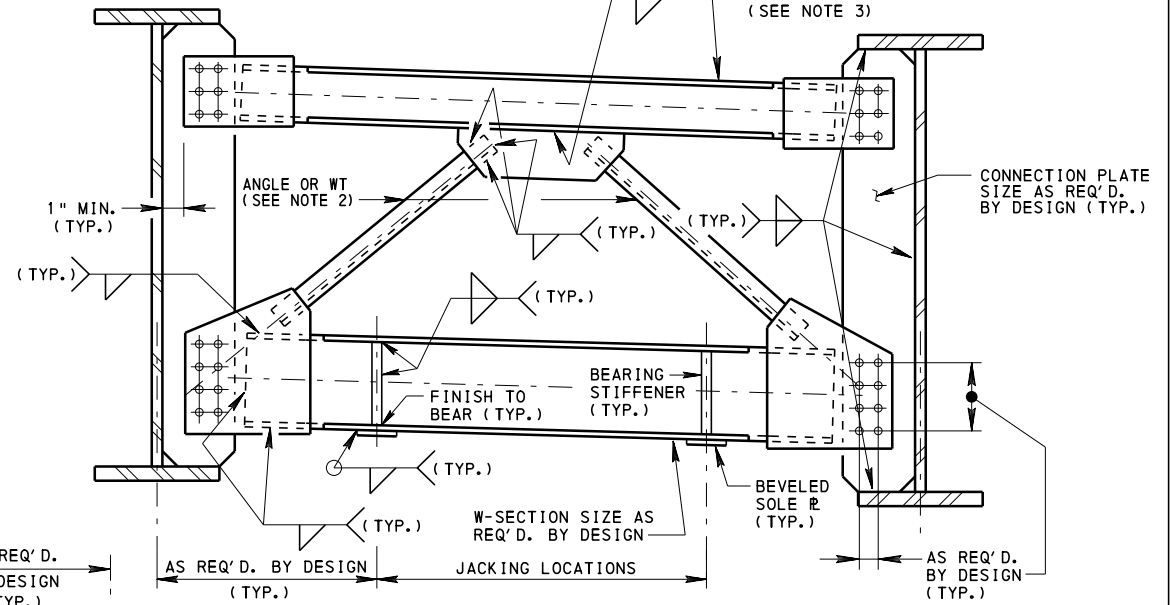
NOTES:

1. REFER TO NOTES ON SHEETS 1, 2 AND 3 FOR DESIGN REQUIREMENTS.
2. MEMBER TYPE AND SIZE AS REQUIRED BY DESIGN. MEMBERS SHOULD TYPICALLY CONSIST OF SINGLE ANGLES OR WT SECTIONS. BACK TO BACK DOUBLE ANGLES ARE PERMITTED FOR UNPAINTED WEATHERING STEEL BRIDGES ONLY.
3. FOR END DIAPHRAGMS, SUPPORT EDGE OF DECK WITH TOP CHORD, AND PROVIDE A SINGLE ROW OF 3/4" Ø STUDS AT A NOMINAL 1'-0" SPACING.

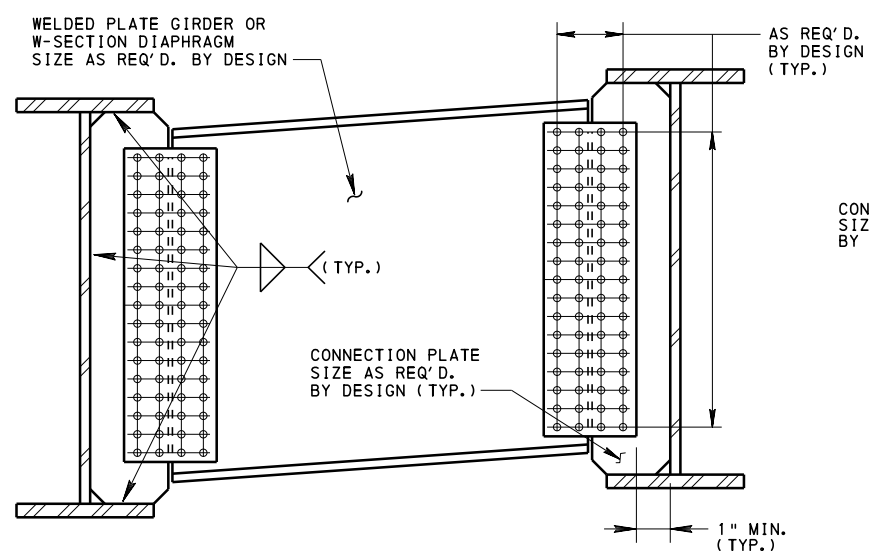
\* A SINGLE JACKING POINT AT THE MIDSPAN OF THE DIAPHRAGM MAY ALSO BE USED. IF SHOWN ACCEPTABLE BY DESIGN.

WELDED PLATE GIRDER OR W-SECTION DIAPHRAGM SIZE AS REQ'D. BY DESIGN (SEE NOTE 3)

\* JACKING LOCATIONS AS REQ'D. BY DESIGN (TYP.)

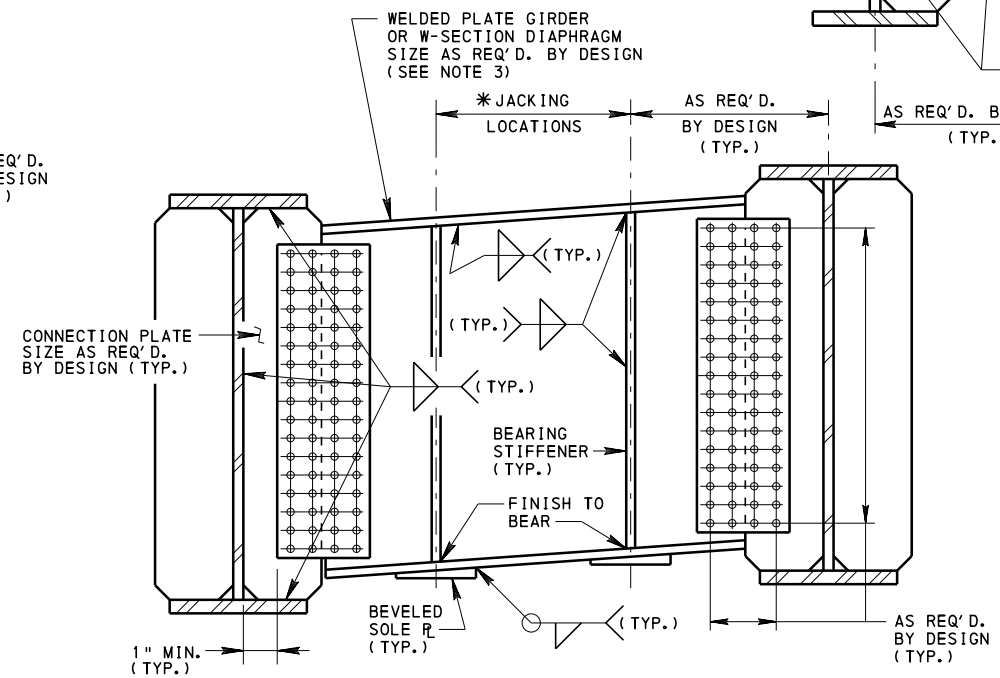


TYPE K INVERTED



SOLID PLATE

INTERMEDIATE DIAPHRAGMS



SOLID PLATE

END DIAPHRAGMS

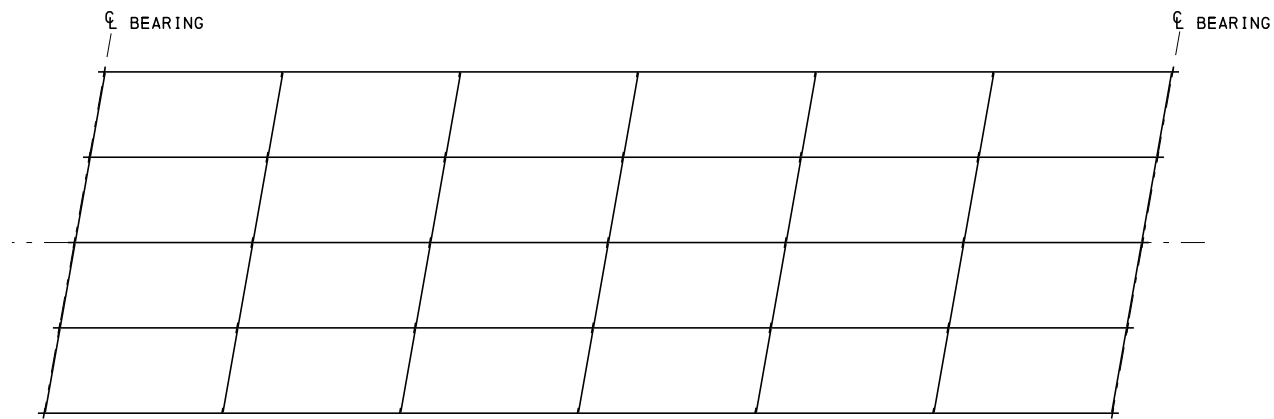
COMMONWEALTH OF PENNSYLVANIA  
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STANDARD  
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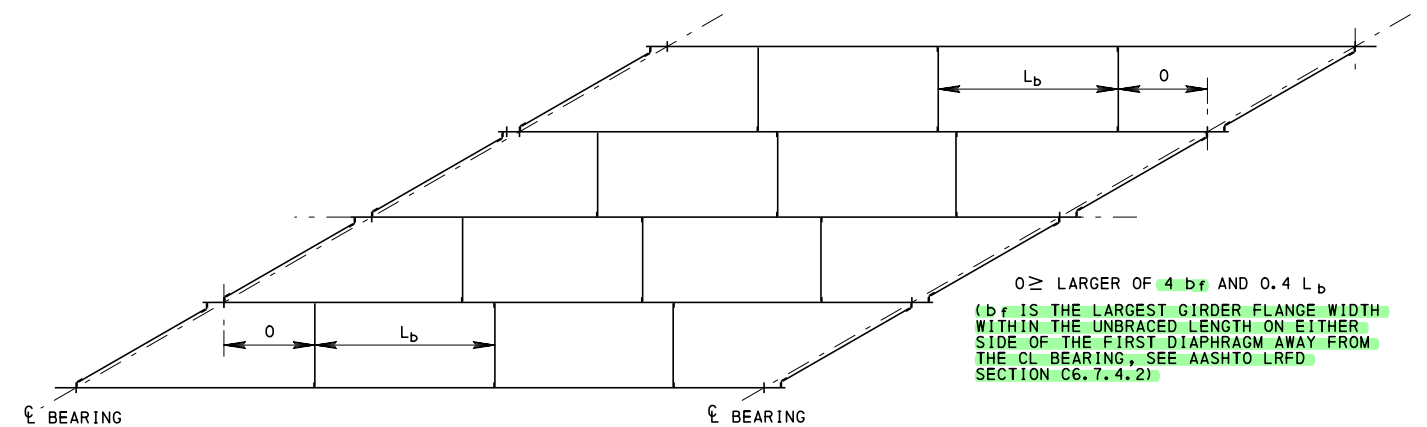
RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Biele*  
ACT. DIR., BUR. OF PROJECT DELIVERY

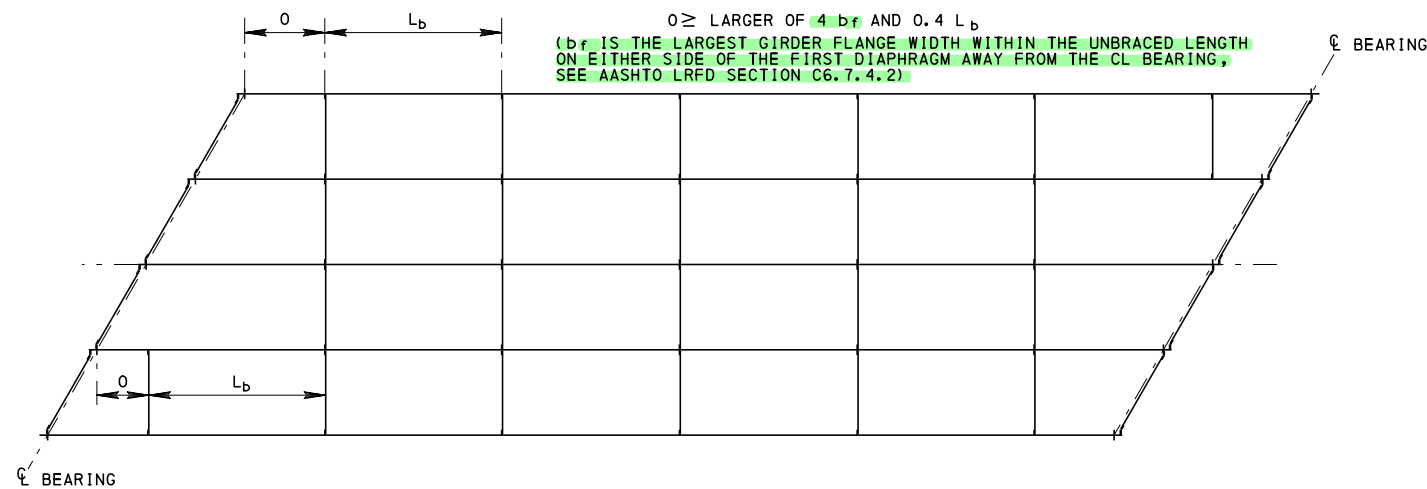
SHEET 4 OF 5  
BD-619M



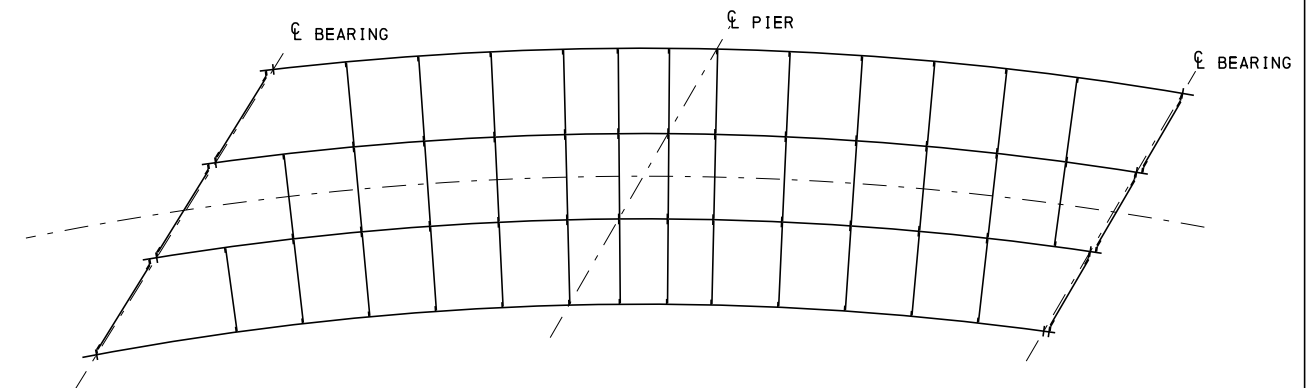
SKewed SUPPORTS WITH CONTIGUOUS CROSS-FRAME LINES  
PARALLEL TO THE SKEW (SKEW  $\geq 70^\circ$ )



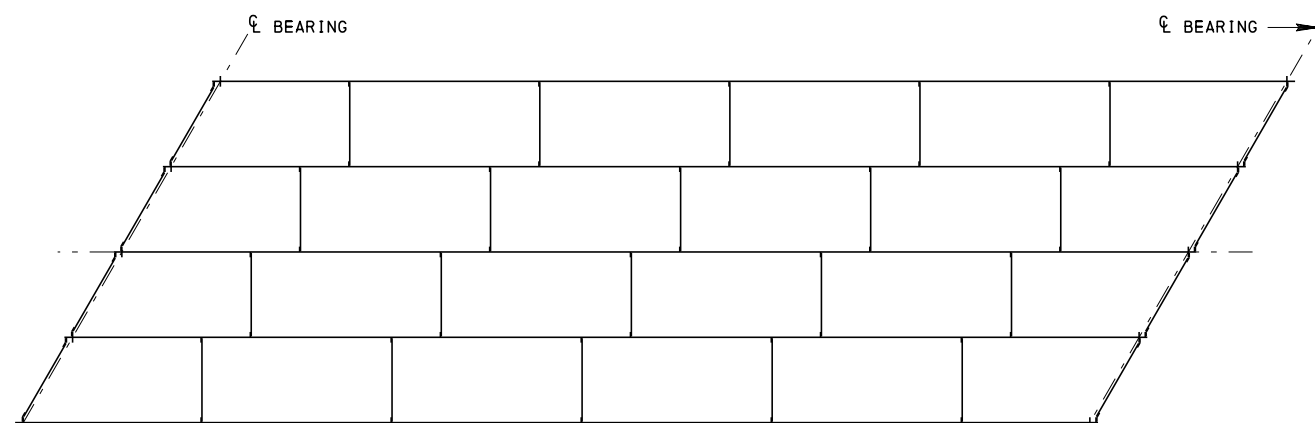
SEVERELY SKEWED SUPPORTS WITH STAGGERED CROSS-FRAME LINES



CONTIGUOUS CROSS-FRAME LINES (WITHIN THE SPAN)  
NORMAL TO THE GIRDER TANGENTS (SKEW  $< 70^\circ$ )



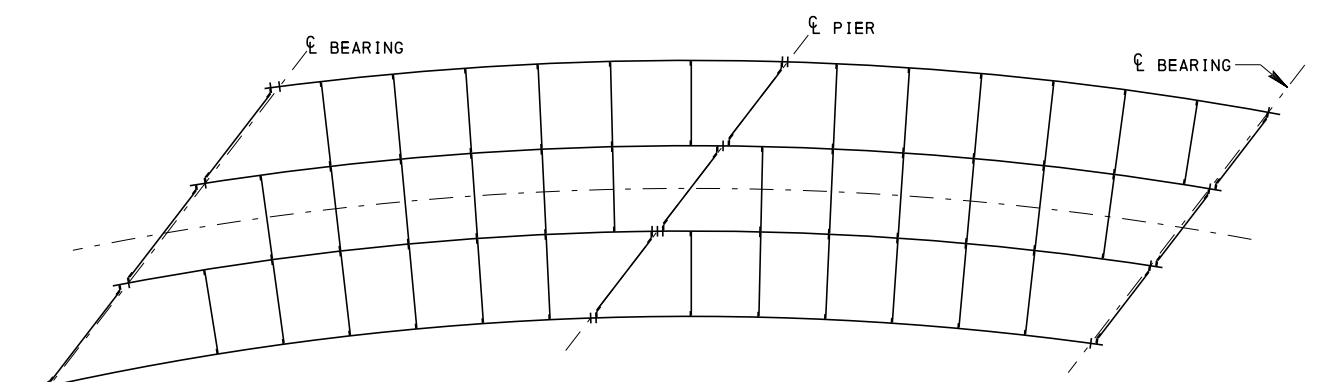
SKewed AND CURVED WITH CONTIGUOUS CROSS-FRAME LINES  
NO CROSS-FRAME LINE ALONG THE SKEWED INTERIOR SUPPORT



DISCONTINUOUS (STAGGERED) CROSS-FRAME LINES ALONG THE  
ENTIRE SPAN NORMAL TO THE GIRDER TANGENTS (SKEW  $< 70^\circ$ )

**NOTE:**

THESE FRAMING PLANS ARE CONCEPTUAL ONLY AND ARE PROVIDED ONLY TO ILLUSTRATE POTENTIAL FRAMING ARRANGEMENTS FOR VARIOUS CURVED AND/OR SKEWED BRIDGE GEOMETRIES. DESIGNERS SHALL ESTABLISH A STRUCTURE SPECIFIC FRAMING PLAN, CONSIDERING ECONOMY OF FABRICATION AND CONSTRUCTION AS WELL AS CONTROL OF FORCE EFFECTS. REFER TO AASHTO LRFD SECTION C6.7.4.2 FOR ADDITIONAL DISCUSSION REGARDING EFFICIENT FRAMING ARRANGEMENTS.



SKewed AND CURVED WITH DISCONTINUOUS CROSS-FRAME LINES  
CROSS-FRAME LINE ALONG THE SKEWED INTERIOR SUPPORT

**SKEWED INTERIOR SUPPORT LINES:**

- FOR SKEWS  $< 70^\circ$ , CROSS-FRAMES ALONG THE SKEWED SUPPORT LINE ARE NOT GENERALLY RECOMMENDED.
- DETAILING AT INTERSECTIONS WITH CROSS-FRAMES NORMAL TO GIRDER IS COMPLEX.
- NOT NEEDED IF CROSS-FRAMES NORMAL TO GIRDER ARE AT BEARINGS THAT RESIST LATERAL FORCES AND FLANGE ARE ADEQUATELY BRACED.

WHERE DISCONTINUOUS CROSS-FRAMES ARE UTILIZED NEAR INTERIOR SUPPORTS, ENSURE THAT:

- A CROSS-FRAME IS MATCHED WITH EACH BEARING THAT RESISTS LATERAL FORCE
- WHERE A BEARING DOES NOT RESIST LATERAL FORCE, GIRDER BOTTOM FLANGE IS ADEQUATELY BRACED.

**COMMONWEALTH OF PENNSYLVANIA  
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BUREAU OF PROJECT DELIVERY**

**STANDARD  
CROSS FRAME AND SOLID PLATE  
DIAPHRAGMS FOR STEEL BEAM/GIRDER  
BRIDGES DESIGNED  
WITH REFINED METHODS OF ANALYSIS**

RECOMMENDED AUG. 30, 2019  
*John J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Mark V. Bate*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 5  
BD-619M

**CONCEPTUAL FRAMING PLANS**



LATERAL STABILITY BRACING  
DESIGN CRITERIA FOR GIRDER BRIDGES  
PRIOR TO DECK COMPLETION:

THE CRITERION IN THIS STANDARD APPLIES ONLY TO COMPLETELY ERECTED STEEL SUPERSTRUCTURE, WITHOUT THE DECK. THE STABILITY OF PARTIAL AND COMPLETED GIRDERS IN THE VARIOUS STAGES OF ERECTION PRIOR TO INSTALLATION OF ALL GIRDERS AND DIAPHRAGMS IS THE RESPONSIBILITY OF THE CONTRACTOR AS SPECIFIED IN PUBLICATION 408 SECTION 1050.3(c). (APPLIES TO TANGENT, SKEWED AND CURVED BRIDGES. APPLIES TO SINGLE AND MULTI-SPAN BRIDGES.)

1. PROVIDE LATERAL BRACING FOR BRIDGES WITH SPANS IN EXCESS OF 300 FT. TO AID IN CONSTRUCTION OF THE BRIDGE. DESIGN BRACING FOR THE SPECIFIED WIND LOADS.
2. EVALUATE THE NEED FOR LATERAL BRACING FOR SPANS IN EXCESS OF 200 FT. BASED ON LATERAL DEFLECTION.
3. GIRDERS SHALL BE DESIGNED SO THAT NO LATERAL BRACING IS NECESSARY FOR GIRDER SPANS LESS THAN 200 FEET, RATIO OF GIRDER SPACING OVER GIRDER DEPTH LESS THAN OR EQUAL TO 2 AND A BRIDGE CROSS SECTION WITH 4 OR MORE GIRDERS. THE ENGINEER WILL EVALUATE THE DEAD LOAD PLUS WIND CONDITION WITH AN UNBRACED TOP FLANGE, AND IF NECESSARY, MODIFY THE GIRDER DESIGN.
4. EVALUATE LATERAL DEFLECTION OF STEEL SUPERSTRUCTURE FOR A PERMISSIBLE DEFLECTION OF L/150. PROVIDE BRACING IF DEFLECTION LIMIT IS EXCEEDED. AN ACCEPTABLE ANALYSIS METHOD IS A HAND CALCULATION FOR A SINGLE FASCIA GIRDER (NON COMPOSITE) OR A GRID ANALYSIS FOR THE ENTIRE STEEL SUPERSTRUCTURE FRAMING. THE DIAPHRAGM ACTION OF THE STAY-IN-PLACE FORMS SHALL BE NEGLECTED. FINALLY, IF A GRID ANALYSIS IS USED, THE DIAPHRAGM/GIRDER CONNECTION SHALL BE MODELED AS A PIN IN THE PLANE OF THE GRID. IT IS CONSERVATIVE TO ASSUME PINNED DIAPHRAGM TO GIRDER CONNECTIONS. A MORE RIGOROUS ANALYSIS MODELING PARTIAL FIXITY AT THE CONNECTIONS CONSISTENT WITH THE CONNECTION DETAILING IS ACCEPTABLE.

5. EVALUATE GIRDER STRESSES FOR COMBINED STEEL SUPERSTRUCTURE DEAD LOADS AND WIND LOADS USING THE FOLLOWING LOAD COMBINATIONS:  
STRENGTH I - 1.25x(DC) + 1.5x(CDL) + 1.5x(CLL)  
STRENGTH III - 1.25x(DC) + 1.25x(CDL) + 1.0(CW)  
STRENGTH IV - 1.4x(DC) + 1.4x(CDL) + 1.4x(CLL)  
SERVICE - 1.0x(DC) + 1.0x(CDL) + 1.0x(CLL) + 1.0x(CW)  
UPLIFT (MIN.) - 0.9x(DC) + 0.9x(CDL) + 1.0x(CW)  
UPLIFT (MAX.) - 1.35x(DC) + 1.35x(CDL) + 1.0x(CW)  
NOTE:  
DC = PERMANENT DEAD LOAD  
CDL= CONSTRUCTION DEAD LOAD  
CLL= CONSTRUCTION LIVE LOAD  
CW = WIND LOAD

6. USE THE MINIMUM DESIGN WIND LOAD SPECIFIED IN THE TABLE ON THIS SHEET, EXCEPT FOR BRIDGES OVER TRAFFIC, INCREASE THESE PRESSURES BY 5 PSF.
7. WIND LOAD PER FOOT OF BRIDGE IS (GIRDER DEPTH + DECK THICKNESS AT FASCIA GIRDER) X DESIGN WIND PRESSURE. DESIGN WINDWARD GIRDER FOR THE FULL MINIMUM DESIGN WIND LOAD. DESIGN ALL OTHER GIRDERS, EXCEPT THE FIRST INTERIOR GIRDER ADJACENT TO THE WINDWARD GIRDER, FOR HALF THE MINIMUM DESIGN WIND LOAD.
8. USE OVERSIZED OR SLOTTED HOLES TO DESIGN THE GUSSET PLATES.
9. DESIGN BOLTED CONNECTION OF THE BRACING TO GIRDER TO PREVENT SLIP FROM WIND FORCES WITH THE PERMISSIBLE INCREASE IN ALLOWABLE SLIP FORCE. DESIGN CONNECTIONS FOR ACTUAL FORCES. PROVIDE OVERSIZED OR SLOTTED HOLES AND DESIGN THE CONNECTION FOR WIND FORCES ONLY.
10. USE PERMANENT BRACING ARRANGEMENT; CABLE BRACING IS NOT CONSIDERED PERMANENT. PROVIDE SAME CORROSION PROTECTION USED IN THE AS-DESIGNED STRUCTURAL STEEL.
11. GIRDER SECTION CHECKS FOR THE PERMANENT CONDITION ARE BEYOND THE SCOPE OF THESE CRITERIA. THE CRITERIA FOR THESE CHECKS ARE SPECIFIED IN AASHTO AND DESIGN MANUAL PART 4 WITH METHODOLOGY SHOWN IN THE AISC STEEL BRIDGE DESIGN HANDBOOKS.

REFERENCES:

THE REFERENCE FOR EACH CRITERION ON THIS SHEET IS AS FOLLOWS:

- R1. EXPERIENCE INDICATES THAT SPANS IN EXCESS OF 300 FT. GENERALLY HAVE WIND ISSUES DURING CONSTRUCTION.
- R2. EXPERIENCE INDICATES THAT WIND MAY AFFECT THE STEEL SUPERSTRUCTURE IN A MANNER THAT WOULD REQUIRE WIND BRACING FOR SPANS FROM 200 TO 300 FT.
- R3. EXPERIENCE OF THE APC BRIDGE COMMITTEE, STEEL SUPERSTRUCTURE STABILITY SUBCOMMITTEE INDICATES THAT SPANS LESS THAN 200 FT. HAVE NOT HAD WIND ISSUES DURING CONSTRUCTION.
- R4. L/150 IN 300 FT. IS 2 FT. THIS WAS FELT TO BE ACCEPTABLE TO BOTH DESIGN PERSONNEL AND CONTRACTORS.
- R5. AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- R6. ENGINEERING FOR STRUCTURAL SAFETY IN CONSTRUCTION OF BRIDGE SUPERSTRUCTURES (REFERENCE MANUAL , OCTOBER 2013, NHI COURSE NUMBER 130102).
- R7. PROFESSIONAL EXPERIENCE
- R8. CONTRACTOR PREFERENCE
- R9. PROFESSIONAL EXPERIENCE
- R10. CONTRACTOR PREFERENCE
- R11. DESIGN SPECIFICATION FOR THE PERMANENT CONDITION

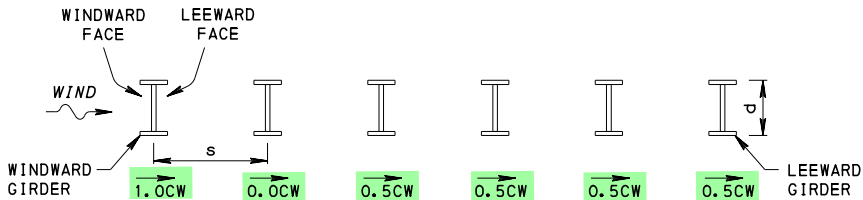
STAGED CONSTRUCTION CONSIDERATIONS

WHEN PHASED/STAGED CONSTRUCTION IS SPECIFIED, THE FOLLOWING ITEMS SHALL BE ADDRESSED:

1. THE LATERAL STABILITY BRACING DESIGN CRITERIA SHALL BE APPLIED FOR EACH STAGE OF CONSTRUCTION. THE WIND BRACING ARRANGEMENT REQUIRED FOR THE FINAL CONDITION MAY NOT PROVIDE THE REQUIRED STABILITY OF EACH STAGE.
2. THE DESIGNER SHALL INVESTIGATE AND ADDRESS THE VERTICAL AND LATERAL MOVEMENTS DURING PHASED/STAGED CONSTRUCTION. THE DETAILING AND CONSTRUCTIBILITY OF BRACING SPANNING BETWEEN GIRDERS OF DIFFERENT STAGES MUST BE ENSURED AND MAY REQUIRE DETAILS TO ACCOMODATE THE MOVEMENTS. ANTICIPATED MOVEMENTS SHALL BE NOTED ON THE PLANS SO THAT THE CONTRACTOR CAN ACCOUNT FOR THEM IN ANY DESIGN AND DETAILING.

MINIMUM DESIGN WIND PRESSURE CW ( PSF)  
AND PRESSURE DISTRIBUTION TO GIRDERS

FOR LATERAL BRACING DURING CONSTRUCTION



CONSTRUCTION DURATION	0-6 WEEKS		6 WEEKS-1 YEAR		1-2 YEARS	
SUPERSTRUCTURE HEIGHT ABOVE GROUND LEVEL (FT.)	s/d≤2	2<s/d≤4	s/d≤2	2<s/d≤4	s/d≤2	2<s/d≤4
0-15	19	21	26	28	29	32
20	20	22	27	30	31	34
25	21	23	28	31	32	35
30	22	24	30	32	34	37
40	24	26	31	34	36	39
50	25	27	33	36	38	41
60	26	28	34	37	39	42
70	27	29	35	39	40	44
80	28	30	37	40	42	45
90	28	31	38	41	43	47
100	29	31	38	42	43	47

NOTES:

1. LINEAR INTERPOLATION FOR INTERMEDIATE VALUES OF HEIGHT IS ACCEPTABLE.
2. BASIC WIND SPEED IS 115 MPH WITH A 1.4 LOAD FACTOR BUILT INTO IT AND IS BASED ON AN APPROXIMATE 7% PROBABILITY OF EXCEEDANCE IN 50 YEARS.
3. EXPOSURE CONDITION IS CATEGORY C APPLICABLE TO OPEN GRASSLAND AND SCATTERED OBSTRUCTION GENERALLY LESS THAN 30 FEET HIGH.
4. FOR BRIDGES NOT EXPOSED TO CATEGORY C, THESE WIND PRESSURES NEED TO BE ADJUSTED ACCORDINGLY. USE REFERENCE IN NOTE R6 AS A GUIDELINE.

CHANGE 2  
CHANGE 5

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DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
STEEL GIRDER BRIDGES  
LATERAL BRACING CRITERIA  
AND DETAILS

BC-732M	PERMANENT METAL DECK FORMS
BC-753M	STEEL GIRDER DETAILS
BC-754M	STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDERS ONLY)
REFERENCE DRAWINGS	

RECOMMENDED NOV. 23, 2022  
L. W. B.  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 1 OF 6  
BD-620M

**ADDITIONAL LATERAL STABILITY CRITERIA  
FOR SKEWED STEEL BRIDGES**

(APPLIES TO STRAIGHT AND CURVED BRIDGES)

1. THE DESIGN ENGINEER SHALL CHECK SKEWED BRIDGES FOR THE FOLLOWING LOADING CONDITIONS:
  - A) WIND LOADING ON THE STEEL SUPERSTRUCTURE PRIOR TO DECK PLACEMENT - THE PROCEDURE SHOULD FOLLOW THAT USED FOR THE STRAIGHT, UNSKEWED BRIDGE. THE LOADED AREA SHALL BE THE VERTICAL PLANE AREA OF THE FASCIA GIRDER.
  - B) PARTIAL WIDTH LOADING UNDER STAGED CONSTRUCTION FOR FUTURE DECK REPLACEMENT AS DIRECTED BY THE DEPARTMENT.
  - C) VERTICAL AND LATERAL DEFLECTIONS SHALL BE EVALUATED FOR STEEL SELF-WEIGHT AND THE DECK DEAD LOAD.
2. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER ROTATION DURING THE DECK POUR BOTH IN AND OUT OF THE GIRDER PLANE. GIRDERS AND THEIR BEARING STIFFENERS SHOULD BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE CHECKED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.
3. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.
4. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.
5. USE TOP OR BOTTOM FLANGE BRACING FOR STRAIGHT GIRDERS. FOR GIRDERS WITH NARROW TOP FLANGE WIDTH, IT IS RECOMMENDED TO USE BOTTOM FLANGE LATERAL BRACING.

**ADDITIONAL LATERAL STABILITY CRITERIA  
FOR STRAIGHT STEEL GIRDER BRIDGES**

1. USE TOP OR BOTTOM FLANGE BRACING FOR STRAIGHT GIRDERS. FOR GIRDERS WITH NARROW TOP FLANGE WIDTH, IT IS RECOMMENDED TO USE BOTTOM FLANGE LATERAL BRACING.
2. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.
3. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER IN PLANE ROTATIONS DURING THE DECK POUR. GIRDERS AND THEIR BEARING STIFFENERS SHOULD BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE CHECKED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.
4. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.

**ADDITIONAL LATERAL STABILITY CRITERIA  
FOR CURVED STEEL GIRDER BRIDGES**

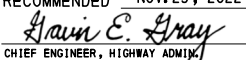
1. THE DESIGN ENGINEER SHALL CHECK CURVED STEEL GIRDER BRIDGES FOR THE FOLLOWING LOADING CONDITIONS:
  - A) WIND LOADING ON THE STEEL SUPERSTRUCTURE PRIOR TO DECK PLACEMENT - THE PROCEDURE SHALL FOLLOW THAT USED FOR THE STRAIGHT, UNSKEWED BRIDGE. THE LOADED AREA IS THE SURFACE AREA OF THE LONGEST GIRDER. ALLOWABLE HORIZONTAL DEFLECTIONS SHALL BE BASED ON CRITERIA FOR STRAIGHT UNSKEWED GIRDERS AND BRIDGES PRIOR TO DECK PLACEMENT.
  - B) PARTIAL WIDTH LOADING UNDER STAGED CONSTRUCTION FOR FUTURE DECK REPLACEMENT AS DIRECTED BY THE DEPARTMENT.
  - C) VERTICAL AND LATERAL DEFLECTIONS SHALL ALSO BE EVALUATED FOR STEEL SELF-WEIGHT AND THE DECK DEAD LOAD.
2. BEARINGS SHALL BE DESIGNED TO ACCOMMODATE GIRDER ROTATION DURING THE DECK POUR BOTH IN AND OUT OF THE GIRDER PLANE. GIRDERS AND THEIR BEARING STIFFENERS SHALL BE VERTICAL AT THE BEARINGS UNDER FULL DEAD LOAD. UPLIFT SHALL BE EVALUATED AT EACH BEARING FOR WORST LOADING CONDITION IN EACH CONSTRUCTION PHASE.
3. INCLUDE LATERAL WIND BRACING IN THE DESIGN OF GIRDERS THAT DO NOT MEET THE CRITERIA AS SHOWN ON SHEET 1. DESIGN LATERAL BRACING TO CARRY WIND LOADS ONLY AND DETAIL THE BRACING SO THAT IT WILL NOT PARTICIPATE IN CARRYING PRIMARY STRUCTURE FORCES.
4. THE ENGINEER SHALL IDENTIFY THE NEED FOR AND LOCATION OF FALSEWORK AND PROVIDE INFORMATION AS PER DM4 D2.5.3 1P; HOWEVER, THE DESIGN AND FOUNDATION OF THE FALSEWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.
5. DESIGN LATERAL BRACING FOR WIND LOADS. DESIGN AND DETAIL THE LATERAL BRACING SO THAT TORSIONAL FORCES FROM DEAD LOADS AND LIVE LOADS ON THE GIRDER ARE NOT RESISTED BY THE LATERAL BRACING.

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STANDARD

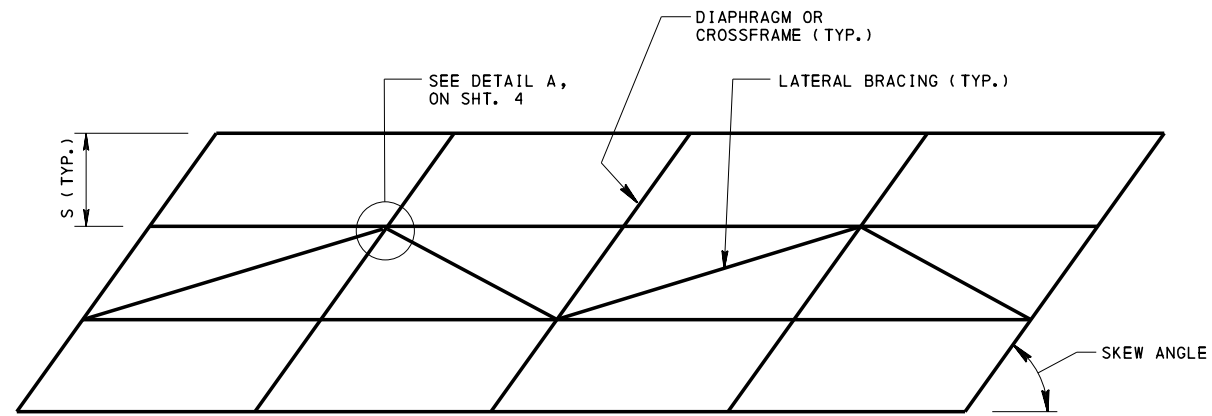
STEEL GIRDER BRIDGES  
LATERAL BRACING CRITERIA  
AND DETAILS

RECOMMENDED NOV. 23, 2022  
  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
  
CHIEF ENGINEER, HIGHWAY ADMIN

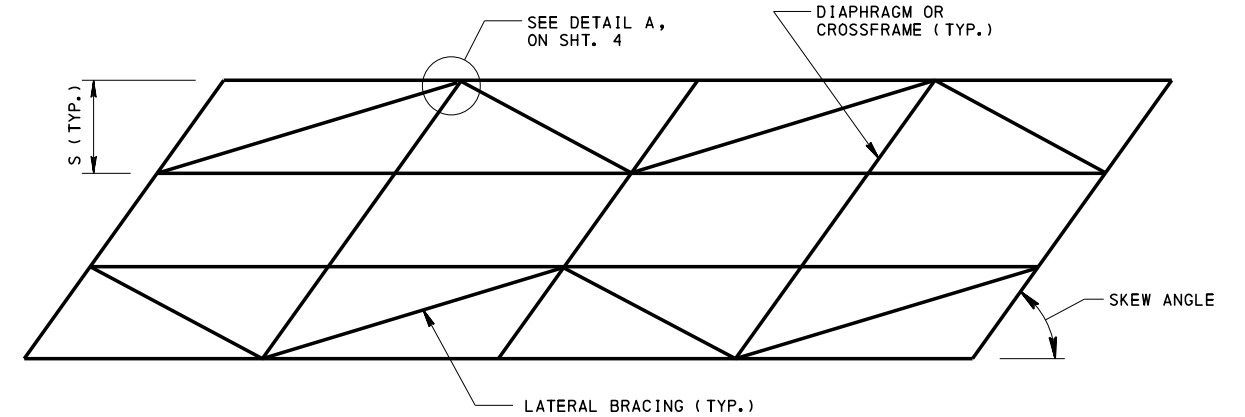
SHEET 2 OF 6

BD-620M

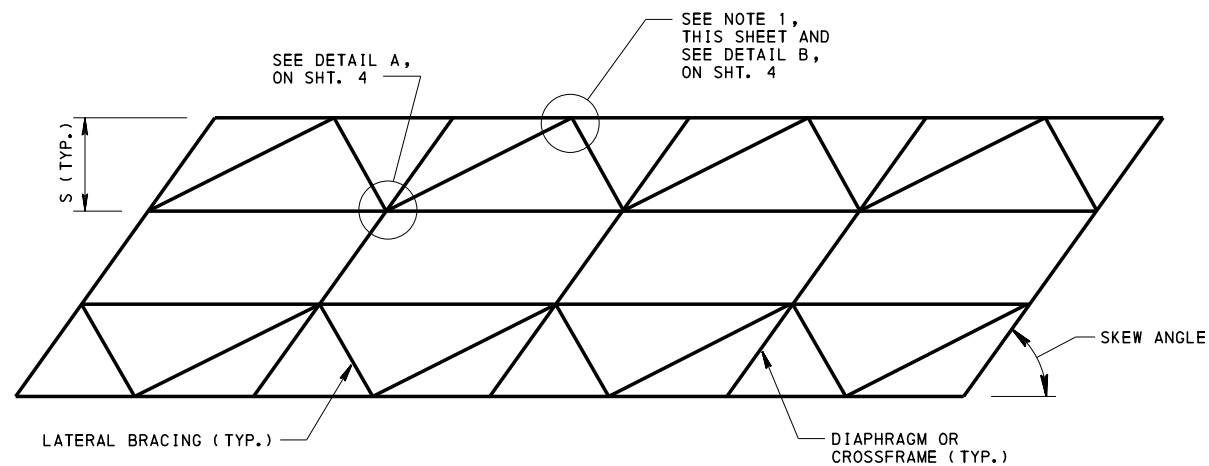


**PLAN**  
**LATERAL BRACING**  
**(PREFERRED)**

FOR ODD NUMBER OF GIRDERS, OFFSET BRACING ONE BAY.  
 TYPICAL SKEWED STRUCTURE WHEN DESIGN IS NOT  
 CONTROLLED BY WIND LOADING OF FLANGE.



**PLAN**  
**ALTERNATE LATERAL BRACING - TYPE 1**  
 TYPICAL SKEWED STRUCTURE

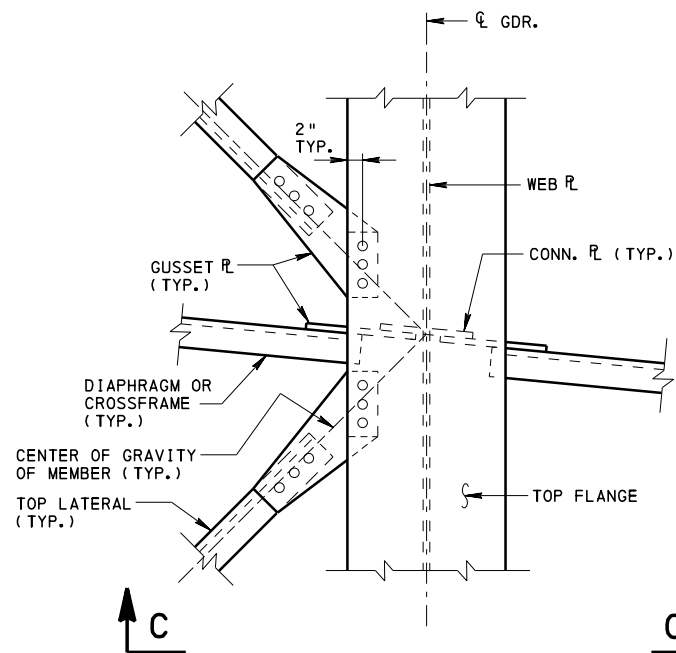


**PLAN**  
**ALTERNATE LATERAL BRACING - TYPE 2**  
 TYPICAL SKEWED STRUCTURE

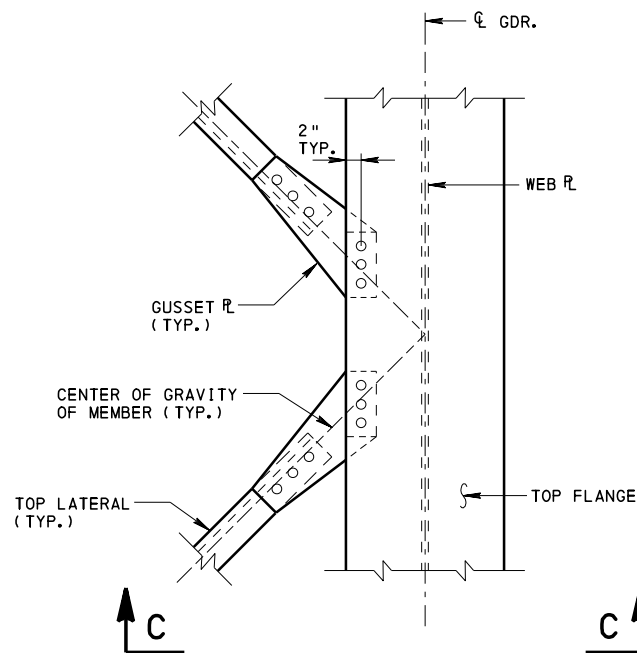
**NOTES:**

1. USE INTERMEDIATE BRACING POINT (DETAIL B, SHT. 4) AS NEEDED IF DESIGN IS CONTROLLED BY LATERAL FLANGE BENDING AT FASCIA GIRDERS AND LATERAL STABILITY.
2. USE ANGLE OR STRUCTURAL TEE BRACING MEMBERS WHENEVER POSSIBLE.
3. LATERAL BRACING FIELD CONNECTIONS SHALL BE MADE FOR  $\frac{7}{8}$ " Ø ASTM F3125 GRADE A325 H.S. BOLTS USING OVERSIZED HOLES IN THE GUSSET PLATES, MINIMUM 2 BOLTS PER CONNECTION.
4. FOR EVEN NUMBER OF GIRDERS, CENTER GIRDER BAY OR SYMMETRICAL LAYOUT IS ACCEPTABLE. FOR ODD NUMBER OF GIRDERS, EITHER SINGLE BAY BRACING ADJACENT TO CENTER GIRDER OR SYMMETRICAL, BOTH BAYS ADJACENT TO CENTER GIRDER, LAYOUT IS ACCEPTABLE.
5. PARTIAL LENGTH LATERAL BRACING IS PERMITTED.

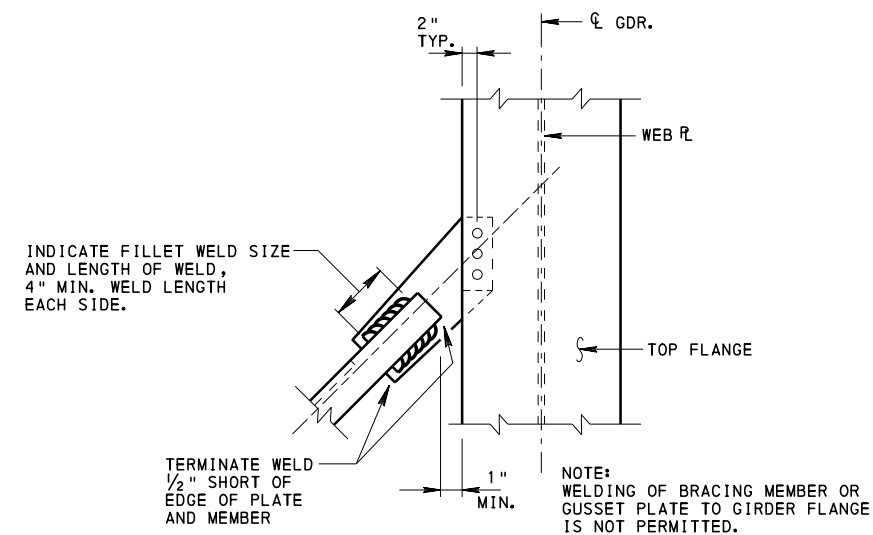
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BRIDGE OFFICE		
STANDARD		
STEEL GIRDER BRIDGES LATERAL BRACING CRITERIA AND DETAILS (STRAIGHT GIRDERS)		
RECOMMENDED NOV. 23, 2022 <i>[Signature]</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 23, 2022 <i>[Signature]</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 3 OF 6 BD-620M



**PLAN**  
**DETAIL A**  
TYPICAL AT CROSSFRAME



**PLAN**  
**DETAIL B**  
INTERMEDIATE BRACING POINT  
(SEE NOTE 1, ON SHT. 3)



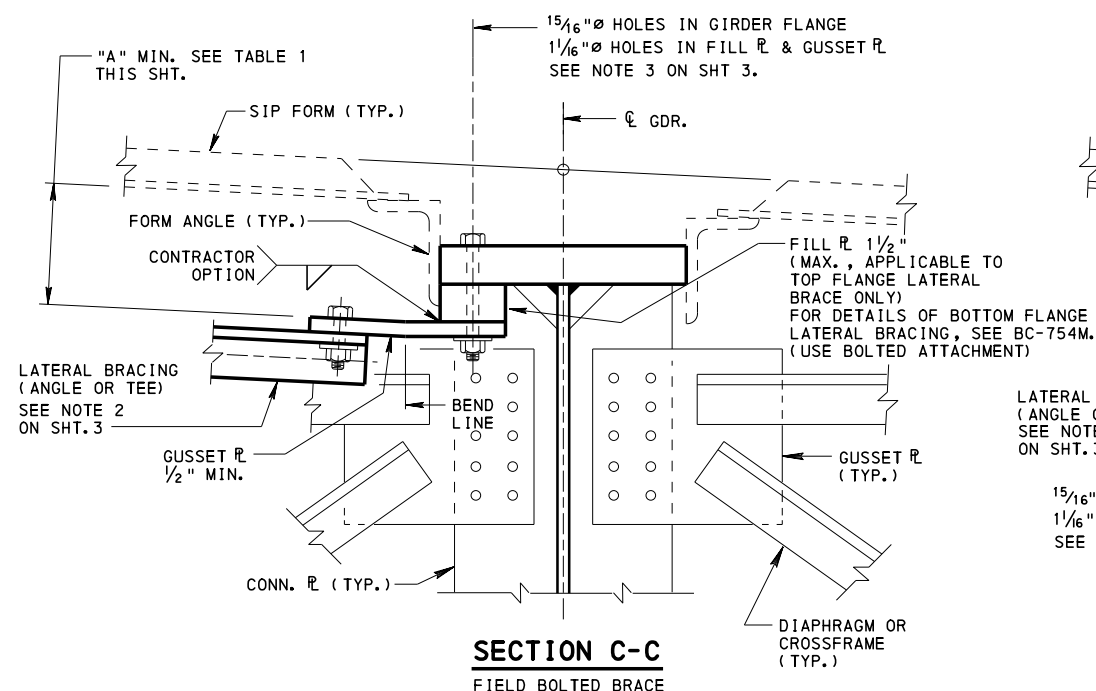
**PLAN**  
**VIEW D**  
SHOP WELDED OPTION  
(FOR BRACING MEMBER TO GUSSET)

## TOP FLANGE LATERAL BRACING CONNECTIONS

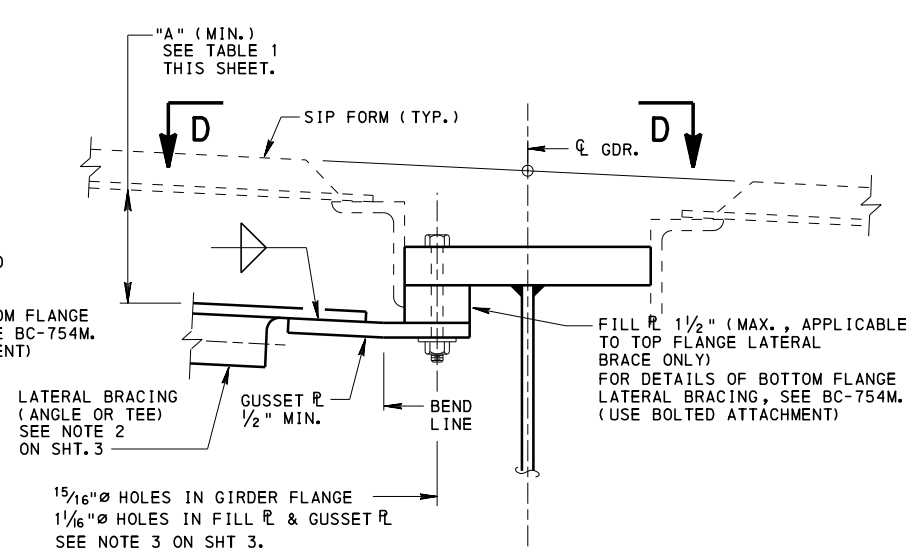
NOTE: PREFERRED ARRANGEMENT IS TO ATTACH LATERAL BRACING TO THE BOTTOM FLANGE AS SHOWN ON BC-754M. THE TOP FLANGE ATTACHMENT DETAILS ARE SHOWN FOR THE INFREQUENT SITUATIONS THAT NECESSITATE ATTACHMENT TO THE TOP FLANGE.

**TABLE 1**

CLEAR DISTANCE BETWEEN GIRDER FLANGES	DIM. "A"
9'-0"	4½"
8'-0" TO 9'-0"	3"
6'-0" TO 8'-0"	2½"
UNDER 6'-0"	2"



**SECTION C-C**  
FIELD BOLTED BRACE



**ALTERNATE SECTION C-C**  
SHOP WELDED, FIELD BOLTED BRACE

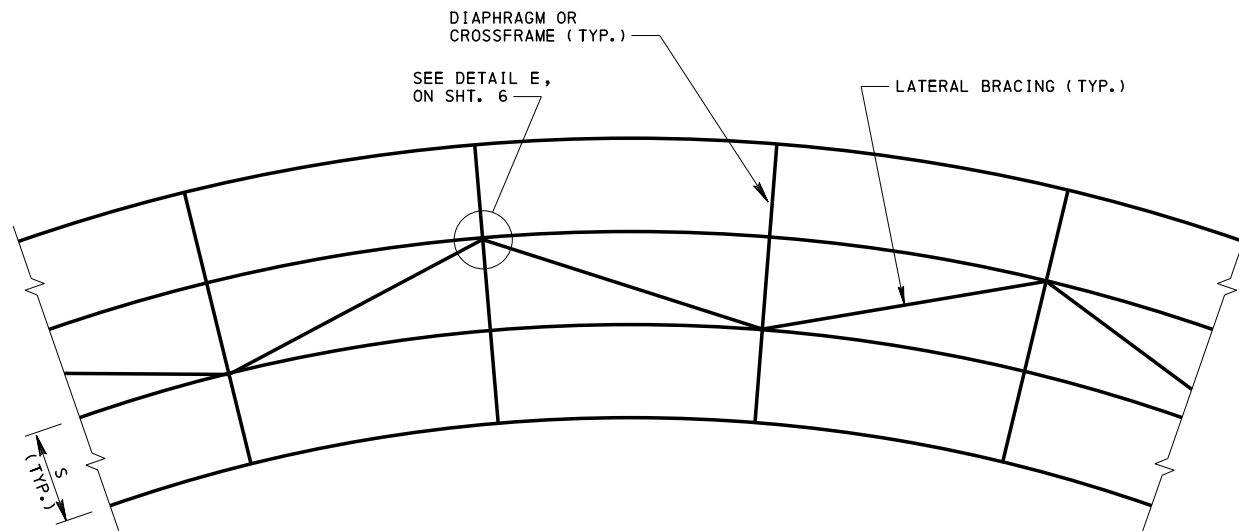
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

**STANDARD**  
**STEEL GIRDER BRIDGES**  
**LATERAL BRACING CRITERIA AND DETAILS**  
(STRAIGHT GIRDERS)

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

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*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

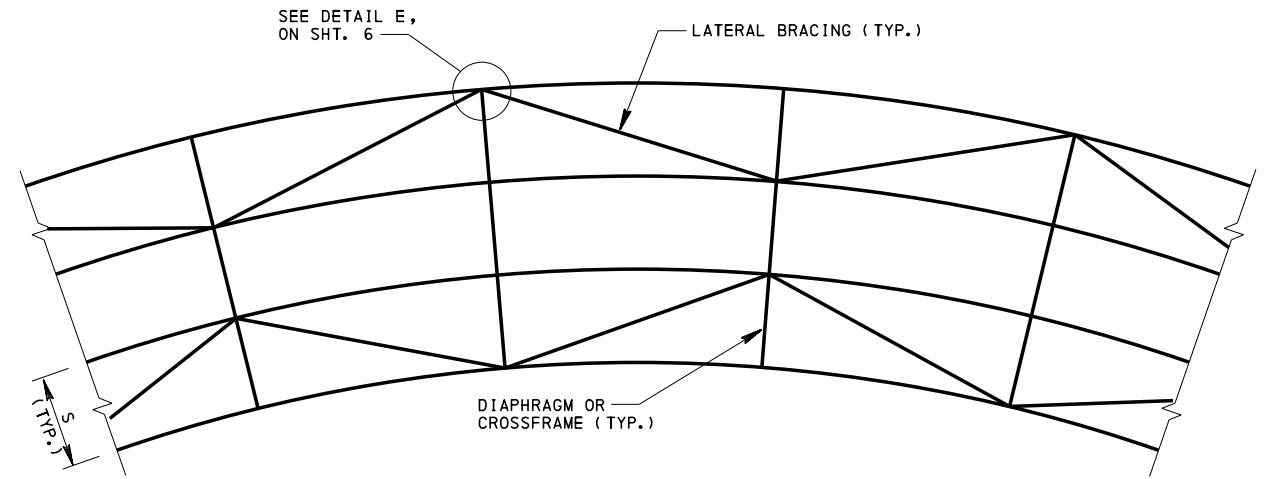
SHEET 4 OF 6  
BD-620M



PLAN

**LATERAL BRACING  
(PREFERRED)**

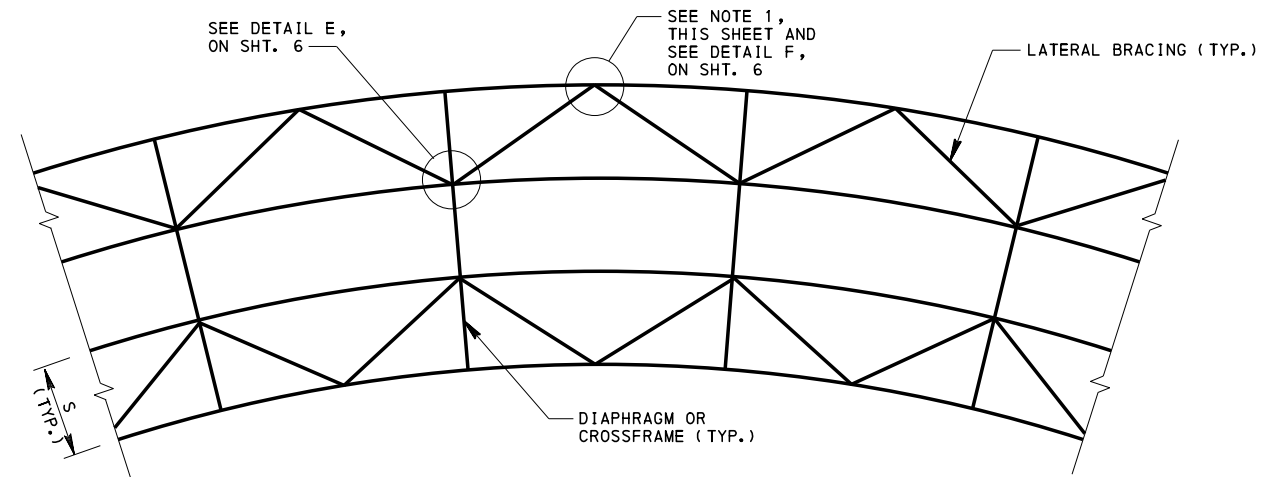
TYPICAL CURVED STRUCTURE  
FOR ODD NUMBER OF GIRDERS, OFFSET BRACING ONE BAY.



PLAN

**ALTERNATE LATERAL BRACING - TYPE 1**

TYPICAL CURVED STRUCTURE



PLAN

**ALTERNATE LATERAL BRACING - TYPE 2**

**NOTES:**

1. USE INTERMEDIATE BRACING POINT (DETAIL F, SHT. 6) AS NEEDED IF DESIGN IS CONTROLLED BY LATERAL FLANGE BENDING AT FASCIA GIRDERS AND LATERAL STABILITY.
2. USE ANGLE OR STRUCTURAL TEE BRACING MEMBERS WHENEVER POSSIBLE.
3. LATERAL BRACING FIELD CONNECTIONS SHALL BE MADE FOR  $\frac{7}{8}$ "  $\emptyset$  ASTM **F3125 GRADE** A325 H.S. BOLTS USING OVERSIZED HOLES IN THE GUSSET PLATES. MINIMUM 2 BOLTS PER CONNECTION.
4. FOR EVEN NUMBER OF GIRDERS, CENTER GIRDER BAY OR SYMMETRICAL LAYOUT IS ACCEPTABLE. FOR ODD NUMBER OF GIRDERS, EITHER SINGLE BAY BRACING ADJACENT TO CENTER GIRDER OR SYMMETRICAL, BOTH BAYS ADJACENT TO CENTER GIRDER, LAYOUT IS ACCEPTABLE.
5. PARTIAL LENGTH LATERAL BRACING IS PERMITTED.

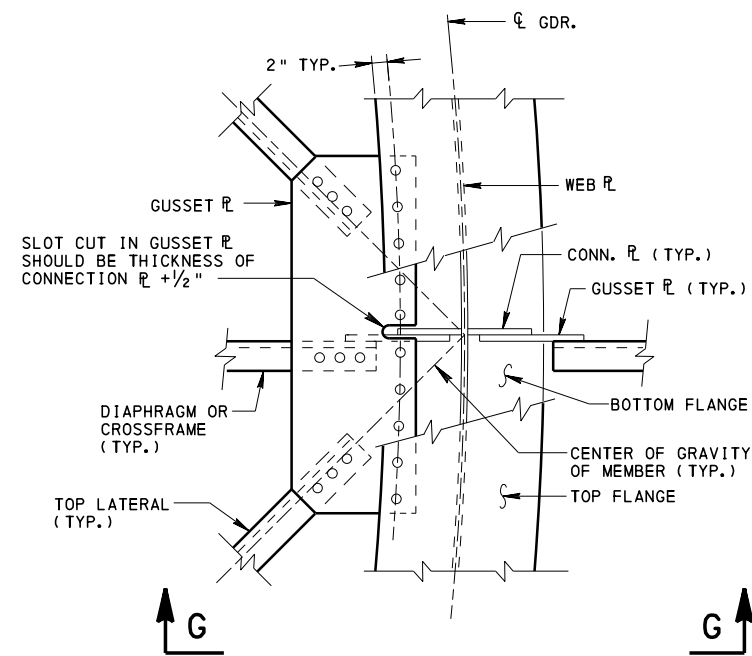
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
STEEL GIRDER BRIDGES  
LATERAL BRACING CRITERIA AND DETAILS  
(CURVED BRIDGES)

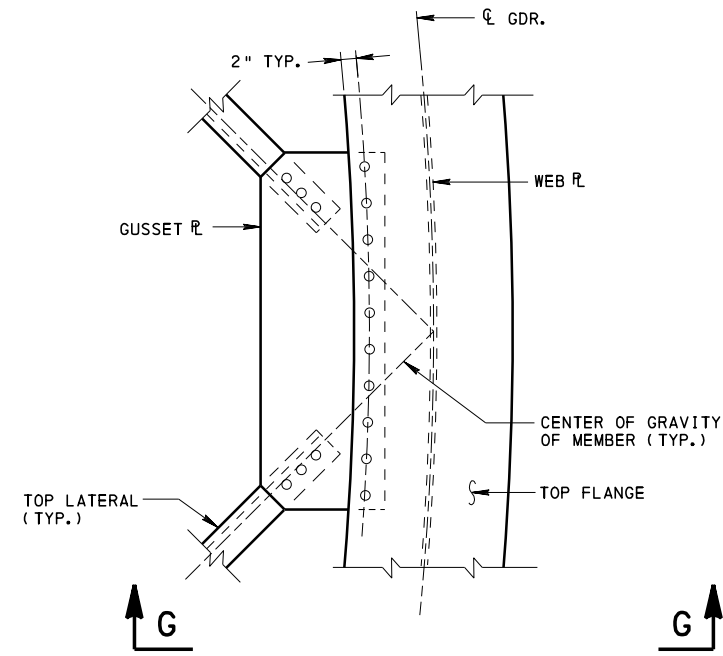
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

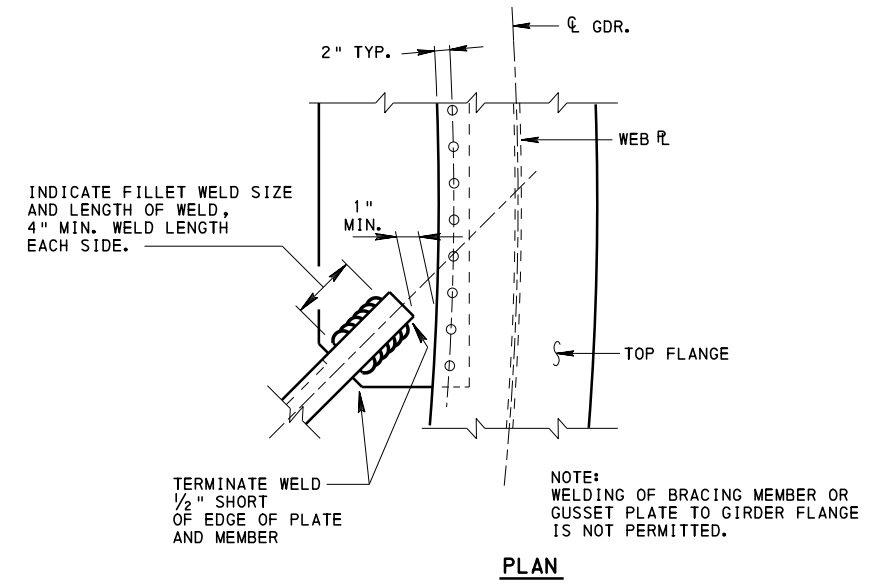
SHEET 5 OF 6  
BD-620M



**PLAN**  
**DETAIL E**  
TYPICAL AT CROSSFRAME



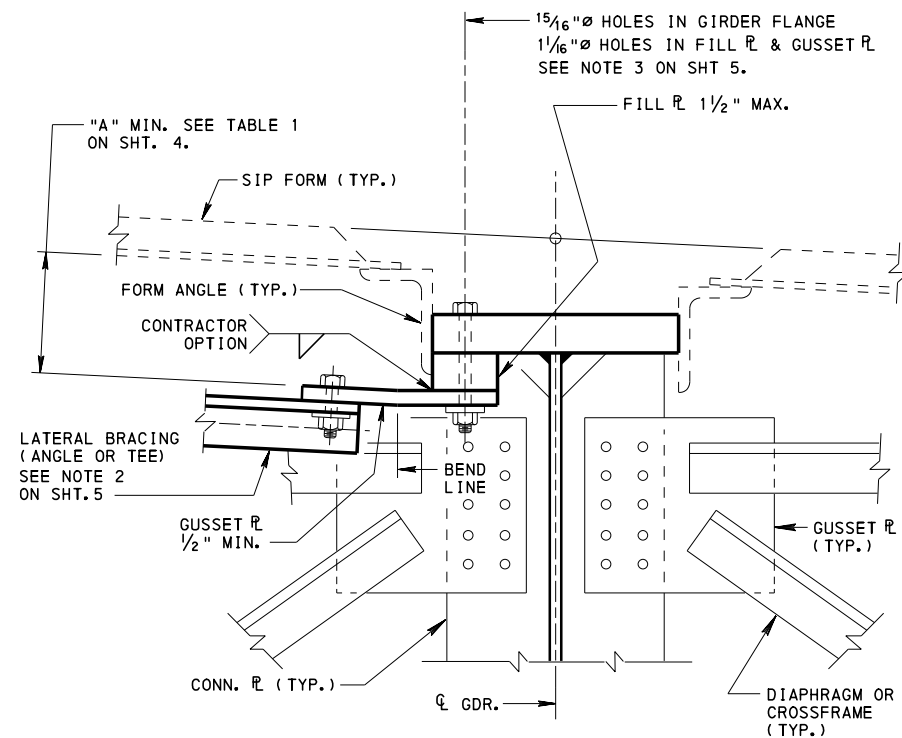
**PLAN**  
**DETAIL F**  
INTERMEDIATE BRACING POINT  
(SEE NOTE 1, ON SHT. 5)



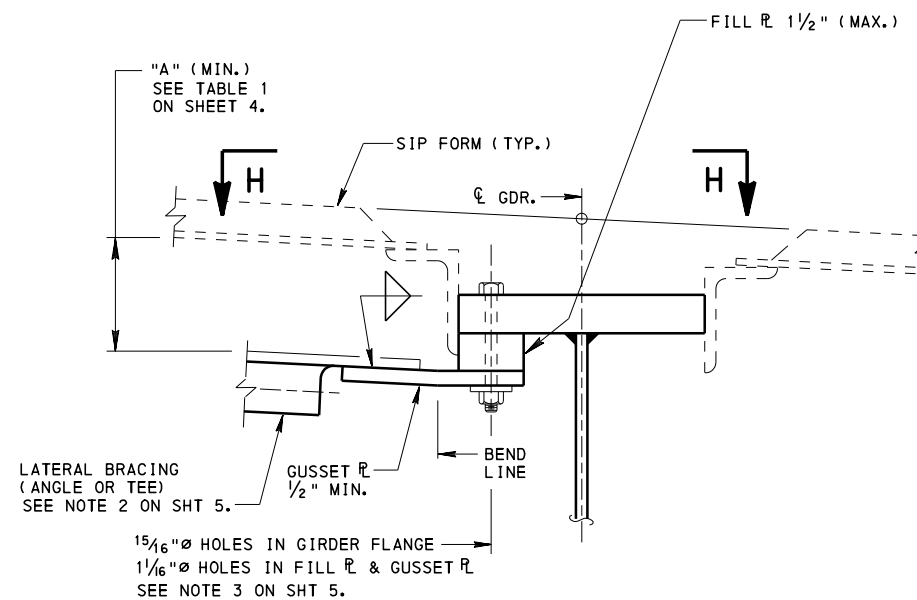
**PLAN**  
**VIEW H**  
SHOP WELDED OPTION  
(FOR BRACING MEMBER TO GUSSET)

## TOP FLANGE LATERAL BRACING CONNECTIONS

NOTE: BOTTOM FLANGE LATERAL BRACING IS NOT PERMITTED WITHOUT PRIOR APPROVAL OF CHIEF BRIDGE ENGINEER SINCE THE BRACING WILL CHANGE THE BEHAVIOR OF THE GIRDERS TO BEHAVE AS A PSEUDO-BOX GIRDER.



**SECTION G-G**  
FIELD BOLTED BRACE



**ALTERNATE SECTION G-G**  
SHOP WELDED, FIELD BOLTED BRACE

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

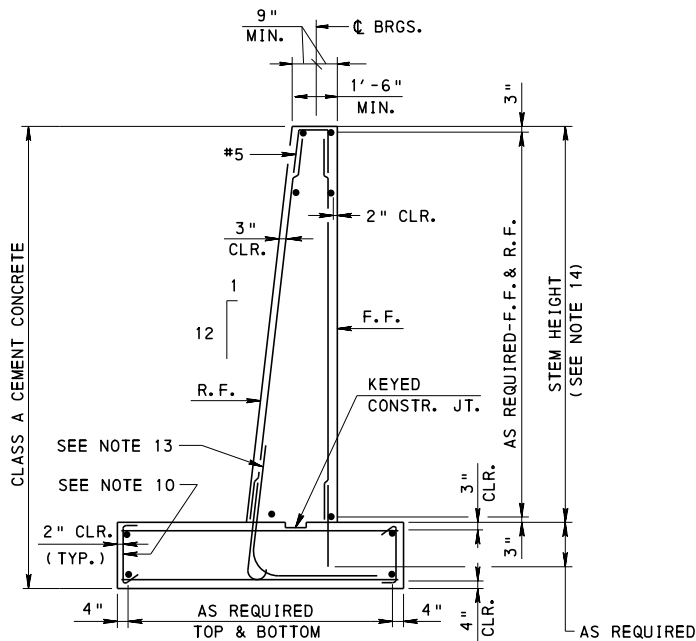
STANDARD  
STEEL GIRDER BRIDGES  
LATERAL BRACING CRITERIA AND DETAILS  
(CURVED GIRDERS)

RECOMMENDED NOV. 23, 2022  
*L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 6 OF 6  
BD-620M





**TYPICAL SECTION WITHOUT BACKWALL**  
(WITH OR WITHOUT BATTER)

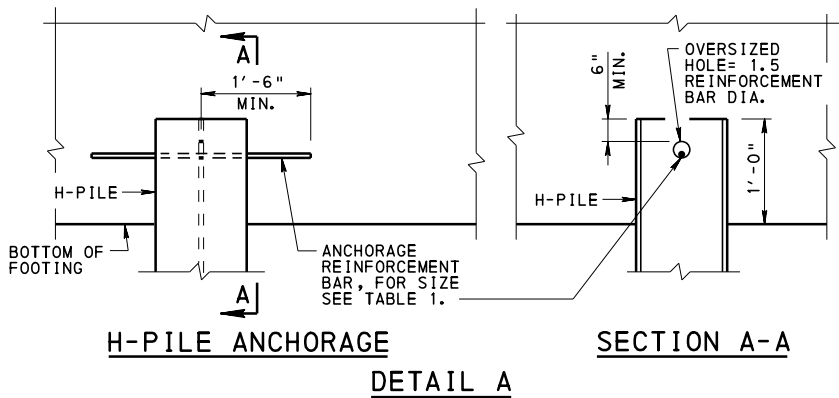
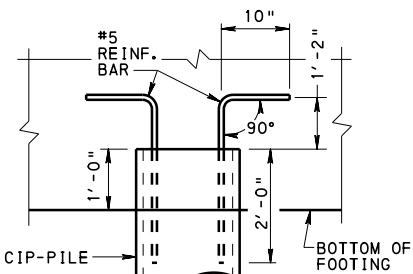


TABLE 1	
SIZE OF THREADED BAR BASED ON PILE SIZE	
PILE SIZE	BAR SIZE
HP 8 x 36	#5
HP 10 x 42	#5
HP 10 x 57	#6
HP 12 x 53	#6
HP 12 x 63	#6
HP 12 x 74	#6
HP 12 x 84	#7
HP 14 x 73	#6
HP 14 x 89	#7
HP 14 x 102	#7
HP 14 x 117	#8

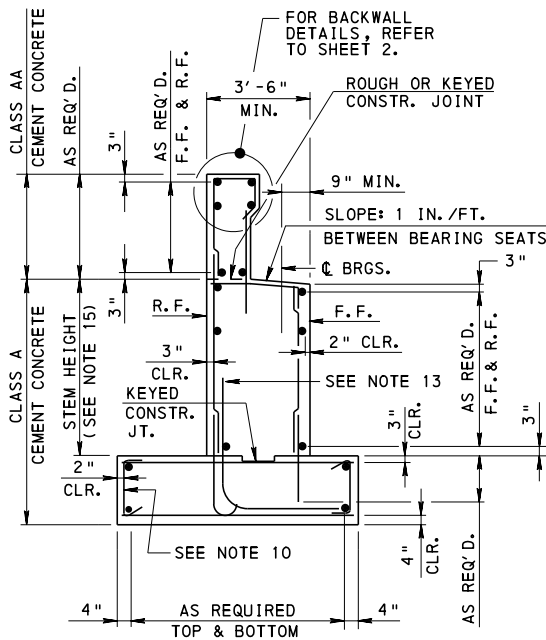


**CIP-PILE ANCHORAGE  
DETAIL B**

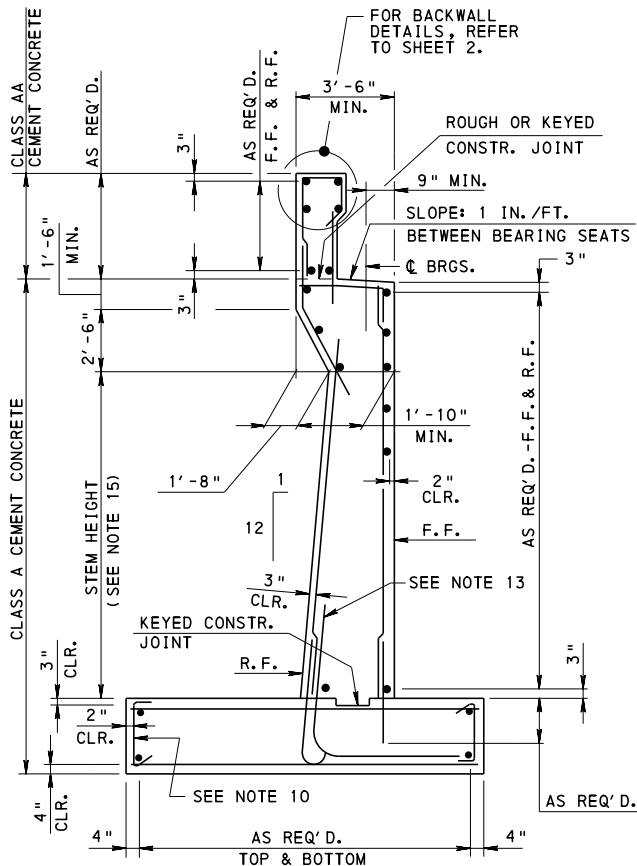
**PILE ANCHORAGE DETAILS**

REQUIRED IF ANY OF THE FOLLOWING CONDITIONS EXIST:

1. SITE CLASS E & F.
2. RESPONSE ACCELERATION COEFFICIENT GREATER THAN OR EQUAL TO 0.1.
3. PILE IS SUBJECT TO UPLIFT FORCES AT STRENGTH OR EXTREME LIMIT STATES.



**TYPE I**



**TYPE II**

**TYPICAL SECTION WITH BACKWALL**

**NOTES:**

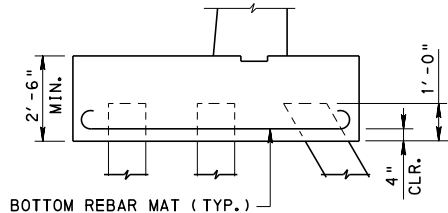
1. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. MATERIALS AND **WORK QUALITY** ARE TO BE IN ACCORDANCE WITH SPECIFICATIONS PUB. 408.
3. ABUTMENT DIMENSIONS TO BE DETERMINED BY THE DESIGN.
4. FOR DETERMINING BACKWALL USE, SEE DESIGN MANUAL, PART 4, STRUCTURES.
5. PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS, UNLESS OTHERWISE NOTED.
6. USE CLASS AA CEMENT CONCRETE IN BACKWALLS. USE CLASS A CEMENT CONCRETE IN OTHER PARTS OF ABUTMENT.
7. ALL BACKWALL REINFORCEMENT IS TO BE EPOXY COATED.
8. FOR ADDITIONAL EPOXY COATED REINFORCEMENT BARS, SEE DESIGN MANUAL, PART 4, STRUCTURES, SECTION D5.4.3.6P AND AS NOTED.
9. FOR WEEP HOLE DETAILS, SEE SHEET **3** AND BC-751M.
10. TIE TOP AND BOTTOM MATS OF REINFORCING STEEL WITH #4 TIE BARS AT A MAXIMUM SPACING OF 4'-0" IN BOTH DIRECTIONS. PROVIDE TIE BARS WITH 90° HOOK AT ONE END AND 135° HOOK AT THE OTHER END. ALTERNATE 90° AND 135° HOOKS AT TOP IN ALTERNATE TIES.
11. EPOXY COAT J-BARS AND L-BARS PROTRUDING FROM THE FOOTINGS INTO THE STEMS.
12. KEY FOR CONSTRUCTION JOINT MAY BE FORMED INTO THE STEM OR INTO THE FOOTING.
13. OPTIONAL DETAIL TO REINFORCE TOE AND STEM IN LIEU OF J-BAR.
14. BATTER NOT REQUIRED IF STEM HEIGHT IS LESS THAN 12'-0".
15. PROVIDE TYPE I ABUTMENT WHEN STEM HEIGHT IS LESS THAN 12'-0" OTHERWISE PROVIDE TYPE II ABUTMENT.

**INSTRUCTIONS**

- F.F. = FRONT FACE, R.F. = REAR FACE.
- INDICATE REINFORCEMENT BAR LAP SPLICE LENGTH AND EMBEDMENT LENGTH OF DOWELS ON THE PLANS.

**DESIGN DATA**

- DENSITY OF BACKFILL MATERIAL = 120 LB/FT<sup>3</sup>
- DENSITY OF CONCRETE = 150 LB/FT<sup>3</sup>
- EQUIVALENT FLUID EARTH PRESSURE = 35 PSF/FT OF DEPTH.
- LIVELOAD SURCHARGE = REFER TO DESIGN MANUAL, PART 4, D3.11.
- FOR BACKWALL DESIGN CRITERIA, REFER TO DESIGN MANUAL, PART 4, STRUCTURES, D11.6.
- NEGLECT THE EFFECT OF PASSIVE PRESSURE DUE TO SOIL IN FRONT OF WALL.
- 1'-0" MINIMUM TOE.
- 2'-0" FOOTING THICKNESS FOR SPREAD FOOTINGS, 2'-6" MINIMUM FOOTING THICKNESS FOR FOOTINGS ON PILES.



**PILE FOOTING**

NOTE:  
FOR PILE ANCHORAGE  
SEE DETAIL A AND B

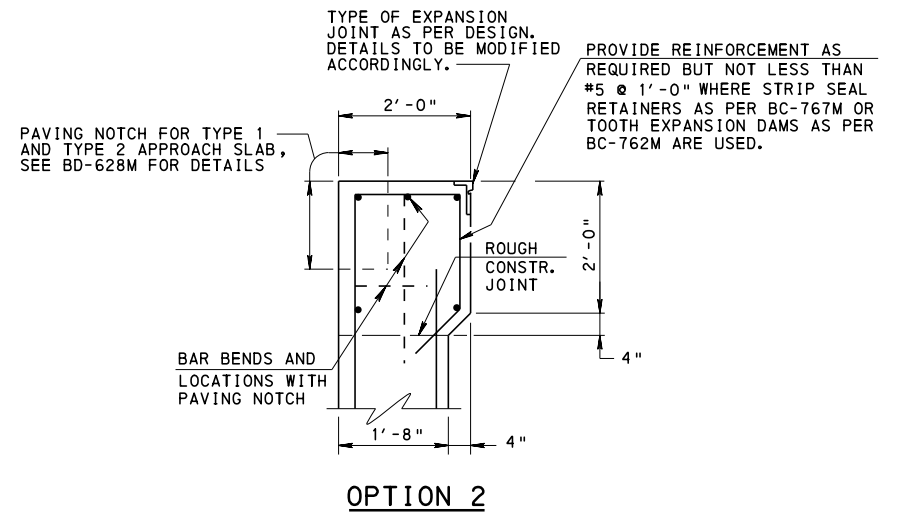
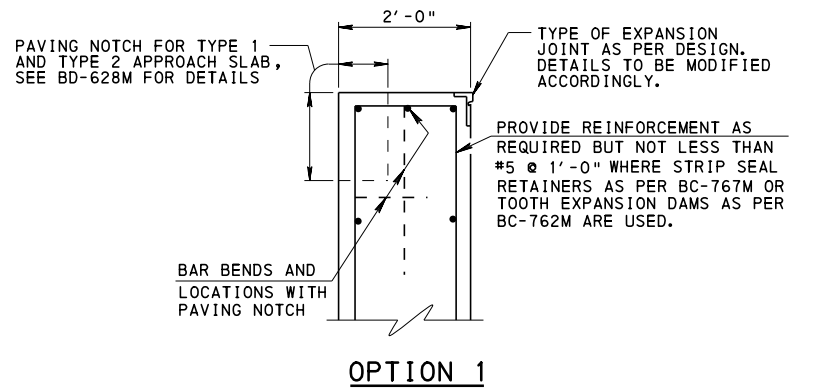
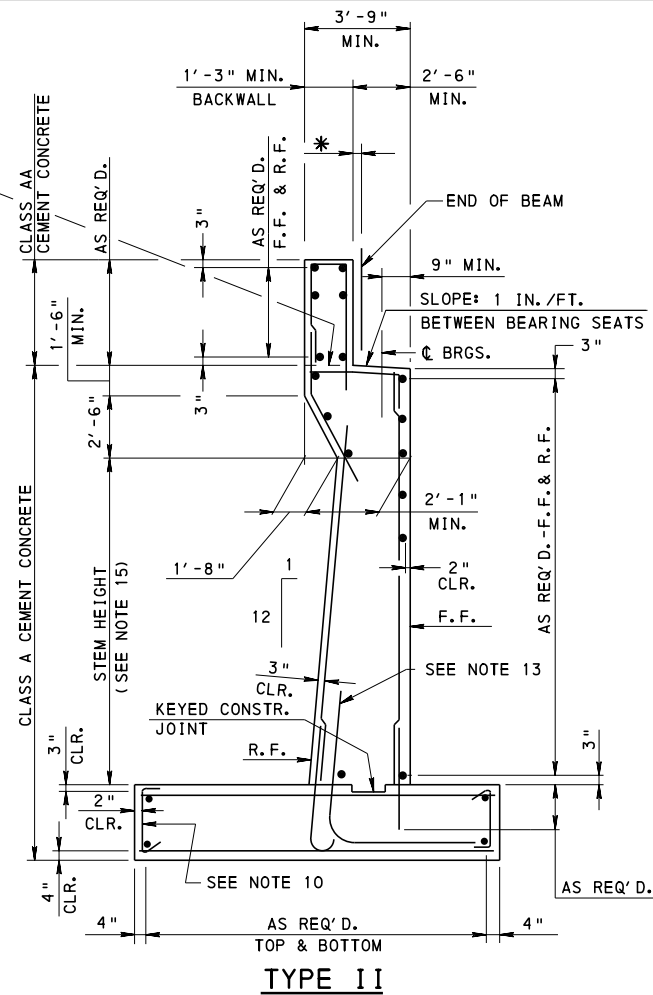
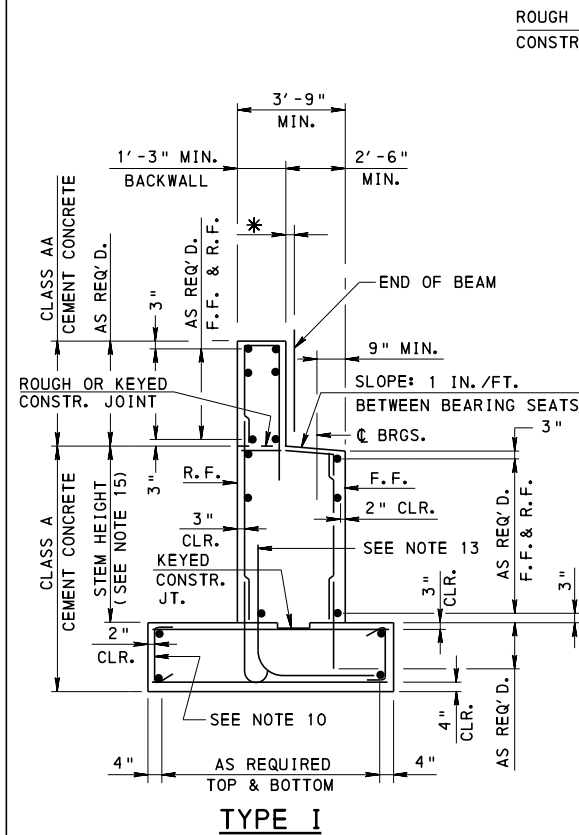
REFERENCE DRAWINGS	
BD-628M	BRIDGE APPROACH SLABS
BC-735M	WALL CONSTR. AND EXPANSION JOINT DETAILS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXP. DAM FOR PRESTRESSED CONC. & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONC. & STEEL I-BEAM BRIDGES
BC-788M	TYP. WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
REINFORCED CONCRETE ABUTMENTS  
TYPICAL SECTIONS AND DETAILS**

RECOMMENDED AUG. 30, 2019 <i>James J. Ringer</i> ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 <i>Michael V. Bittler</i> ACT. DIR., BUR. OF PROJECT DELIVERY	SHEET 1 OF 3 <b>BD-621M</b>
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\* CLEARANCE = JOINT OPENING + 2" MIN.



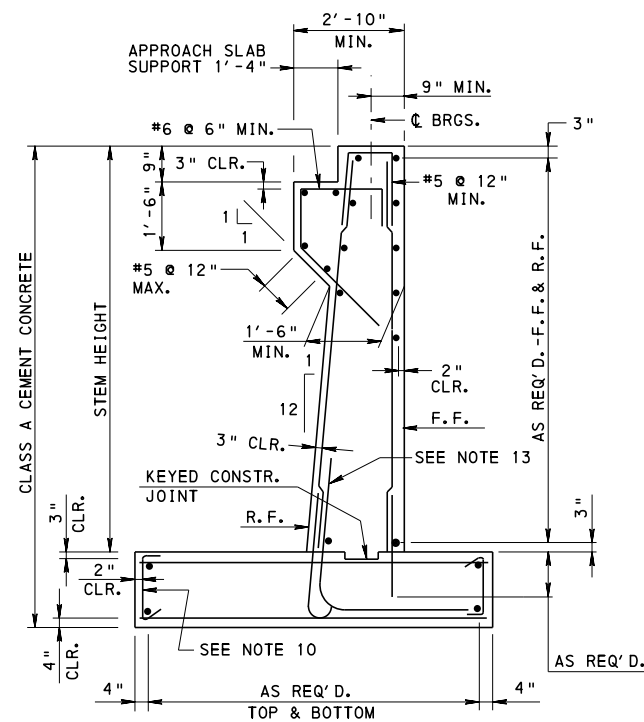
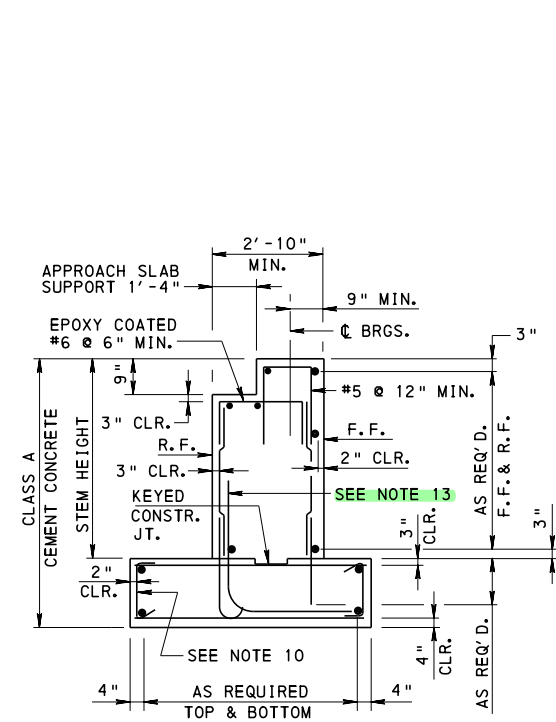
### BACKWALL DETAILS

(WITHOUT BACKWALL SUPPORTED APPROACH SLAB OR WITH TYPE 1 AND TYPE 2 APPROACH SLAB)

### NOTES:

1. FOR NOTES, SEE SHEET 1.

### TYPICAL SECTION WITH BACKWALL FOR TYPE 3 AND 4 APPROACH SLABS



STEM HEIGHT LESS THAN 12'-0"

STEM HEIGHT GREATER THAN 12'-0"

### TYPICAL SECTION WITHOUT BACKWALL FOR TYPE 1 AND TYPE 2 APPROACH SLAB CORBEL

(SEE TABLE A)

TABLE A BEAM DEPTHS FOR APPROACH SLAB CORBEL		
BEAM TYPE	APPROACH SLAB TYPE (SEE NOTE 1)	MAXIMUM BEAM DEPTH
PRESTRESSED CONCRETE ADJACENT BOX BEAMS	1	24"
	2	27"
PRESTRESSED CONCRETE SPREAD BOX BEAMS	1	21"
	2	27"
PRESTRESSED CONCRETE AASHTO TYPE I-BEAMS	N/A	N/A
PRESTRESSED CONCRETE PA BULB-TEE BEAMS	N/A	N/A
PRESTRESSED CONCRETE PA I-BEAMS	N/A	N/A
STEEL BEAMS	1	2'-1 1/2"
	2	2'-6 1/2"

### TABLE A NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. DO NOT USE A CORBEL WHEN THE BEAM DEPTHS ARE GREATER THAN INDICATED.

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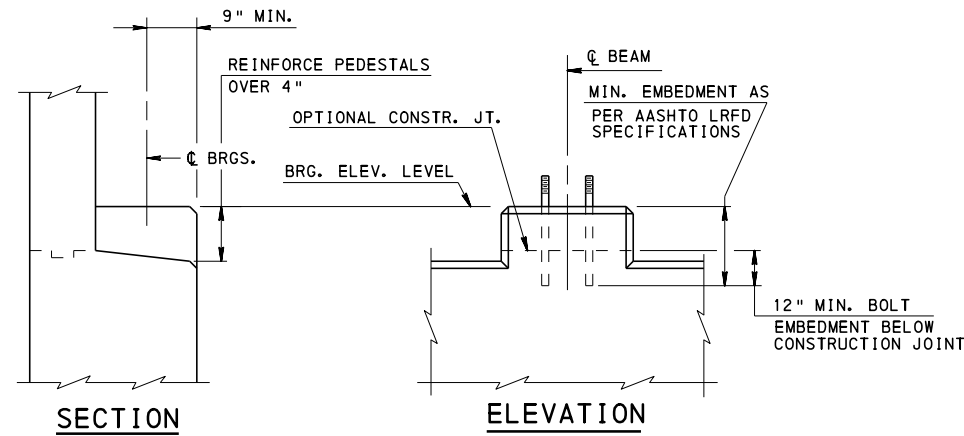
STANDARD  
REINFORCED CONCRETE ABUTMENTS  
TYPICAL SECTIONS AND DETAILS

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

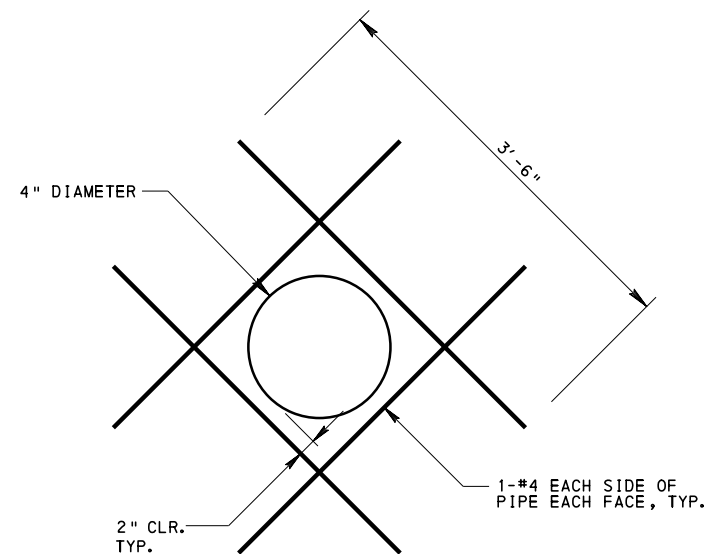
SHEET 2 OF 3

BD-621M



## ABUTMENT WITH BACKWALL

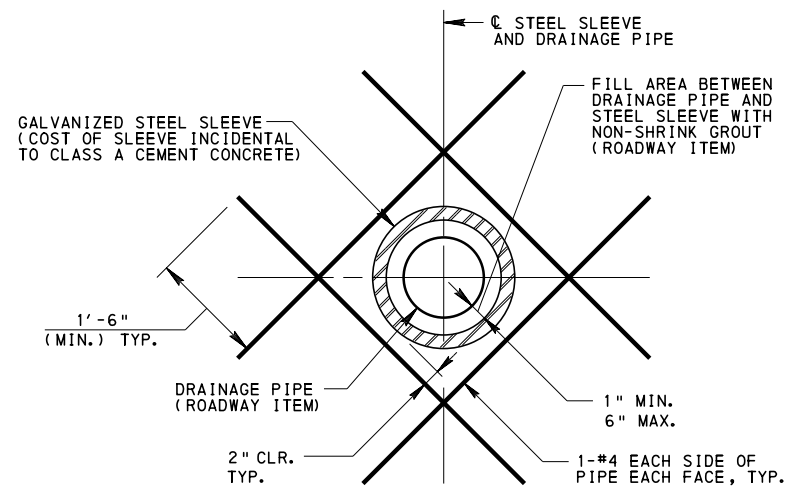
NOTE: BACKWALL NOT SHOWN



## WEEP HOLE REINFORCEMENT DETAIL

### NOTES:

1. REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A DIAGONAL FASHION AS SHOWN.
2. LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.

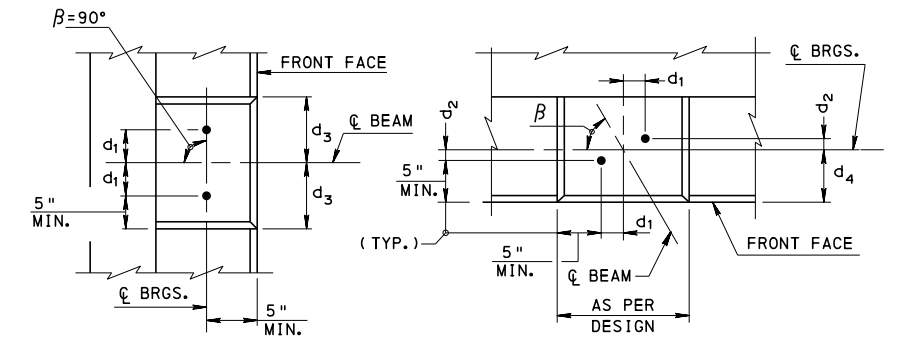


## SECTION B-B

## DRAINAGE THROUGH WALL STEM

### NOTES:

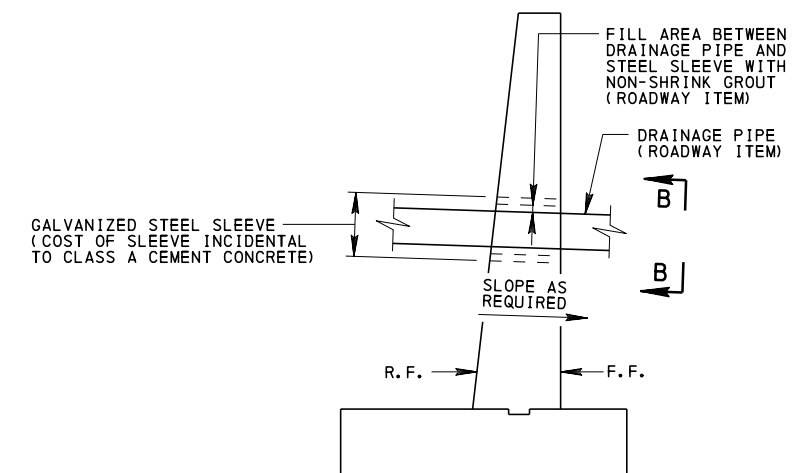
1. INDICATE SIZE AND LOCATION OF THE GALVANIZED STEEL SLEEVE AND DRAINAGE PIPE ON THE CONTRACT PLANS.
2. INDICATE STEEL SLEEVE INVERT ELEVATION AND SLOPE ON THE CONTRACT PLANS.
3. DETERMINE SIZE OF STEEL SLEEVE BASED ON THE OUTSIDE DIMENSION OF THE DRAINAGE PIPE.



## ANCHOR BOLT PLAN

### INSTRUCTIONS

- SHOW SKEW ANGLE  $\beta$  AND THE DIMENSIONS  $d_1, d_2, d_3, d_4$  REQUIRED FOR LOCATION OF THE ANCHOR BOLTS ON THE PLANS.
- BEARING AREA AND SETTING OF ANCHOR BOLTS TO CONFORM TO SECTION 1001.3(k) 9 AND 1001.3(f) OF PUB. 408.
- IF THE BOLT EMBEDMENT CANNOT BE FULLY DEVELOPED IN NEW CONCRETE CAP, THEN THE BOLT EMBEDMENT DEVELOPMENT MUST BE DONE IN THE EXISTING CONCRETE SECTION.



## SLEEVE DETAIL

### NOTES:

1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
REINFORCED CONCRETE ABUTMENTS  
ANCHOR BOLT AND DRAINAGE DETAILS

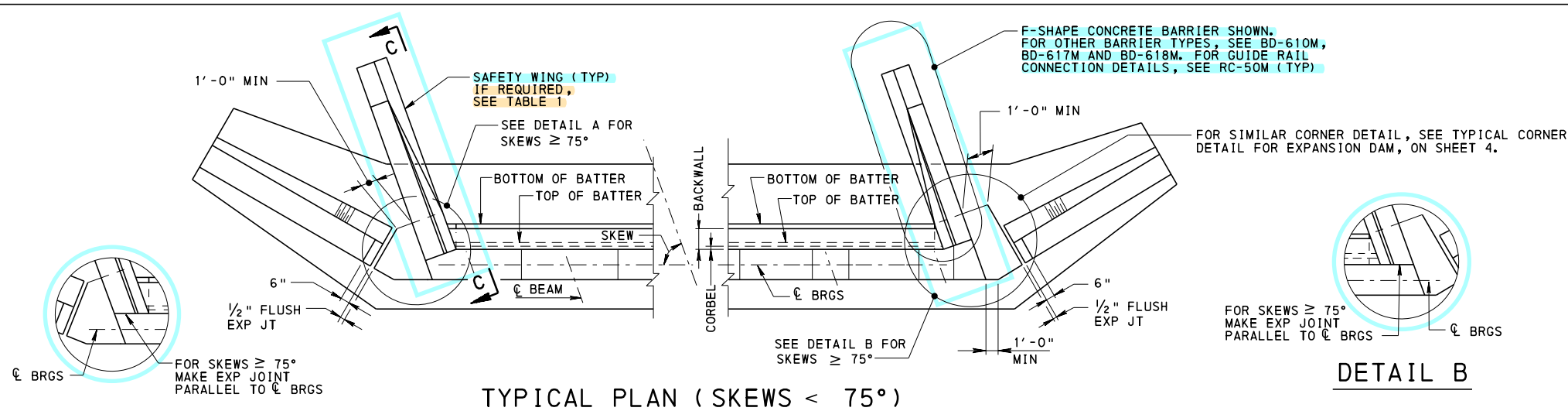
RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 3

BD-621M

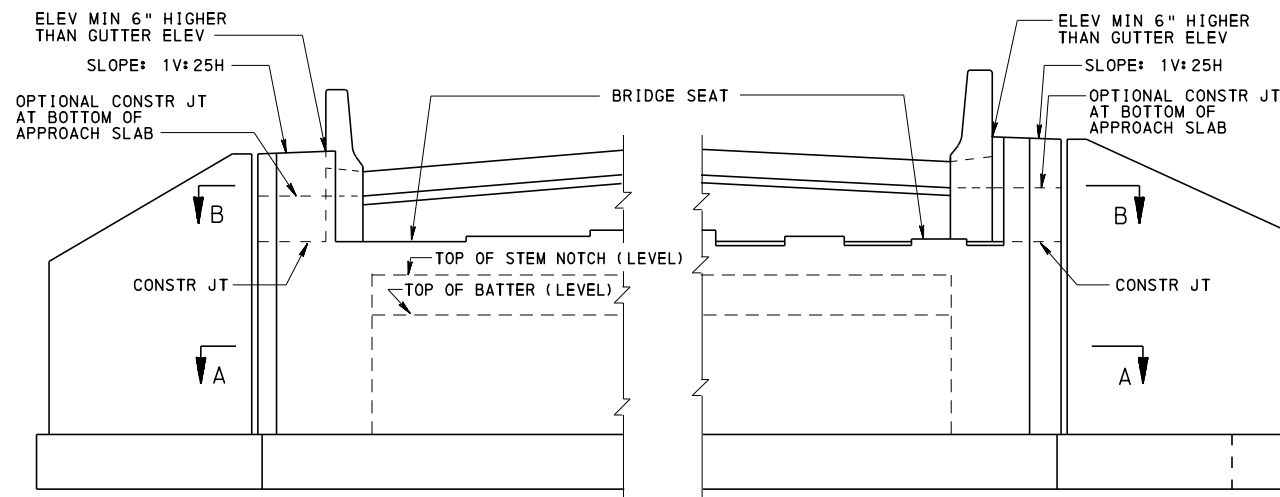
- CHANGE 2
- CHANGE 3
- CHANGE 5
- CHANGE 7



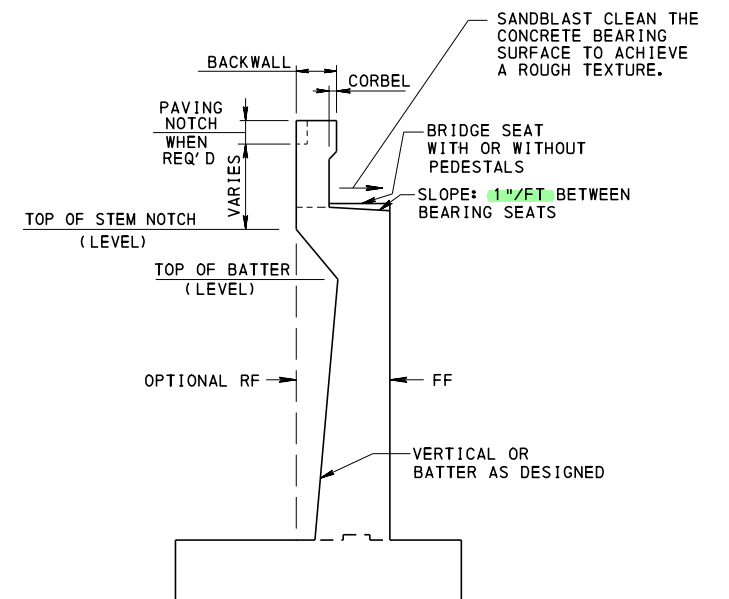
DETAIL A

TYPICAL PLAN (SKEWS < 75°)

DETAIL B

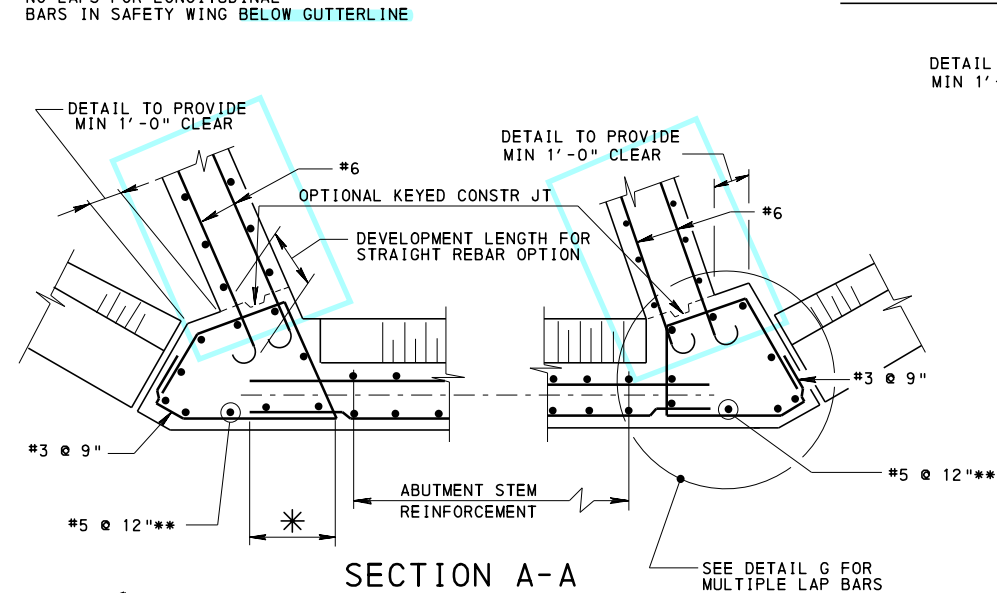


TYPICAL ELEVATION

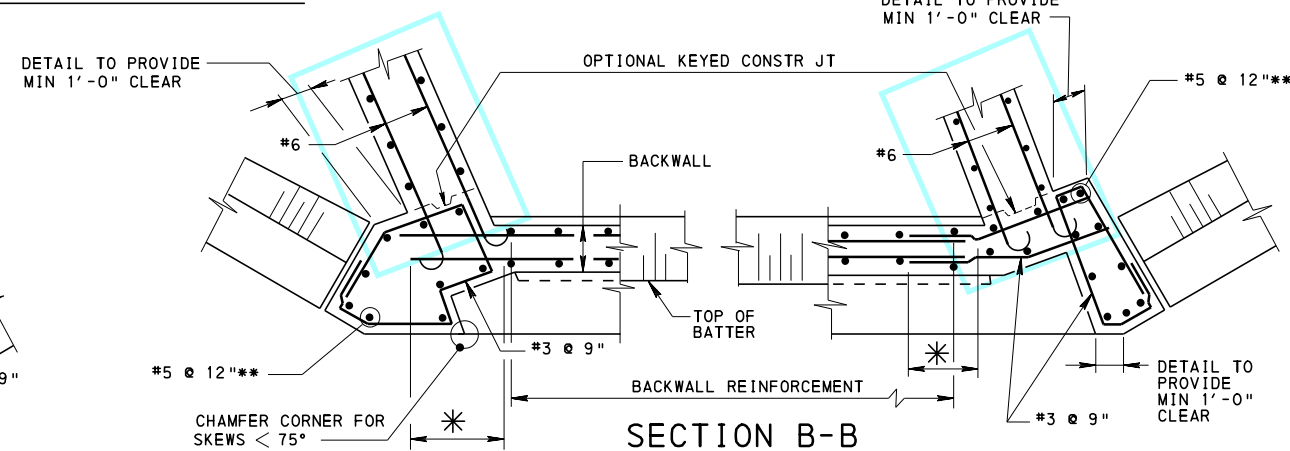


ABUTMENT SECTION

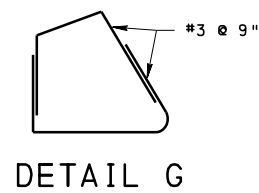
NOTE:  
NO LAPS FOR LONGITUDINAL  
BARS IN SAFETY WING BELOW GUTTERLINE



SECTION A-A



SECTION B-B



DETAIL G

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE  
BARS WITH LAPS. SEE DETAIL G.

\* EXTEND HORIZONTAL REINFORCEMENT INTO  
CORNER THE MINIMUM DEVELOPMENT LENGTH.  
BEND AS REQUIRED. (TYP)

\*\* IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT,  
#6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING  
MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

GENERAL NOTES:

- FOR SECTION C-C, SEE SHEET 2.
- HOOKS ON BARS EXTENDING FROM SAFETY WING INTO THE BACKWALL OR STEM MAY BE TURNED IN ANY DIRECTION.
- SAFETY WINGS ARE NOT NEEDED WHEN USING APPROACH SLAB TYPES 1 - 4 (SEE BD-628M).
- ON UNDIVIDED HIGHWAYS WITH TWO-WAY TRAFFIC, PROVIDE END TRANSITIONS THAT CONNECT TO A THREE-BEAM GUIDE RAIL.
- ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS, PROVIDE APPROACH END TRANSITIONS THAT CONNECT TO A THREE-BEAM GUIDE RAIL AND PROVIDE TRAILING END TRANSITIONS THAT CONNECT TO A W-BEAM GUIDE RAIL IF WARRANTED BY THE LENGTH OF NEED OR OTHER OBSTRUCTIONS.
- END CHAMFERS, ON THE BARRIER, ARE NOT REQUIRED ON THE TRAILING END OF THE BARRIER ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL.

TABLE 1

APPROACH SLAB TYPE	SAFETY WING REQUIRED?
TYPE 1-4 (BD-628M)	NO <sup>(1)</sup>
RC-23M (BRADD)	YES <sup>(2)</sup>
NONE	YES <sup>(2)</sup>

(1) BARRIERS INTEGRAL WITH APPROACH SLAB  
(2) BARRIERS SUPPORTED BY SAFETY WINGS

BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	VERTICAL WALL CONCRETE BARRIER
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	ABUTMENT DETAILS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC ABUTMENTS WITH BACKWALL  
FLARED WINGS  
LAYOUT AND DETAILS

RECOMMENDED OCT. 7, 2024

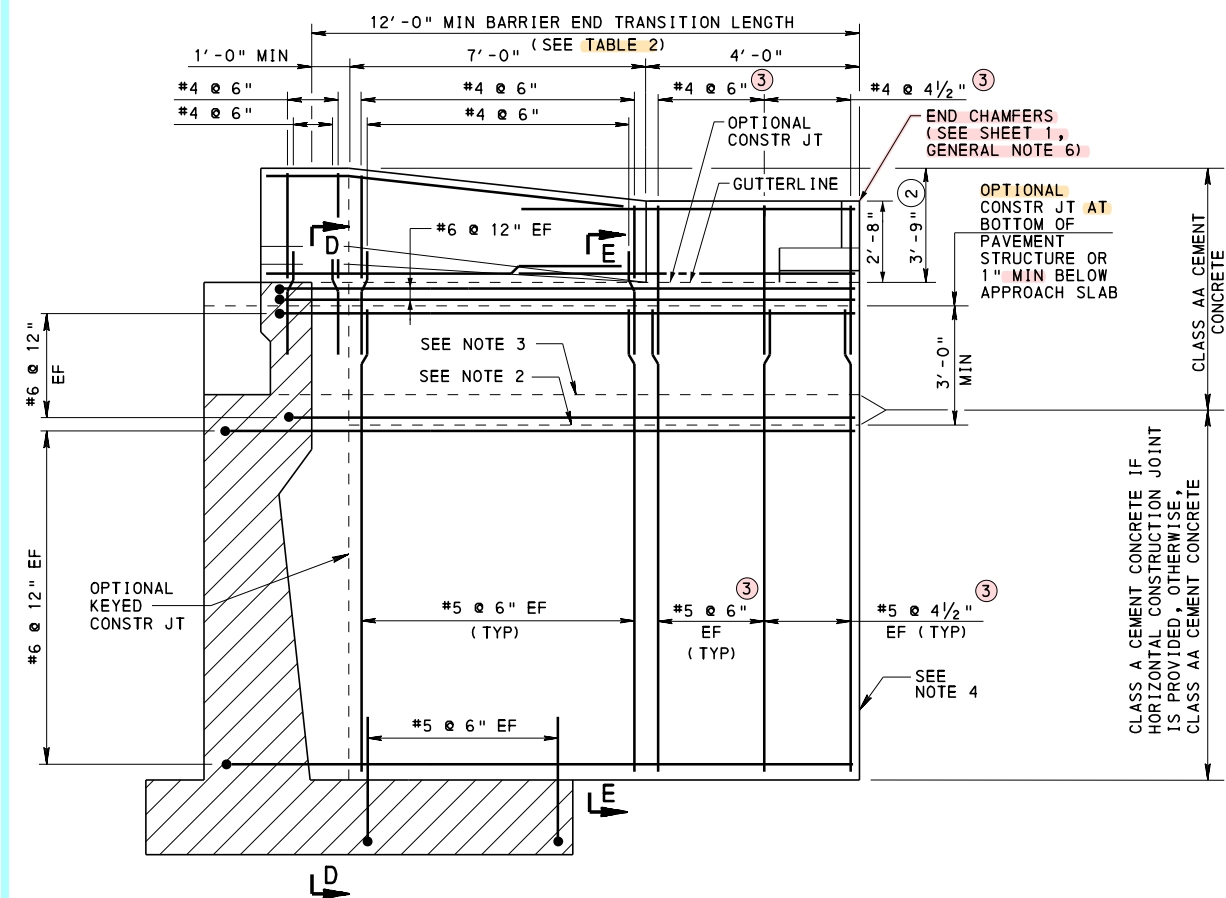
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024

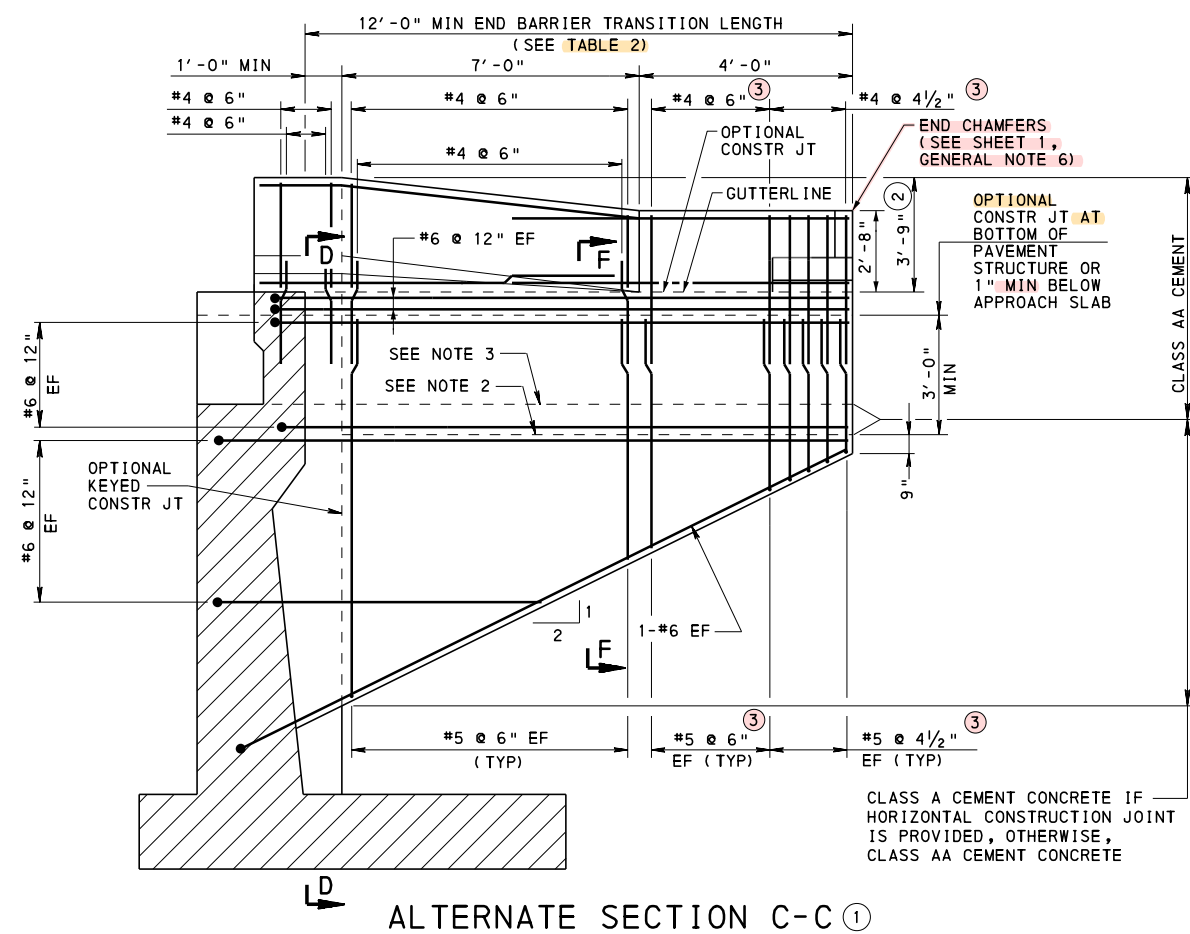
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 13

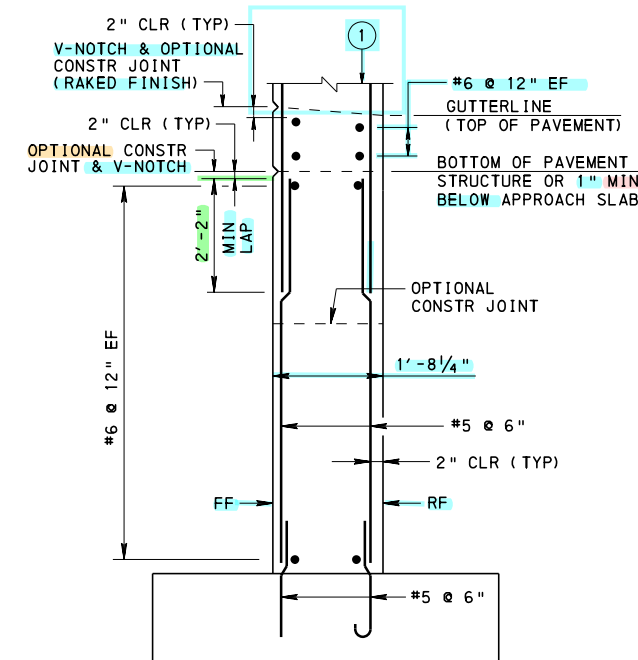
BD-622M



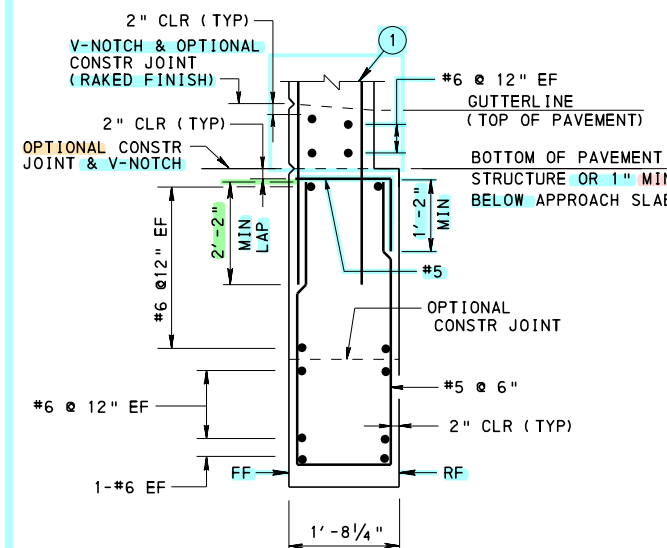
SECTION C-C ①



ALTERNATE SECTION C-C ①



SECTION D-D



SECTION F-F

BARRIER TYPE	MINIMUM BARRIER END TRANSITION LENGTH
32", 42", 45" F-SHAPE CONCRETE BARRIER	12'-0"
32" VERTICAL WALL CONCRETE BARRIER	7'-0"
42" VERTICAL WALL CONCRETE BARRIER	10'-0"
PA BRIDGE BARRIER	9'-0"
PA TYPE 10M BRIDGE BARRIER	9'-0"

## NOTES:

- FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 1.
- OPTIONAL CONSTRUCTION JOINT LOCATED 3'-0" MINIMUM FROM BOTTOM OF DECK FOR BEAM DEPTHS LESS THAN 2'-1".
- OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 2'-1".
- DENOTES PREFERRED CONFIGURATION OF BARRIER WALL ON FOOTING FOR ABUTMENT STEM HEIGHTS MEASURED FROM TOP OF FOOTING TO TOP OF BEAM SEAT LESS THAN 30'-0". ALTERNATE CONFIGURATIONS OF BARRIER WALLS ON FOOTINGS CAN BE USED ONLY WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
- IF FILL HEIGHTS ON BOTH SIDES OF THE SAFETY WING WALL CAN NOT BE MAINTAINED WITHIN 5'-0" OF EACH OTHER, THEN ALL REINFORCEMENT BARS MUST BE DESIGNED.

## LEGEND:

- SEE SHEETS 3-5 FOR REINFORCEMENT DETAILS OF THE F-SHAPE CONCRETE BARRIER. SEE BD-610M, BD-617M AND BD-618M FOR REINFORCEMENT DETAILS FOR THE PA BRIDGE BARRIER, PA TYPE 10M BRIDGE BARRIER AND VERTICAL WALL CONCRETE BARRIER.
- 45" F-SHAPE CONCRETE BARRIER SHOWN. 32" AND 42" F-SHAPE CONCRETE BARRIER SIMILAR
- BAR SPACING SHOWN FOR CONNECTION OF A THREE-BEAM TERMINAL CONNECTOR. ADJUST BAR SPACING FOR CONNECTION OF A W-BEAM TERMINAL CONNECTOR FOR TRAILING END ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS. SEE SHEETS 9-11 FOR REINFORCEMENT DETAILS FOR F-SHAPE BARRIERS. SEE OTHER STANDARDS FOR OTHER BARRIER TYPES.

## COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

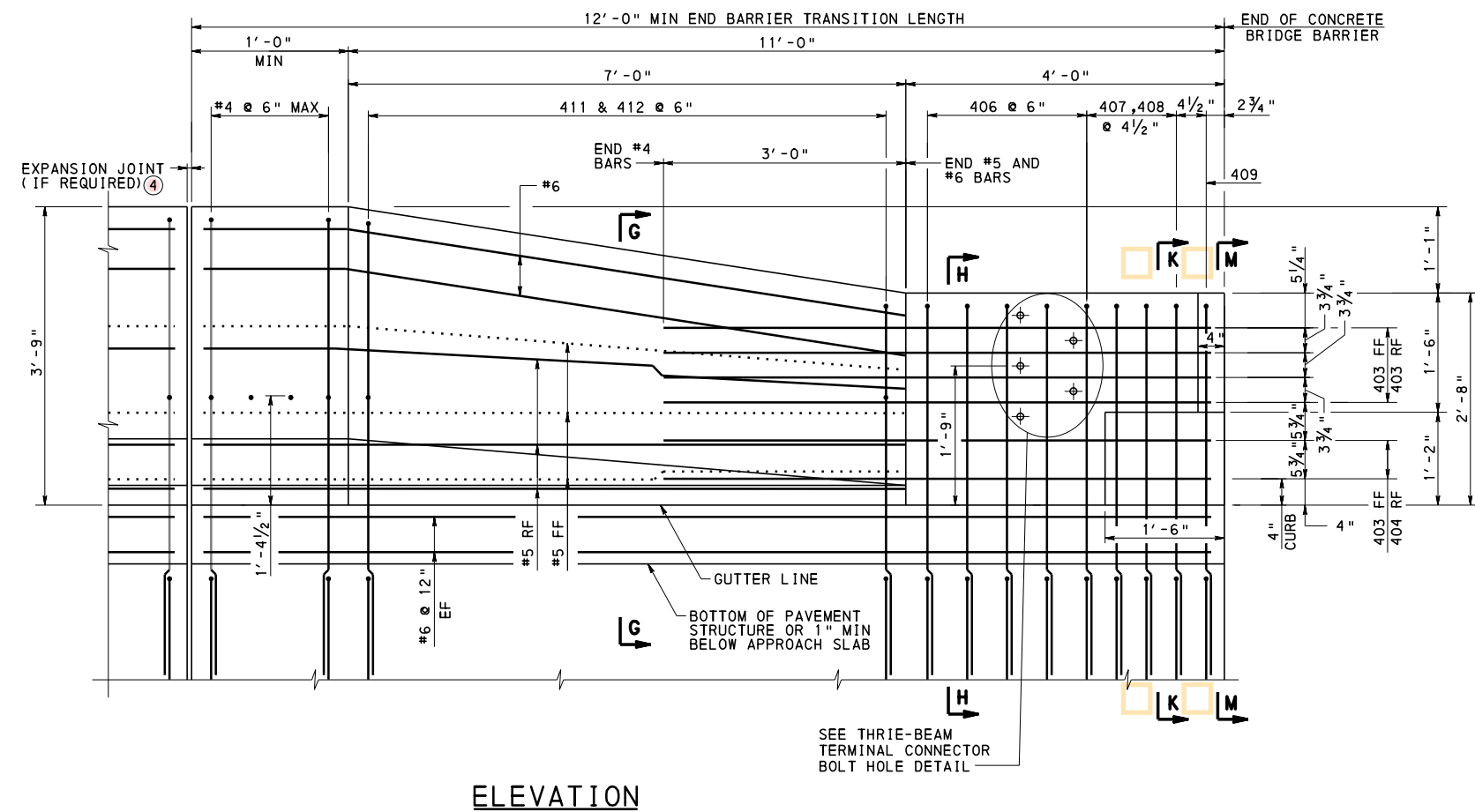
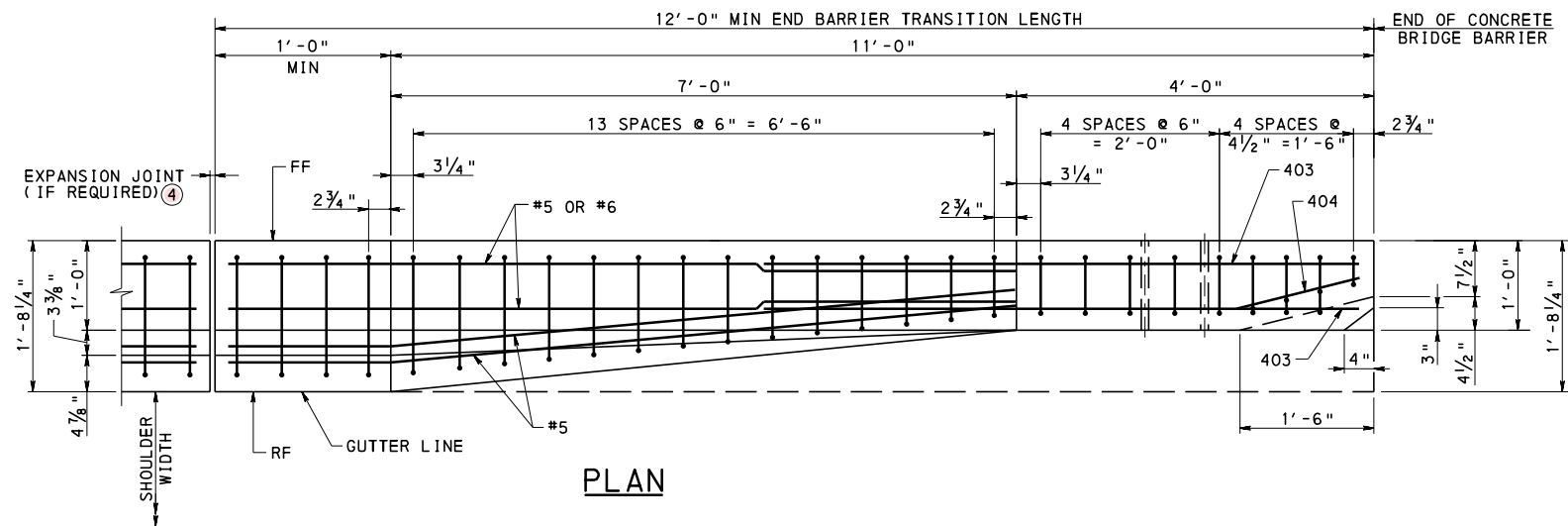
## STANDARD RC ABUTMENTS WITH BACKWALL SAFETY WING DETAILS

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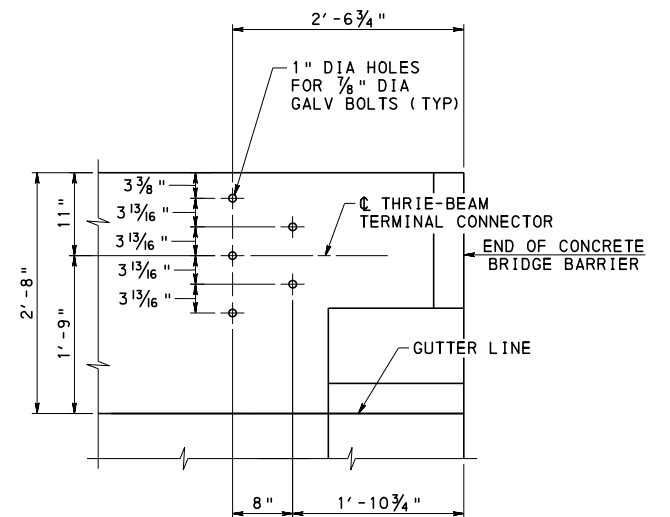
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 CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 13  
 BD-622M





**45" F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION REINFORCEMENT DETAIL**  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)



**THRIE-BEAM  
TERMINAL CONNECTOR  
BOLT HOLE DETAIL**

**LEGEND:**

- ④ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

**NOTES:**

- FOR SECTIONS G-G, H-H, K-K, AND M-M, SEE SHEET 6.
- FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
- FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

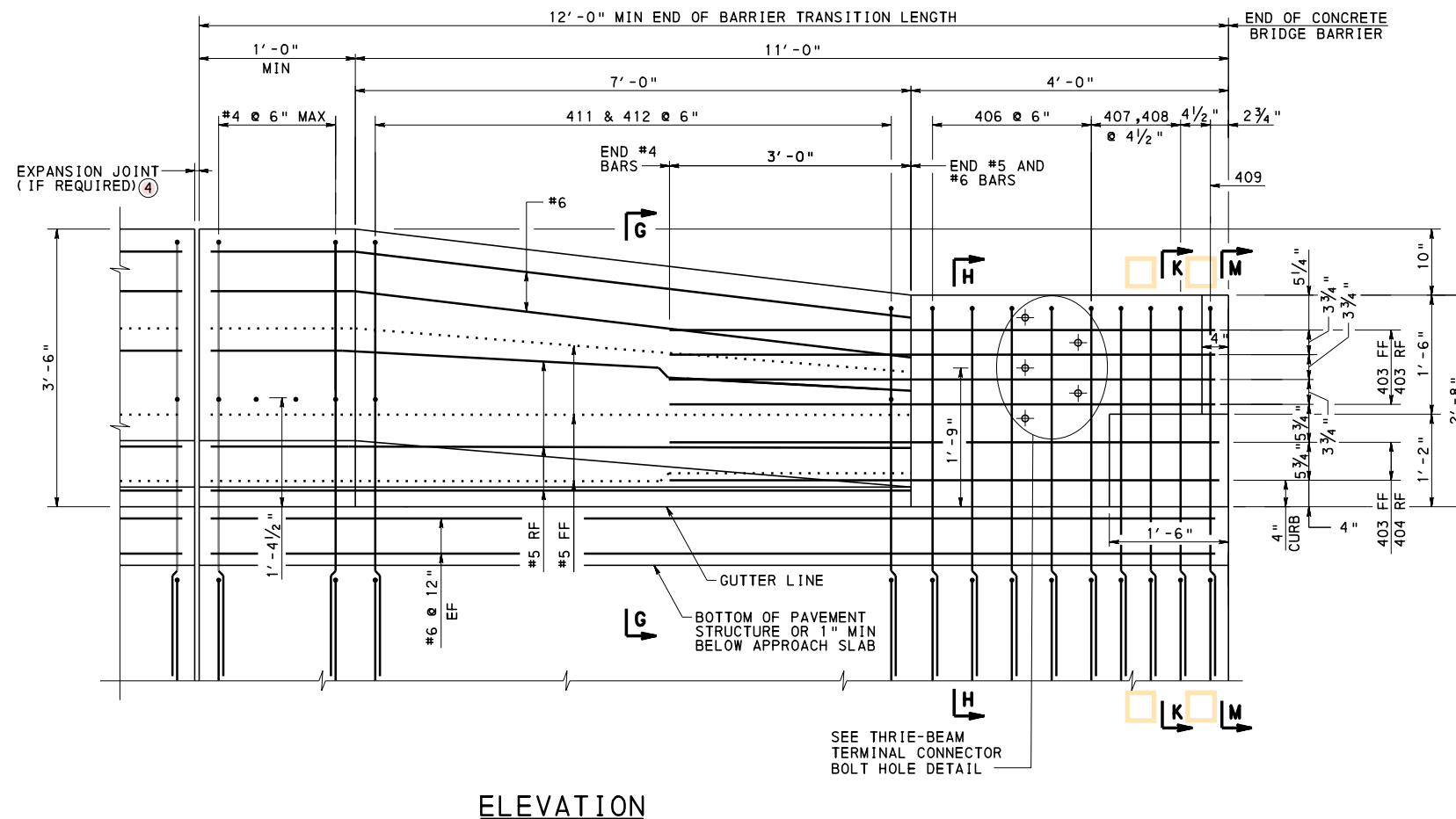
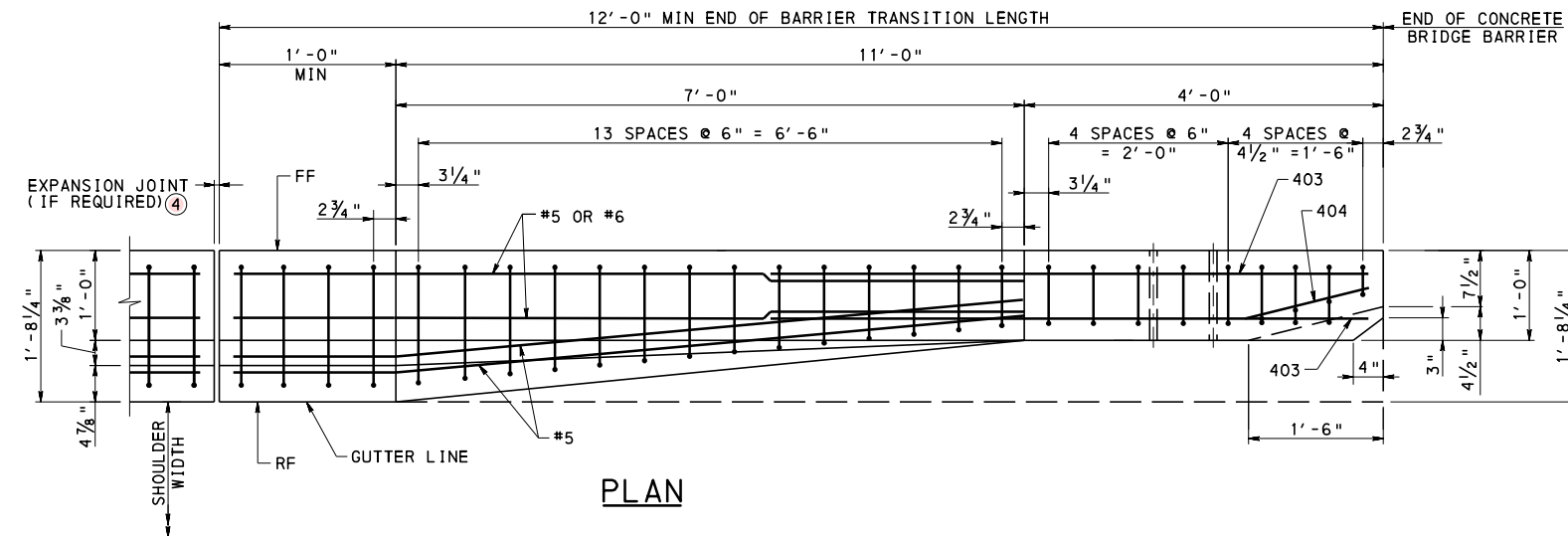
**STANDARD  
RC ABUTMENTS WITH BACKWALL  
BRIDGE BARRIER  
END TRANSITION REINFORCEMENT  
WITH THRIE-BEAM CONNECTION - 1**

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 3 OF 13  
BD-622M





**42" F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION REINFORCEMENT DETAIL**  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

#### LEGEND:

- ④ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

#### NOTES:

- FOR SECTIONS G-G, H-H, K-K, AND M-M, SEE SHEET 6.
- FOR THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL, SEE SHEET 3.
- FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
- FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

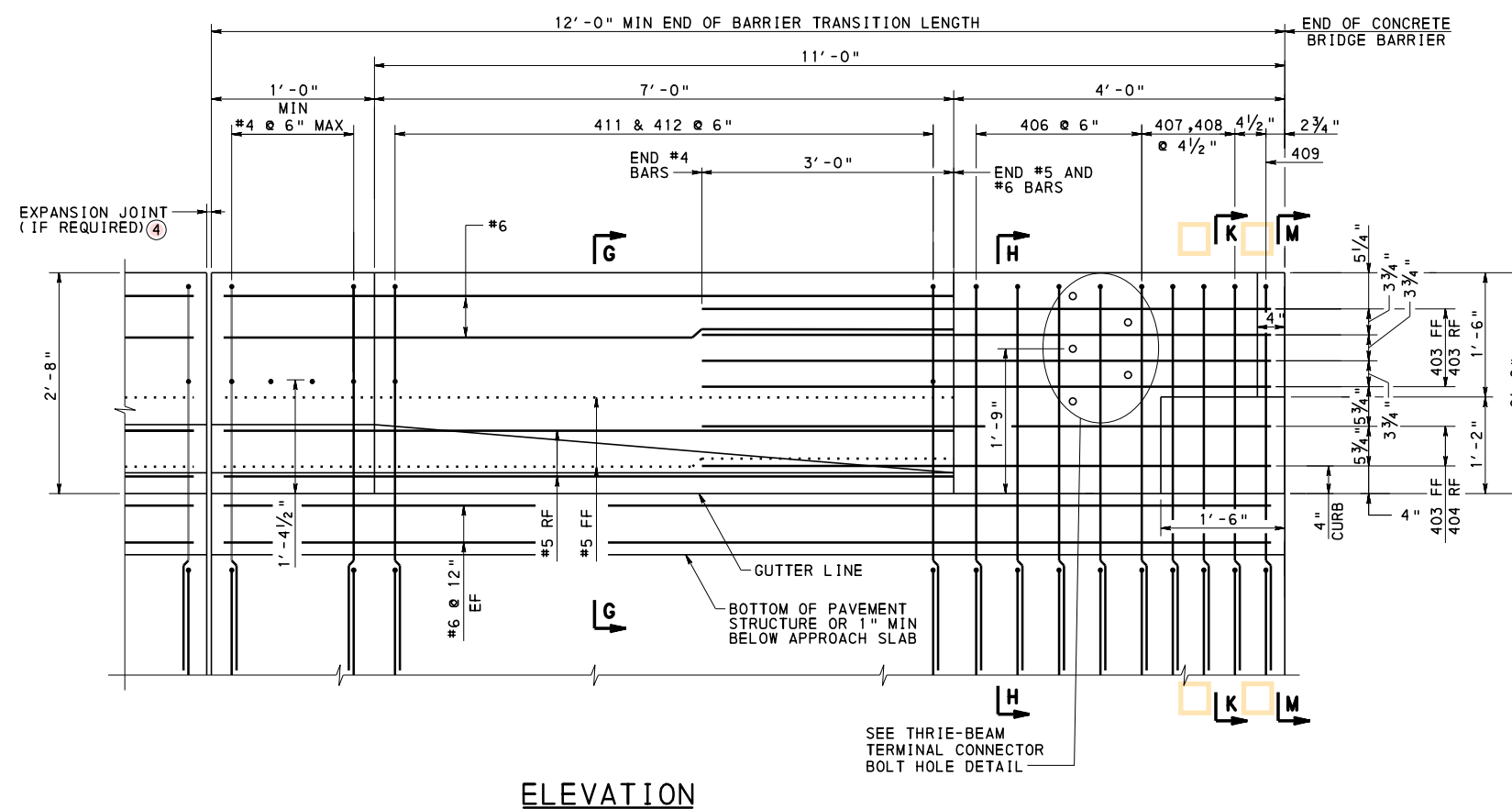
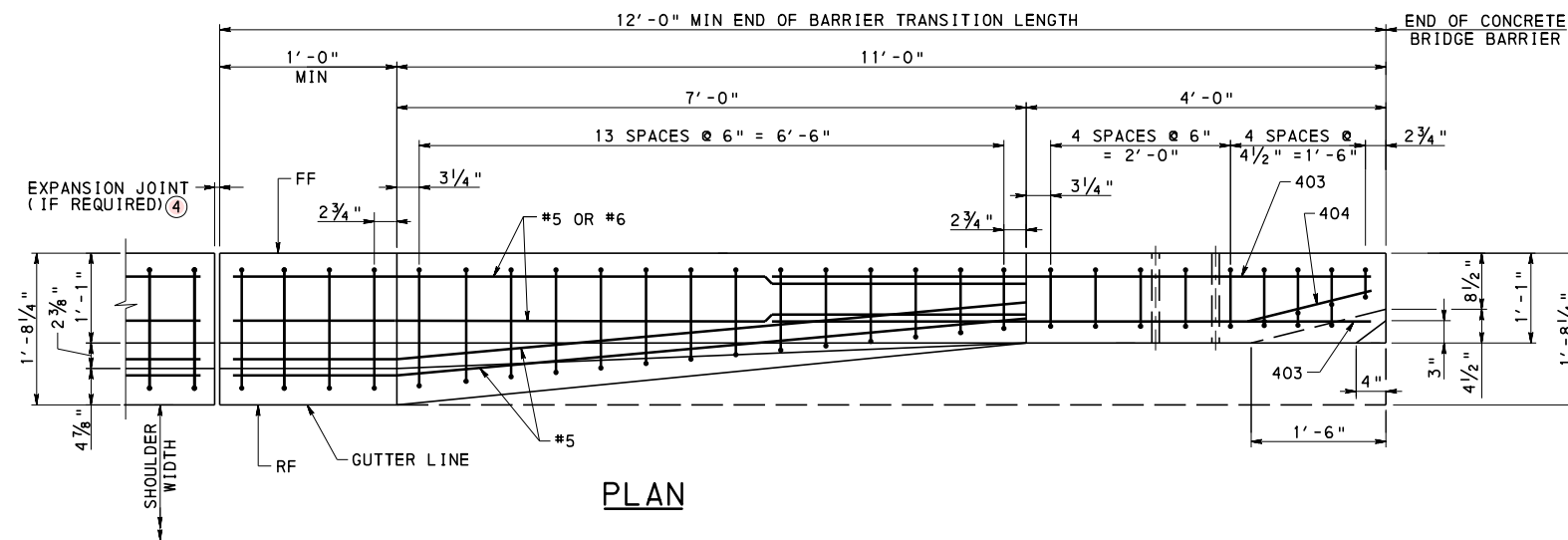
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

**STANDARD  
RC ABUTMENTS WITH BACKWALL  
BRIDGE BARRIER  
END TRANSITION REINFORCEMENT  
WITH THRIE-BEAM CONNECTION - 2**

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 4 OF 13  
BD-622M



**32" F-SHAPE CONCRETE BRIDGE BARRIER END TRANSITION  
WITH THRIE-BEAM CONNECTION REINFORCEMENT DETAIL**  
(WITH CURB SHOWN, WITHOUT CURB SIMILAR)

**LEGEND:**

- ④ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

**NOTES:**

- FOR SECTIONS G-G, H-H, K-K, AND M-M, SEE SHEET 6.
- FOR THRIE-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL, SEE SHEET 3.
- FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
- FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

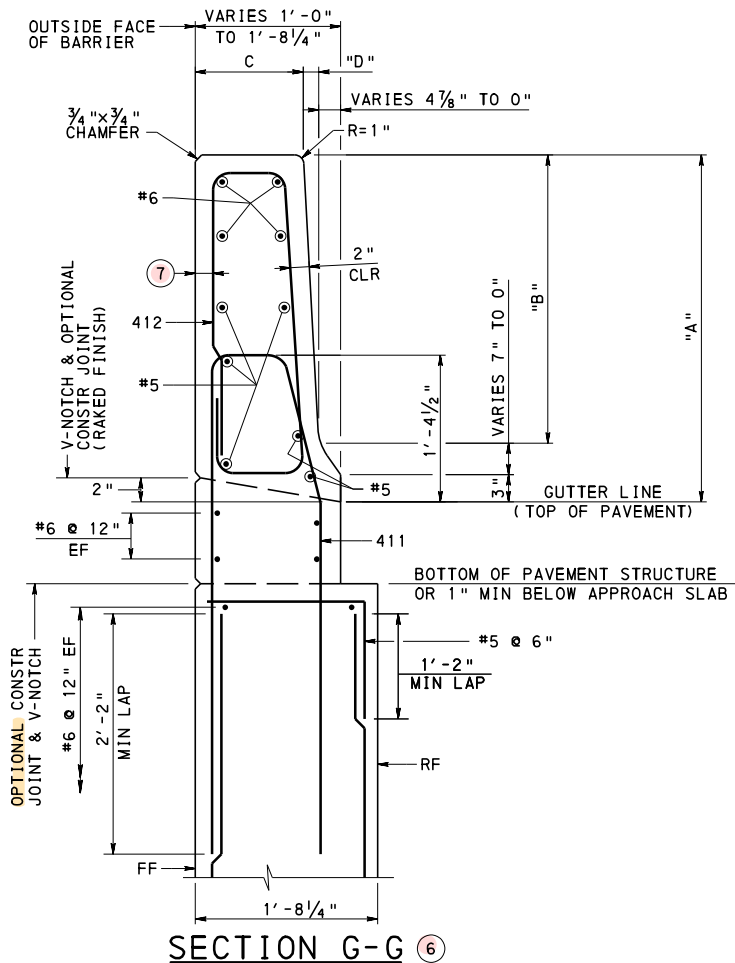
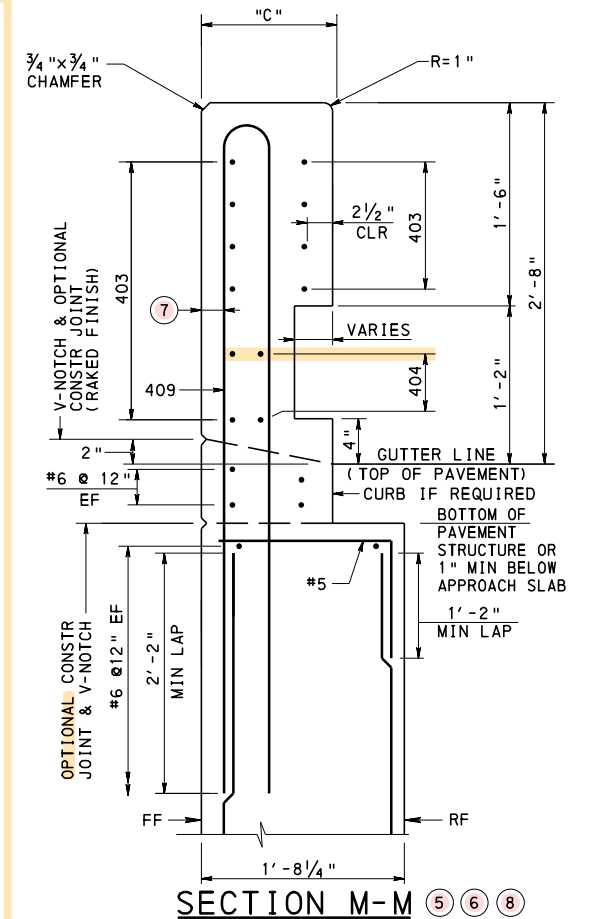
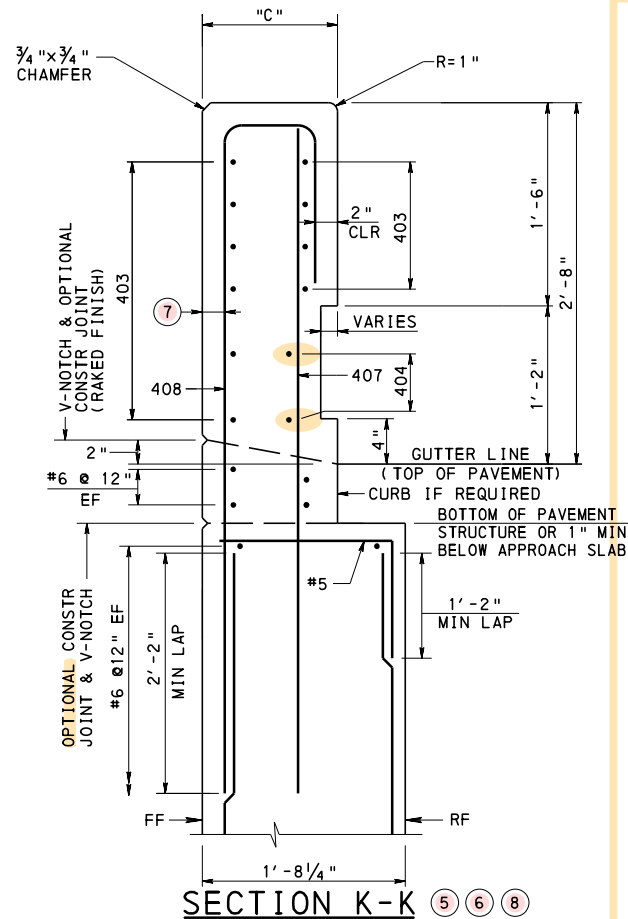
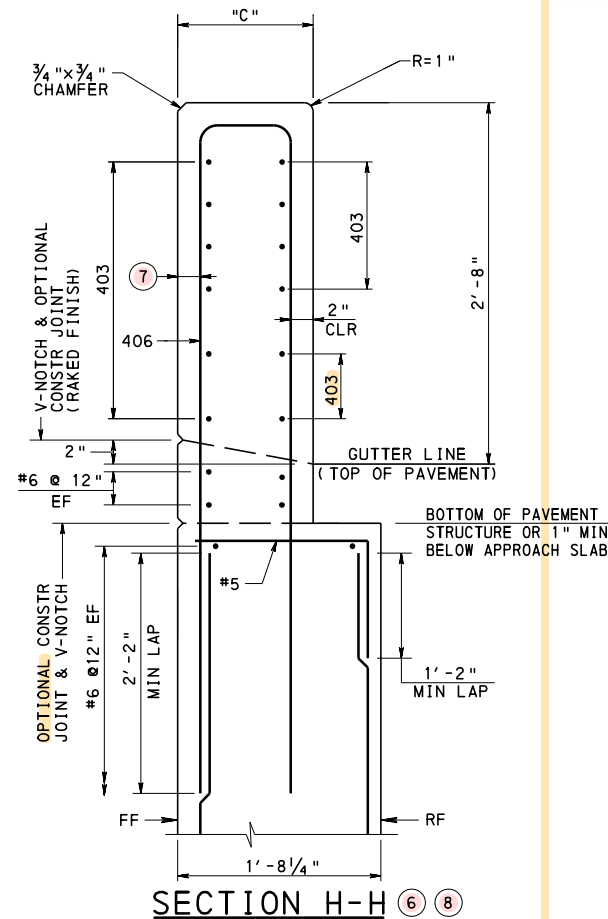
**COMMONWEALTH OF PENNSYLVANIA  
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BUREAU OF BRIDGE**

**STANDARD  
RC ABUTMENTS WITH BACKWALL  
BRIDGE BARRIER  
END TRANSITION REINFORCEMENT  
WITH THRIE-BEAM CONNECTION - 3**

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 13  
**BD-622M**



### LEGEND:

- (5) TYPICAL SECTIONS SHOWN WITH CURB, WITHOUT CURB SIMILAR.
- (6) FOR DETAILS OF THE BARRIER SUPPORT WALLS, SEE SHEET 2.
- (7) 2" CLR FOR SAFETY WINGS.  
2 5/8" CLR FOR U-WINGS.
- (8) REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING.  
REINFORCEMENT IN U-WING BELOW END TRANSITION IS AS  
REQUIRED BY DESIGN.

TABLE 3

BARRIER TYPE	"A"	"B"	"C"	"D"
32" F-SHAPE CONCRETE BARRIER	2'-8"	1'-10"	1'-1"	VARIES 2 3/8" TO 0"
42" F-SHAPE CONCRETE BARRIER	VARIES 3'-6" TO 2'-8"	VARIES 2'-8" TO 1'-10"	1'-0"	VARIES 3 3/8" TO 0"
45" F-SHAPE CONCRETE BARRIER	VARIES 3'-9" TO 2'-8"	VARIES 2'-11" TO 1'-10"	1'-0"	VARIES 3 3/8" TO 0"

### NOTES:

1. FOR 406, 407, 408, 409, 411 AND 412 BAR DETAILS, SEE SHEET 7.
2. FOR 403 AND 404 BAR DETAILS, SEE SHEET 8.

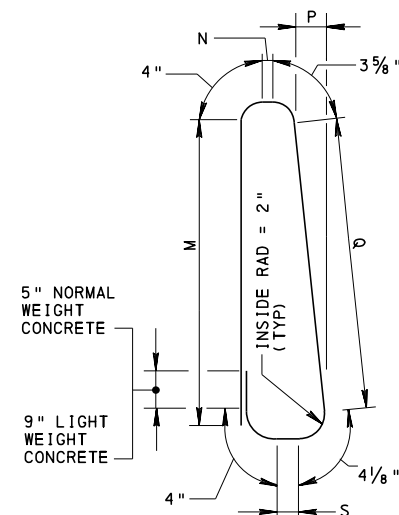
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DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC ABUTMENTS WITH BACKWALL  
BRIDGE BARRIER  
END TRANSITION REINFORCEMENT  
WITH THRIE-BEAM CONNECTION - 4

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

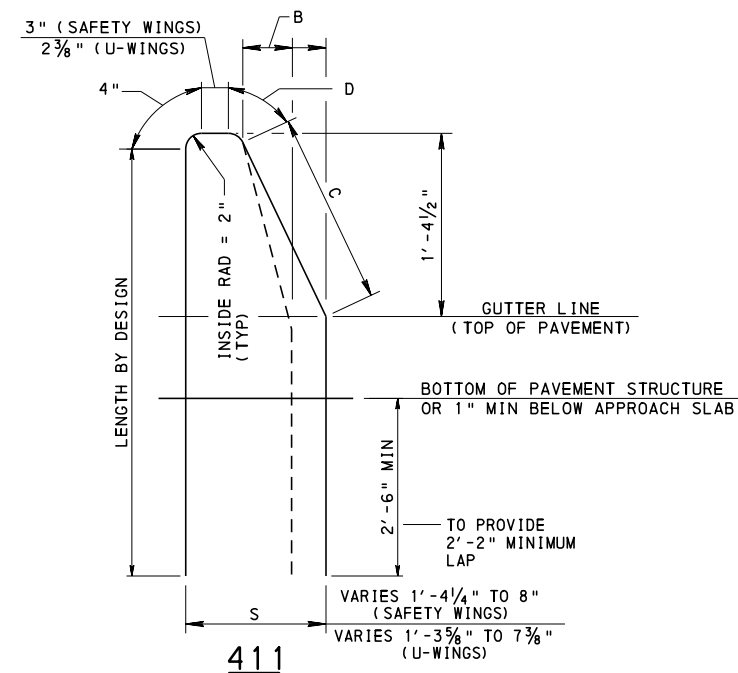
SHEET 6 OF 13  
BD-622M



412

(FOR DIMENSIONS M, N, P, Q AND S, SEE TABLE 4)

TABLE 4 ( 412)					
M, N, P, Q AND S DIMENSIONS					
	M	N	P	Q	S
45" F-SHAPE CONCRETE BARRIER	VARIES 3'-0 1/2" TO 1'-11 1/2"	3 3/8" (SAFETY WINGS) 2 3/4" (U-WINGS)	VARIES 3 3/8" TO 0"	VARIES 2'-10 3/4" TO 1'-9 3/4"	VARIES 6 3/4" TO 3 3/8" (SAFETY WINGS) VARIES 6 1/8" TO 2 3/4" (U-WINGS)
42" F-SHAPE CONCRETE BARRIER	VARIES 2'-9 1/2" TO 1'-11 1/2"	3 3/8" (SAFETY WINGS) 2 3/4" (U-WINGS)	VARIES 3 3/8" TO 0"	VARIES 2'-7 3/4" TO 1'-9 3/4"	VARIES 6 3/4" TO 3 3/8" (SAFETY WINGS) VARIES 6 1/8" TO 2 3/4" (U-WINGS)
32" F-SHAPE CONCRETE BARRIER	1'-11 1/2"	4 1/2" (SAFETY WINGS) 3 3/8" (U-WINGS)	VARIES 2 1/4" TO 0"	1'-9 3/4"	VARIES 6 3/4" TO 4 1/2" (SAFETY WINGS) VARIES 6 1/8" TO 3 3/8" (U-WINGS)

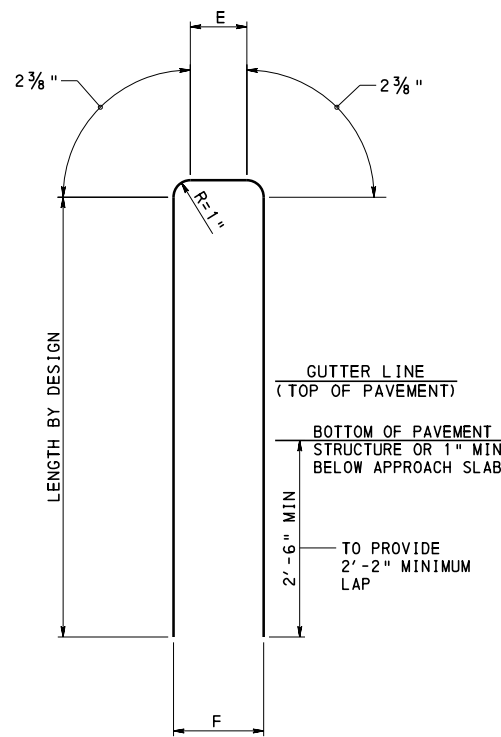


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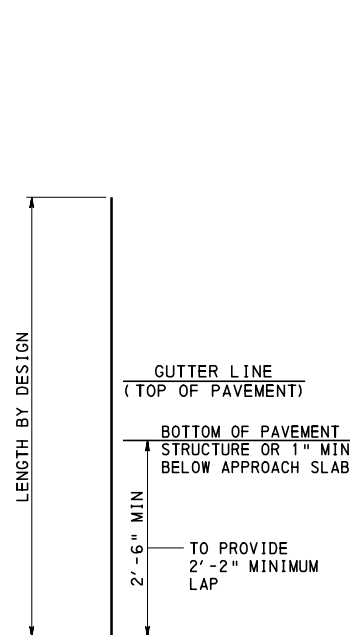
(FOR DIMENSIONS "B", "C" AND "D", SEE TABLE 5)

TABLE 6 ( 406 , 408 , 409)					
E, F, G AND H DIMENSIONS					
SAFETY WINGS	42 & 45" F-SHAPE CONCRETE BARRIER	E	F	G	H
	32" F-SHAPE CONCRETE BARRIER	5"	8"	6 1/4"	4"
U-WINGS	42 & 45" F-SHAPE CONCRETE BARRIER	4 3/8"	7 3/8"	5 5/8"	3 3/8"
	32" F-SHAPE CONCRETE BARRIER	5 3/8"	8 3/8"	7 1/8"	4 3/8"

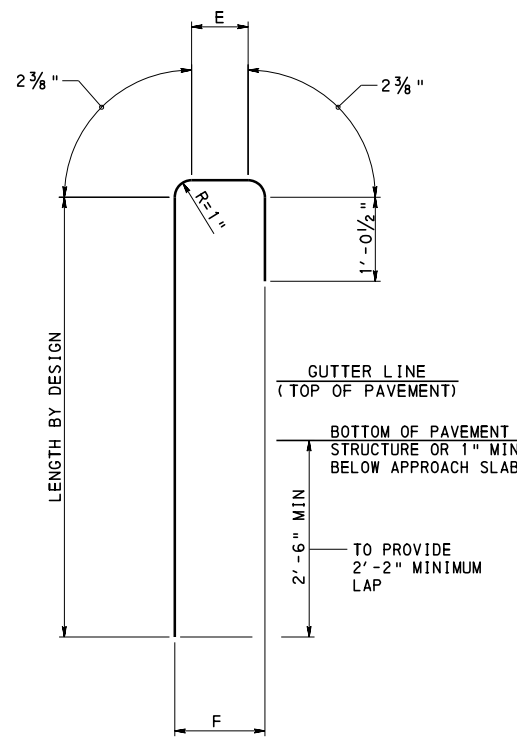
TABLE 5 ( 411)			
B, C, AND D DIMENSIONS			
	B	C	D
45" F-SHAPE CONCRETE BARRIER	VARIES 1/4" TO 8 5/8"	1'-4 3/8"	VARIES 2 1/2" TO 4"
42" F-SHAPE CONCRETE BARRIER	VARIES 1/4" TO 8 5/8"	1'-4 3/8"	VARIES 2 1/2" TO 4"
32" F-SHAPE CONCRETE BARRIER	VARIES 1 1/4" TO 8 5/8"	1'-4 3/8"	VARIES 2 1/2" TO 4"



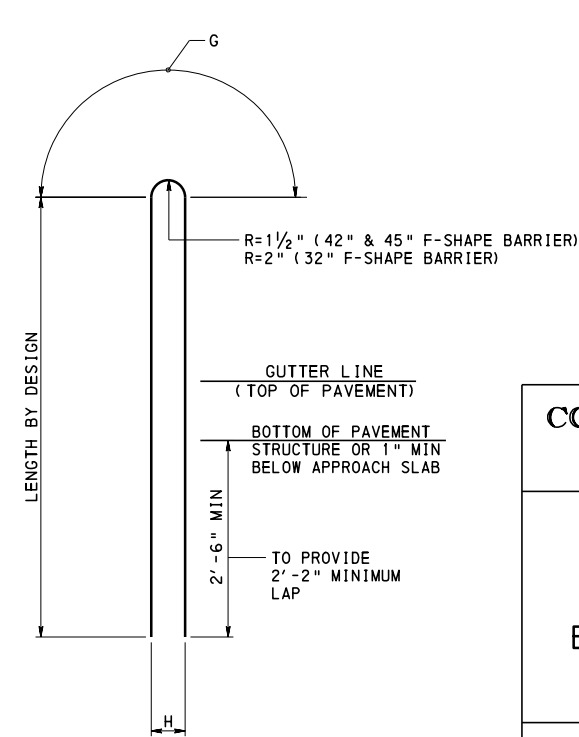
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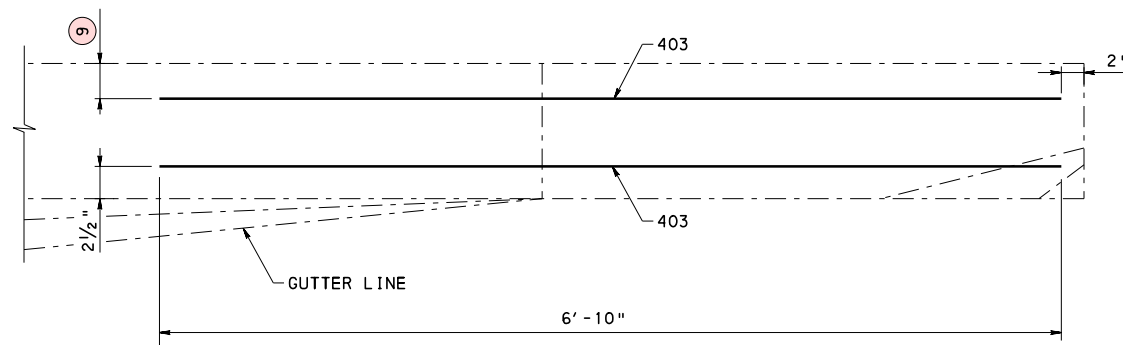
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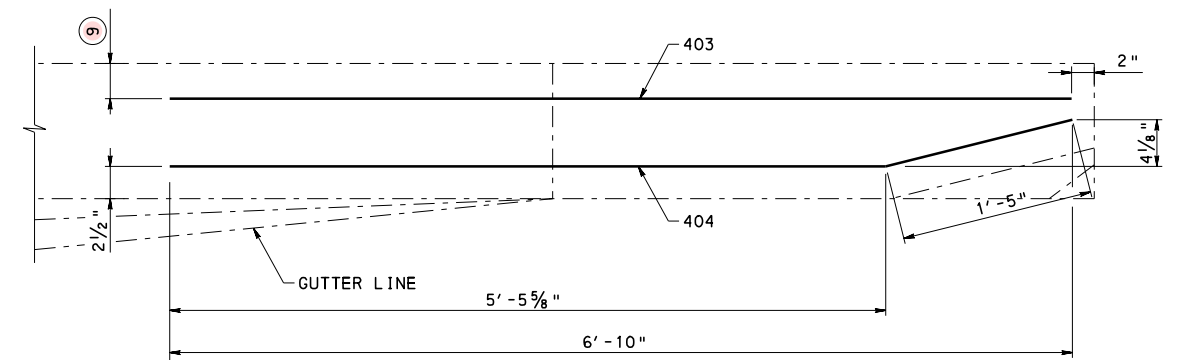
408



409



PLAN  
403



PLAN  
404

LEGEND:

- ⑨ 2 1/2" CLR FOR SAFETY WINGS.  
3 1/8" CLR FOR U-WINGS.

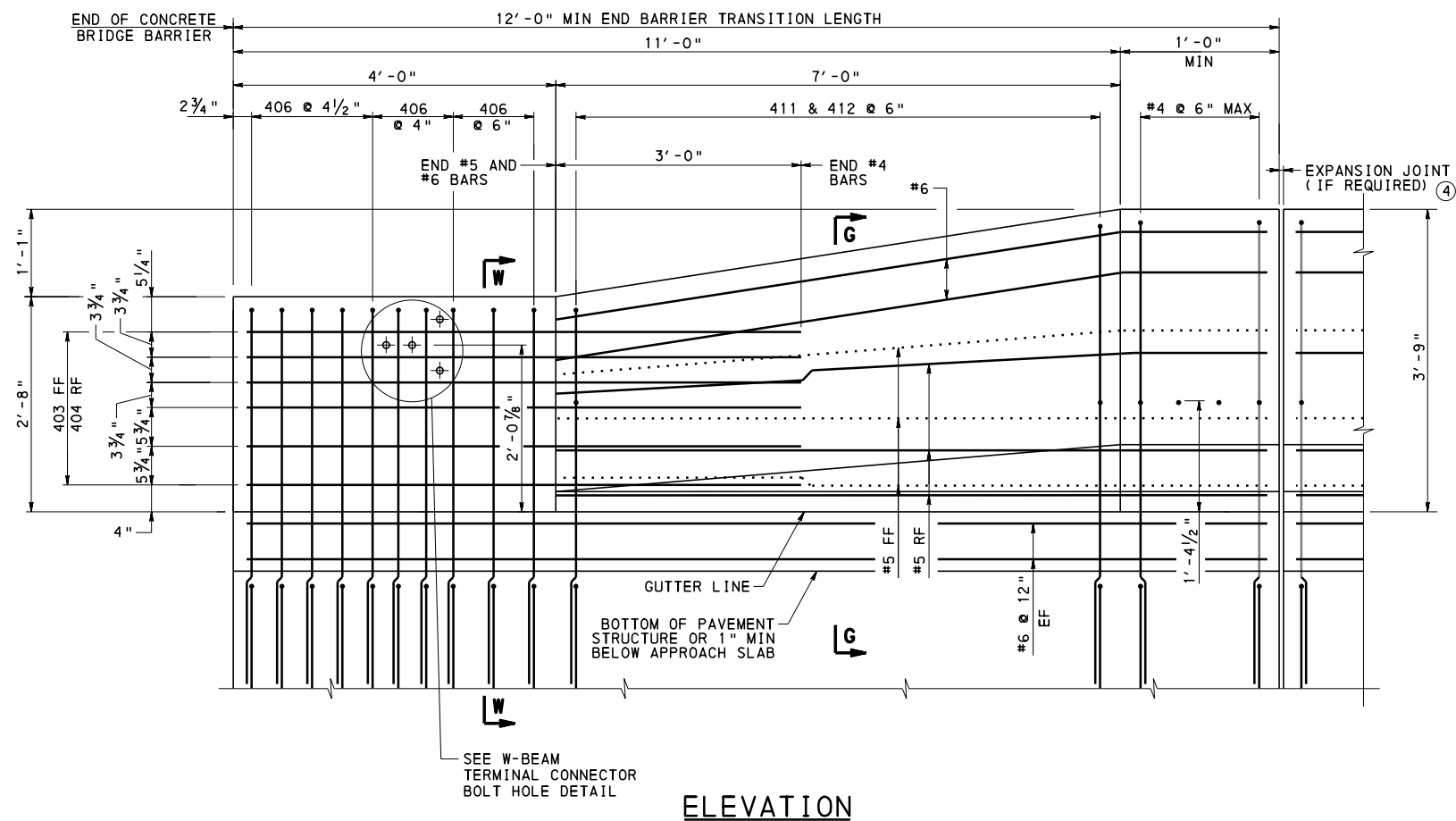
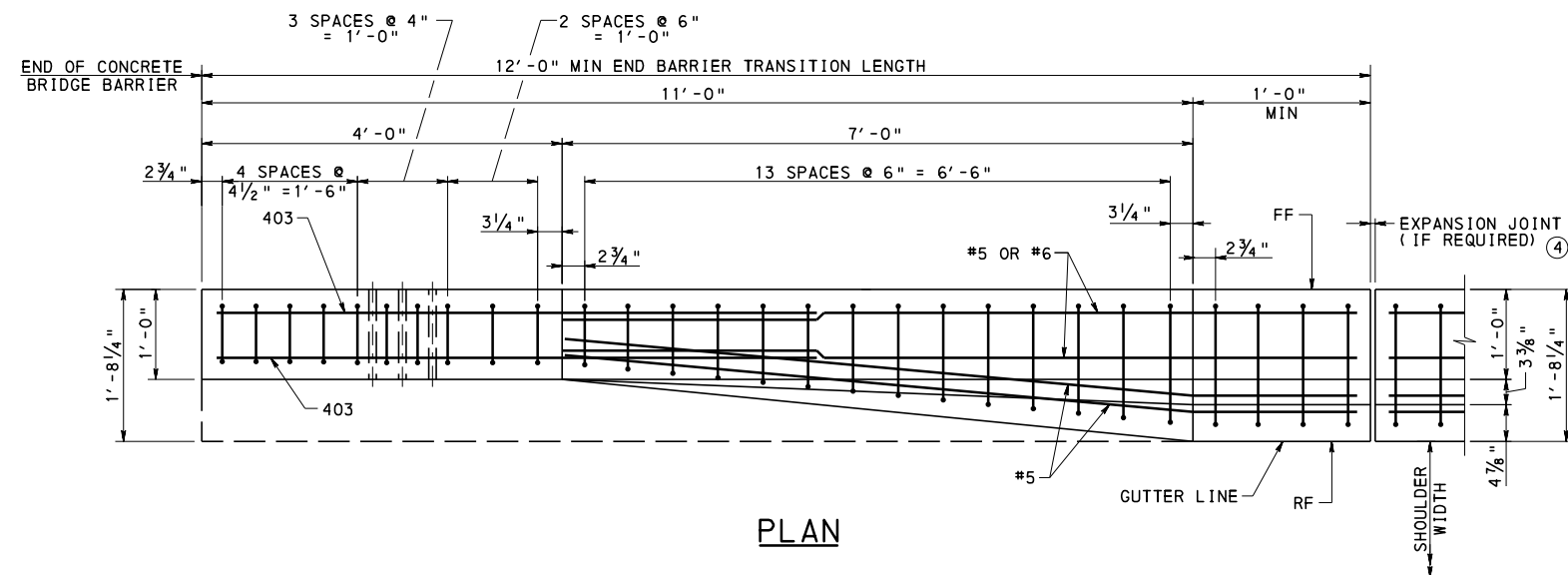
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC ABUTMENTS WITH BACKWALL  
BRIDGE BARRIER END TRANSITION  
REINFORCEMENT DETAILS - 2

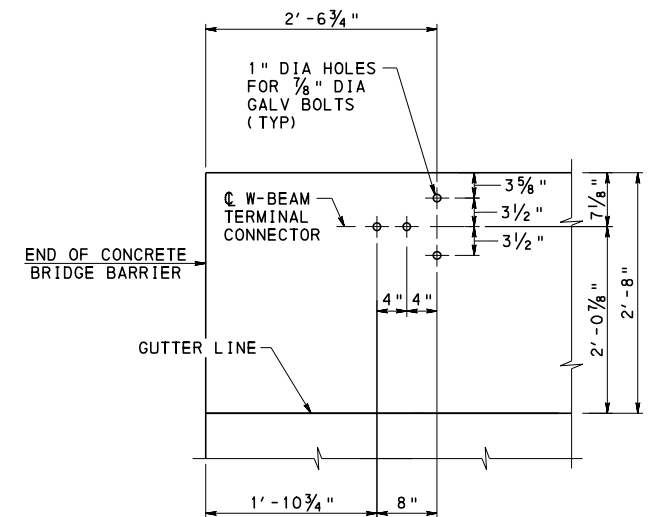
RECOMMENDED OCT. 7, 2024  
*Kevin D. Sarge*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 8 OF 13  
BD-622M



**45" F-SHAPE CONCRETE BRIDGE BARRIER TRAILING END TRANSITION  
WITH W-BEAM CONNECTION REINFORCEMENT DETAIL**



**W-BEAM  
TERMINAL CONNECTOR  
BOLT HOLE DETAIL**

**LEGEND:**

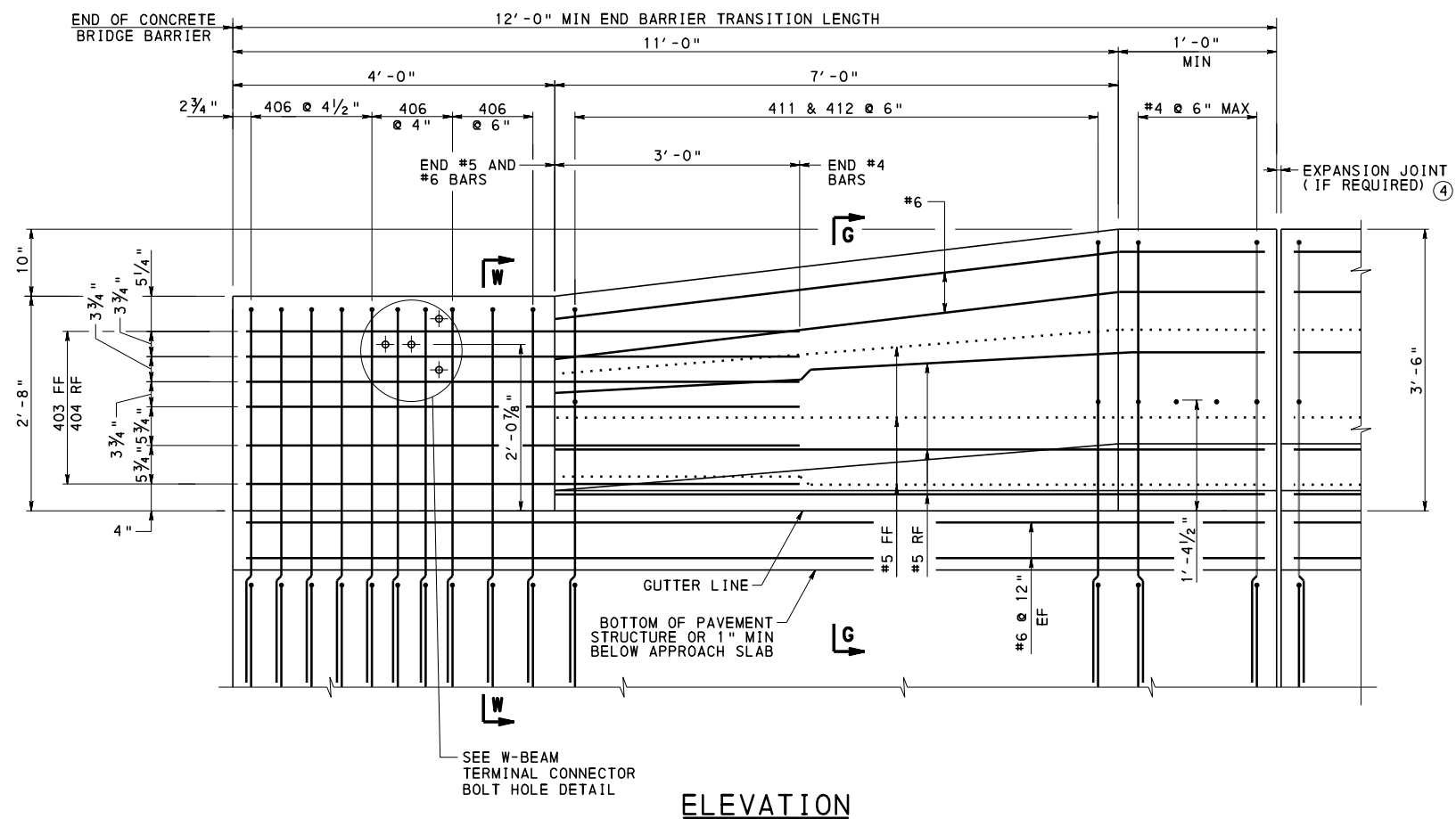
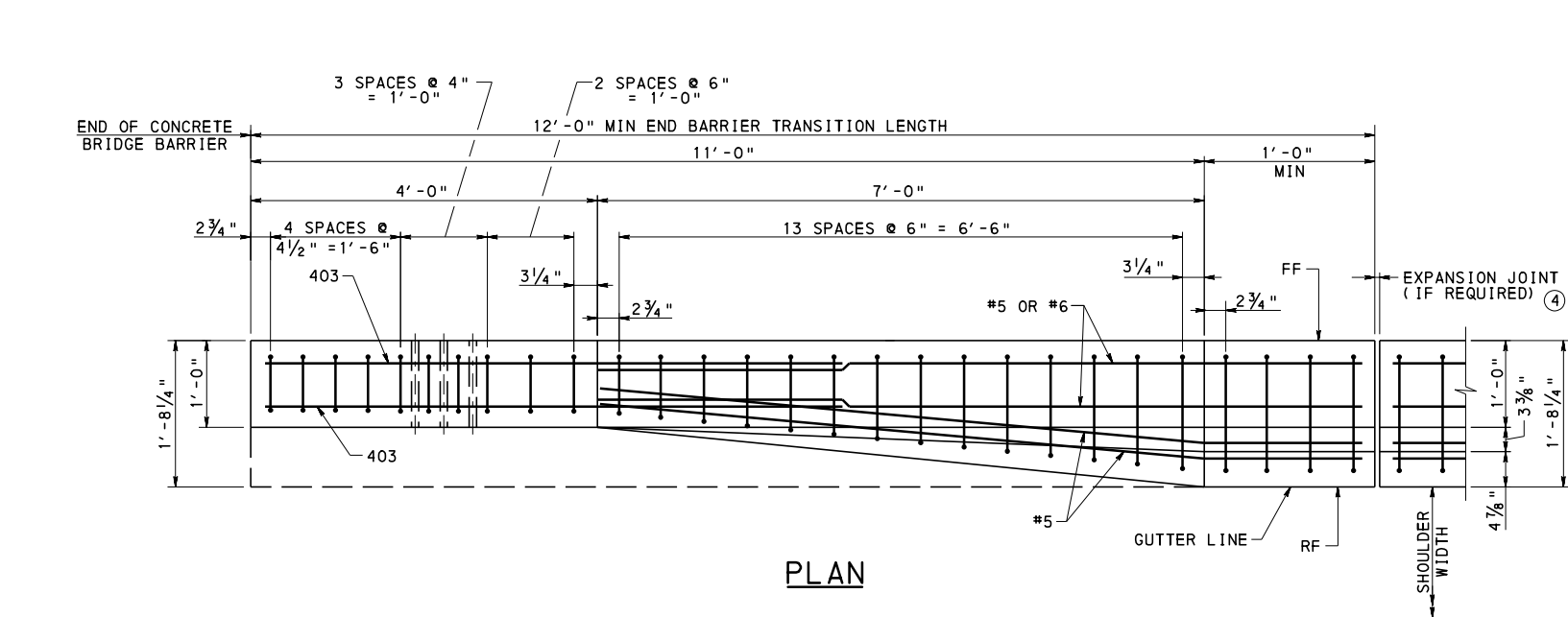
- ④ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

**NOTES:**

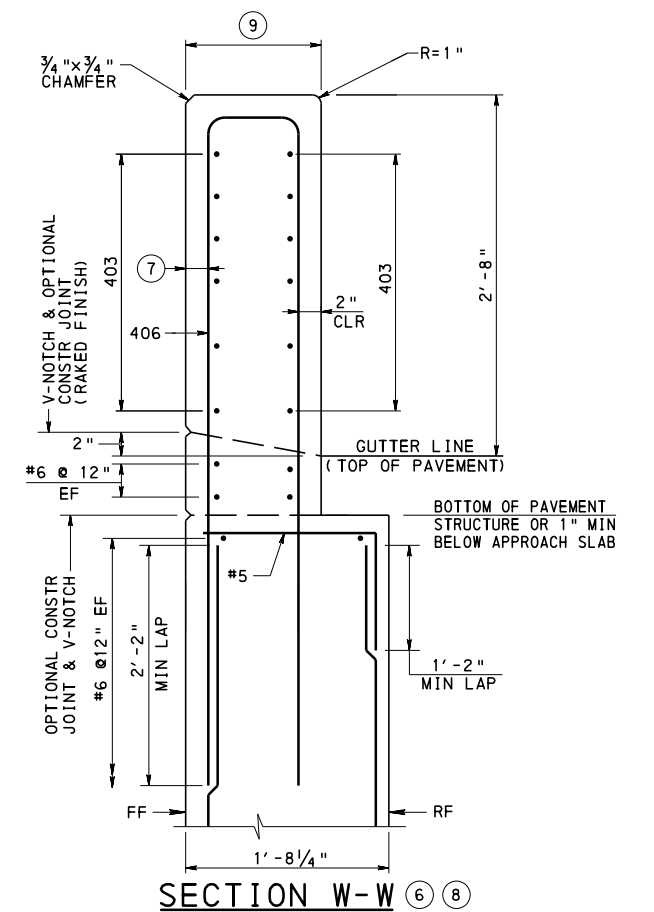
- FOR SECTION G-G, SEE SHEET 6.
- FOR SECTION W-W, SEE SHEET 10.
- FOR 406, 411 AND 412 BAR DETAILS, SEE SHEET 7.
- FOR 403 BAR DETAIL, SEE SHEET 8.

<b>COMMONWEALTH OF PENNSYLVANIA</b> <b>DEPARTMENT OF TRANSPORTATION</b> BUREAU OF BRIDGE		
STANDARD RC ABUTMENTS WITH BACKWALL BRIDGE BARRIER END TRANSITION REINFORCEMENT WITH W-BEAM CONNECTION - 1		
RECOMMENDED OCT. 7, 2024  CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024  CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 9 OF 13 BD-622M





42" F-SHAPE CONCRETE BRIDGE BARRIER TRAILING END TRANSITION  
WITH W-BEAM CONNECTION REINFORCEMENT DETAIL

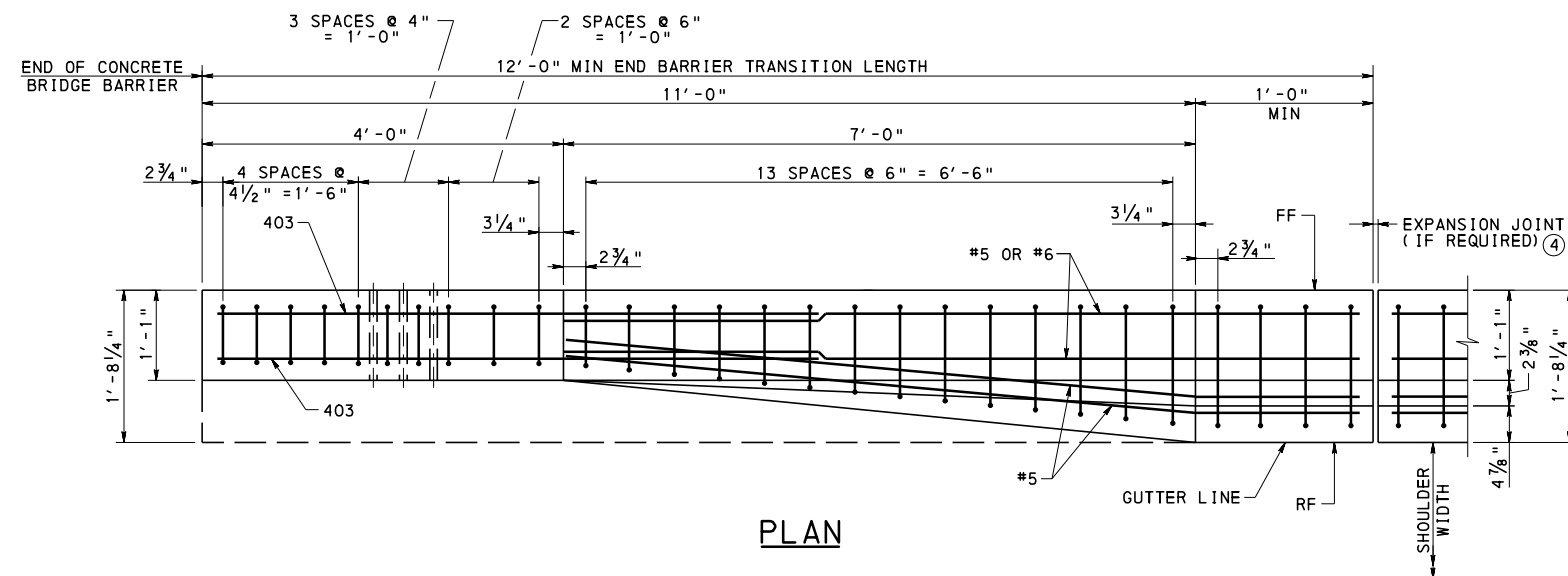


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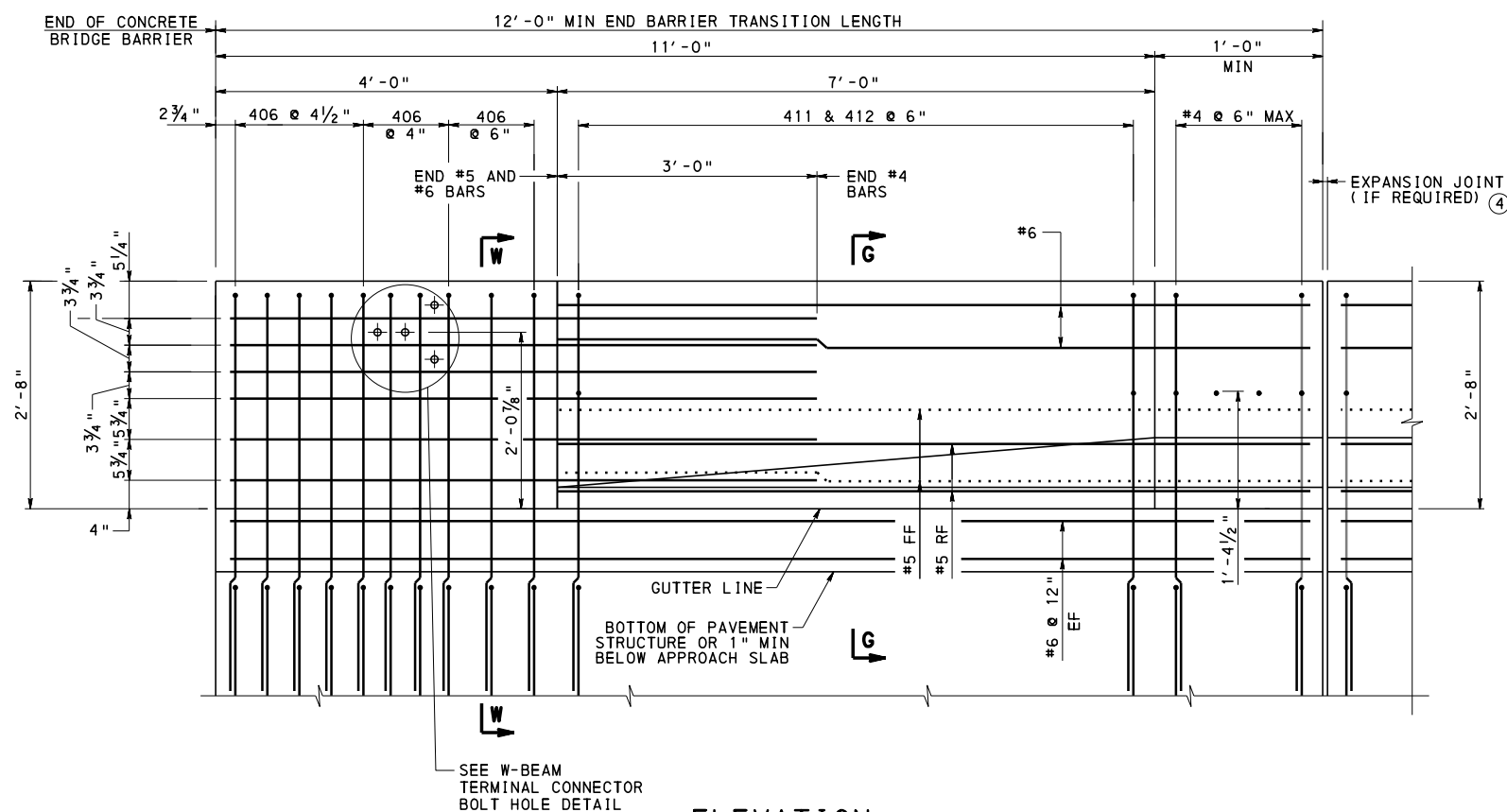
- ④ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".
- ⑥ FOR DETAILS OF THE BARRIER SUPPORT WALLS, SEE SHEET 2.
- ⑦ 2" CLR FOR SAFETY WINGS. 2 5/8" CLR FOR U-WINGS.
- ⑧ REINFORCEMENT AND INFORMATION SHOWN FOR SAFETY WING. REINFORCEMENT IN U-WING BELOW END TRANSITION IS AS REQUIRED BY DESIGN.
- ⑨ 1'-0" FOR 42" AND 45" BARRIERS. 1'-1" FOR 32" BARRIER.

# NOTES:

- 1. FOR SECTION G-G, SEE SHEET 6.
- 2. FOR W-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL, SEE SHEET 9.
- 3. FOR 406, 411 AND 412 BAR DETAILS, SEE SHEET 7.
- 4. FOR 403 BAR DETAIL, SEE SHEET 8.



PLAN



ELEVATION

**32" F-SHAPE CONCRETE BRIDGE BARRIER TRAILING END TRANSITION  
WITH W-BEAM CONNECTION REINFORCEMENT DETAIL**

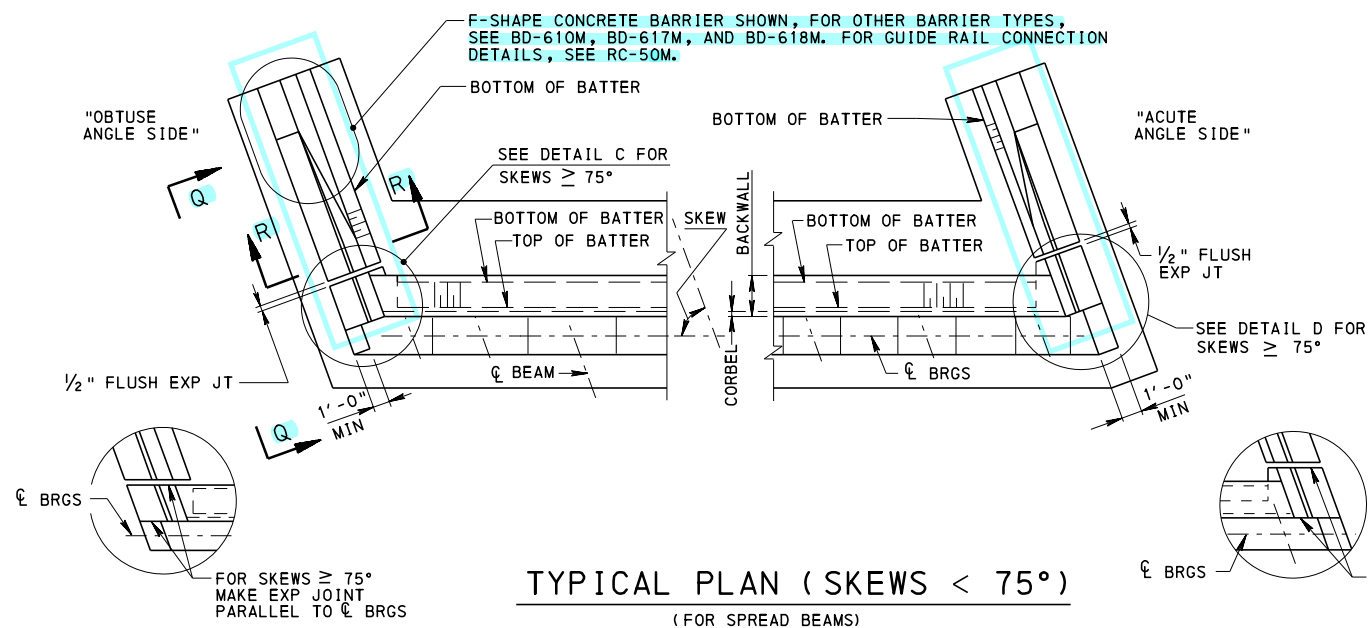
**LEGEND:**

- ④ EXPANSION JOINT AS REQUIRED. IF AN EXPANSION JOINT IS NOT PRESENT, KEEP LAP LENGTHS BEYOND END BARRIER TRANSITION FOR #5 AND #6 BARS. MINIMUM LAP FOR #5 BAR IS 3'-7", MINIMUM LAP FOR #6 BAR IS 4'-4".

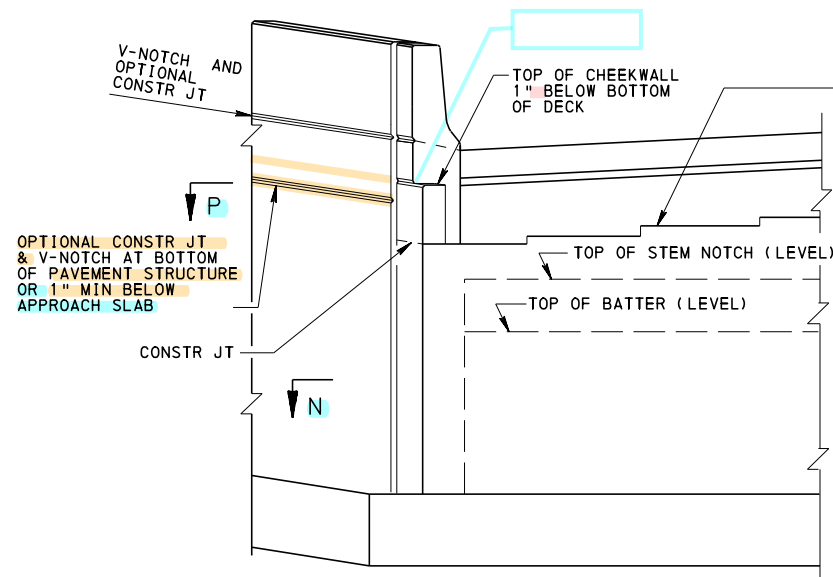
**NOTES:**

1. FOR SECTION G-G, SEE SHEET 6.
2. FOR SECTION W-W, SEE SHEET 10.
3. FOR W-BEAM TERMINAL CONNECTOR BOLT HOLE DETAIL, SEE SHEET 9.
4. FOR 406, 411 AND 412 BAR DETAILS, SEE SHEET 7.
5. FOR 403 BAR DETAIL, SEE SHEET 8.

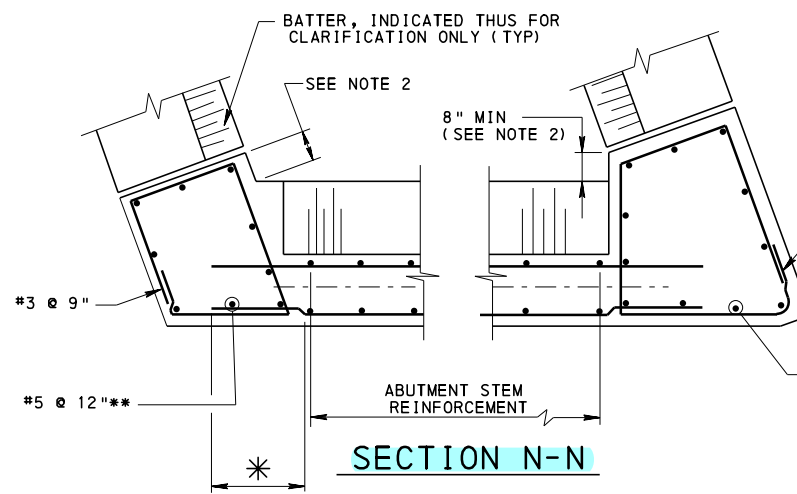
<b>COMMONWEALTH OF PENNSYLVANIA</b> <b>DEPARTMENT OF TRANSPORTATION</b> BUREAU OF BRIDGE		
STANDARD RC ABUTMENTS WITH BACKWALL BRIDGE BARRIER END TRANSITION REINFORCEMENT WITH W-BEAM CONNECTION - 3		
RECOMMENDED OCT. 7, 2024  CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024  CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 11 OF 13 BD-622M



DETAIL C



TYPICAL ELEVATION

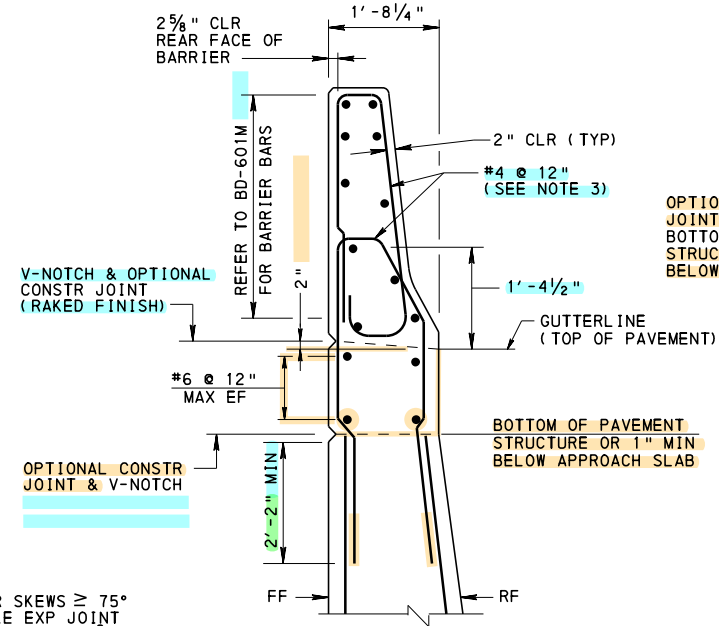


SECTION N-N

\* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP)

ABUTMENT WITH U-WINGS

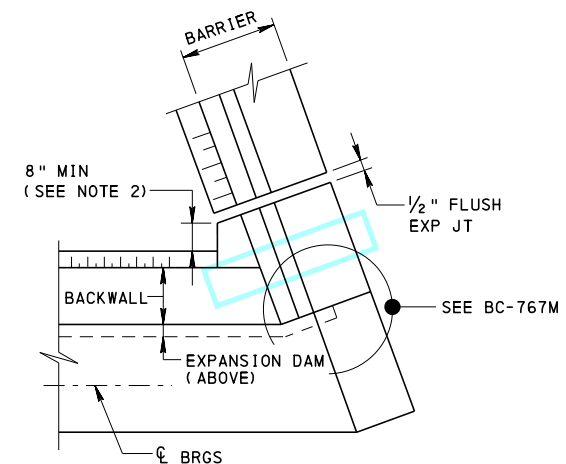
NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G, SHEET 1.



SECTION R-R

(WITH OR WITHOUT BATTER)  
45" F-SHAPE CONCRETE BARRIER SHOWN.  
32" AND 42" F-SHAPE CONCRETE BARRIER SIMILAR.

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.



TYPICAL CORNER DETAIL FOR EXPANSION DAM (SKEWS < 75°)

NOTE: ACUTE SIDE WITH 45" F-SHAPE CONCRETE BARRIER IS SHOWN FOR NEOPRENE STRIP SEAL DAM. 32" AND 42" F-SHAPE CONCRETE BARRIER AND TOOTH EXPANSION DAM ARE SIMILAR.

#### NOTES:

- LAYOUT OF CORNER DETAILS ARE SHOWN TO ACCOMMODATE TURNING OF NEOPRENE STRIP SEAL DAM AT 90° TO BARRIER. SEE TYPICAL CORNER DETAIL FOR EXPANSION DAM THIS SHEET. DETAIL IS SIMILAR FOR TOOTH EXPANSION DAM.
- EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.
- WITHIN 10'-0" ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL FOLLOW DETAILS SHOWN ON SHEETS 3-11.

#### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE

#### STANDARD

#### RC ABUTMENTS WITH BACKWALL U-WINGS LAYOUT AND DETAILS

RECOMMENDED OCT. 7, 2024

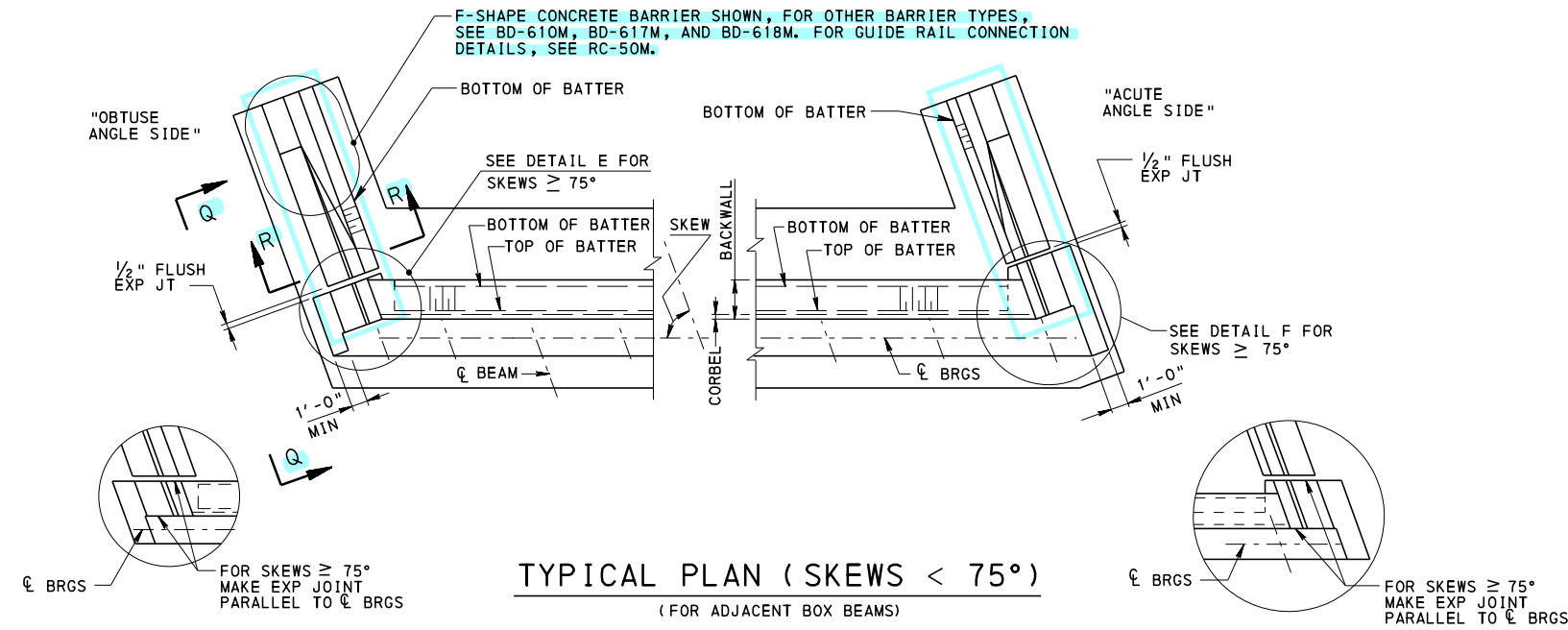
*Kevin D. Senger*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024

*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

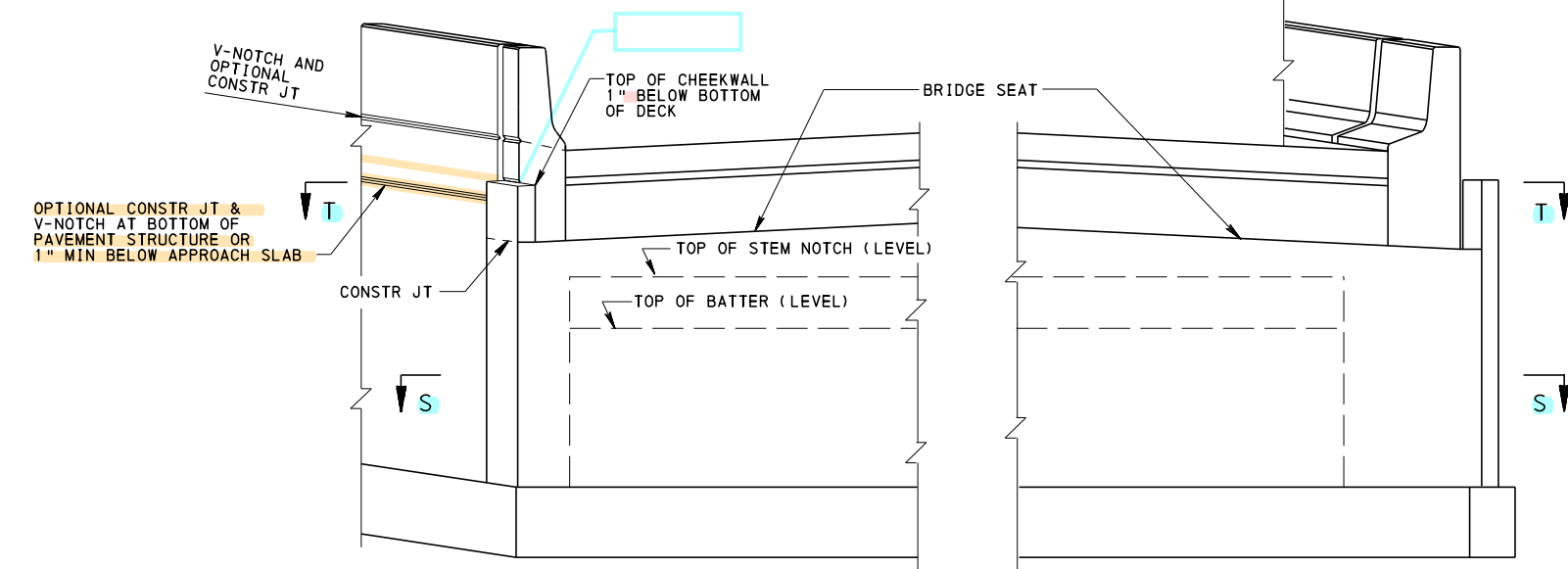
SHEET 12 OF 13

BD-622M

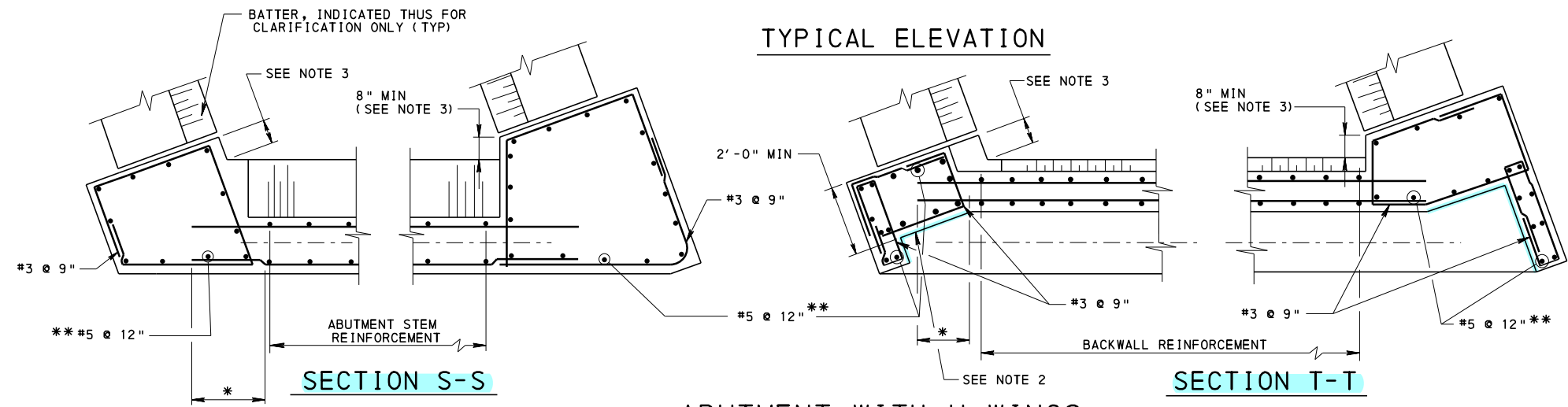


DETAIL E

DETAIL F



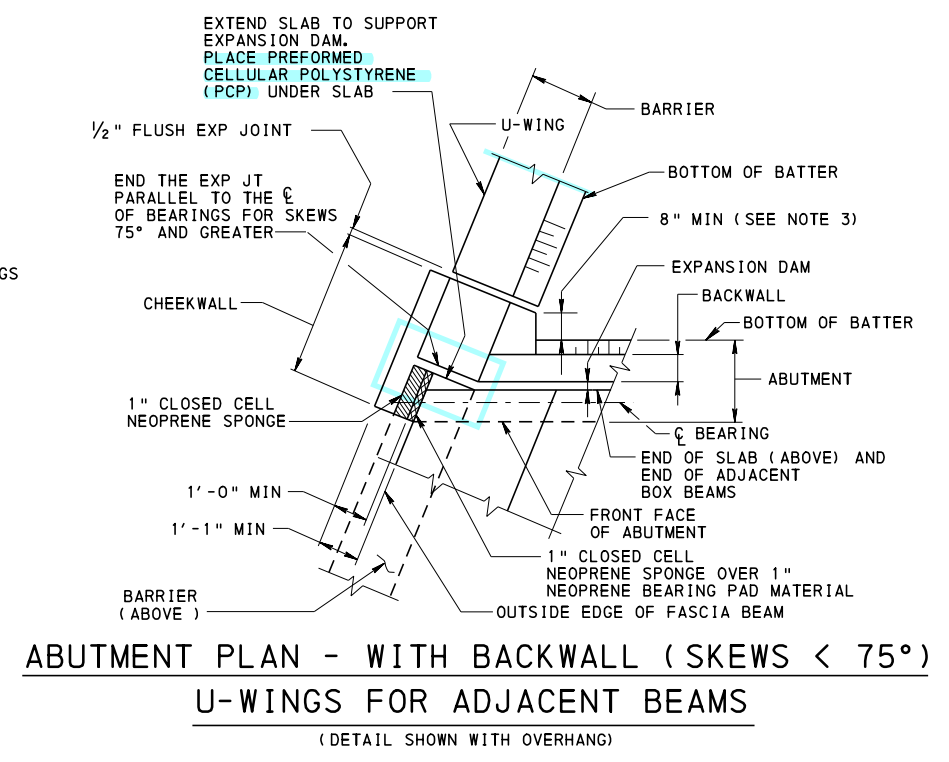
TYPICAL ELEVATION



\* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP)

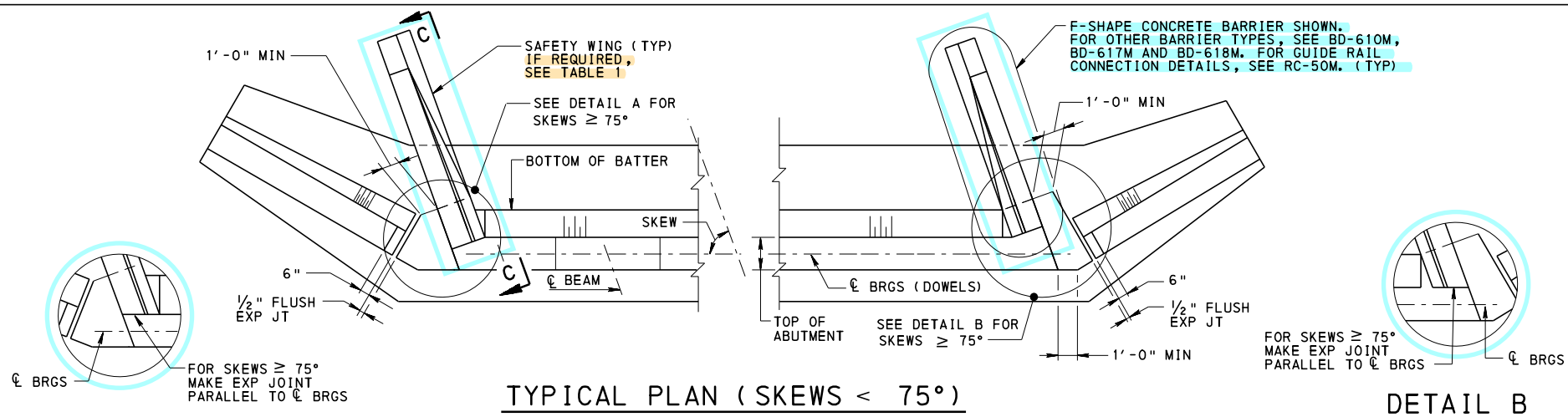
ABUTMENT WITH U-WINGS  
NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G, SHEET 1.

\*\* IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.



- NOTES:
1. FOR SECTIONS Q-Q AND R-R, SEE SHEET 12.
  2. LAYOUT OF CORNER DETAILS ARE SHOWN TO ACCOMMODATE TURNING OF NEOPRENE STRIP SEAL DAM AT 90° TO BARRIER. SEE TYPICAL CORNER DETAIL FOR EXPANSION DAM SHEET 4 FOR SKEWS < 75°. DETAIL IS SIMILAR FOR TOOTH EXPANSION DAM.
  3. EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BACK OF BACKWALL AND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD RC ABUTMENTS WITH BACKWALL U-WINGS LAYOUT AND DETAILS FOR ADJACENT BOX BEAMS		
RECOMMENDED OCT. 7, 2024 <i>Kevin D. Senger</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Glenn E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 13 OF 13 BD-622M

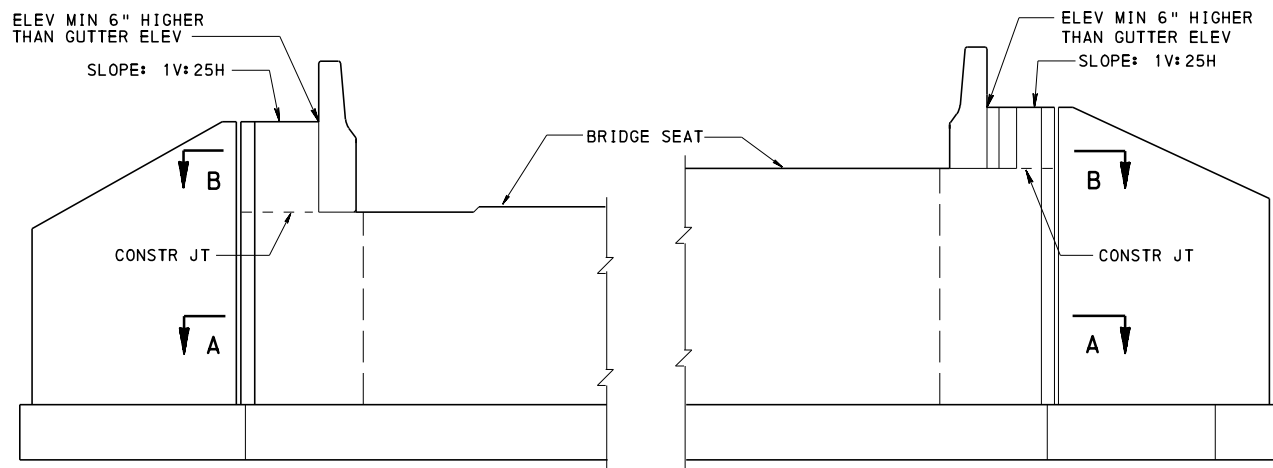


DETAIL A

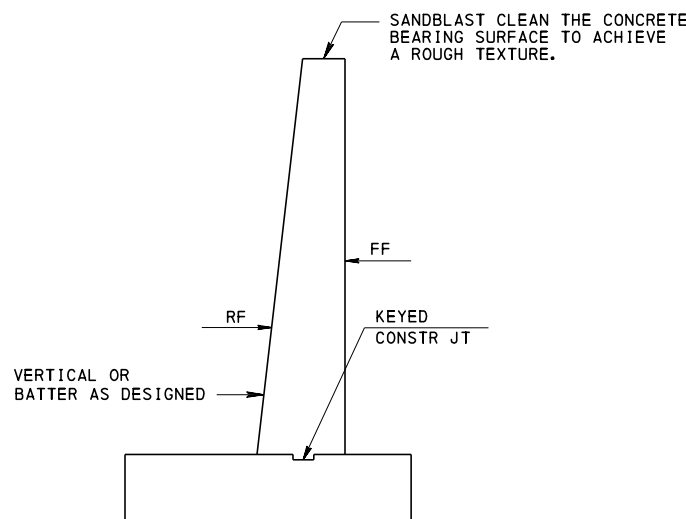
DETAIL B

GENERAL NOTES:

- FOR SECTION C-C, SEE SHEET 2.
- HOOKS ON BARS EXTENDING FROM SAFETY WING INTO THE STEM MAY BE TURNED IN ANY DIRECTION.
- SAFETY WINGS ARE NOT NEEDED WHEN USING APPROACH SLAB TYPES 1 - 4 (SEE BD-628M).
- ON UNDIVIDED HIGHWAYS WITH TWO-WAY TRAFFIC, PROVIDE END TRANSITIONS THAT CONNECT TO A THREE-BEAM GUIDE RAIL.
- ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS, PROVIDE APPROACH END TRANSITIONS THAT CONNECT TO A THREE-BEAM GUIDE RAIL AND PROVIDE TRAILING END TRANSITIONS THAT CONNECT TO A W-BEAM GUIDE RAIL IF WARRANTED BY THE LENGTH OF NEED OR OTHER OBSTRUCTIONS.
- END CHAMFERS, ON THE BARRIER, ARE NOT REQUIRED ON THE TRAILING END OF THE BARRIER ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL.



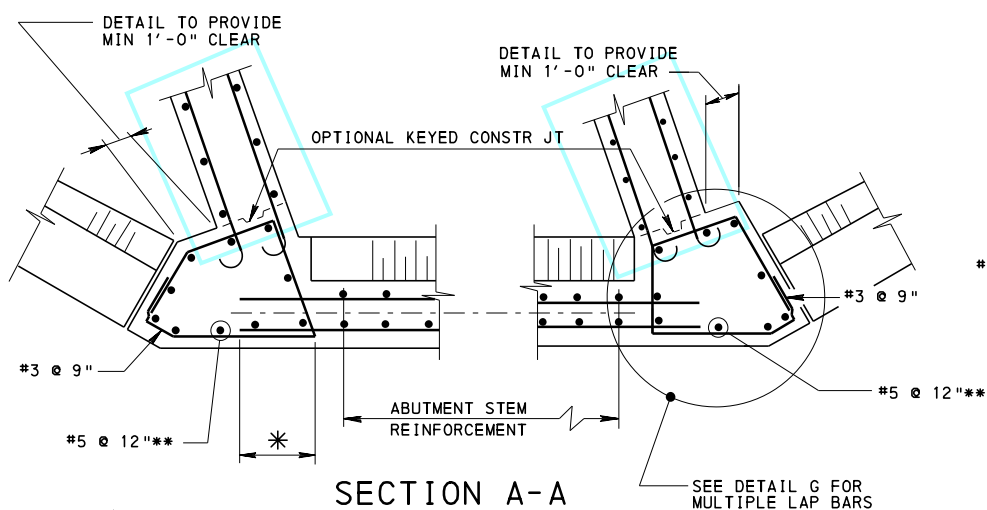
TYPICAL ELEVATION



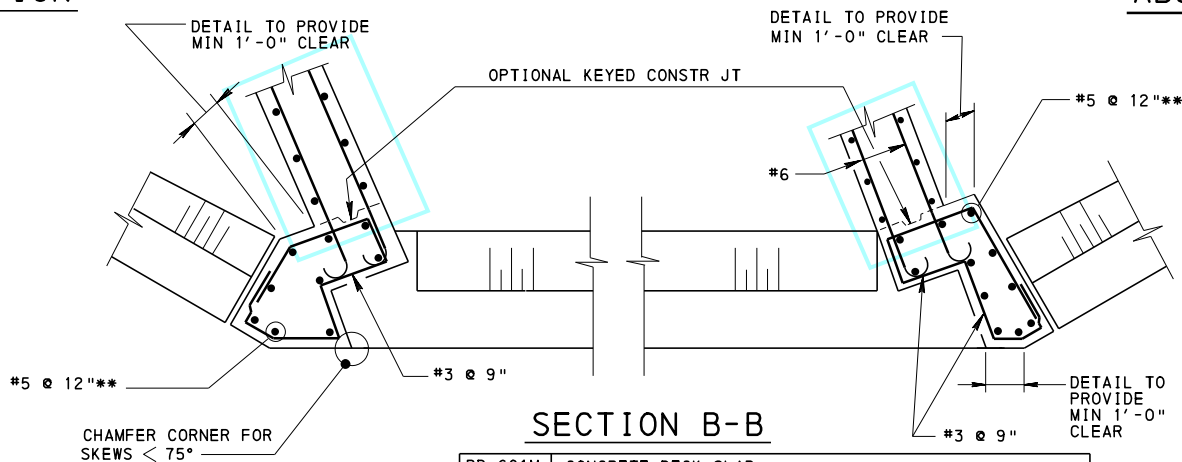
ABUTMENT SECTION

NOTE:

- NO LAPS ARE PERMITTED FOR LONGITUDINAL BARS IN SAFETY WING BELOW GUTTERLINE.



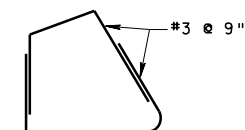
SECTION A-A



SECTION B-B

TABLE 1	
APPROACH SLAB TYPE	SAFETY WING REQUIRED?
TYPE 1-4 (BD-628M)	NO <sup>(1)</sup>
RC-23M (BRADD)	YES <sup>(2)</sup>
NONE	YES <sup>(2)</sup>

(1) BARRIERS INTEGRAL WITH APPROACH SLAB  
(2) BARRIERS SUPPORTED BY SAFETY WINGS



DETAIL G

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G.

\* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP)

\*\* IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	VERTICAL WALL CONCRETE BARRIER
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	REINFORCED CONCRETE ABUTMENTS WITH BACKWALL
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	ABUTMENT DETAILS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-51M	TYPE 31 STRONG POST GUIDE RAIL

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

RC ABUTMENTS WITHOUT BACKWALL

FLARED WINGS  
LAYOUT AND DETAILS

RECOMMENDED OCT. 7, 2024

*Kevin J. Senger*  
CHIEF BRIDGE ENGINEER

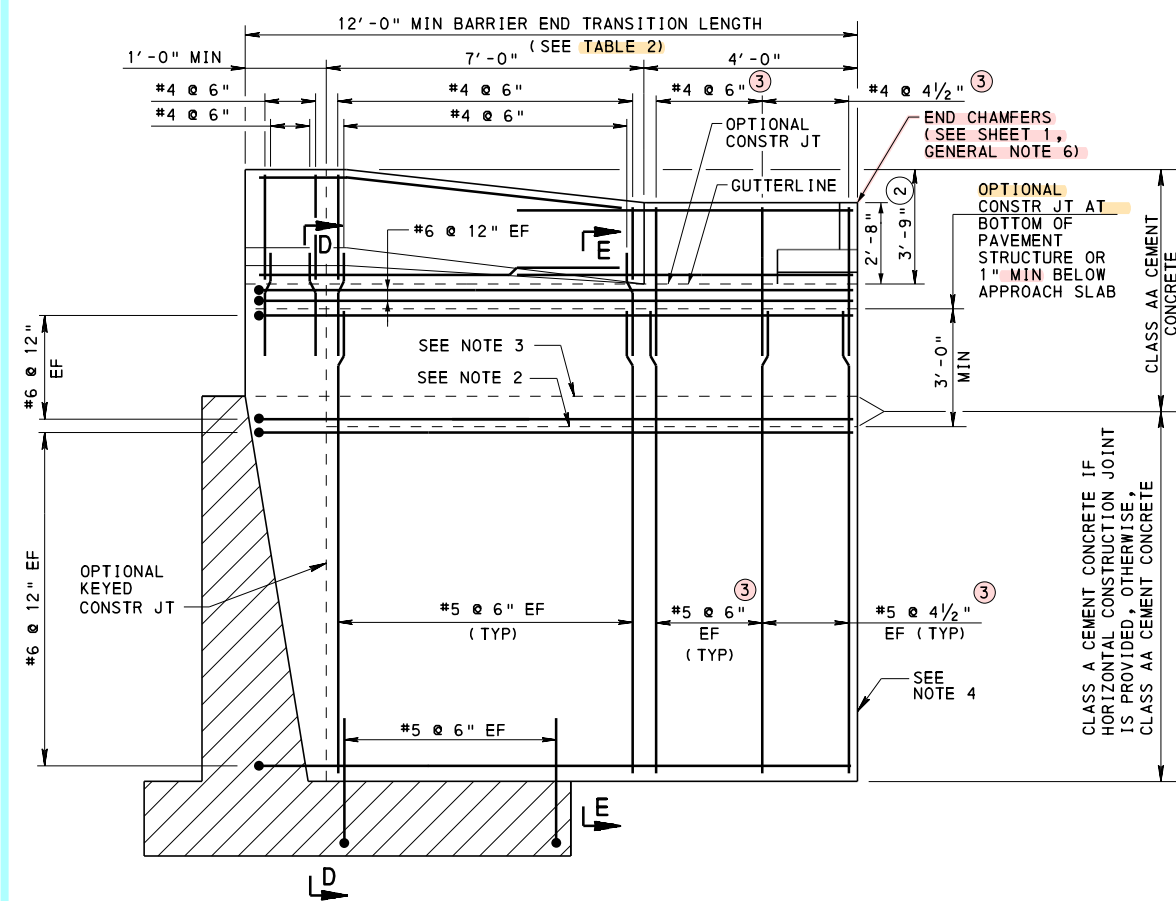
RECOMMENDED OCT. 7, 2024

*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

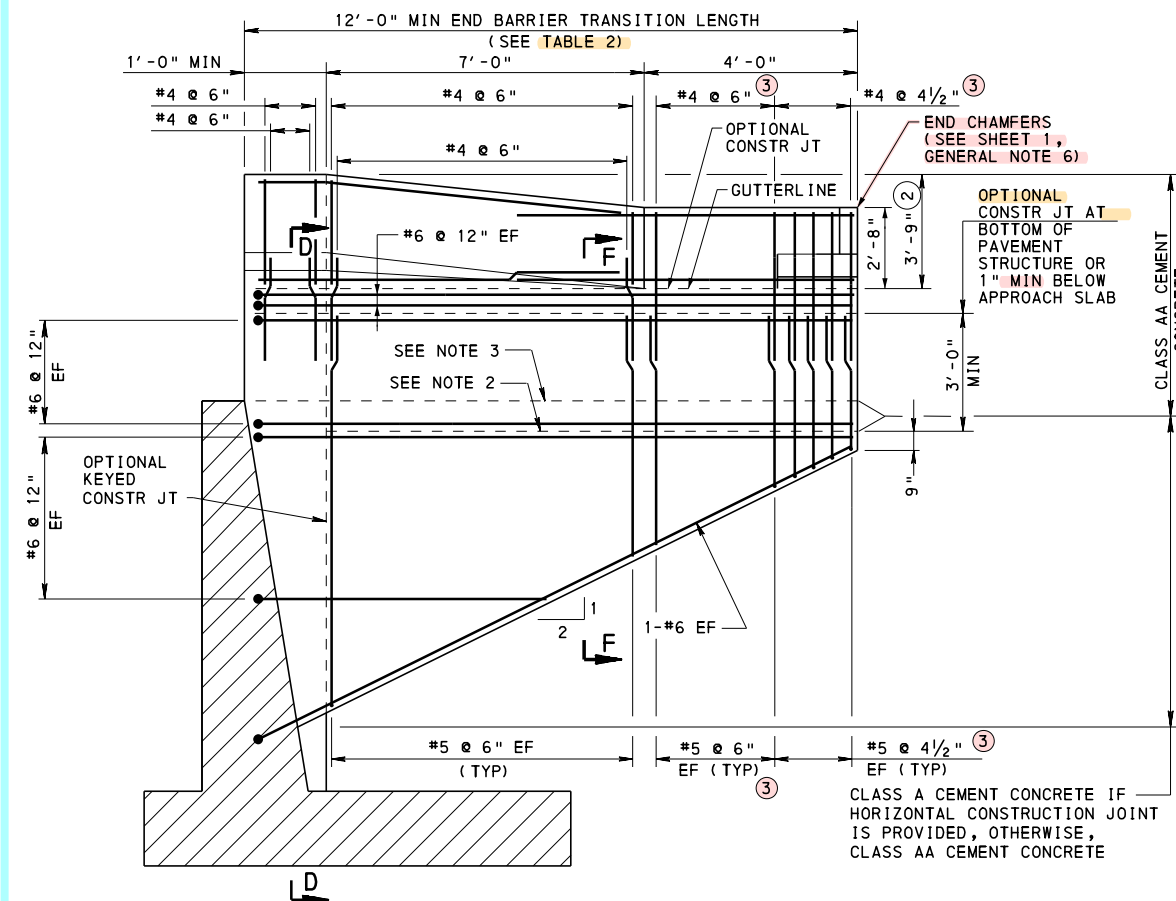
SHEET 1 OF 4

BD-624M

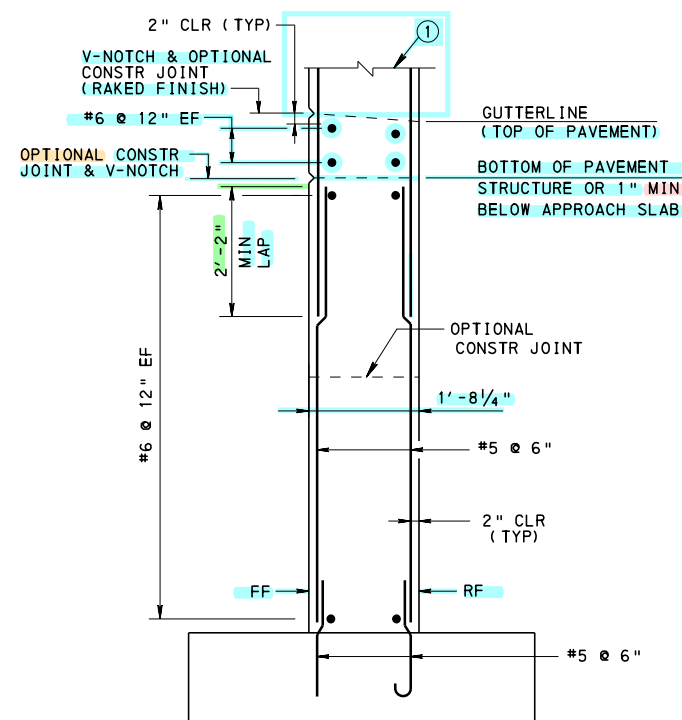




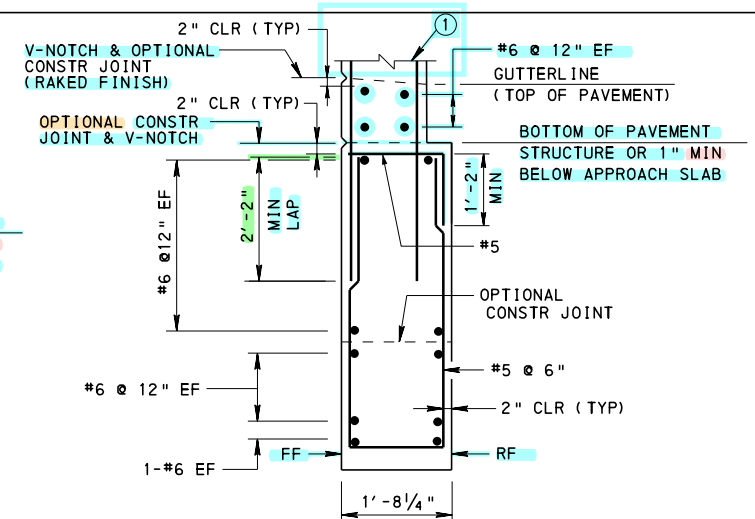
SECTION C-C ①



ALTERNATE SECTION C-C ①



SECTION D-D



SECTION F-F

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 1.
2. OPTIONAL CONSTRUCTION JOINT LOCATED 3'-0" MINIMUM FROM BOTTOM OF DECK FOR BEAM DEPTHS LESS THAN 2'-1".
3. OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 2'-1".
4. DENOTES PREFERRED CONFIGURATION OF BARRIER WALL ON FOOTING FOR ABUTMENT STEM HEIGHTS MEASURED FROM TOP OF FOOTING TO TOP OF BEAM SEAT LESS THAN 30'-0". ALTERNATE CONFIGURATIONS OF BARRIER WALLS ON FOOTINGS CAN BE USED ONLY WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
5. IF FILL HEIGHTS ON BOTH SIDES OF THE SAFETY WING WALL CAN NOT BE MAINTAINED WITHIN 5'-0", OF EACH OTHER, THEN ALL REINFORCEMENT BARS MUST BE DESIGNED.

LEGEND:

- ① SEE BD-622M, SHEETS 3-11 FOR DETAILS OF THE F-SHAPE BARRIER END SECTIONS ABOVE THE GUTTERLINE. SEE BD-610M, BD-617M AND BD-618M FOR REINFORCEMENT DETAILS FOR THE PA BRIDGE BARRIER, TYPE 10M BRIDGE BARRIER AND VERTICAL WALL CONCRETE BARRIER.
- ② 45" F-SHAPE CONCRETE BARRIER SHOWN. 32" & 42" F-SHAPE CONCRETE BARRIER SIMILAR.
- ③ BAR SPACING SHOWN FOR CONNECTION OF A THREE-BEAM TERMINAL CONNECTOR. ADJUST BAR SPACING FOR CONNECTION OF A W-BEAM TERMINAL CONNECTOR FOR TRAILING END ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS. SEE BD-622M, SHEETS 9-11, FOR REINFORCEMENT DETAILS FOR F-SHAPE BARRIERS. SEE OTHER STANDARDS FOR OTHER BARRIER TYPES.

TABLE 2

BARRIER TYPE	MINIMUM BARRIER END TRANSITION LENGTH
32", 42", 45" F-SHAPE CONCRETE BARRIER	12'-0"
32" VERTICAL WALL CONCRETE BARRIER	7'-0"
42" VERTICAL WALL CONCRETE BARRIER	10'-0"
PA BRIDGE BARRIER	9'-0"
PA TYPE 10M BRIDGE BARRIER	9'-0"

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD

RC ABUTMENTS WITHOUT BACKWALL  
SAFETY WING DETAILS

RECOMMENDED OCT. 7, 2024

*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024

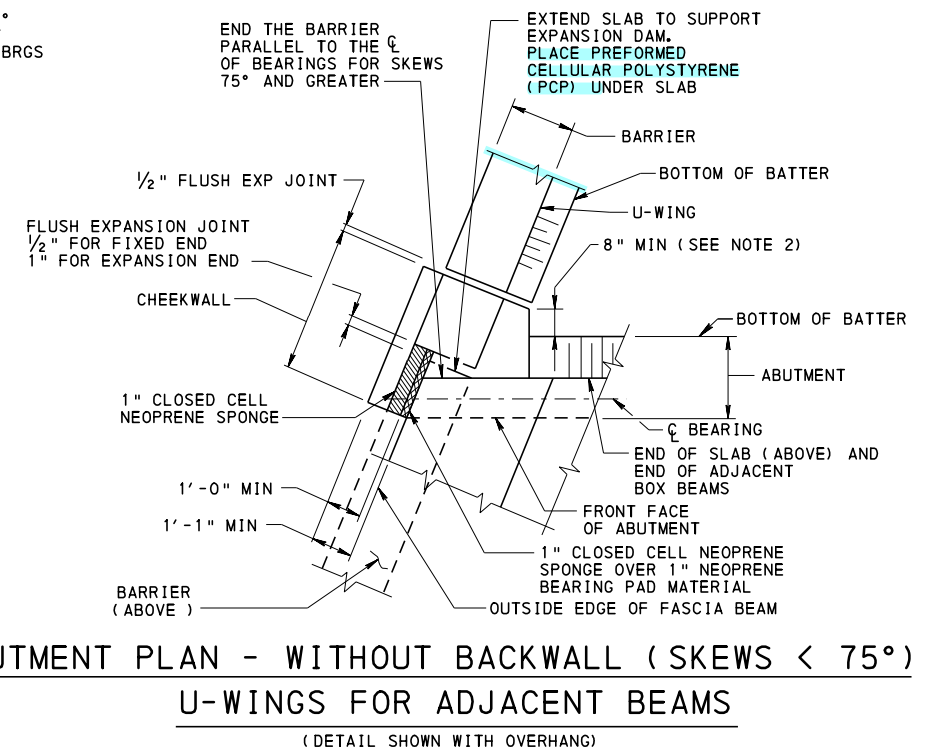
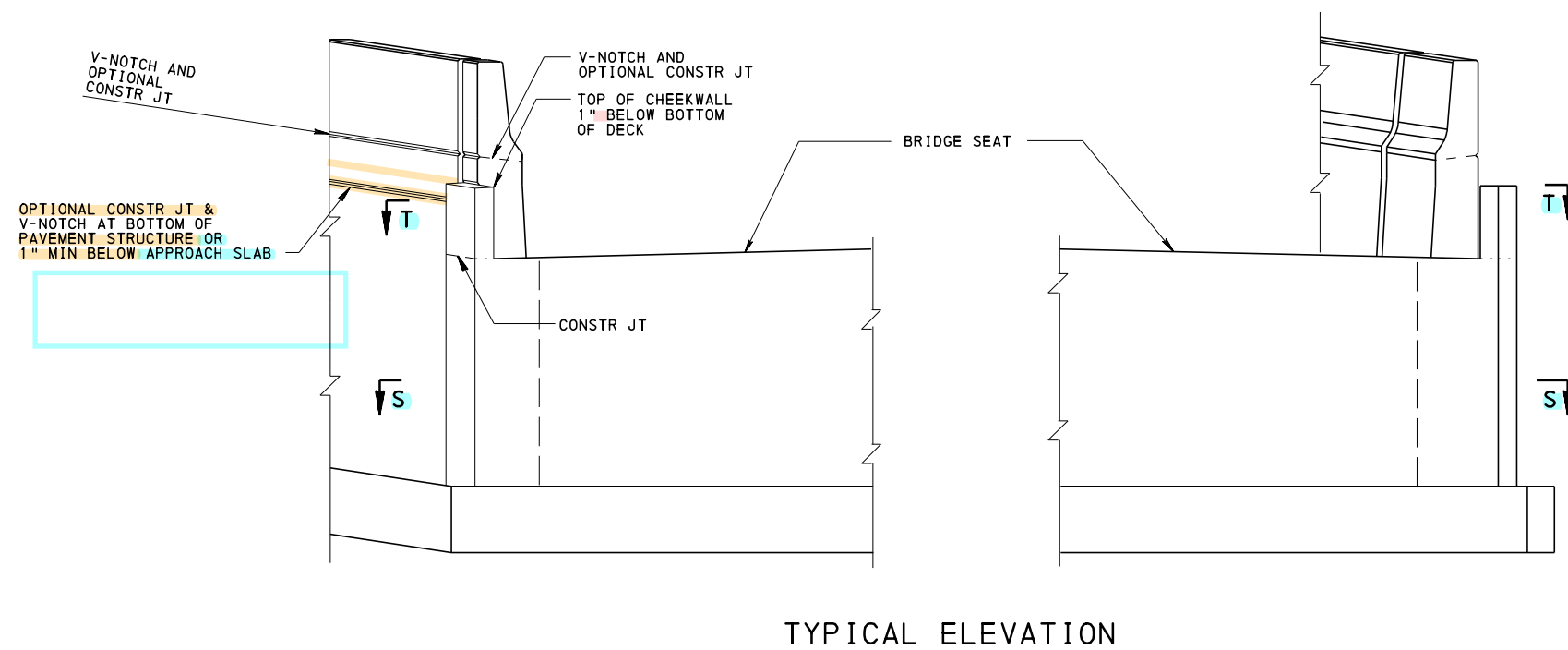
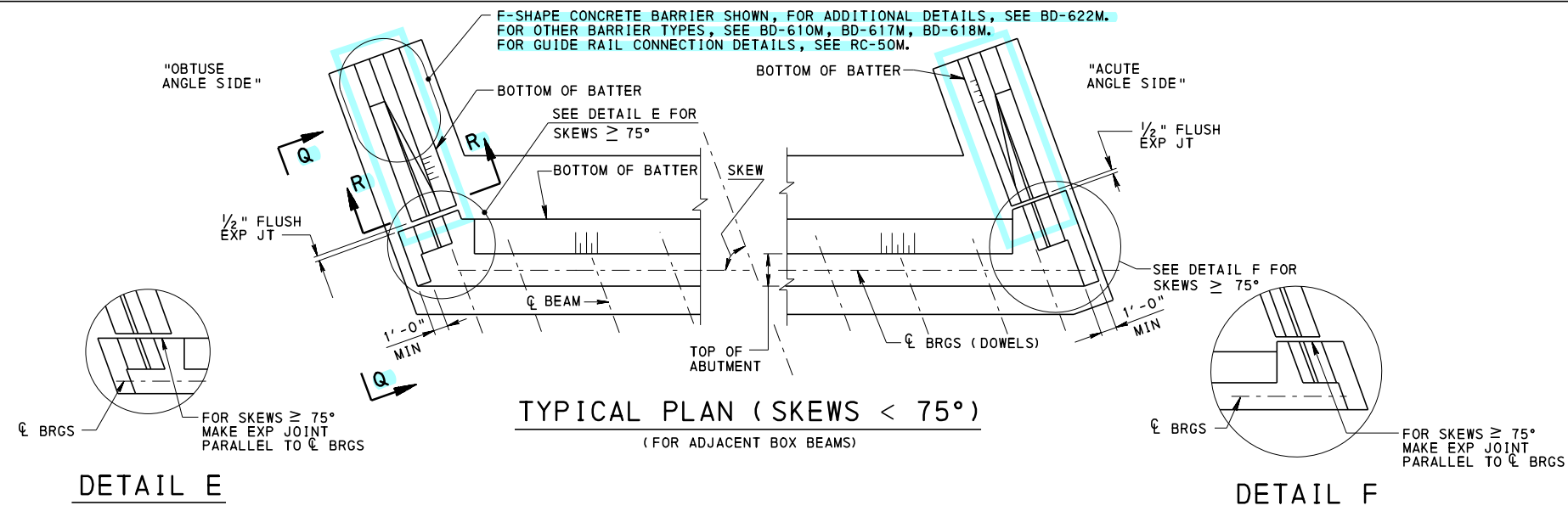
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 4

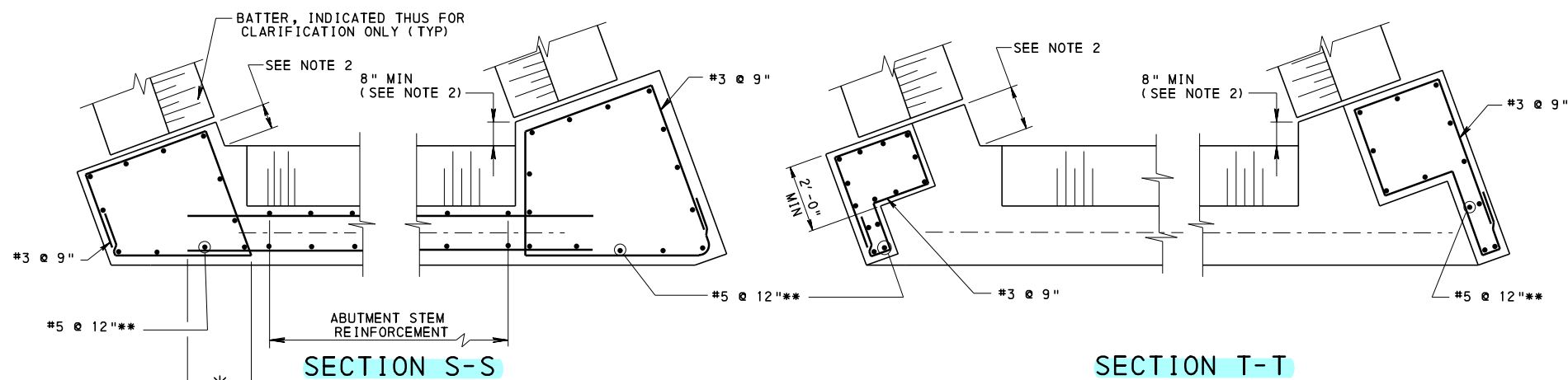
BD-624M







- NOTES:**
- FOR SECTION Q-Q AND R-R, SEE SHEET 3.
  - EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.



\* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP)

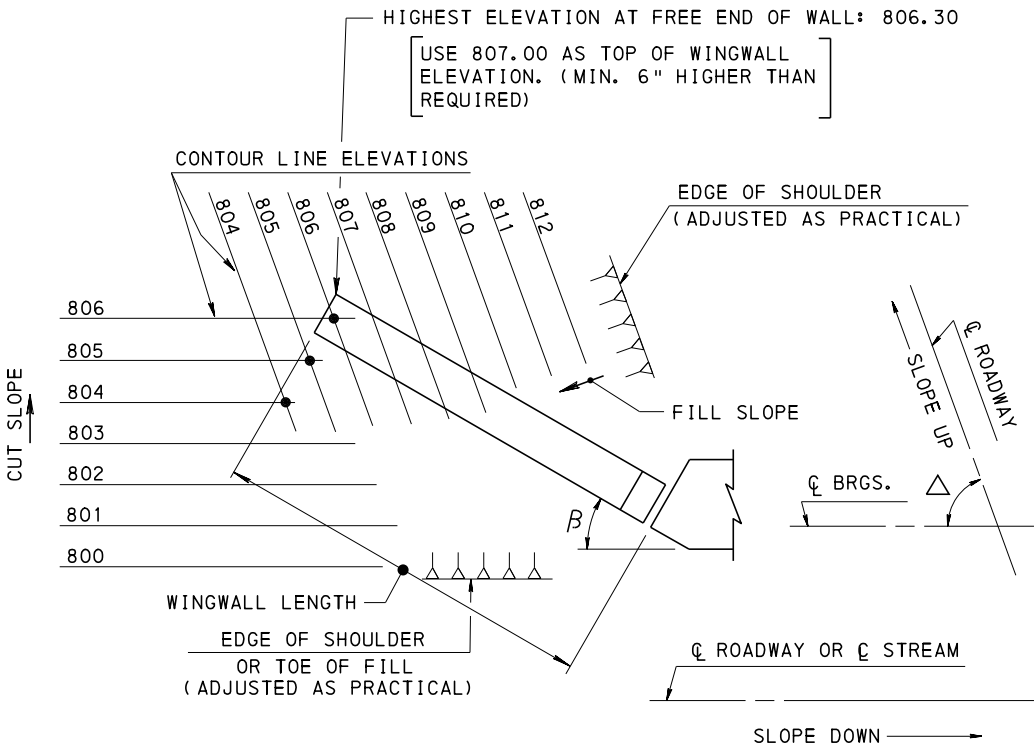
**ABUTMENT WITH U-WINGS**

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE BARS WITH LAPS. SEE DETAIL G, SHEET 1.

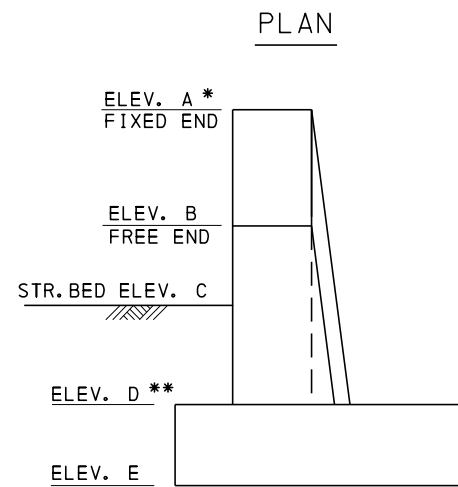
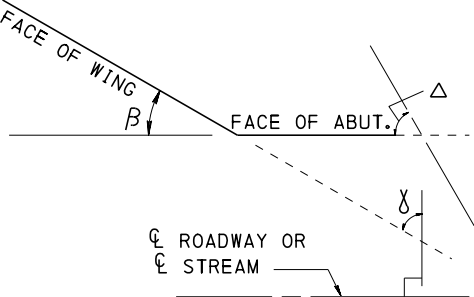
\*\* IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE		
STANDARD		
RC ABUTMENTS WITHOUT BACKWALL		
U-WINGS LAYOUT AND DETAILS FOR ADJACENT BOX BEAMS		
RECOMMENDED OCT. 7, 2024 <i>Kevin D. Senger</i> CHIEF BRIDGE ENGINEER	RECOMMENDED OCT. 7, 2024 <i>Glenn E. Gray</i> CHIEF ENGINEER, HIGHWAY ADMIN.	SHEET 4 OF 4 BD-624M

IN GENERAL, PROVIDE WINGWALLS OF SUFFICIENT LENGTH TO RETAIN THE ROADWAY EMBANKMENT TO THE REQUIRED EXTENT AND TO FURNISH PROTECTION AGAINST EROSION. COMPUTE WINGWALL LENGTHS USING THE ACTUAL CONDITION AT THE SITE. THE FOLLOWING METHOD IS PROPOSED TO COMPUTE THE REQUIRED LENGTHS.



LENGTH OF WINGWALL  
SCHEME A



TYPICAL SECTION

GIVEN:

BRIDGE SKEW ( $\Delta$ ) = \_\_\_\_\_'; ANGLE BETWEEN FRONT FACE OF WING & FRONT FACE OF ABUTMENT ( $\beta$ ) = \_\_\_\_\_';

ANGLE BETWEEN PERPENDICULAR TO ROADWAY CENTERLINE & FRONT FACE OF WING ( $\gamma$ ) = \_\_\_\_\_';

FIND WING LENGTH:

ELEV. A\* - ELEV. C =  $\frac{\text{WING LENGTH} \times \sin(\beta)}{\text{CUT SLOPE}} + \frac{\text{WING LENGTH} \times \cos(\gamma)}{\text{FILL SLOPE}}$

( ) = W.L. ( ) + W.L. ( )

W.L. ( ) = \_\_\_\_\_

W.L. = \_\_\_\_\_ CALL \_\_\_\_\_  
( FOR 'U' WINGS ADD 3' TO THE COMPUTED LENGTH. )

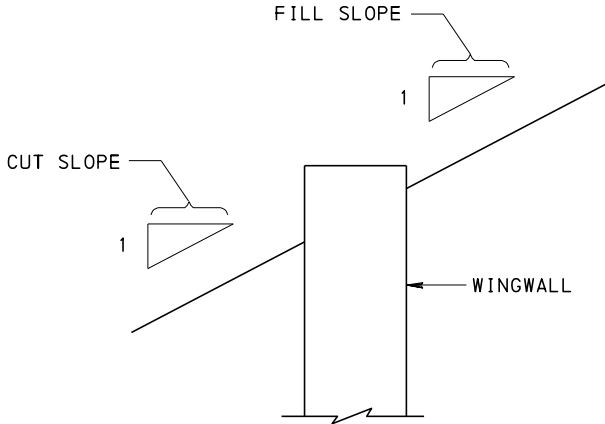
FIND ELEV. B :

ELEV. B = ELEV. A -  $\frac{\text{WING LENGTH} \times \cos(\gamma)}{\text{FILL SLOPE}}$  = \_\_\_\_\_ - \_\_\_\_\_ x \_\_\_\_\_

HENCE ELEV. B = \_\_\_\_\_

\* SUBTRACT 6" TO COMPUTE WING LENGTH ONLY.  
\*\* [ELEV. C - ELEV. D] = 12" + STREAMBED SLOPE x  $\cos(\beta)$  OR MORE ON OUTLET END ONLY.

LENGTH OF WINGWALL  
SCHEME B



SLOPE DEFINITIONS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
WINGWALL LENGTH

RC-12M BACKFILL AT STRUCTURES  
REFERENCE DRAWINGS

RECOMMENDED APR. 29, 2016  
RECOMMENDED APR. 29, 2016  
CHIEF BRIDGE ENGINEER  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 1  
BD-625M



CHANGE 2

GENERAL NOTES  
(FOR CONTRACT DRAWINGS)

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS PUBLICATION 408, AASHTO/AWS D1.5 BRIDGE WELDING CODE AND THE SPECIAL PROVISIONS.

2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.

3. USE CLASS A CEMENT CONCRETE FOR CONCRETE EMBEDMENT, CAST-IN-PLACE CONCRETE, LAGGING, WALLS, AND CORBELS.

4. FOR PRECAST CONCRETE LAGGING FOLLOW SECTION 714 OF PUB 408 AND USE 4000 PSI CONCRETE. CHAMFER EXPOSED CONCRETE EDGES 3/4" x 3/4" WHERE NOTED.

5. PROVIDE GRADE 60 REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706. DO NOT WELD GRADE 60 REINFORCING BARS UNLESS SPECIFIED. GRADE 40 REINFORCING STEEL BARS MAY BE SUBSTITUTED WITH A PROPORTIONAL INCREASE IN CROSS-SECTIONAL AREA IF APPROVED BY THE CHIEF BRIDGE ENGINEER. DO NOT USE RAIL STEEL ASTM A 996 WHERE BENDING OR WELDING OF THE REINFORCEMENT BARS IS INDICATED.

6. PROVIDE STRUCTURAL STEEL CONFORMING TO AASHTO M270 (ASTM A709) GRADE 36 OR 50. PIPE CONFORMING TO API GRADE N-80 OR ASTM A53 MAY BE USED AS PERMANENT CASING.

7. PROVIDE WELDED STUD SHEAR CONNECTORS MANUFACTURED FROM STEEL CONFORMING TO ASTM A108.

8. IF REQUIRED, PROVIDE PERMANENT CASING CONFORMING TO ASTM A 53 AT THE ANCHOR HEAD. API GRADE N-80 CASING WITH FLUSH JOINT THREADED CONNECTION TO ASTM A 53 PIPE MAY BE USED FOR THE REMAINDER OF THE CASING. [USE FOR LATENT ANCHOR SYSTEMS WHERE STRUCTURAL WELDS ARE REQUIRED.]

9. PROVIDE PERMANENT CASING IN THE BACKFILL WHEN CONSTRUCTING A WALL FROM THE BOTTOM UP. SPLICING OF PILES IS DISCOURAGED. IF CONDITIONS DICTATE, PROVIDE SPLICE A MINIMUM OF 5' BELOW FINISHED GROUND LINE IN FRONT OF THE WALL. USE SPLICE DETAIL IN ACCORDANCE WITH BC-757M.

10. CONTROL PILE DRIVING BY THE WAVE EQUATION ANALYSIS. DRIVE TEST PILES TO ABSOLUTE REFUSAL. THE ENGINEER SHALL VERIFY FROM THE TEST PILE DRIVING RESULTS THE CAPABILITY OF THE PILE HAMMER SELECTED BY THE CONTRACTOR. DRIVE BEARING PILES TO ABSOLUTE REFUSAL INTO THE STRATUM DEFINED BY A TIP ELEVATION WHICH IS PREDETERMINED BY THE ENGINEER FROM TEST PILES. THE STRUCTURE CONTROL ENGINEER SHALL DETERMINE THE ACCEPTABILITY OF THE BEARING PILES WHICH ATTAIN ABSOLUTE REFUSAL ABOVE THE PREDETERMINED TIP ELEVATIONS.

11. PROVIDE PILE TIP REINFORCEMENT FOR DRIVEN PILES.

12. FOR CAST-IN-PLACE WALLS DRIVE OR PLACE PILES TO WITHIN 2" IN 10' OF VERTICAL. DRIVE OR PLACE EACH PILE TO WITHIN 3" OF THE INDICATED LOCATION AT FINISHED GROUND LINE IN FRONT OF THE WALL.

13. FOR PRECAST LAGGING DRIVE OR PLACE PILES TO WITHIN 1" IN 10' OF VERTICAL, BUT DO NOT ALLOW AN OUT-OF-PLANE OFFSET OF MORE THAN 1" IN 10" WITH RESPECT TO ADJACENT PILES. DRIVE OR PLACE EACH PILE WITHIN 2" HORIZONTALLY OF THE INDICATED LOCATION AT FINISHED GROUND LINE. PROVIDE MINIMUM BEARING DISTANCE FOR PRECAST LAGGING AT EDGE OF PILE FLANGE AS INDICATED IN PRECAST CONCRETE LAGGING DETAILS. IF NECESSARY, FABRICATE PRECAST LAGGING AFTER DRIVING OR PLACING PILES TO ENSURE PROPER FIT AND BEARING DISTANCE.

14. PROVIDE ANCHOR TENDONS CONSISTING OF 7-WIRE UNCOATED STRANDS CONFORMING TO AASHTO M 203 (ASTM A 416) WITH LOW-RELAXATION WIRE CONFORMING TO ASTM A 421, GRADE 270. [FOR ANCHORS CONSISTING OF STRANDS]

15. PROVIDE ANCHOR TENDONS CONSISTING OF STEEL BARS CONFORMING TO AASHTO-M275, TYPE II.

16. FOR GROUTING ANCHORS USE NEAT CEMENT OR SAND CEMENT GROUT WITH TYPE I, II, OR III PORTLAND CEMENT CONFORMING TO AASHTO M85. [INDICATE TYPE II FOR CORROSIVE ENVIRONMENTS.] BULLETIN 15 APPROVED NONSHRINK OR EXPANSIVE ADDITIVES MAYBE USED.

17. PROVIDE NO. 57 COARSE AGGREGATE FOR STRUCTURAL BACKFILL. PLACE BACKFILL IN ACCORDANCE WITH SECTION 1001.3(c)(2)(b) OF PUB. 408.

18. FOR AS-DESIGNED PERMANENT ANCHOR WALL - THE CONTRACTOR IS RESPONSIBLE FOR THE FINAL DESIGN AND DETAILED DESIGN OF THE FOLLOWING:

• ANCHOR STRAND DESIGN

• TRUMPET DESIGN

• UNBONDED STRESSING LENGTH

• BOND LENGTH DESIGN

• STEEL CASING EMBEDMENT LENGTH [LATENT ANCHORS ONLY]

• ANCHOR HEADS

• CENTRALIZERS

• ANCHOR CORROSION PROTECTION SYSTEM

• GROUTING PROCEDURE

• TIMBER LAGGING DESIGN

• JACKING ASSEMBLY - HYDRAULIC JACK AND PUMP, STRESSING ANCHORAGE, PRESSURE GAGES/LOAD CELLS, DIALS TO MEASURE MOVEMENT AND JACK CHAIR

19. FOR CONTRACTOR DESIGNED PERMANENT ANCHOR WALL - THE CONTRACTOR IS RESPONSIBLE FOR THE FULL DESIGN, DETAILING, FABRICATION AND CONSTRUCTION OF THE PERMANENTLY ANCHORED WALL IN ACCORDANCE WITH THE SPECIAL PROVISION PERMANENT ANCHORED WALL.

20. PROVIDE PERFORMANCE, PROOF, AND CREEP TESTING OF ANCHORS AND INDICATE TESTING REQUIREMENTS AND RESULTS IN ACCORDANCE WITH THE SPECIAL PROVISIONS. FOR ANCHORS THAT FAIL TEST REQUIREMENTS, REPLACE ANCHORS OR MODIFY THE STRUCTURE TO MEET ALL DESIGN CODES AND REQUIREMENTS IN ACCORDANCE WITH THE SPECIAL PROVISION.

21. SUBMIT FINAL DESIGN CALCULATIONS AND DESIGN DETAILS IN ACCORDANCE WITH THE SPECIAL PROVISIONS.

22. CHAMFER EXPOSED CONCRETE EDGES 1" X 1" EXCEPT AS NOTED.

23. GALVANIZE MATERIAL IN ACCORDANCE WITH SECTION 1105.02(s) 1 OF PUB. 408. REPAIR GALVANIZED SURFACES DAMAGED DURING CONSTRUCTION IN ACCORDANCE WITH SECTION 1105.02(s) 2 OF PUB. 408.

24. REPAIR EPOXY COATED SURFACES DAMAGED DURING CONSTRUCTION IN ACCORDANCE WITH SECTION 1092.3(e) OF PUB. 408.

25. ENSURE INTIMATE CONTACT BETWEEN EXCAVATION FACE AND THE BACK FACE OF TIMBER LAGGING PRIOR TO STRESSING ANCHOR. [FOR TOP DOWN INSTALLATION]

26. GRIND AND FINISH ANCHOR OPENINGS IN DOUBLE PILES TO A SMOOTH CONDITION.

27. APPLY SHEAR STUDS TO WEBS OF DRIVEN PILES AFTER DRIVING PILES TO REFUSAL. WELD SHEAR STUDS IN ACCORDANCE WITH AASHTO/AWS D1.5 SECTIONS 7.5.5 AND 7.6.

28. WELDING SPECIFICATIONS: ANSI/AASHTO/AWS/D1.5 BRIDGE WELDING CODE AND IN ACCORDANCE WITH SECTION 1105.03(m) OF PUB. 408 AND THE SPECIAL PROVISIONS. USE QUALIFIED WELDERS IN ACCORDANCE WITH AWS D1.5 SECTION 5 PART B. FOLLOW D1.1 FOR TUBULAR (API OR ASTM A53) MATERIAL.

29. FIELD WELDING OF STEEL: USE THE SHIELDED METAL ARC PROCESS AND LOW HYDROGEN ELECTRODES WHICH ARE COMPATIBLE WITH THE BASE METAL AS SPECIFIED, AND IN ACCORDANCE WITH AN APPROVED WELD PROCEDURE SPECIFICATION.

30. DO NOT WELD WHEN SURFACES TO BE WELDED ARE MOIST OR EXPOSED TO RAIN, SNOW OR WIND, OR WHEN WELDERS ARE EXPOSED TO INCLEMENT CONDITIONS THAT WILL ADVERSELY AFFECT THE QUALITY OF THE WORK.

31. DO NOT WELD OR BURN WHEN THE TEMPERATURE IS BELOW 0-DEGREES F. PREHEAT AND MAINTAIN THE TEMPERATURE OF THE METAL TO AT LEAST 70-DEGREES F WHEN THE TEMPERATURE OF THE METAL IS BETWEEN 0-DEGREES AND 30-DEGREES F DURING WELDING OR BURNING. EXTEND THE AREA TO BE HEATED 3 INCHES BEYOND THE WELD IN ALL DIRECTIONS.

32. REMOVE ANY MOISTURE PRESENT AT POINT OF WELD BY APPLICATION OF HEAT. PROVIDE WINDBREAKS FOR PROTECTION FROM DIRECT WIND.

33. THOROUGHLY CLEAN ALL PORTIONS OF NEW SURFACES TO RECEIVE WELDS OF ALL FOREIGN MATTER, INCLUDING PAINT FILM, FOR A DISTANCE OF 2" FROM EACH SIDE OF THE OUTSIDE LINES OF WELD PRIOR TO PLACING THE WELD.

34. TEST INDICATED WELDS USING NON-DESTRUCTIVE METHODS IN ACCORDANCE WITH AASHTO AWS D1.5 2002 BRIDGE WELDING CODE, SECTION 6.7.

35. LAGGING MAY BE PLACED INSIDE THE REAR FLANGE, IF BLOCKED, OR INSIDE THE FRONT FLANGE.

NOTES TO DESIGNER

1. APPLICABILITY OF THIS STANDARD DRAWING:

• THIS STANDARD APPLIES TO PERMANENT ANCHORED WALLS WITH DISCRETE VERTICAL ELEMENTS.

• THIS STANDARD APPLIES TO ANCHORS BONDED IN ROCK. ANCHORS BONDED IN SOIL ARE PERMITTED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.

• THIS STANDARD APPLIES TO DISCRETE VERTICAL ELEMENTS WITH FOUNDATIONS ON OR INTO ROCK. DISCRETE VERTICAL ELEMENTS TERMINATING IN SOIL ARE PERMITTED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.

2. SOLDIER PILES MAY BE DESIGNED USING H-PILES, WIDE FLANGE BEAMS OR CONCRETE DRILLED SHAFTS. ANCHORED WALLS MAY BE DESIGNED USING STEEL SHEET PILES.

3. PROVIDE REINFORCEMENT BAR DEVELOPMENT LENGTHS AND SPLICE LENGTHS IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, AS SUPPLEMENTED BY DESIGN MANUAL PART 4.

4. PROVIDE NOT LESS THAN TWO LAYERS OF CORROSIVE PROTECTION FOR THE TENDONS BY ENCAPSULATION IN A GROUT-FILLED CORRUGATED PLASTIC OR DEFORMED STEEL SHEATH.

5. APPLY PROTECTIVE COATINGS FOR REINFORCED CONCRETE SURFACES IN ACCORDANCE WITH DESIGN MANUAL PART 4 WHERE WALL IS EXPOSED TO SALT SPRAY. SEE SECTION 1019 OF PUBLICATION 408.

6. PROVIDE EPOXY COATED REINFORCING BARS IN ACCORDANCE WITH DESIGN MANUAL 4 CONSIDERING POTENTIALLY CORROSIVE ENVIRONMENTS.

7. PROVIDE CONCRETE CAP OVER ANCHOR PLACED BELOW FINAL GRADE.

8. STEEL PILES MAY BE GRADE 50 STEEL; HOWEVER, BASE POINT BEARING CAPACITY ON NOT MORE THAN 36 KSI. DESIGNER MAY USE 50 KSI WHEN EVALUATING COMBINED BENDING AND AXIAL LOADS FOR GRADE 50 PILES.

9. SPECIFY PROTECTIVE COATINGS FOR STEEL COMPONENTS IN ACCORDANCE WITH DESIGN MANUAL PART 4 CONSIDERING POTENTIALLY CORROSIVE ENVIRONMENTS. THE FOLLOWING PROVIDES GENERAL GUIDANCE:

• STEEL ANCHORAGE FULLY ENCASED IN CONCRETE - NO ADDITIONAL PROTECTION REQ'D.

• STEEL EMBEDDED IN ROCK SOCKET / SHAFT SECTION AND ENCASED IN CONCRETE, INCLUDING LEAN CONCRETE FILL - ZINC PRIMER, GALVANIZING, OR EPOXY COATING

• EXPOSED STEEL OR STEEL ENCASED IN LEAN CONCRETE - THREE-COAT PAINT SYSTEM, GALVANIZING, OR EPOXY COATING

• DRIVEN PILES - DEDUCT 1/16" SACRIFICIAL STEEL AROUND FULL PERIMETER

• PILES IN CONTACT WITH BACKFILL - THREE-COAT PAINT SYSTEM, GALVANIZING, OR EPOXY COATING

• WHERE PROTECTIVE COATING IS REQUIRED, GALVANIZING IS PREFERRED.

PROVIDE THREE-COAT PAINT SYSTEM IN ACCORDANCE WITH SECTION 1060 OF PUB.408. PROVIDE GALVANIZING IN ACCORDANCE WITH SECTION 1105.02(s) OF PUB.408. PROVIDE EPOXY COATING IN ACCORDANCE WITH SECTION 1092 OF PUB.408.

10. DO NOT USE STEEL BARS FOR ANCHORS WITH BOTTOM UP INSTALLATION DUE TO POTENTIAL DAMAGE FROM SETTLEMENT, UNLESS APPROVED BY THE CHIEF BRIDGE ENGINEER.

11. INDICATE ON THE DESIGN DRAWINGS "ANCHOR DESIGN LOAD". USE SER-I LIMIT STATE TO DETERMINE THE ANCHOR DESIGN LOAD. THE PERFORMANCE TEST LOAD IS DEFINED AS A MULTIPLIER (1.33) TIMES THE ANCHOR DESIGN LOAD. ANCHOR DESIGN LOAD WILL NOT EXCEED 0.6 GUARANTEED ULTIMATE TENSILE STRENGTH (GUTS) AND ANCHOR PROOF TEST LOAD WILL NOT EXCEED 0.8 GUTS.

12. LOCK-OFF LOAD SHALL NOT BE LESS THAN 50% OF THE ULTIMATE TENSILE STRENGTH OF THE STRANDS. IF ADDITIONAL STRANDS ARE REQUIRED FOR REDUNDANCY, A MINIMUM OF 40% OF THE ULTIMATE TENSILE STRENGTH OF THE STRANDS MAY BE USED. IN ANY CASE, THE STRANDS AND ANCHOR ASSEMBLY (INCLUDING WEDGES) ARE CLEANED OF ANY CONTAMINANTS IMMEDIATELY BEFORE LOCK-OFF, AND THE STRANDS AND WEDGES ARE CLEANED, GREASED, AND CAPPED WITHIN 48 HOURS AFTER LOCK-OFF.

13. FOR BOTTOM UP INSTALLATION, BACKFILL UP TO A MINIMUM HEIGHT OF 4' ABOVE THE ANCHOR LOCATION, OR AS REQUIRED TO DEVELOP SUFFICIENT PASSIVE PRESSURE PRIOR, TO ANCHOR INSTALLATION AND STRESSING.

14. REQUIRE ADDITIONAL CLEAR CONCRETE COVER TO REINFORCEMENT BARS TO ACCOUNT FOR IMPRESSIONS OF AESTHETIC SURFACE TREATMENT.

15. AFTER PLACEMENT OF CEMENT CONCRETE IN CONCRETE EMBEDMENT, PLACE LEAN CEMENT CONCRETE OR FLOWABLE FILL IN REMAINDER OF DRILLED HOLE UP TO TOP OF GROUND. REMOVE LEAN CEMENT CONCRETE OR FLOWABLE FILL DURING EXCAVATION TO PLACE TIMBER LAGGING. [FOR TOP DOWN INSTALLATION] FLOWABLE FILL PER PUB 408 SECTION 220.2, TYPE A OR B.

16. DESIGN FOR THE PRESENCE OF WATER BEHIND THE WALL AS REQUIRED BY SITE CONDITIONS AND DRAINAGE. DRAINS ARE TO OUTLET AT MAXIMUM INTERVALS OF 100'.

17. IF CAST-IN-PLACE CAP BEAM IS USED, CONSTRUCT THE CAP BEAM AFTER LOCK OFF OF ANCHORS.

18. IF PRECAST LAGGING IS USED, LOCK OFF ANCHORS PRIOR TO INSTALLATION.

19. UNLESS SPECIFICALLY REQUIRED TO ADDRESS DRAINAGE NEEDS FOR SPECIFIC SITE CONDITIONS AVOID PLACEMENT OF INLETS, UTILITY HOLES, AND DRAINAGE FACILITIES IN THE BACKFILL OF THE ANCHORED WALL TO AVOID DAMAGE TO ANCHORS DUE TO INSTALLATION OR MAINTENANCE ACTIVITIES.

20. EVALUATE ACCESSIBILITY OF DRILLING RIG TO PILE LOCATIONS. ENSURE THAT A RELATIVELY LEVEL AREA CAN BE ACCOMMODATED ADJACENT TO THE PILE LOCATIONS FOR DRILLING OPERATIONS.

21. USE REDUCED SECTION PROPERTIES AT OPENINGS FOR ANCHOR PENETRATIONS IN THE PILE SECTIONS AT ANCHOR LOCATIONS.

22. SIZE TIMBER LAGGING IN ACCORDANCE WITH CONSTRUCTION HANDBOOK FOR BRIDGE TEMPORARY WORKS BY AASHTO.

23. DESIGN CONCRETE AND REINFORCEMENT FOR A TEST LOAD OF 125% TO 150% OF UNFACTORED LOAD PER AASHTO ARTICLE 11.9.8.1 IN ADDITION TO THE STRENGTH CONDITION. FOR SINGLE PILE W/C.I.P. WALL AND COLUMN ALTERNATIVE, DESIGNER MUST EVALUATE BOTH A MINIMUM AND MAXIMUM STRUCTURAL BACKFILL DENSITY TO LIMIT WALL DEFLECTION TOWARDS BACKFILL DUE TO ANCHOR STRESSING OPERATIONS. INCLUDE STRUCTURAL BACKFILL DENSITY RANGE ON CONTRACT DRAWINGS AND SPECIAL PROVISIONS.

GENERAL ANCHOR WALL DESIGN METHODOLOGY

1. ESTABLISH PROJECT REQUIREMENTS INCLUDING ALL GEOMETRY, EXTERNAL LOADING CONDITIONS (TEMPORARY AND/OR PERMANENT, ETC.), CONSTRUCTION CONSTRAINTS AND PERFORMANCE CRITERIA IN ACCORDANCE WITH THE SPECIAL PROVISIONS.

2. EVALUATE SITE SUBSURFACE CONDITIONS AND RELEVANT PROPERTIES OF IN SITU SOIL AND ROCK.

3. ESTABLISH ANCHOR INCLINATION ANGLES. INCLINE ANCHORS TO MINIMIZE ANCHOR LENGTH, TO AVOID UTILITIES AND OTHER UNDERGROUND OBSTRUCTIONS, TO STAY WITHIN RIGHT-OF-WAY, AND TO OPTIMIZE ANCHOR FORCE.

4. DETERMINE EARTH PRESSURE DISTRIBUTIONS, INCLUDING SURCHARGES, FOR WALL WITH APPROPRIATE LOAD FACTORS AND LIMIT STATES AS PER DESIGN MANUAL PART 4 AND THIS STANDARD. RESISTING PASSIVE PRESSURE BEGINS AT BOTTOM OF WALL.

5. EVALUATE GLOBAL STABILITY FOR ANCHORED SYSTEM USING LIMIT EQUILIBRIUM ANALYSES. REVISE ANCHOR GEOMETRY IF NECESSARY.

6. FOR ANALYSIS AND DESIGN OF WALL ELEMENTS, EMBEDMENT DEPTHS AND ANCHOR FORCES, USE EITHER AASHTO METHOD OR TWO DIMENSIONAL BEAM FINITE ELEMENT COMPUTER MODEL.

7. DESIGN WALL ELEMENTS FOR THE RESULTING FORCES (MOMENT, SHEAR AND AXIAL) AND DEFLECTION, WITH THE EXCEPTION OF SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN ALTERNATIVE, LIMIT DEFLECTION TO A MAXIMUM OF 1" UNLESS THE SENSITIVITY OF ADJACENT STRUCTURES OR FACILITIES REQUIRES A LESSER LIMIT. WALL DEFLECTION IN EXCESS OF 1" IS PERMITTED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER. INCLUDE MONITORING PROGRAM TO VERIFY THAT DEFLECTION OF ADJACENT STRUCTURES DOES NOT EXCEED 1" LIMIT. DEFLECTION TOWARDS THE BACKFILL FOR SINGLE PILE DESIGN W/C.I.P. WALL AND COLUMN DESIGNS SHALL BE PREVENTED IN ORDER TO AVOID OR REDUCE CRACKING ON EXPOSED FACE.

8. DETERMINE REQUIRED PILE EMBEDMENT OR CONCRETE EMBEDMENT DEPTH FOR SHAFT AND ROCK SOCKET.

9. ESTIMATE NUMBER OF STRANDS OR BAR DIAMETER REQUIRED TO RESIST ANCHOR FORCES. ESTIMATE ANCHOR BOND LENGTH AND PULLOUT CAPACITY. FINAL DETERMINATION OF THE SIZE AND NUMBER OF STRANDS OR BAR DIAMETER, ANCHOR BOND DIAMETER, GROUTING METHOD, GROUTING PRESSURE AND ANCHOR BOND LENGTH IS THE RESPONSIBILITY OF THE ANCHOR SPECIALTY CONTRACTOR.

10. CHECK AXIAL LOAD RESISTANCE OF THE CONCRETE EMBEDMENT OR DRIVEN PILE.

11. CHECK TEMPORARY CONDITIONS (CONSTRUCTION STAGING) FOR THE STR-I LIMIT STATE.

12. CHECK DEFLECTION FOR THE WORST CASE SER-I LIMIT STATES.

13. CHECK WALL COMPONENTS SUCH AS BEARING PLATE ASSEMBLY, CORBEL, AND WALER.

14. CHECK WALL REDUNDANCY AS PER WALL REDUNDANCY PROCEDURE ON SHEET 2.

15. CHECK THAT SUFFICIENT PASSIVE PRESSURE CAN BE DEVELOPED BEHIND THE WALL AT THE UPPERMOST ANCHOR TO RESIST THE ANCHOR TEST LOAD.

BD-627M		MOMENT SLABS	
BC-736M		REINFORCEMENT BAR FABRICATION DETAILS	
BC-751M		BRIDGE DRAINAGE	
BC-757M		STEEL PILE TIP REINFORCEMENT & SPLICES	
RC-12M		BACKFILL AT STRUCTURES	
RC-54M		BARRIER PLACEMENT AT OBSTRUCTIONS	
REFERENCE DRAWINGS			

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY	
STANDARD ANCHORED WALLS NOTES	
RECOMMENDED AUG. 30, 2019 <i>James J. Ringer</i> ACTING CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 30, 2019 <i>Michael J. B. [Signature]</i> ACT. DIR., BUR. OF PROJECT DELIVERY
SHEET 1 OF 9 BD-626M	

WALL REDUNDANCY

1. ANCHOR LOADS: USE EXT III LIMIT STATE TO DETERMINE ANCHOR REDUNDANCY LOADS ASSUMING ONE ANCHOR FAILS. USE ANCHOR RESISTANCE EQUAL TO ANCHOR PROOF TEST LOAD, 0.8 GUTS.
2. WALL ELEMENTS AND FOUNDATION FOR REDUNDANCY: DESIGN WALL ELEMENTS AND FOUNDATION FOR EXT-III.
3. DEFLECTION CHECKS ARE NOT REQUIRED FOR REDUNDANCY.
4. DESIGN ANCHOR WALL TO PROTECT FROM CATASTROPHIC FAILURE DUE TO THE FAILURE OF ANY ONE ANCHOR AS FOLLOWS:

a.) WALL WITH CAST-IN-PLACE FACING: DESIGN THE FACING TO DISTRIBUTE LOAD TO ADJACENT SOLDIER PILES AND ANCHORS IN THE EVENT ANY ONE ANCHOR FAILS.

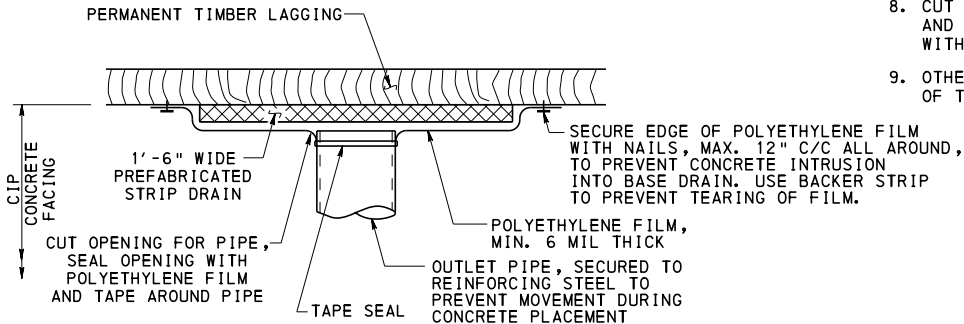
b.) WALL WITH PRECAST LAGGING: DESIGN A POSITIVE MEANS OF REDUNDANCY IN THE EVENT ANY ONE ANCHOR FAILS USING ONE OR MORE, BUT NOT LIMITED TO, THE FOLLOWING METHODS:

• PROVIDE CONTINUOUS REINFORCED CAST-IN-PLACE CONCRETE CAP BEAM

• PROVIDE HORIZONTAL STEEL TIE RODS BETWEEN PILES

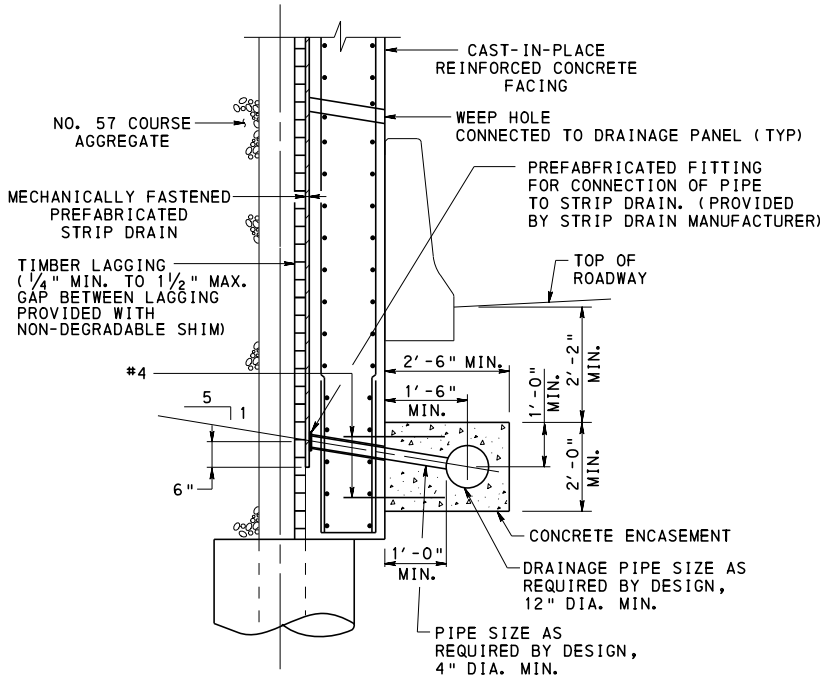
• PROVIDE ADDITIONAL ANCHORS

• DESIGN ADJACENT ANCHORS TO RESIST ADDITIONAL LOAD REDISTRIBUTED FROM THE FAILED ANCHOR



ALTERNATE FITTING  
FOR CONNECTION OF PIPE TO STRIP DRAIN

WITH C. I. P. WALL SHOWN, WITH PRECAST LAGGING SIMILAR



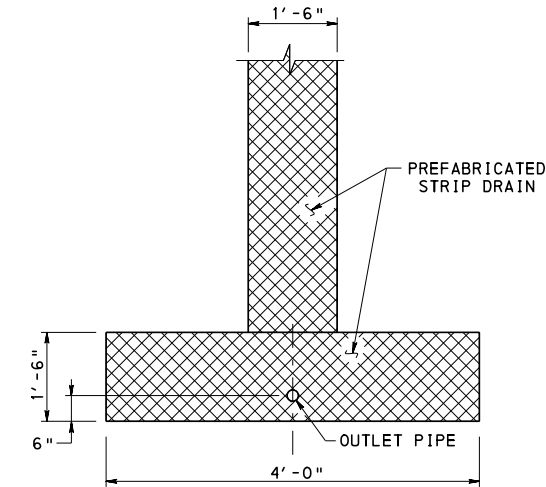
SECTION AT DRAINAGE PANEL

WITH C. I. P. WALL SHOWN, WITH PRECAST LAGGING SIMILAR

TYPICAL LATENT ANCHOR CONSTRUCTION PROCEDURE

LATENT ANCHORS: THE USE OF LATENT ANCHORS MAY BE CONSIDERED FOR STRENGTHENING OR LIMITING DISPLACEMENT OF EXISTING WALLS, WITH OR WITHOUT A NEW CONCRETE BLANKET WALL. THE CASING IS DESIGNED AS A STRUCTURAL MEMBER, TRANSFERING THE ANCHOR LOAD TO THE CASING EMBEDMENT (BOND) LENGTH. THE ANCHOR IS NOT ENGAGED BY THE WALL UNTIL THERE IS A TENDENCY FOR WALL MOVEMENT.

1. DRILL THROUGH WALL, FILL AND INTO THE ROCK TO THE REQUIRED STEEL CASING EMBEDMENT LENGTH. HOLE MUST BE OF SUFFICIENT DIAMETER TO ACCEPT ALL COMPONENTS AND PROVIDE SPECIFIED COVER.
2. FILL HOLE WITH SUFFICIENT GROUT AND PLUNGE CASING TO THE FULL DEPTH OF EMBEDMENT LENGTH TO ENSURE FULL GROUTING OF ANNULAR SPACE BETWEEN CASING AND ROCK.
3. AFTER SUFFICIENT CURE OF THE GROUT, WITH A MINIMUM COMPRESSIVE STRENGTH OF 1000 PSI AND A MINIMUM OF 16 HOURS, DRILL ANCHOR BOND LENGTH, INSTALL ANCHOR, AND PRESSURE GROUT THE BOND LENGTH.
4. INSTALL HOT DIPPED GALVANIZED BEARING PLATE, FIELD WELD THE PLATE TO THE STEEL CASING, AND FIELD GALVANIZE. CLEAN AND FIELD GALVANIZE THE EXPOSED END OF CASING.
5. PRIOR TO TESTING THE ANCHORS, WEDGE THE STEEL CASING IN THE HOLE THROUGH THE WALL TO FIRMLY SECURE IT. AFTER ANCHOR BOND GROUT HAS CURED, PERFORM LOAD TESTS AND PROOF TESTS ON THE ANCHORS AND LOCK OFF LOAD TO THE DESIGN LOAD IN ACCORDANCE WITH THE SPECIAL PROVISIONS. JACK AGAINST BEARING PLATE. DO NOT APPLY JACKING LOADS TO THE WALL.
6. GROUT THE STEEL CASING UNTIL GROUT EMERGES FROM END OF CASING. GROUT ANNULAR SPACE BETWEEN CASING AND THE WALL.
7. CONSTRUCT ANCHOR CORBELS. ENSURE FULL CONSOLIDATION OF CONCRETE BEHIND BEARING PLATE.
8. CUT EXCESS TENDON LENGTH. INSTALL GREASE FILLED GALVANIZED CAP, AND CAULK JOINT BETWEEN BEARING PLATE AND CONCRETE ON ALL SIDES WITH APPROVED ELASTOMERIC CAULKING COMPOUND.
9. OTHER METHODS OF CONSTRUCTION MAY BE CONSIDERED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.



ELEVATION AT DRAINAGE PANEL

LIMIT STATES AND LOADING

1. USE THE FOLLOWING LOAD FACTORS:

LIMIT STATE	LOAD FACTORS FOR ANCHOR WALL DESIGNS					
	LOAD TYPES					
	DC	DD	DW	EH	LS	LL
STR-I **	1.25	1.25	1.50	1.35	1.75	1.75
EXT-III *	1.25	1.25	1.50	1.05	1.15	1.15
SER-I	1.00	1.00	1.00	1.00	1.00	1.00

- \* - FOR REDUNDANCY ANALYSIS
- \*\* - USE A LOAD FACTOR FOR EH = 1.5 FOR DIFFICULT GEOLOGY, SUCH AS AREAS PRONE TO LANDSLIDES
- DC - SELF WEIGHT OF WALL COMPONENTS AND VERTICAL COMPONENT OF ANCHOR LOAD
- DD - DOWNDRAW ACTING UPON DRILLED CAISSON OR PILE PER DESIGN MANUAL PART 4.
- DW - WEIGHT OF ATTACHED UTILITIES AND WEIGHT OF WALL-SUPPORTED MOMENT SLAB
- EH - HORIZONTAL EARTH PRESSURE PER DESIGN MANUAL PART 4.
- LS - LIVE LOAD SURCHARGE PER DESIGN MANUAL PART 4.
- LL - LIVE LOAD TRANSMITTED DIRECTLY TO STRUCTURE FROM WALL-SUPPORTED MOMENT SLAB (DOES NOT INCLUDE IMPACT)

NOTE 1: EH LOADS MAY HAVE VERTICAL AND HORIZONTAL COMPONENTS ACTING SIMULTANEOUSLY.

2. LIMIT STATE DESCRIPTIONS:

- STR-I BASIC LOAD COMBINATION FOR DESIGN OF ANCHOR WALL ELEMENTS AND FOUNDATION ELEMENTS.
- EXT-III REDUNDANCY LOAD COMBINATION FOR DESIGN OF ANCHOR WALL ELEMENTS AND FOUNDATION (USE THIS LIMIT STATE WITH OR WITHOUT GLOBAL STABILITY LOAD CONSISTENT WITH THE GOVERNING STRENGTH LIMIT STATE)
- SER-I BASIC LOAD COMBINATION FOR DEFLECTION CHECK AND ANCHOR DESIGN

WALL ELEMENTS CONSIST OF SOLDIER PILE, CONCRETE EMBEDMENT, LAGGING, WALER, WALL FACING, CORBEL, AND BEARING PLATE ASSEMBLY.

FOUNDATION ELEMENTS CONSIST OF SIDE RESISTANCE AND BEARING STRESS OF CONCRETE EMBEDMENT AND PILES.

ANCHOR DESIGN CONSISTS OF STRAND SELECTION AND BOND ZONE.

DEFLECTION CHECK IS FOR HORIZONTAL WALL DISPLACEMENTS.

3. ANCHOR RESISTANCE:

ANCHOR LOAD RESISTANCE	
SER-I	0.6 GUTS
STR-I	0.75 GUTS
EXT-III	0.8 GUTS

GUTS - GUARANTEED ULTIMATE TENSILE STRENGTH

RESISTANCE FACTORS: USE RESISTANCE FACTORS FOR WALL ELEMENTS AND FOUNDATION ELEMENTS IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL 4.

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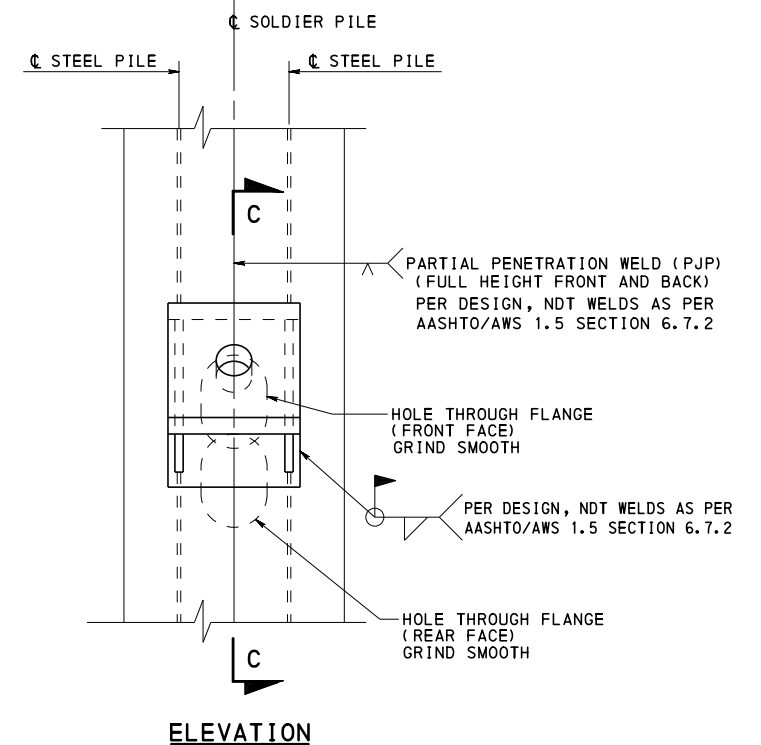
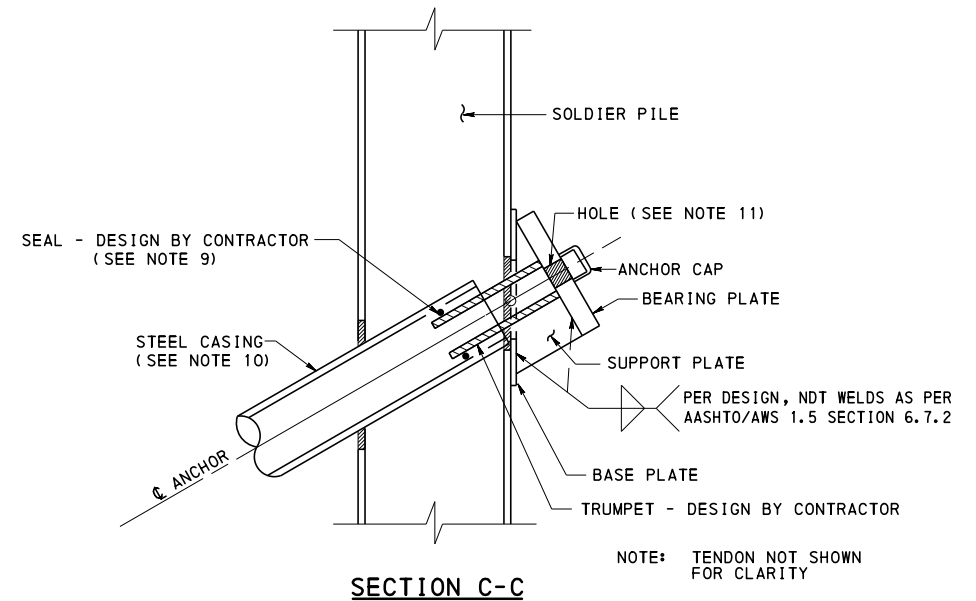
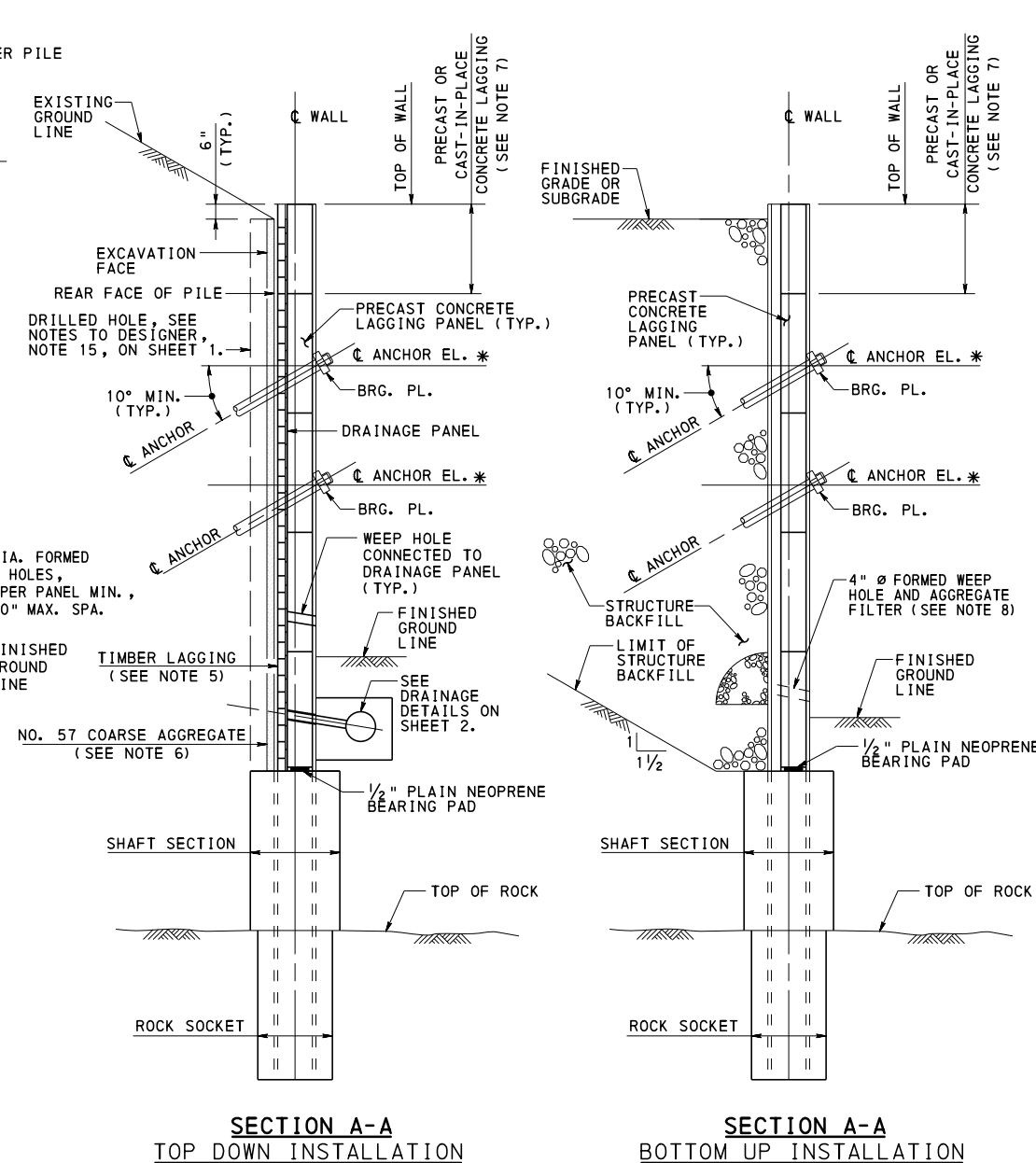
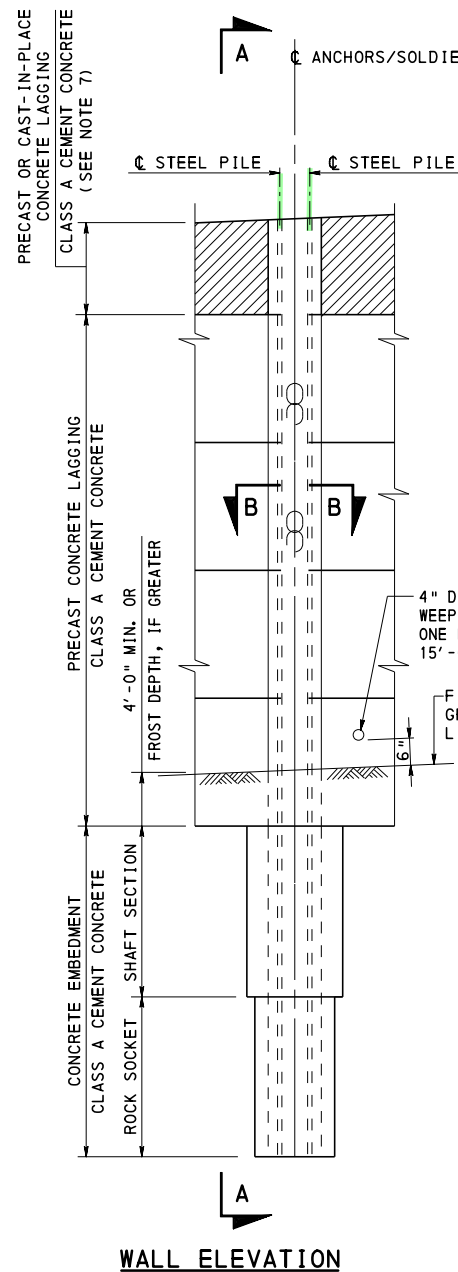
STANDARD  
ANCHORED WALLS  
NOTES AND DRAINAGE DETAILS

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bente*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 9

BD-626M



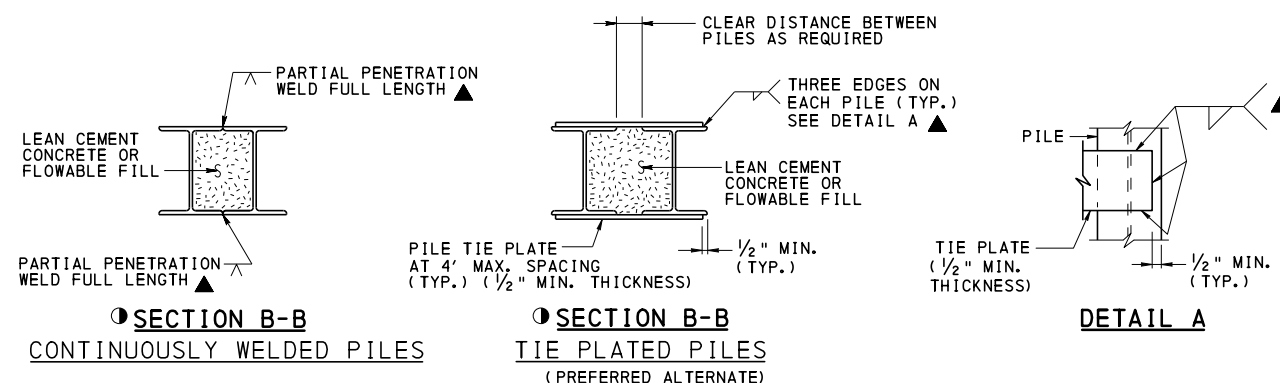
#### LEGEND:

- \* VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

#### NOTES:

1. FOR PRECAST CONCRETE LAGGING DETAILS SEE SHEET 4.
2. FOR CONCRETE EMBEDMENT DETAILS SEE SHEET 9.
3. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
4. FOR ANCHOR DETAILS SEE SHEET 8.
5. PROVIDE ADEQUATE SHORING (TIMBER LAGGING) BEHIND SOLDIER PILES TO RETAIN EXCAVATION FACE AS EXCAVATION PROCEEDS.
6. PROVIDE NO. 57 COARSE AGGREGATE TO FILL ANY GAPS BETWEEN TIMBER LAGGING AND EXCAVATION FACE.
7. USE CAST-IN-PLACE LAGGING WHERE TOP OF WALL IS SLOPED. PRECAST LAGGING MAY BE USED FOR STEPPED TOP OF WALL.
8. FOR WEEP HOLE AND AGGREGATE FILTER DETAILS AND ALTERNATE DRAINAGE DETAILS SEE BC-751M.
9. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND PLASTIC SHEATH FOR ANCHOR DESIGNS WITHOUT PERMANENT STEEL CASINGS.
10. DETAILS WITH PERMANENT STEEL CASING ARE SHOWN. DETAILS ARE SIMILAR WHERE PERMANENT CASING IS NOT REQUIRED AND SHEATHING EXTENDS INTO TRUMPET.
11. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).

### DOUBLE PILE DESIGN W/PRECAST LAGGING TOP DOWN & BOTTOM UP INSTALLATION



#### DETAIL A

- ▲ - WELD PER DESIGN, NDT WELDS AS PER AASHTO/AWS 1.5 SECTION 6.7.2
- - WALL AND LAGGING NOT SHOWN FOR CLARITY (SEE TYPICAL SECTION AT PRECAST LAGGING ON SHEET 4.)

### ANCHORAGE DETAIL

(CONTINUOUSLY WELDED PILES SHOWN, TIE PLATED PILES SIMILAR)

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
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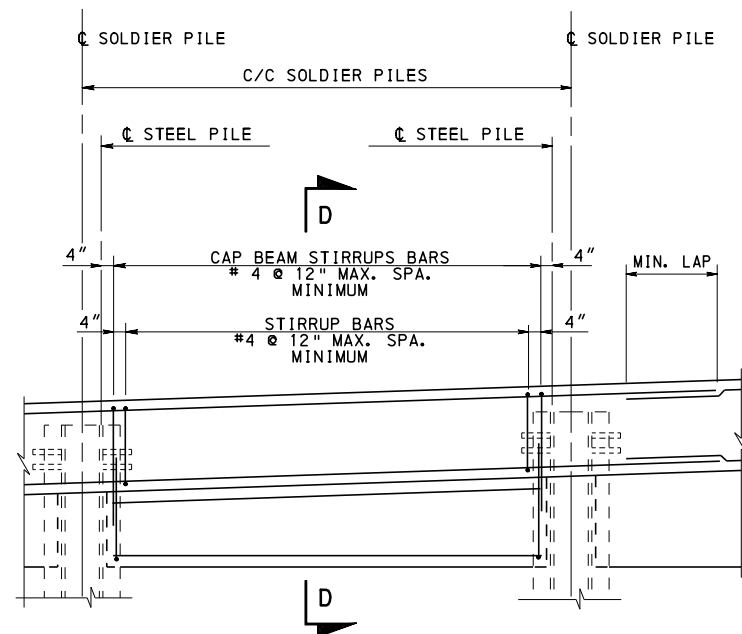
**STANDARD  
ANCHORED WALLS  
DOUBLE PILE DESIGN  
W/PRECAST LAGGING**

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Biele*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 9  
**BD-626M**

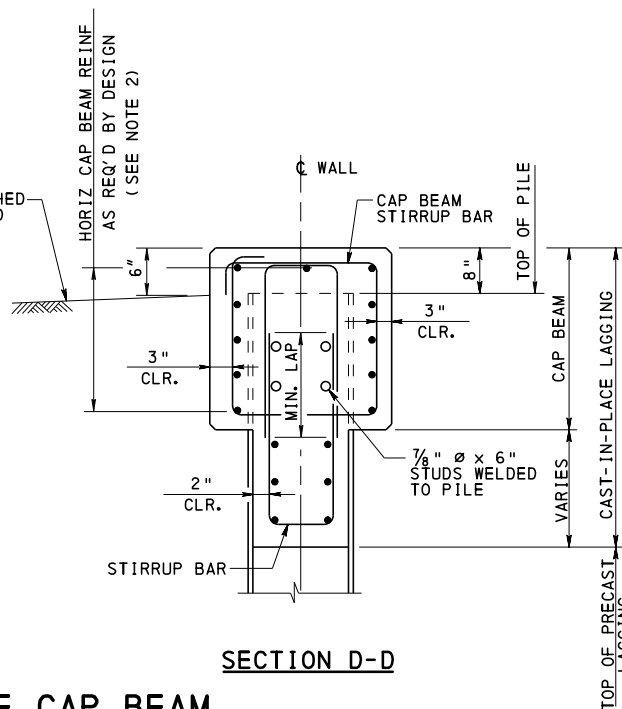




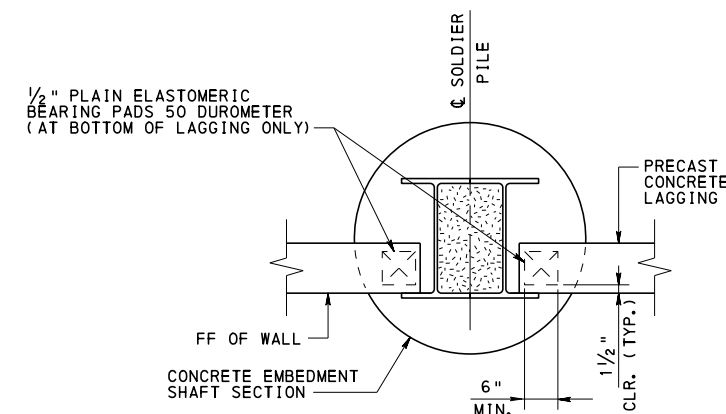
ELEVATION

### CAST-IN-PLACE CAP BEAM

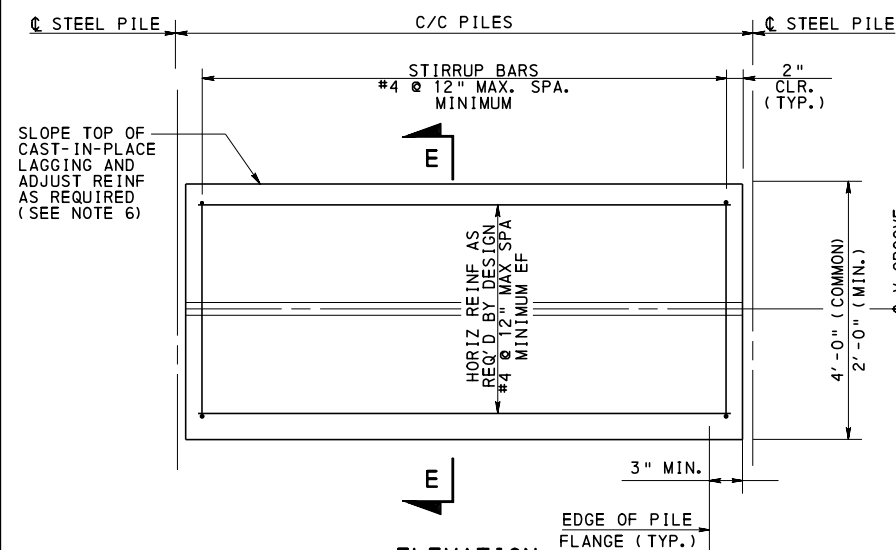
FOR USE OF CAP BEAM FOR REDUNDANCY  
(SEE NOTE 2)



SECTION D-D



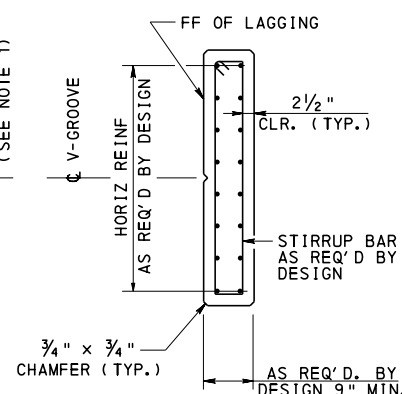
### BEARING PAD DETAIL



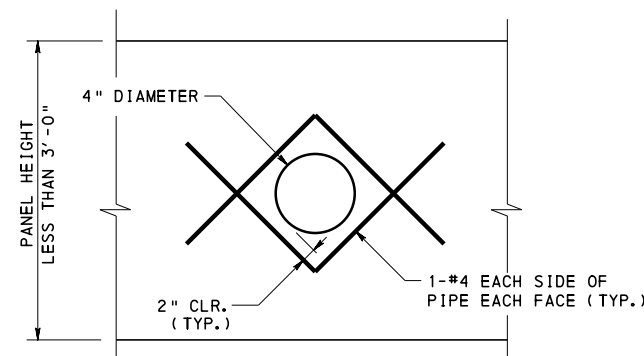
ELEVATION

### PRECAST AND CAST-IN-PLACE CONCRETE LAGGING

(SEE NOTES 3 AND 6)



SECTION E-E



### WEEP HOLE REINFORCEMENT DETAIL

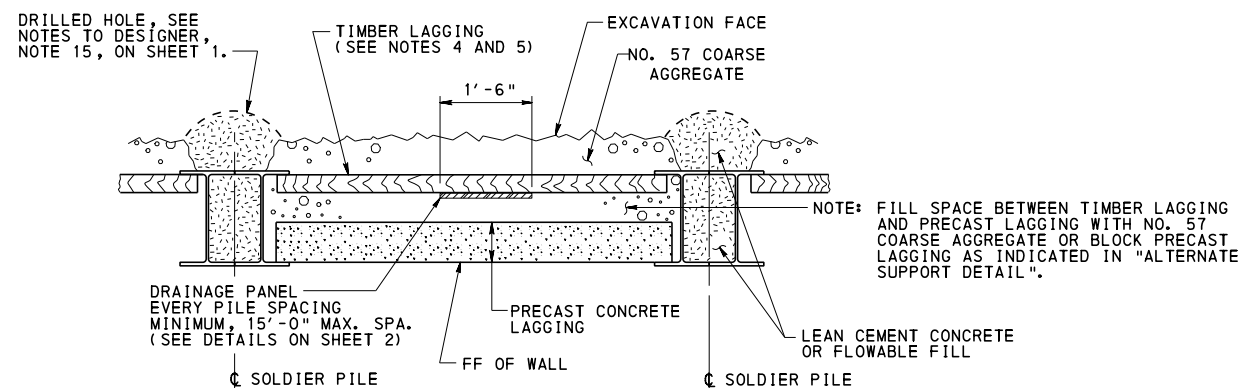
- REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A FASHION AS SHOWN.
- LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.

### NOTES:

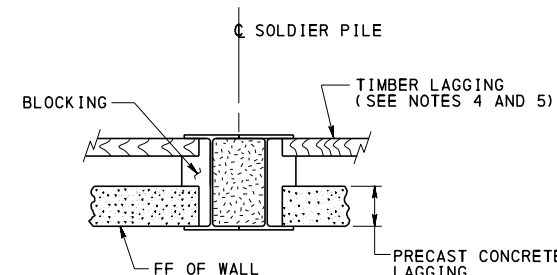
- PROVIDE A V-GROOVE MID-DEPTH IF DESIRED FOR APPEARANCE.
- IF CAP BEAM IS USED FOR REDUNDANCY, DESIGN FOR REDUNDANCY FORCES; OTHERWISE DESIGN FOR APPLICABLE EARTH PRESSURES.
- IF PRECAST CONCRETE LAGGING IS NOT FULLY DETAILED ON THE DESIGN DRAWINGS (NO REINFORCEMENT BAR SCHEDULE), THAN THE CONTRACTOR IS REQUIRED TO SUBMIT SHOP DRAWINGS FOR ACCEPTANCE PRIOR TO FABRICATION.
- PROVIDE TIMBER FOR TIMBER LAGGING IN ACCORDANCE WITH SECTION 1031.2(a) OF PUB. 408.
- ALL TIMBER LAGGING IS TO REMAIN IN PLACE FOR THE FINAL CONSTRUCTION.
- USE CAST-IN-PLACE LAGGING WHERE TOP OF WALL IS SLOPED. PRECAST LAGGING MAY BE USED FOR STEPPED TOP OF WALL.

### LEGEND:

EF EACH FACE  
FF FRONT FACE  
RF REAR FACE



### TYPICAL SECTION AT PRECAST LAGGING

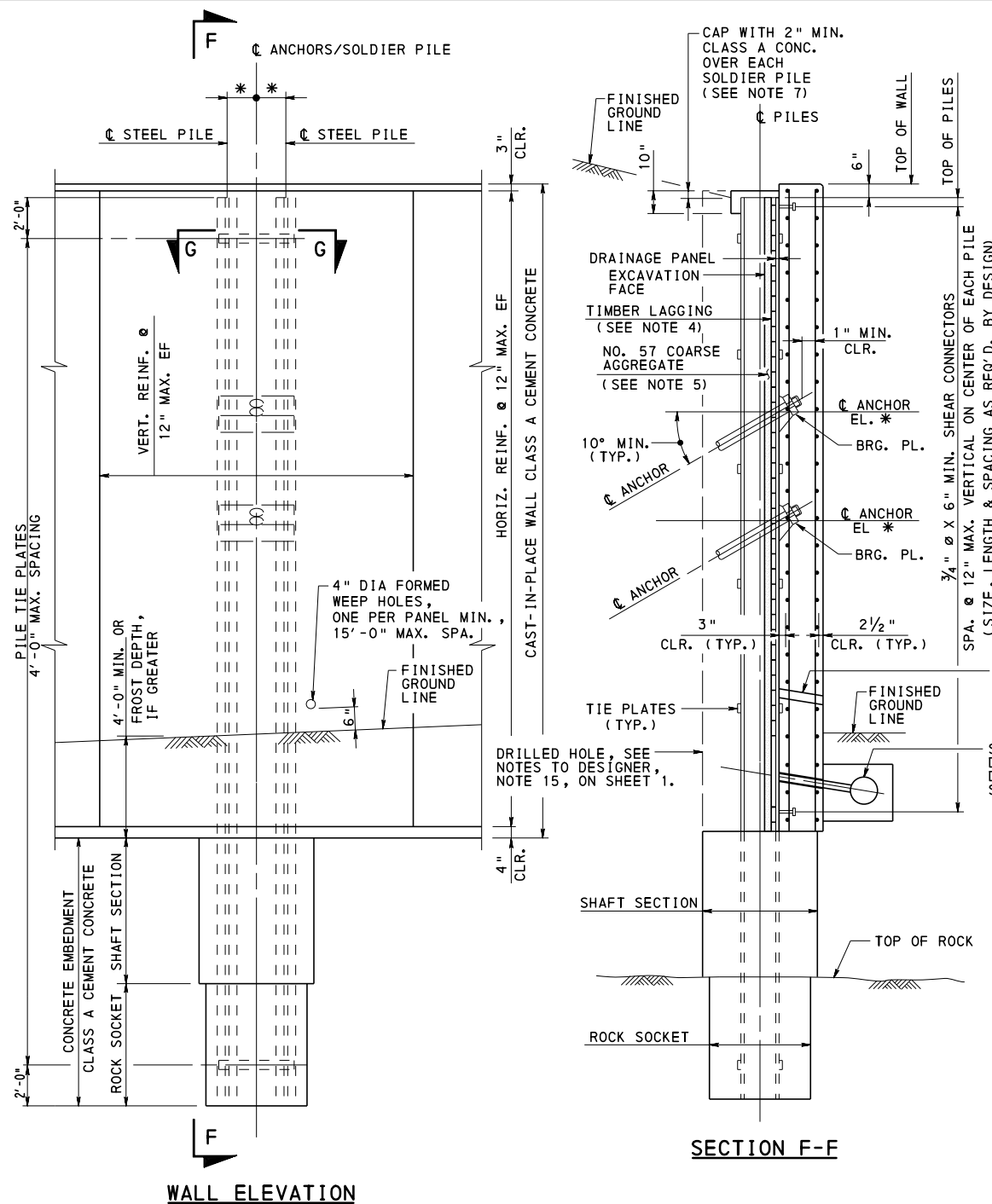


### ALTERNATE SUPPORT DETAIL

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

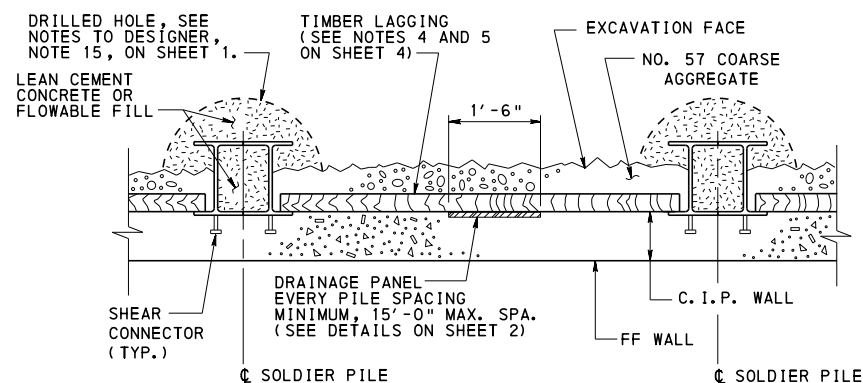
STANDARD  
ANCHORED WALLS  
DOUBLE PILE DESIGN WITH  
PRECAST LAGGING

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER  
RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY  
SHEET 4 OF 9  
BD-626M

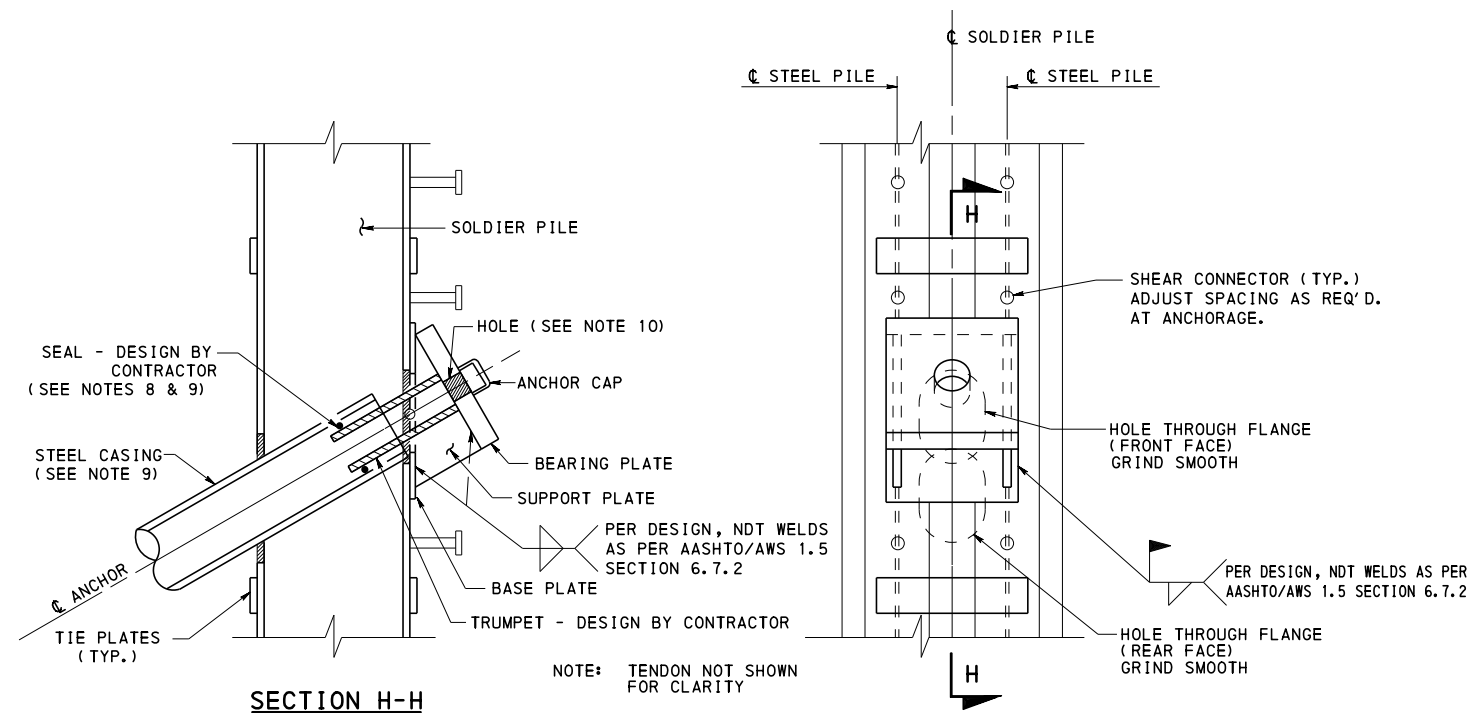


## DOUBLE PILE DESIGN W/CIP WALL

### TOP DOWN INSTALLATION



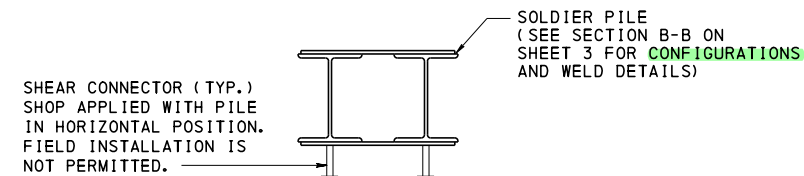
## TYPICAL SECTION AT C.I.P. WALL



## ANCHORAGE DETAIL

(TIE PLATED PILES SHOWN, CONTINUOUSLY WELD PILES SIMILAR)

## ELEVATION



## SECTION G-G

WALL AND LAGGING NOT SHOWN FOR CLARITY  
(SEE TYPICAL SECTION AT C.I.P. WALL ON THIS SHEET)

## NOTES:

- FOR CONCRETE EMBEDMENT DETAILS SEE SHEET 9.
- FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
- FOR ANCHOR DETAILS SEE SHEET 8.
- PROVIDE ADEQUATE SHORING (TIMBER LAGGING) BEHIND SOLDIER PILE FLANGES TO RETAIN EXCAVATION FACE AS EXCAVATION PROCEEDS.
- PROVIDE NO. 57 COARSE AGGREGATE TO FILL ANY GAPS BETWEEN TIMBER LAGGING AND EXCAVATION FACE.
- FOR DOUBLE PILE DESIGN WITH C.I.P. WALL, EITHER PILE CONFIGURATION SHOWN IN SECTION C-C ON SHEET 3 MAY BE USED.
- CONCRETE CAP OVER PILE MAY BE DETAILED FOR MONOLITHIC PLACEMENT INTEGRAL WITH THE WALL FACING.
- PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND PLASTIC SHEATH FOR ANCHOR DESIGNS WITHOUT PERMANENT STEEL CASINGS.
- DETAILS WITH PERMANENT STEEL CASING ARE SHOWN. DETAILS ARE SIMILAR WHERE PERMANENT CASING IS NOT REQUIRED AND SHEATHING EXTENDS INTO TRUMPET.
- HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).
- FOR WEEP HOLE REINFORCEMENT DETAIL SEE SHEET 6.

## LEGEND:

- \* VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

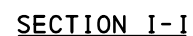
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
ANCHORED WALLS  
DOUBLE PILE DESIGN W/CIP WALL

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 9  
BD-626M



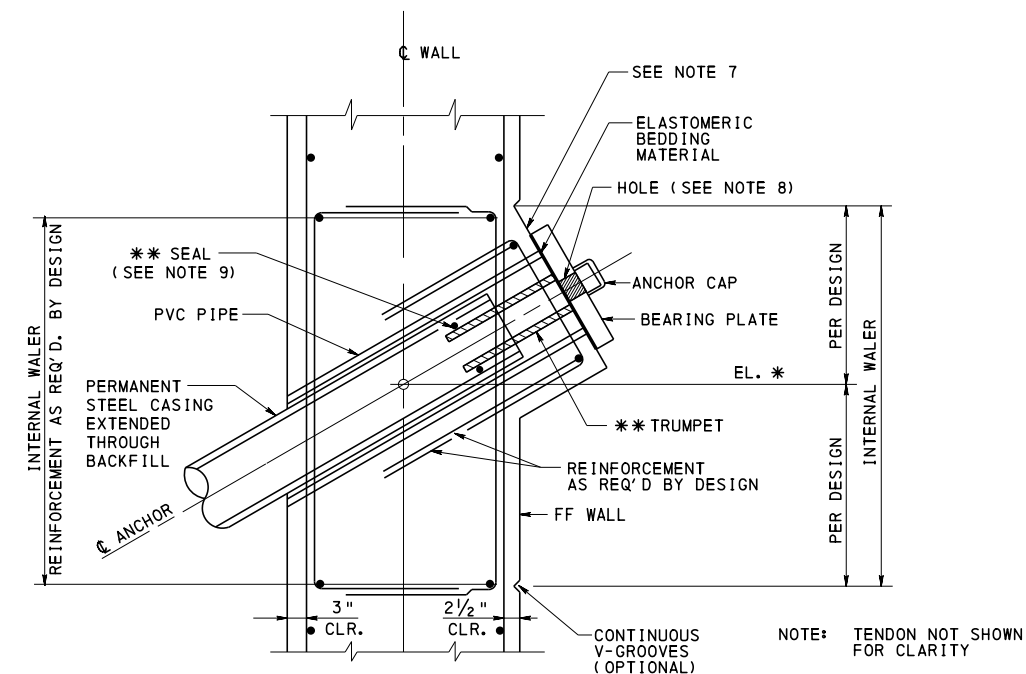
SINGLE PILE DESIGN W/ CIP WALL  
BOTTOM UP INSTALLATION

LEGEND:

- ```

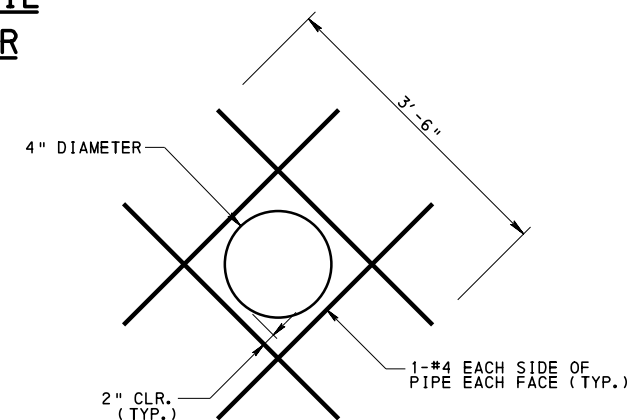
* VALUE TO BE PROVIDED ON
DESIGN DRAWINGS
** CONTRACTOR DESIGN (TO BE
NOTED FOR AS-DESIGNED
WALLS ONLY)
EF EACH FACE
FF FRONT FACE
RF REAR FACE
CIP CAST IN PLACE

```

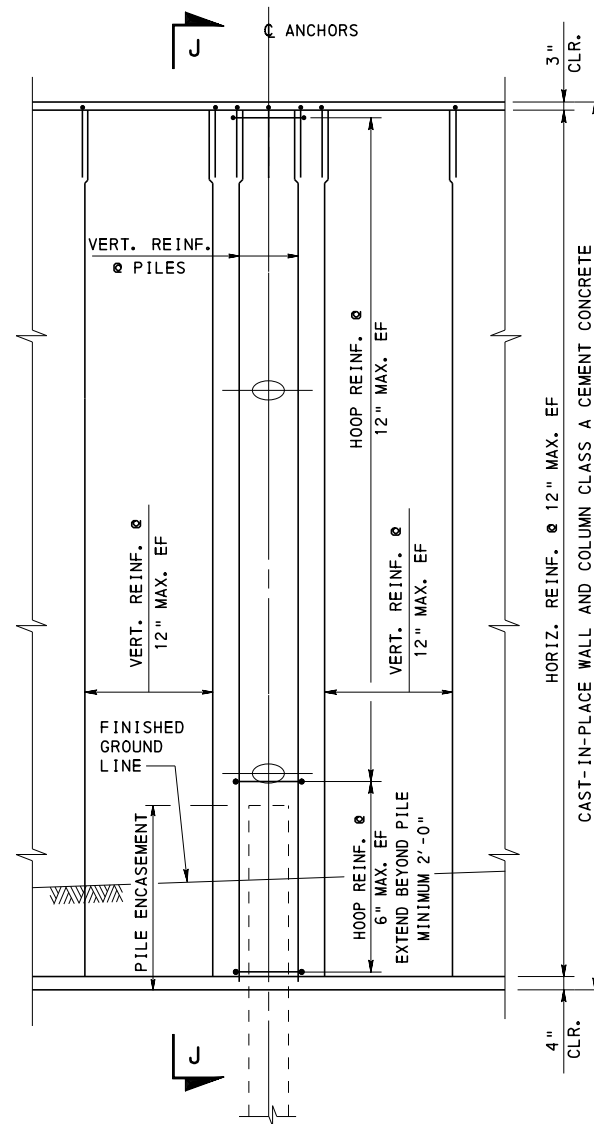


## WEEP HOLE REINFORCEMENT DETAIL

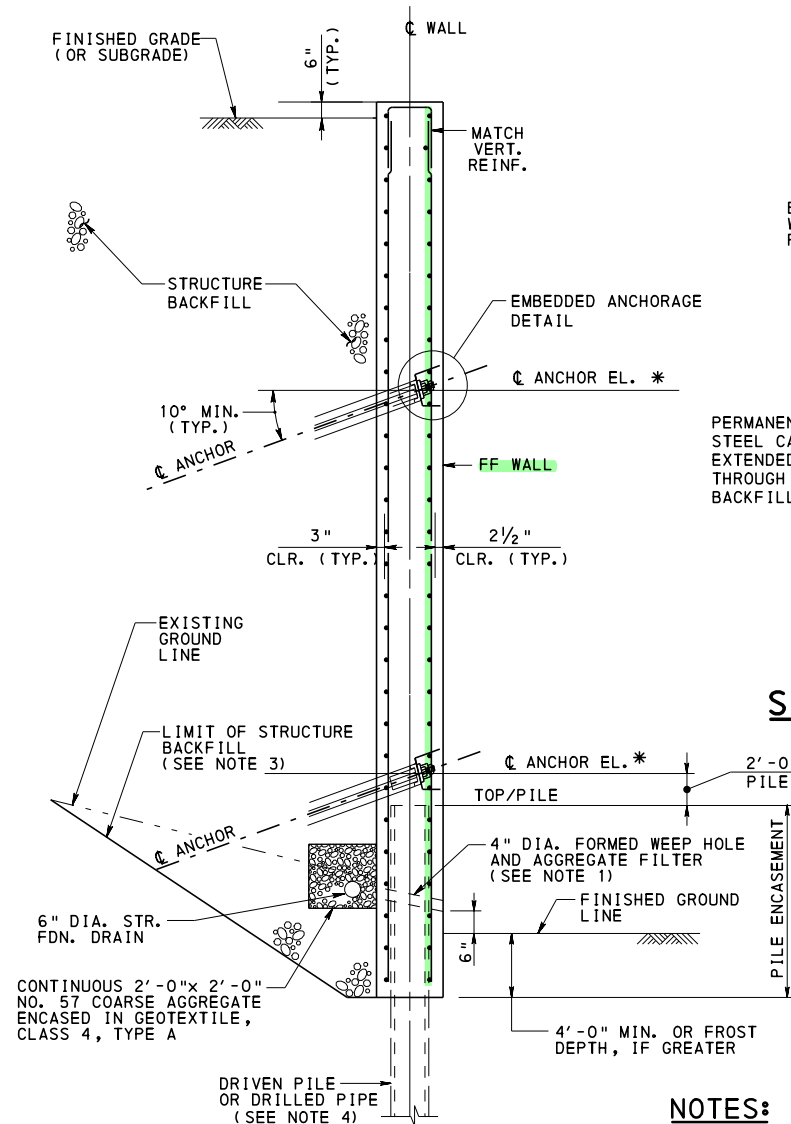
- NOTES:**
1. REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A DIAGONAL FASHION AS SHOWN.
  2. LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.



- ## NOTES:
1. FOR WEEP HOLE AND AGGREGATE FILTER DETAILS AND ALTERNATE DRAINAGE DETAILS SEE BC-751M
  2. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
  3. FOR ANCHOR DETAILS SEE SHEET 8.
  4. PLACE CLASS 4, TYPE A GEOTEXTILE BLANKET BETWEEN STRUCTURE BACKFILL AND EXCAVATION AND SUBGRADE IN ACCORDANCE WITH RC-12M.
  5. PROVIDE ADEQUATE SHORING (TIMBER LAGGING) BEHIND SOLDIER PILES TO RETAIN EXCAVATION FACE AS EXCAVATION PROCEEDS (IF REQUIRED).
  6. CONCRETE EMBEDMENT MAY BE USED INSTEAD OF DRIVEN PILES BASED ON SITE CONDITIONS AND ECONOMY.
  7. PROVIDE SURFACE PERPENDICULAR TO CENTERLINE ANCHOR WITHIN 0.3" TOLERANCE. GRIND CONCRETE SURFACE TO REMOVE PROJECTING IRREGULARITIES EXCEEDING  $\frac{1}{32}$ ". ENSURE THAT THERE ARE NO ACCUMULATIONS OF ZINC AROUND EDGE OF GALVANIZED BEARING PLATE.
  8. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).
  9. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS.

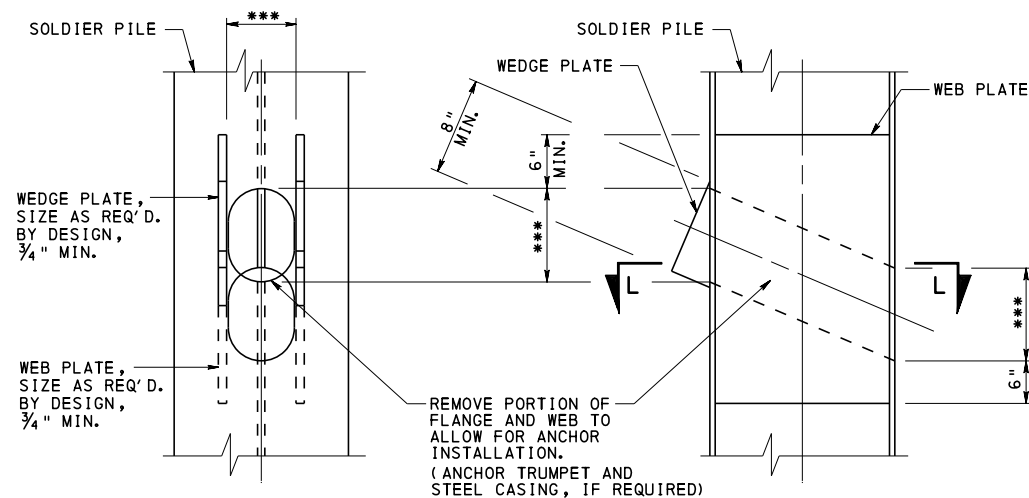


WALL ELEVATION



SECTION J-J

# **SINGLE PILE DESIGN W/ CIP WALL & COLUMN** BOTTOM UP INSTALLATION

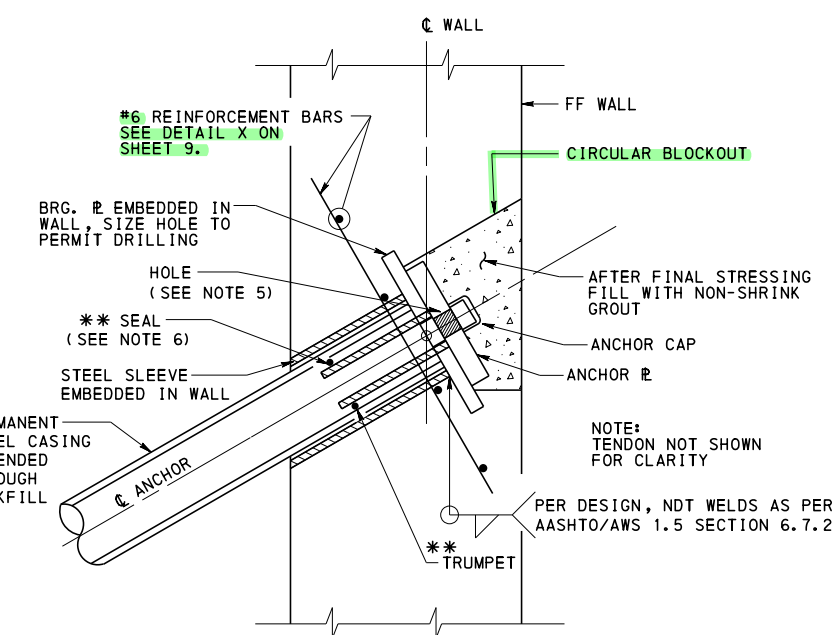


FRONT VIEW

SIDE VIEW

## **THRU-PILE CONNECTION**

\*\*\* - SPACING AS REQUIRED BY ANCHOR TRUMPET AND STEEL CASING, IF REQUIRED



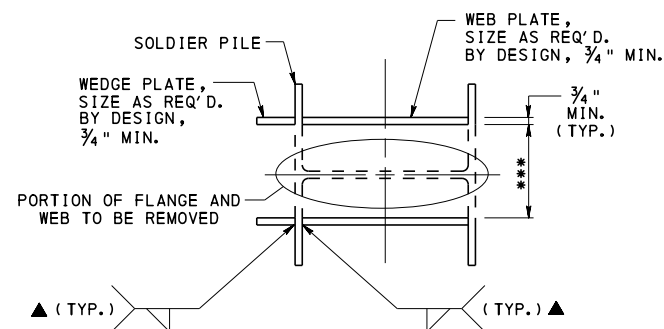
## **EMBEDDED ANCHORAGE DETAIL** **SINGLE PILE W/CIP WALL AND COLUMN**

### **LEGEND:**

- \* VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- \*\* CONTRACTOR DESIGN (TO BE NOTED FOR AS-DESIGNED WALLS ONLY)
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

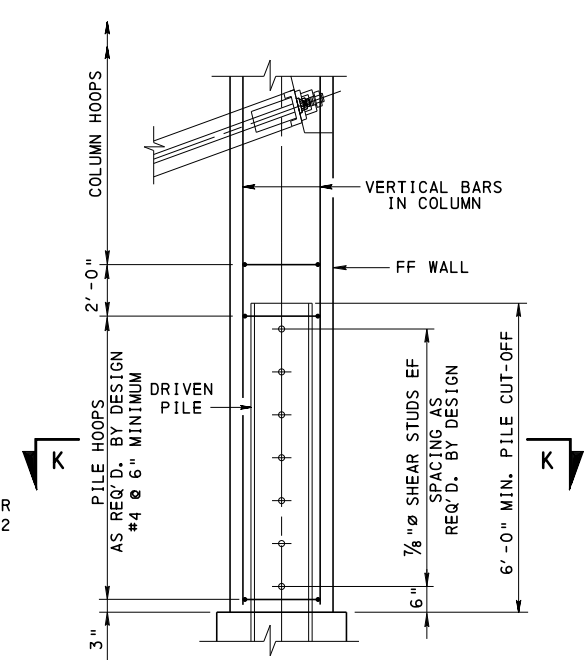
### **NOTES:**

1. FOR WEEP HOLE AND AGGREGATE FILTER DETAILS AND ALTERNATE DRAINAGE DETAILS SEE BC-751M
2. FOR ADJACENT ROADWAY AND DRAINAGE DETAILS SEE SHEET 9.
3. PLACE CLASS 4, TYPE A GEOTEXTILE BLANKET BETWEEN STRUCTURE BACKFILL AND EXCAVATION AND SUBGRADE IN ACCORDANCE WITH RC-12M.
4. PILES WITH CONCRETE EMBEDMENTS MAY BE USED INSTEAD OF DRIVEN PILES BASED ON SITE CONDITIONS AND ECONOMY.
5. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).
6. PROVIDE A WATERTIGHT SEAL BETWEEN TRUMPET AND STEEL CASING FOR ANCHOR DESIGNS WITH PERMANENT STEEL CASINGS.
7. FOR WEEP HOLE REINFORCEMENT DETAIL SEE SHEET 6.
8. FOR ANCHOR DETAILS SEE SHEET 8.

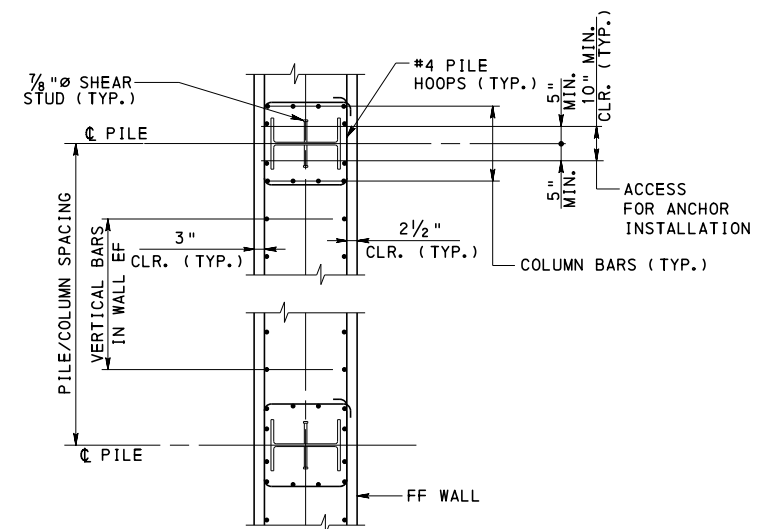


SECTION L-L

▲ - WELD PER DESIGN, NDT WELDS AS PER AASHTO/AWS 1.5 SECTION 6.7.2



## **PILE ENCASEMENT DETAIL**



SECTION K-K

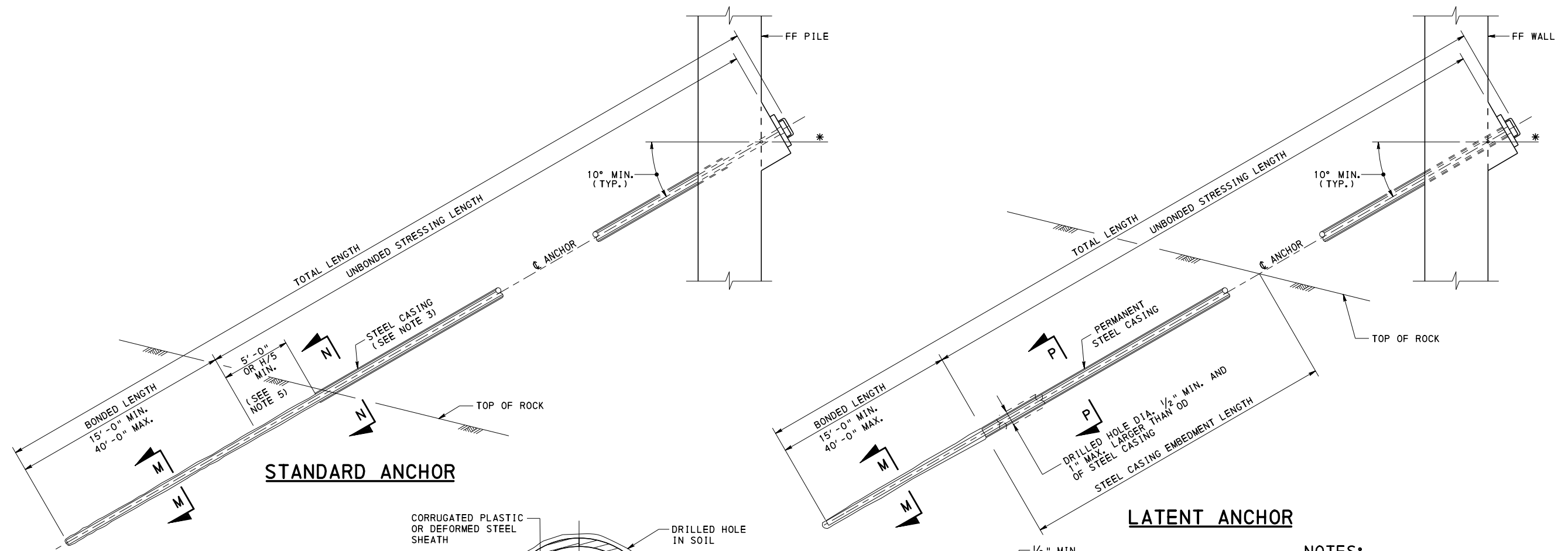
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF PROJECT DELIVERY

**STANDARD**  
**ANCHORED WALLS**  
**SINGLE PILE DESIGN W/CIP WALL & COLUMN**  
**THRU-PILE CONNECTION DETAIL**

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

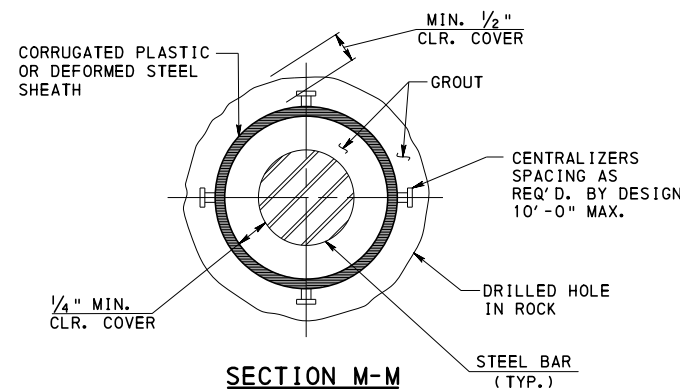
RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 7 OF 9  
**BD-626M**

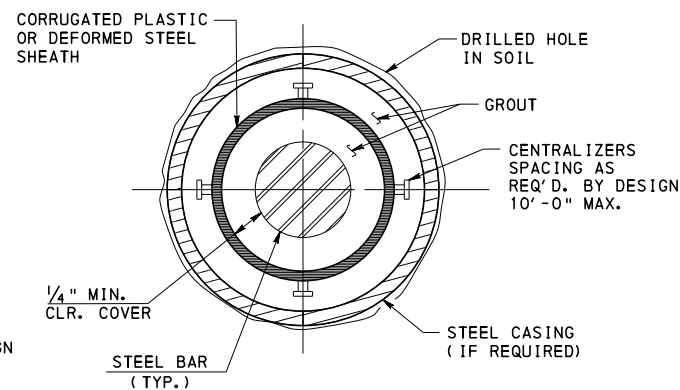


**STANDARD ANCHOR**

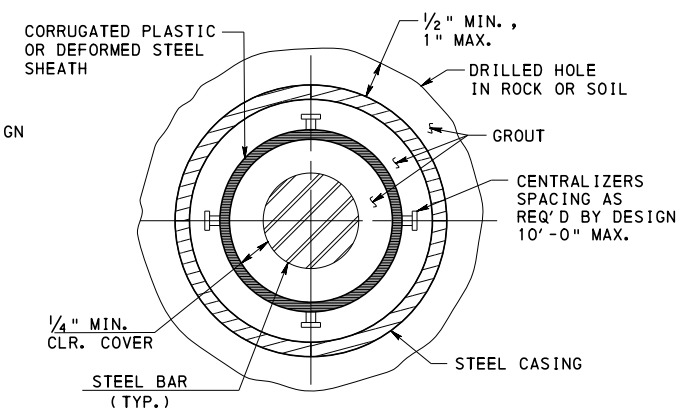
**LATENT ANCHOR**



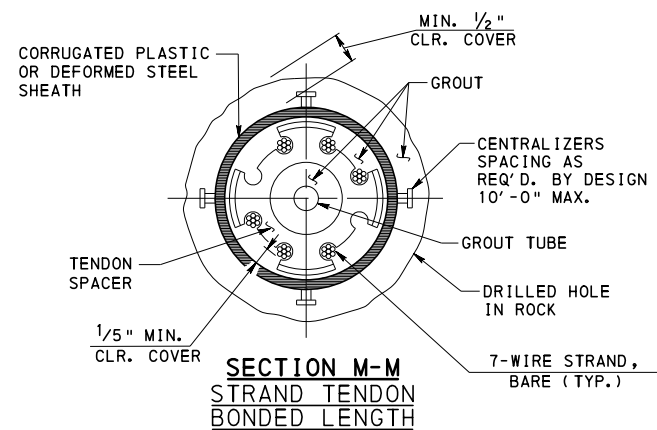
**SECTION M-M  
BAR TENDON  
BONDED LENGTH**



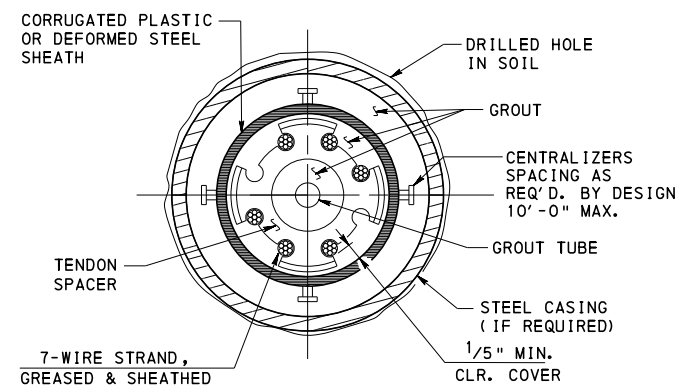
**SECTION N-N  
BAR TENDON  
UNBONDED STRESSING LENGTH  
WITH PERMANENT STEEL CASING**



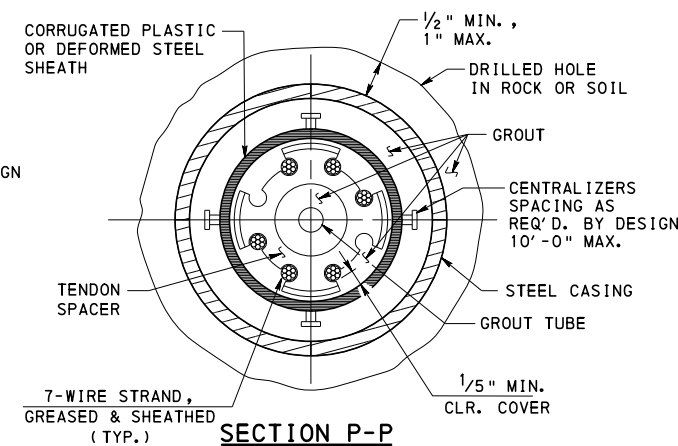
**SECTION P-P  
BAR TENDON  
UNBONDED STRESSING LENGTH  
LATENT ANCHORS**



**SECTION M-M  
STRAND TENDON  
BONDED LENGTH**



**SECTION N-N  
STRAND TENDON  
UNBONDED STRESSING LENGTH  
WITH PERMANENT STEEL CASING**



**SECTION P-P  
STRAND TENDON  
UNBONDED STRESSING LENGTH  
LATENT ANCHORS**

**NOTES:**

1. FOR ANCHORAGE DETAILS, SEE SHEETS 3,5,6,7, AND 9.
2. FOR USE OF LATENT ANCHORS SEE SHEET 2.
3. USE PERMANENT CASING FOR DRILLED ANCHOR HOLES WHERE REQUIRED IN SOILS OR BACKFILL SUBJECT TO CAVING. (STANDARD ANCHOR ONLY)
4. LOCATE UPPER CENTRALIZER A MAXIMUM OF 5' FROM THE TOP OF THE TENDON BOND LENGTH. LOCATE LOWER CENTRALIZER 1' FROM THE BOTTOM OF THE TENDON BOND LENGTH.
5. H = DESIGN HEIGHT OF THE WALL.

**LEGEND:**

- \* VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

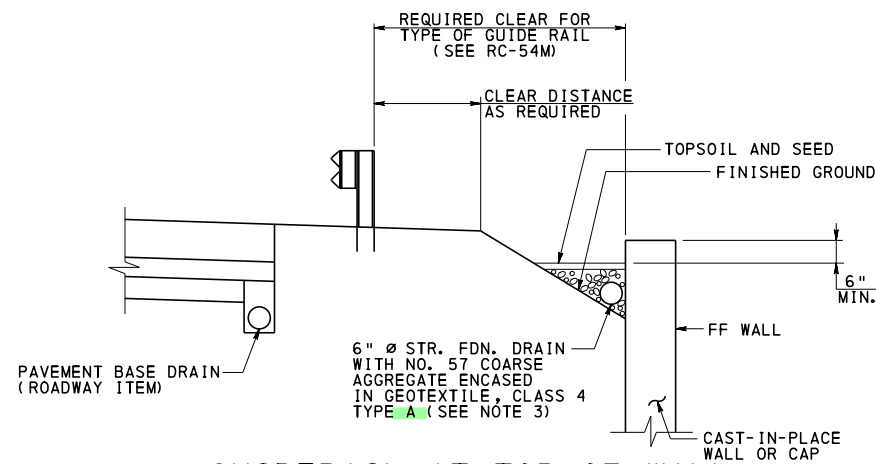
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
ANCHORED WALLS  
ANCHOR DETAILS**

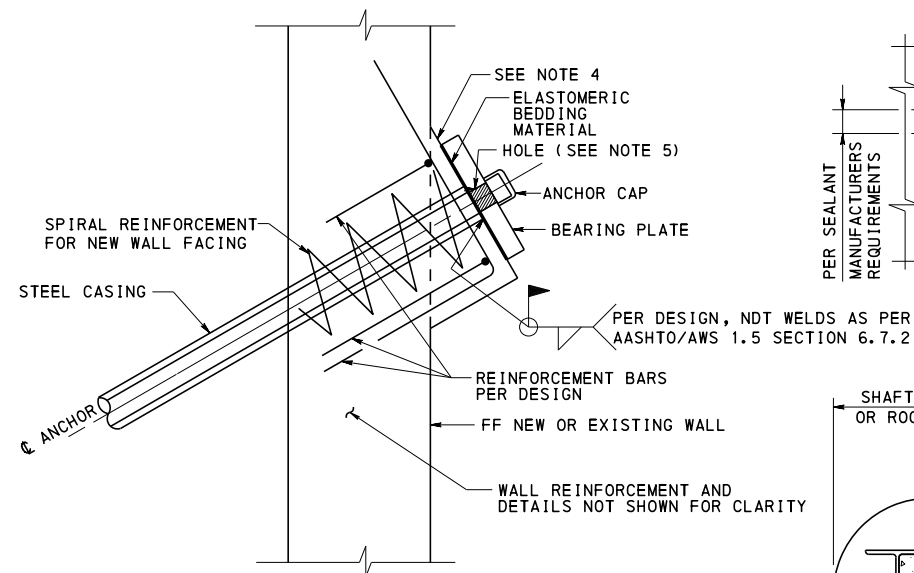
RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. [Signature]*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 8 OF 9  
**BD-626M**



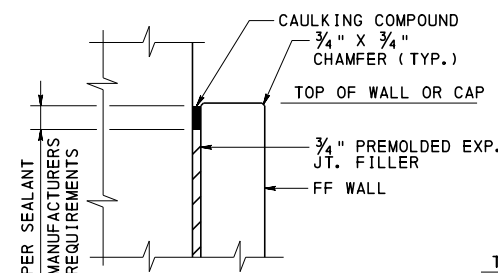
**GUIDERAIL AT TOP OF WALL**



**ANCHORAGE DETAIL  
LATENT ANCHOR**

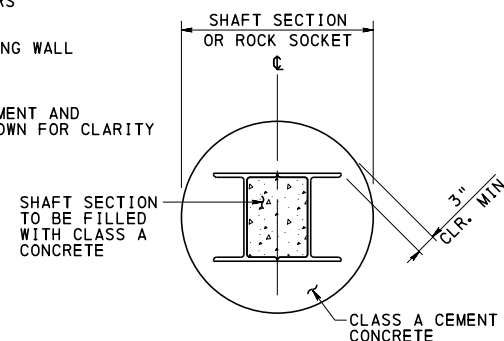
**NOTES:**

1. AS AN ALTERNATE TO A FOUNDATION DRAIN, WEEP HOLES MAY BE PROVIDED 6" ABOVE TOP OF BARRIER PROVIDED THAT APPEARANCE IS ACCEPTABLE AND SUFFICIENT ROADWAY DRAINAGE IS PROVIDED UNLESS PROJECT SPECIFIC PLANS OR SITE CONDITIONS REQUIRE THE NEED FOR BOTH A FOUNDATION DRAIN AND WEEP HOLES.
2. USE FOUNDATION DRAIN FOR BOTTOM UP INSTALLATION ONLY.
3. USE FOUNDATION DRAIN WHERE ROADWAY PAVEMENT DRAINS ONTO SLOPE ABOVE WALL OR WHERE SLOPE ABOVE WALL PRODUCES SIGNIFICANT RUNOFF. PROVIDE IMPERVIOUS BARRIER LAYER ABOVE STRUCTURE BACKFILL.
4. PROVIDE SURFACE PERPENDICULAR TO CENTERLINE ANCHOR WITHIN 0.3° TOLERANCE. GRIND CONCRETE SURFACE TO REMOVE PROJECTING IRREGULARITIES EXCEEDING 1/32". GRIND GALVANIZED SURFACE OF BEARING PLATE SMOOTH TO REMOVE ACCUMULATIONS OF ZINC AROUND EDGES.
5. HOLE DIAMETER WILL BE DEPENDENT ON THE SELECTED ANCHORHEAD (WEDGE PLATE).

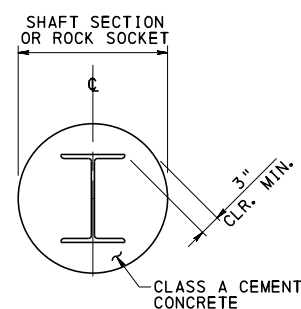


**DETAIL B**

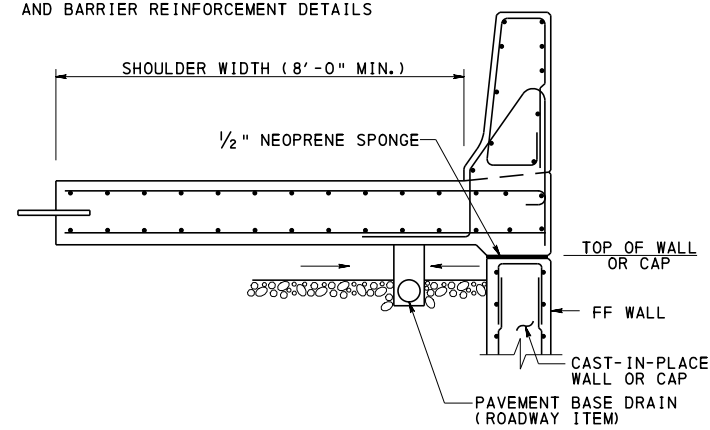
**CONCRETE EMBEDMENT SECTION -  
DOUBLE BEAM**



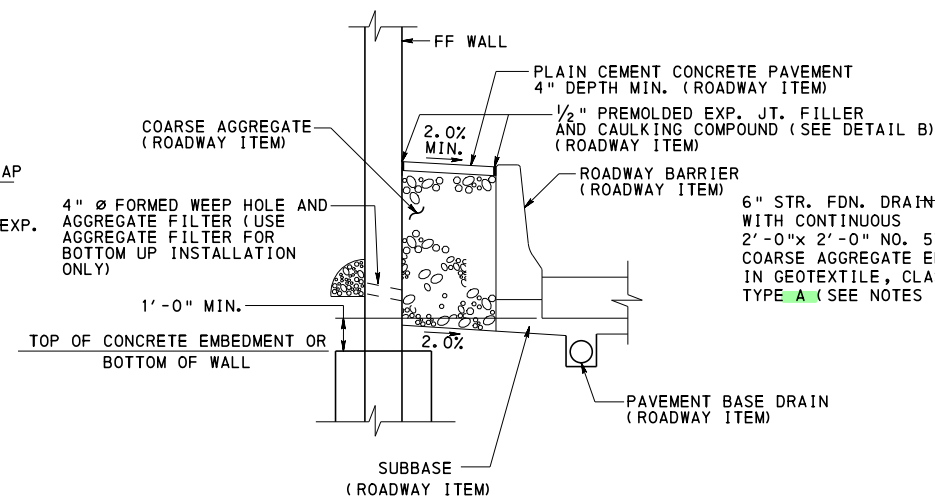
**CONCRETE EMBEDMENT SECTION -  
SINGLE BEAM**



NOTE:  
SEE BD-627M FOR TYPICAL MOMENT SLAB  
AND BARRIER REINFORCEMENT DETAILS

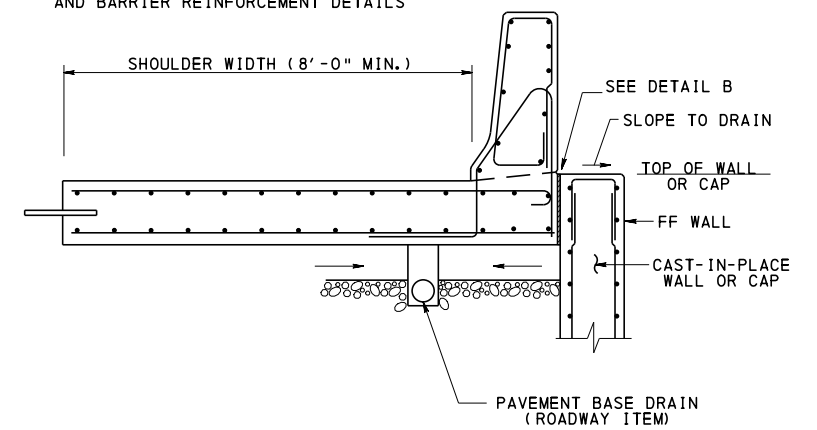


**BARRIER DETAIL 1**

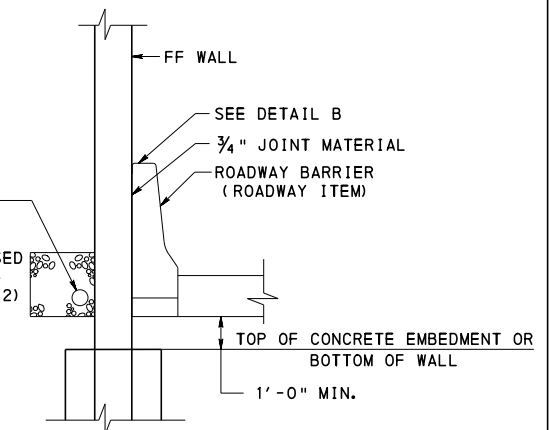


**BARRIER DETAIL 3**

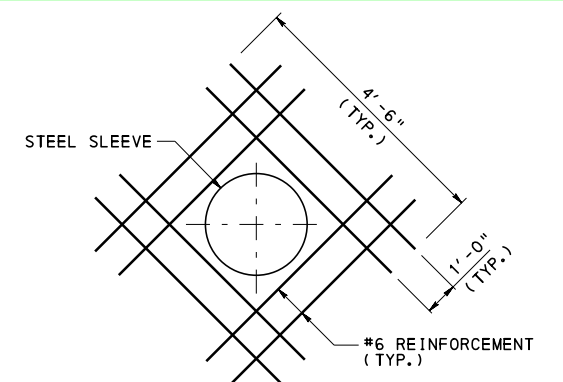
NOTE:  
SEE BD-627M FOR TYPICAL MOMENT SLAB  
AND BARRIER REINFORCEMENT DETAILS



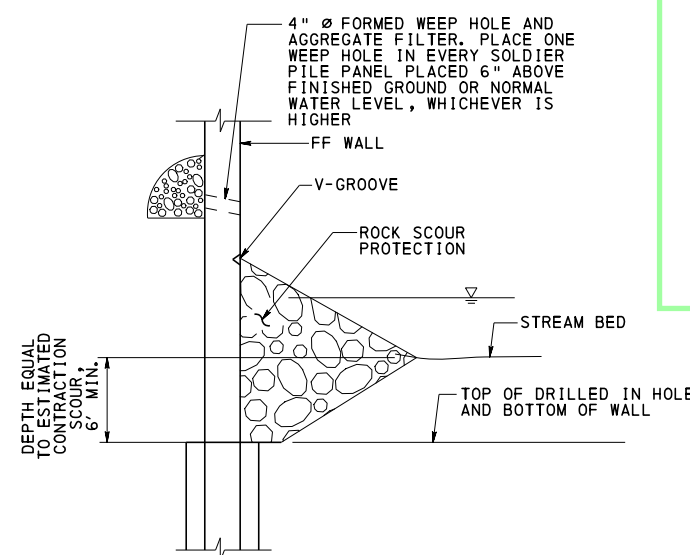
**BARRIER DETAIL 2**



**BARRIER DETAIL 4**



**DETAIL X - EXTRA WALL REINFORCEMENT  
AT TENDON ANCHORAGE**



**TYPICAL SECTION  
AT STREAM**

**LEGEND:**

FF FRONT FACE

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
ANCHORED WALLS  
MISCELLANEOUS DETAILS**

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 9 OF 9  
**BD-626M**



GENERAL NOTES:

- DESIGN SPECIFICATIONS:
  - BARRIER AND MOMENT SLAB DESIGNED IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1992 (INCLUDING THE 1993 AND 1994 INTERIM SPECIFICATIONS), AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES, AUGUST 1993 EDITION (INCLUDING LATEST REVISIONS).
- CONSTRUCTION SPECIFICATIONS AND **PERFORM WORK:**
  - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AND THE CONTRACT SPECIAL PROVISIONS.
- ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
- DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
- REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
- IF NEEDED DETAILS ARE NOT FOUND IN THIS STANDARD, A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

MATERIAL NOTES:

- CAST-IN-PLACE CONCRETE:
  - PROVIDE CLASS AA CEMENT CONCRETE IN THE MOMENT SLAB, BARRIERS, AND TOE WALLS.
- PRECAST CONCRETE BARRIERS:
  - CLASS AA CEMENT CONCRETE, MODIFIED - FURNISH PRECAST BARRIERS IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION 408, SECTION 714, EXCEPT PROVIDE CONCRETE HAVING A 28-DAY COMPRESSIVE STRENGTH OF 4000 PSI WHEN TESTED IN ACCORDANCE WITH PTM NO. 604.
- REINFORCEMENT STEEL:
  - PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 IN BARRIERS OR WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
  - EPOXY COAT ALL REINFORCEMENT BARS.
  - PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH FOR REINFORCING BARS IN ACCORDANCE WITH BC-736M.

INSTRUCTIONS TO DESIGNERS:

- THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DRAWINGS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL REQUIRED DETAILS AND NOTES.
- DESIGN COMPUTATIONS ARE NOT REQUIRED FOR THE MOMENT SLAB AND BARRIER CONFIGURATIONS SHOWN ON THIS STANDARD. WHERE CONDITIONS AND/OR DETAILS DIFFER FROM THE STANDARD, COMPLETE DESIGN COMPUTATIONS MUST BE SUBMITTED TO THE DEPARTMENT. SUCH SPECIAL DESIGNS MUST PROVIDE ULTIMATE STRENGTH EQUAL TO THE DESIGN PROVIDED IN THIS STANDARD.
- DESIGNER TO DETAIL ONLY CAST-IN-PLACE BARRIERS ON THE CONTRACT PLANS. PRECAST BARRIER OPTION IS ONLY PERMITTED AS A CONTRACTOR ALTERNATE.
- CONTRACT DRAWINGS:
  - PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4, THIS STANDARD AND OTHER PENNDOT STANDARDS.
  - PROVIDE COMPLETE DETAILS AND NOTES AS REQUIRED.
  - PROVIDE STAKE OUT PLAN.
  - PROVIDE COMPLETE REINFORCEMENT BAR DETAILS AND BAR SCHEDULE.
  - PROVIDE TOP OF SLAB (OR ROADWAY) ELEVATIONS AT ALL TRANSVERSE JOINT LOCATIONS.
  - PROVIDE ELEVATIONS AT GUTTER LINES AND EDGE OF MOMENT SLAB.
- PAY ITEMS:
  - PROVIDE SEPARATE PAY ITEMS AND INDICATE THE APPROXIMATE QUANTITY FOR CONCRETE, REINFORCEMENT, PROTECTIVE COATINGS, AND ANY OTHER ITEM THAT MAY BE REQUIRED FOR THE CONSTRUCTION OF THE MOMENT SLAB AND BARRIER.
  - EXCAVATION, SUBBASE, AND SUBGRADE DRAINS ARE ROADWAY PAY ITEMS.
- PROVIDE PAVEMENT BASE DRAINS IN ACCORDANCE WITH RC-30M.
- PROTECTIVE COATINGS:
  - APPLY A PROTECTIVE COATING FOR REINFORCED CONCRETE SURFACES (PENETRATING SEALERS, BRIDGE SUPERSTRUCTURE) IN ACCORDANCE WITH PUBLICATION 408, SECTION 1019 TO THE TOP SURFACE OF THE MOMENT SLAB AND TO THE INSIDE FACE AND TOP SURFACES OF THE BARRIERS. DO NOT PLACE PENETRATING SEALERS ON TOP OF ANY SURFACE THAT RECEIVES ASPHALT OVERLAY.
- SUBBASE THICKNESS BENEATH THE MOMENT SLAB AND BARRIER MUST MATCH THE ROADWAY SUBBASE THICKNESS.
- THE 42" F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL4. THE 32" F-SHAPE CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-3. THE ALTERNATE SIDEWALK WITH 42" VERTICAL WALL CONCRETE BARRIER ATTACHED TO A MOMENT SLAB IS DESIGNATED AS MASH TL-2.
- THE 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.

CONTRACT DRAWING NOTES:

- THE FOLLOWING NOTES ARE TO BE PLACED ON THE CONTRACT DRAWINGS WHEN REQUIRED:
- A HIGHER CLASS CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS CONCRETE AT NO ADDITIONAL COST TO THE DEPARTMENT.
  - CONTRACTOR IS PERMITTED TO PROVIDE A PRECAST BARRIER IN PLACE OF THE CAST-IN-PLACE BARRIER. CONTRACTOR MUST SUBMIT SHOP DRAWINGS FOR REVIEW AND ACCEPTANCE IN ACCORDANCE WITH PUBLICATION 408. THE SHOP DRAWINGS MUST COMPLETELY DETAIL THE ENTIRE MOMENT SLAB AND BARRIER ALONG THE REQUIRED LENGTH.
    - CONTRACTOR IS RESPONSIBLE FOR LIFTING, HANDLING AND TRANSPORTATION STRESSES.
    - CONTRACTOR IS RESPONSIBLE FOR TEMPORARY BRACING DESIGN CALCULATIONS AND DETAILS.
    - LIFTING INSERTS:
      - PROVIDE GALVANIZED LIFTING INSERTS.
      - PROVIDE LIFTING INSERTS WITH A MINIMUM CAPACITY OF AT LEAST TWO TIMES THE CALCULATED LOAD ON THE INSERT.
      - PROVIDE A MINIMUM OF TWO LIFTING INSERTS PER BARRIER SECTION.
  - PROVIDE ANY OTHER NOTES AS REQUIRED.

| INDEX OF SHEETS |                                              |
|-----------------|----------------------------------------------|
| SHEET NO.       | SHEET TITLE                                  |
| 1               | GENERAL NOTES                                |
| 2               | TYPICAL C.I.P. BARRIER DETAILS               |
| 3               | TYPICAL PRECAST BARRIER DETAILS              |
| 4               | MISCELLANEOUS DETAILS                        |
| 5               | TOE WALL DETAILS                             |
| 6               | PLANS                                        |
| 7               | END TREATMENT                                |
| 8               | PAVEMENT RELIEF JOINT AND INLET INSTALLATION |

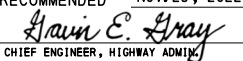
|                |                                                                         |
|----------------|-------------------------------------------------------------------------|
| RC-20M         | CONCRETE PAVEMENT JOINTS                                                |
| <b>RC-21M</b>  | <b>REINFORCED CONCRETE PAVEMENT</b>                                     |
| RC-24M         | PAVEMENT RELIEF JOINT                                                   |
| <b>RC-27M</b>  | <b>PLAIN CONCRETE PAVEMENT</b>                                          |
| RC-30M         | SUBSURFACE DRAINS                                                       |
| <b>RC-50M</b>  | <b>GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS</b>                         |
| BC-709M        | PA TYPE 10M BRIDGE BARRIER                                              |
| BC-713M        | PA BRIDGE BARRIER                                                       |
| BC-735M        | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS                           |
| BC-736M        | REINFORCEMENT BAR FABRICATION DETAILS                                   |
| BC-752M        | CONCRETE DECK SLAB DETAILS                                              |
| BC-767M        | NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES |
| <b>BC-799M</b> | <b>MECHANICALLY STABILIZED EARTH RETAINING WALLS</b>                    |
| BD-601M        | CONCRETE DECK SLAB                                                      |
| BD-610M        | PA BRIDGE BARRIER                                                       |
| BD-617M        | PA TYPE 10M BRIDGE BARRIER                                              |
| BD-618M        | PA VERTICAL WALL BRIDGE BARRIER                                         |
| <b>BD-622M</b> | <b>R.C. ABUTMENTS WITH BACKWALL</b>                                     |
| <b>BD-624M</b> | <b>R.C. ABUTMENTS WITHOUT BACKWALL</b>                                  |
| BD-628M        | BRIDGE APPROACH SLABS                                                   |
| BD-679M        | STRUCTURE MOUNTED SOUND BARRIER WALLS                                   |

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
MOMENT SLABS  
GENERAL NOTES

RECOMMENDED NOV. 23, 2022  
  
CHIEF BRIDGE ENGINEER

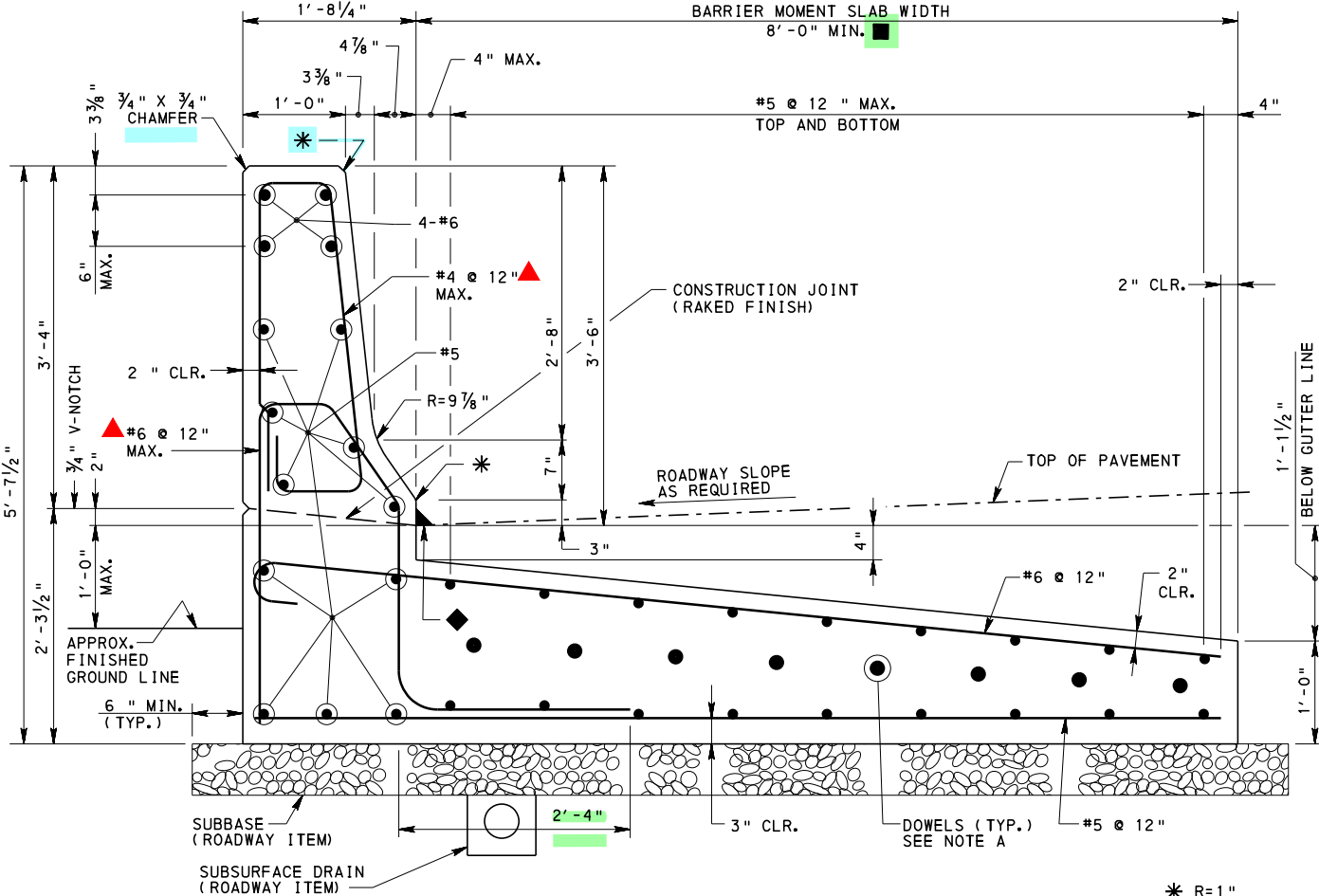
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CHIEF ENGINEER, HIGHWAY ADMIN

SHEET 1 OF 8  
BD-627M

- CHANGE 2
- CHANGE 3
- CHANGE 5

NOTE: e-Notification  
revisions on  
Sheets 2 - 5

e-Notification No. 82,  
dated Jan. 20, 2023



**MOMENT SLAB (BURIED)  
WITH C.I.P. 42" F-SHAPE CONCRETE BARRIER**

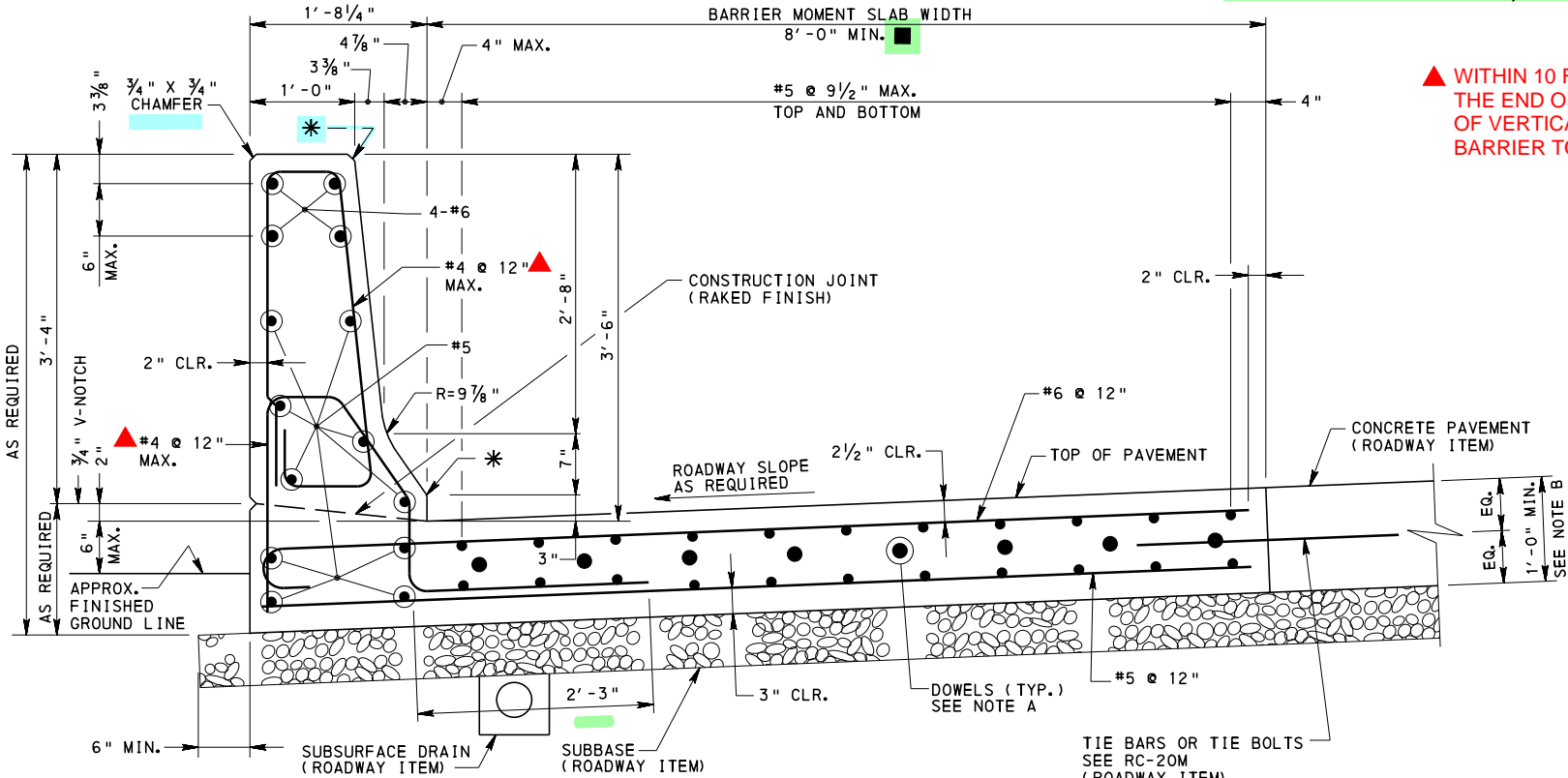
(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

\* R=1"

◆ ASPHALT RUBBER SEALING COMPOUND  
[PUB. 408, SECTION 705.4(g)]

■ AT DISCRETION OF DISTRICT BRIDGE ENGINEER,  
MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0".  
FOR REHABILITATION PROJECTS, SEE SHEET 7

- NOTE A:**  
PROVIDE DOWELS AT EXPANSION JOINTS.  
USE TYPE D OR E JOINT PER RC-20M.  
USE SAME JOINT AS PROVIDED IN PAVEMENT.
- NOTE B:**  
MOMENT SLAB DEPTH TO MATCH DEPTH OF  
CONCRETE PAVEMENT IN ROADWAY.



**MOMENT SLAB (AT-GRADE)  
WITH C.I.P. 42" F-SHAPE CONCRETE BARRIER**

(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

\* R=1"

▲ WITHIN 10 FT. OF AN EXPANSION JOINT AND AT  
THE END OF THE BARRIER, REDUCE SPACING  
OF VERTICAL REINFORCEMENT BARS IN THE  
BARRIER TO HALF THE SHOWN SPACING.

- NOTES**  
1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

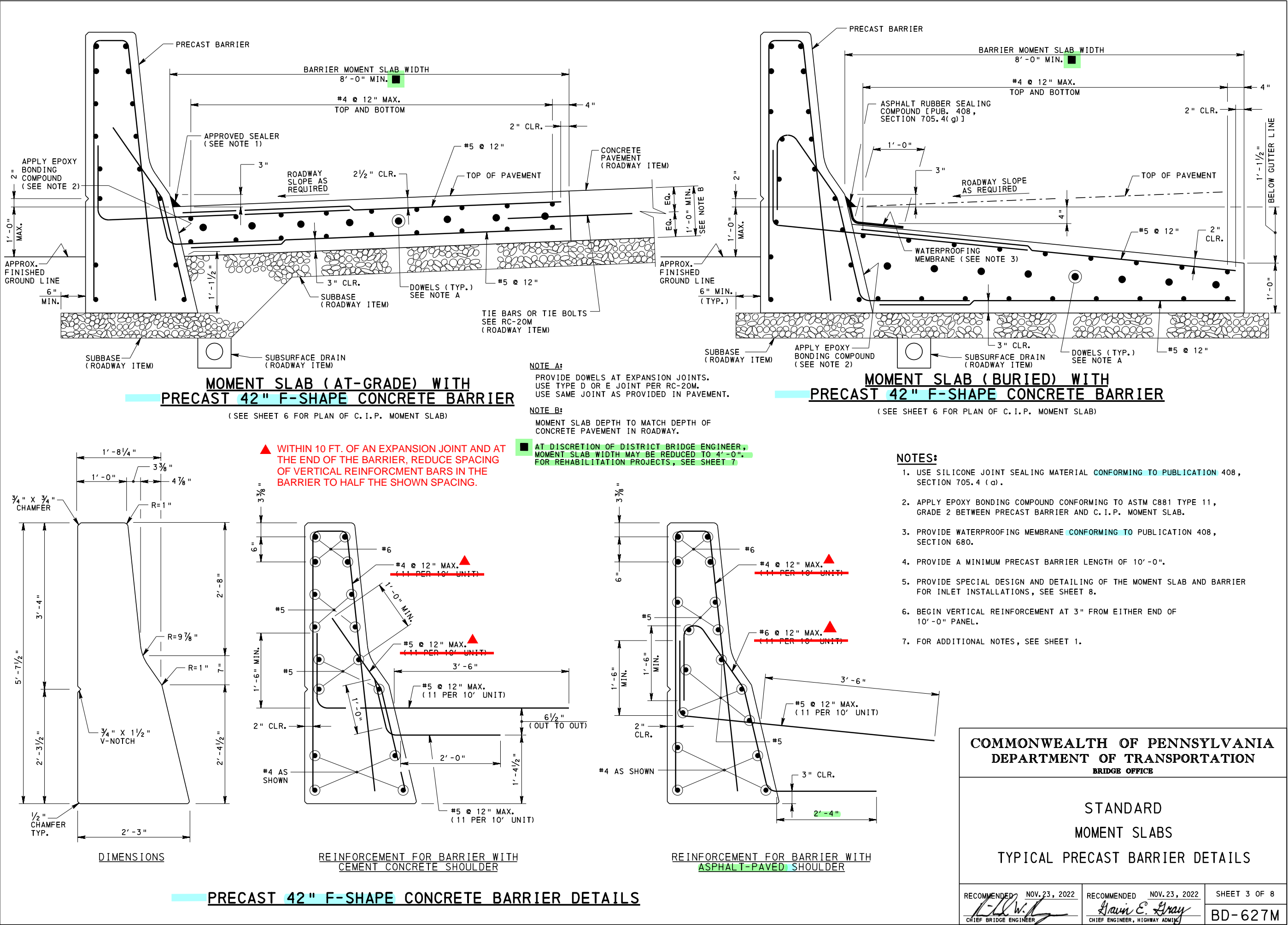
STANDARD  
MOMENT SLABS  
TYPICAL C.I.P. BARRIER DETAILS

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*[Signature]*  
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RECOMMENDED NOV. 23, 2022  
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SHEET 2 OF 8  
BD-627M

e-Notification No. 82,  
dated Jan. 20, 2023



COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

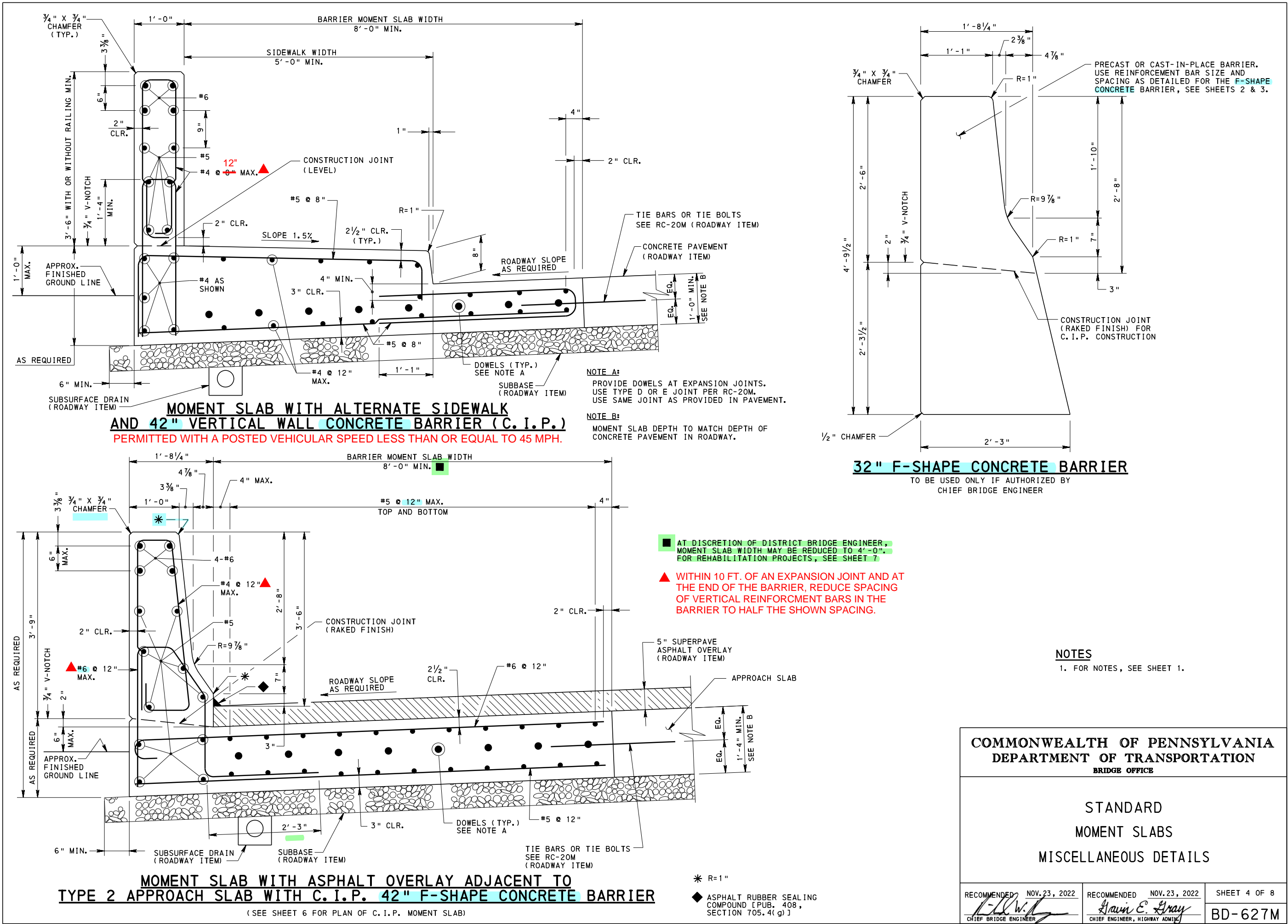
STANDARD  
MOMENT SLABS  
TYPICAL PRECAST BARRIER DETAILS

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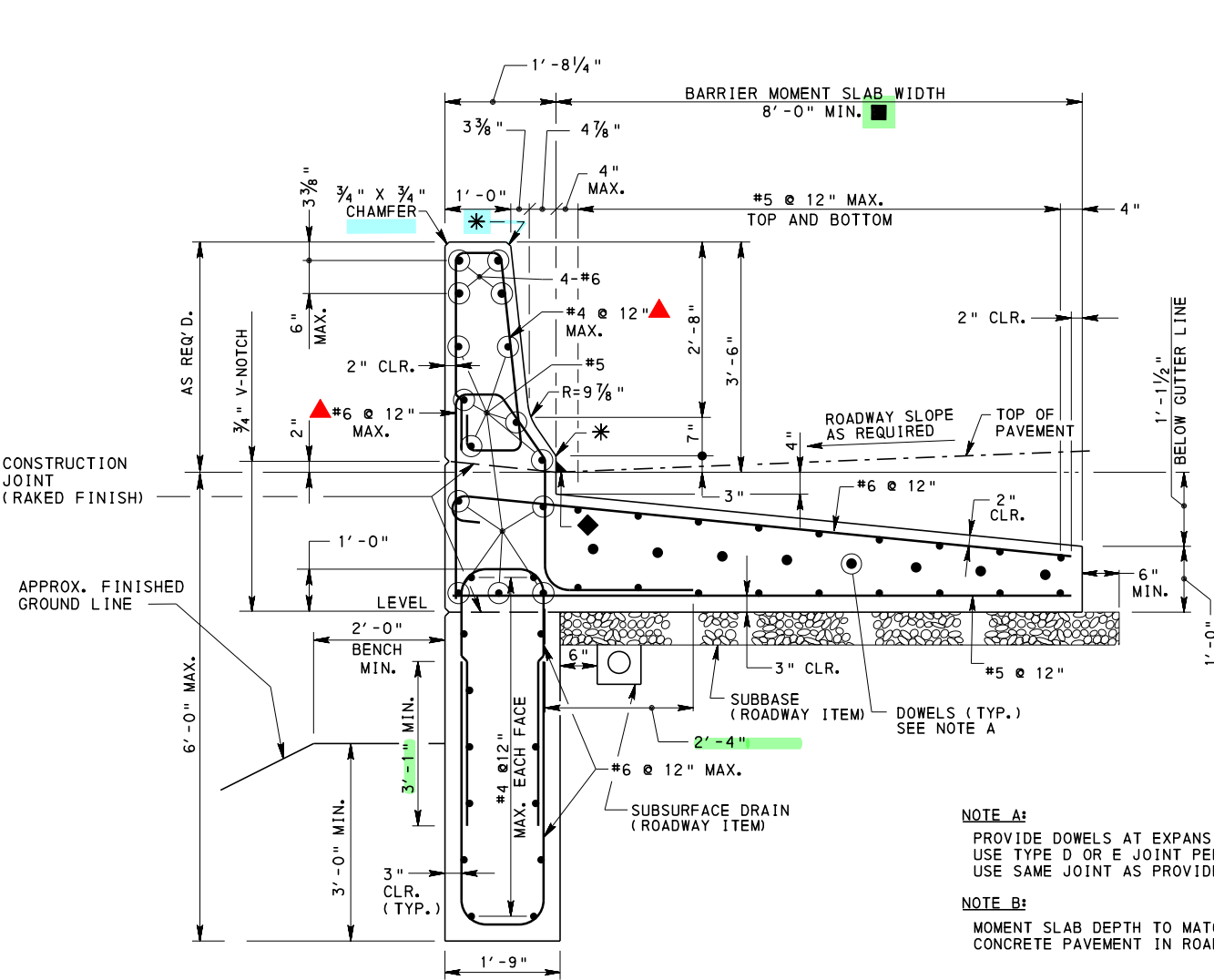
SHEET 3 OF 8  
BD-627M

e-Notification No. 82,  
dated Jan. 20, 2023

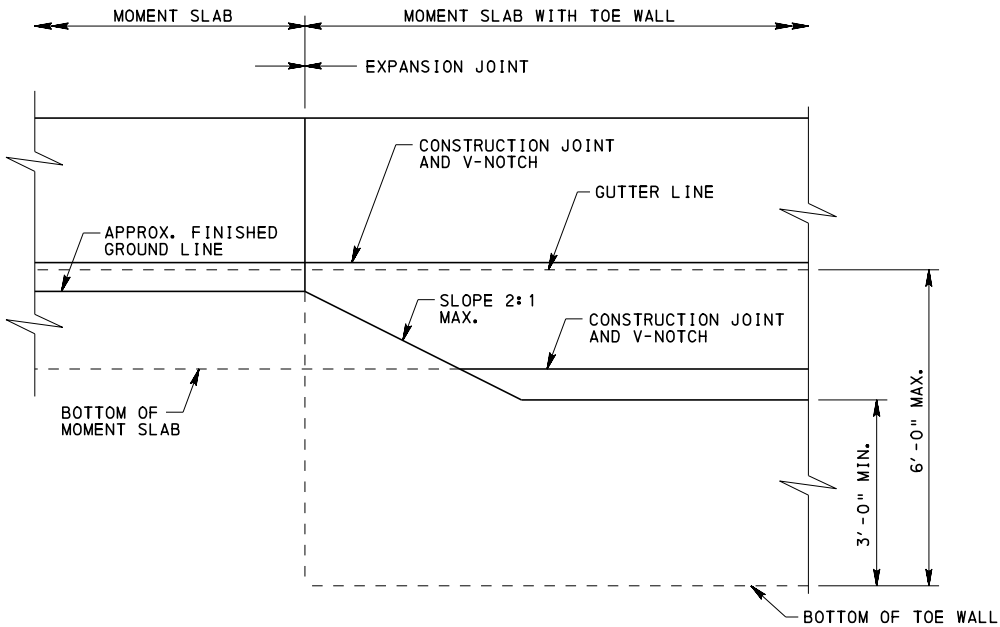




e-Notification No. 82,  
dated Jan. 20, 2023



MOMENT SLAB (BURIED) WITH TOE WALL  
AND C.I.P. 42" F-SHAPE CONCRETE BARRIER  
(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

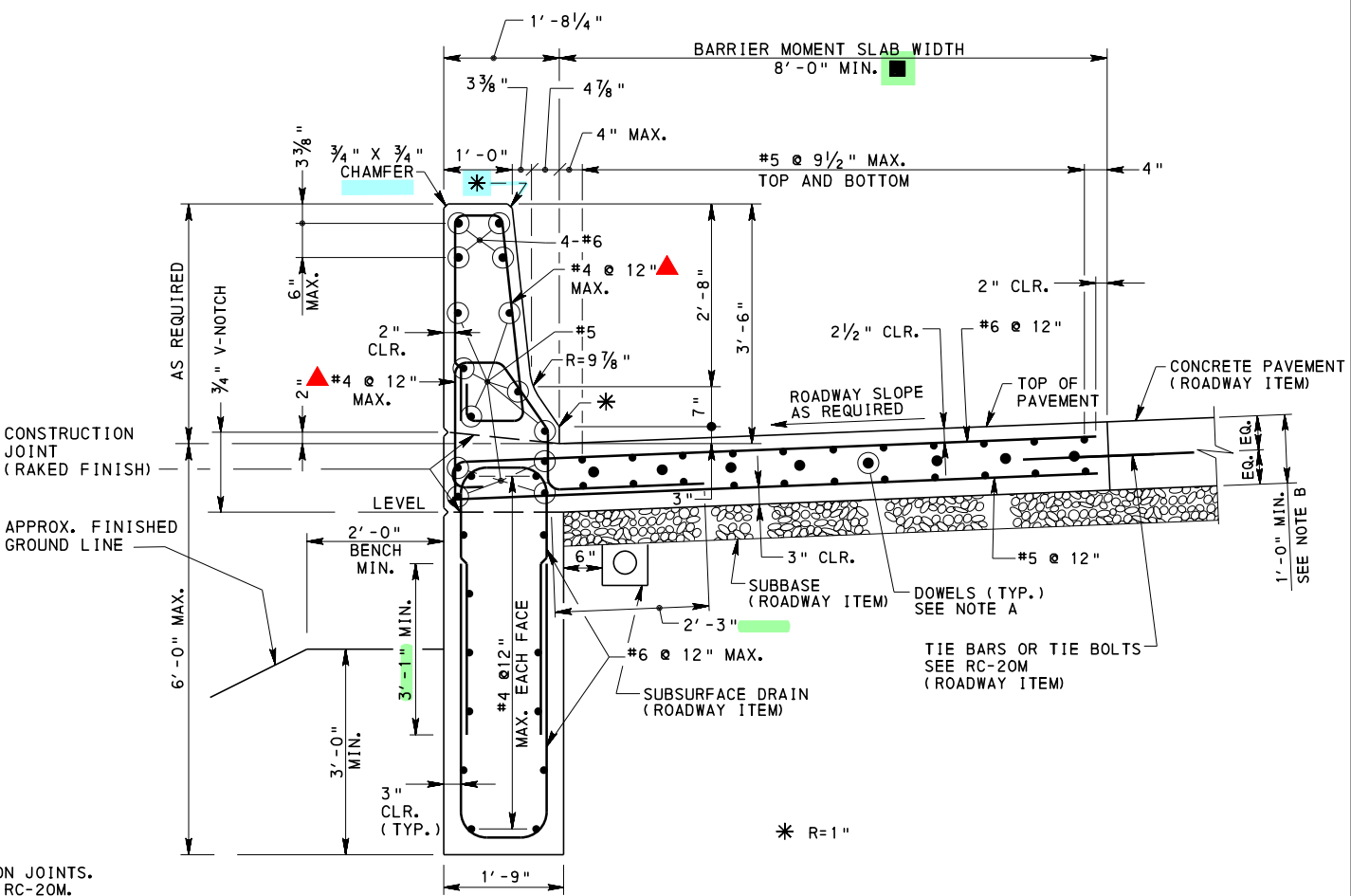


TOE WALL ELEVATION TRANSITION

NOTE A:  
PROVIDE DOWELS AT EXPANSION JOINTS.  
USE TYPE D OR E JOINT PER RC-20M.  
USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B:  
MOMENT SLAB DEPTH TO MATCH DEPTH OF  
CONCRETE PAVEMENT IN ROADWAY.

- \* R=1"
- ◆ ASPHALT RUBBER SEALING COMPOUND  
[PUB. 408, SECTION 705.4(g)]
- AT DISCRETION OF DISTRICT BRIDGE ENGINEER,  
MOMENT SLAB WIDTH MAY BE REDUCED TO 4'-0".  
FOR REHABILITATION PROJECTS, SEE SHEET 7
- ▲ WITHIN 10 FT. OF AN EXPANSION JOINT AND AT  
THE END OF THE BARRIER, REDUCE SPACING  
OF VERTICAL REINFORCEMENT BARS IN THE  
BARRIER TO HALF THE SHOWN SPACING.



MOMENT SLAB (AT-GRADE) WITH TOE WALL  
AND C.I.P. 42" F-SHAPE CONCRETE BARRIER  
(SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB)

NOTES  
1. FOR NOTES, SEE SHEET 1.

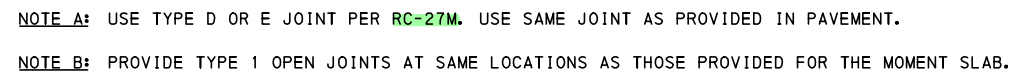
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DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
MOMENT SLABS  
TOE-WALL DETAILS

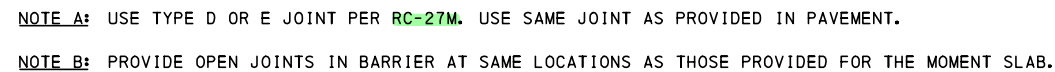
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CHIEF BRIDGE ENGINEER

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*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 5 OF 8  
BD-627M



( PRECAST BARRIER)



( C. I. P. BARRIER)



1. ALL OPEN JOINTS IN THE BARRIER MUST BE FILLED WITH BACKING ROD AND SEALED WITH SILICONE JOINT SEALING MATERIAL ~~AS SPECIFIED IN~~ PUBLICATION 408, SECTION 705.41 (a).
2. EXPOSED JOINTS AT BARRIER MAY VARY FROM 1/2" TO 1" WIDTH FOR TYPE 1 OPEN JOINT AND 1/4" TO 3/4" WIDTH FOR TYPE 2 OPEN JOINT, TO ALLOW FOR HORIZONTAL AND/OR VERTICAL CURVATURE IN WALL.

LOCATE EXPANSION JOINTS IN MOMENT SLAB AND BARRIER TO MATCH THE PAVEMENT JOINTS. DO NOT LOCATE EXPANSION JOINTS WITHIN 6'-0" OF THE CENTERLINE OF LIGHT POLE OR WITHIN 2'-0" OF THE CENTERLINE OF A JUNCTION BOX.

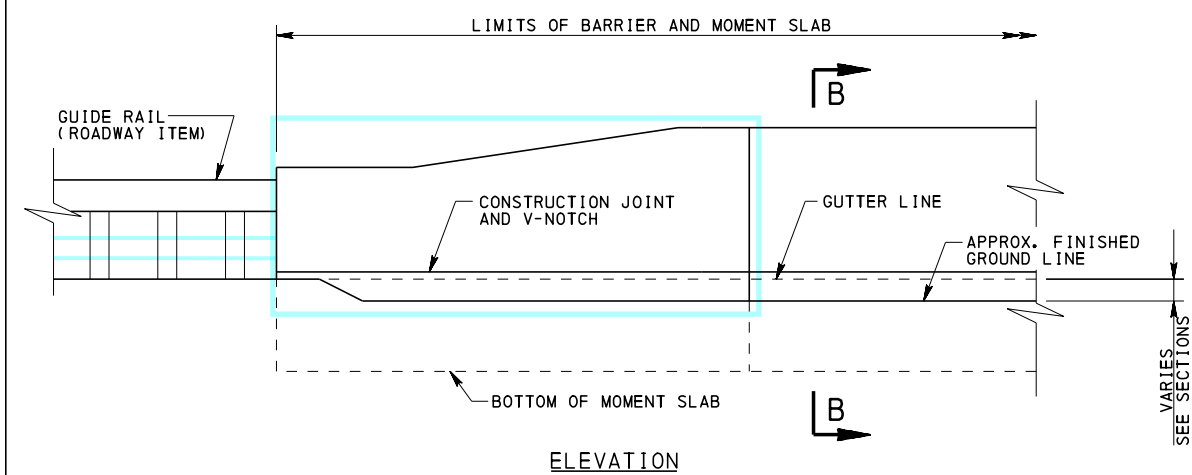
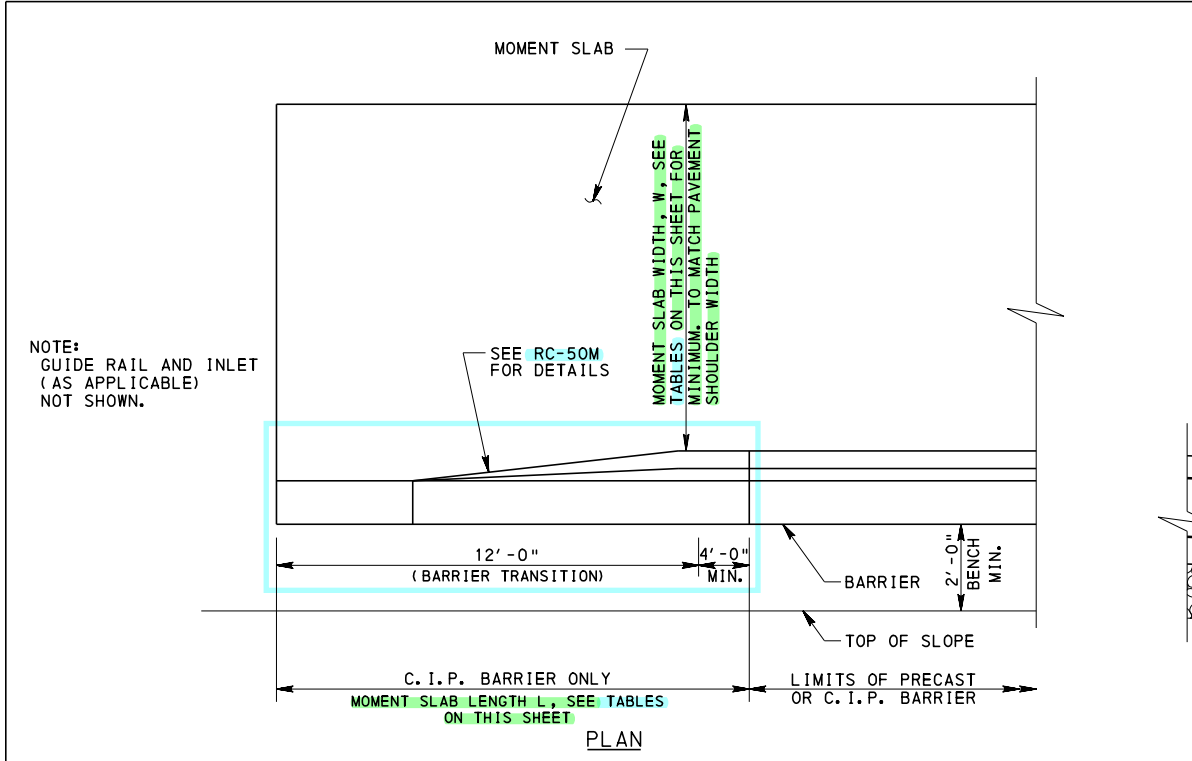
1. FOR NOTES, SEE SHEET 1.

STANDARD  
MOMENT SLABS  
PLANS

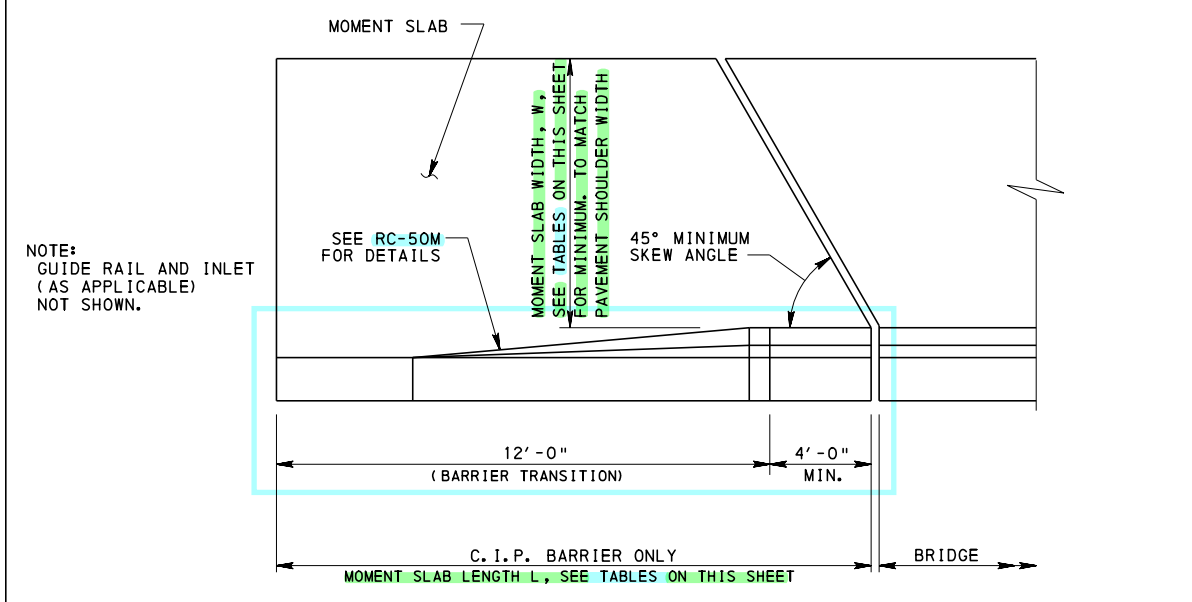
SHEET 6 OF 8

BD-627M

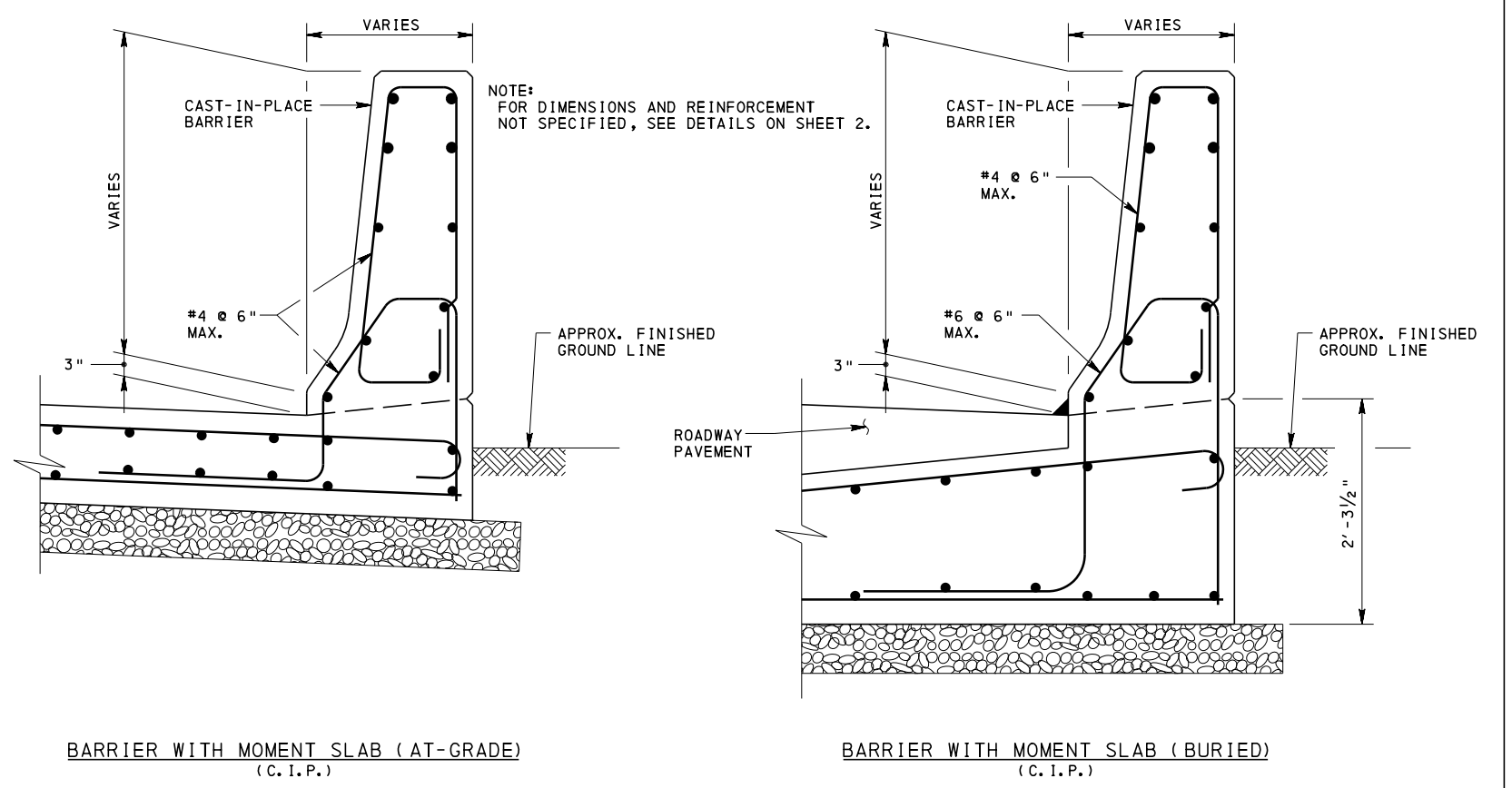




**BARRIER TO GUIDE RAIL TRANSITION**



**MOMENT SLAB ADJACENT TO BRIDGE**



**SECTION B-B**

(REFER TO RC-50M FOR ADDITIONAL INFORMATION)

| MINIMUM MOMENT SLAB DIMENSIONS FOR REHABILITATION PROJECTS |          |         |
|------------------------------------------------------------|----------|---------|
| OPTION                                                     | L        | W       |
| A                                                          | 20' - 0" | 4' - 0" |
| B                                                          | 16' - 0" | 5' - 0" |

NOTE: 1. THE USE OF THIS TABLE IS FOR REHABILITATION ONLY AND AT THE DISCRETION OF THE DISTRICT BRIDGE ENGINEER.  
2. THE DESIGNED CRASH TEST LEVEL IN THIS TABLE IS TL-3.

| MINIMUM MOMENT SLAB DIMENSIONS FOR NEW PROJECTS |  |
|-------------------------------------------------|--|
| L = 16' - 0"                                    |  |
| W = 8' - 0"                                     |  |

- NOTES**
- FOR NOTES, SEE SHEET 1.
  - REFER TO BD-622M OR BD-624M FOR END OF BARRIER TRANSITION DETAILS.

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**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

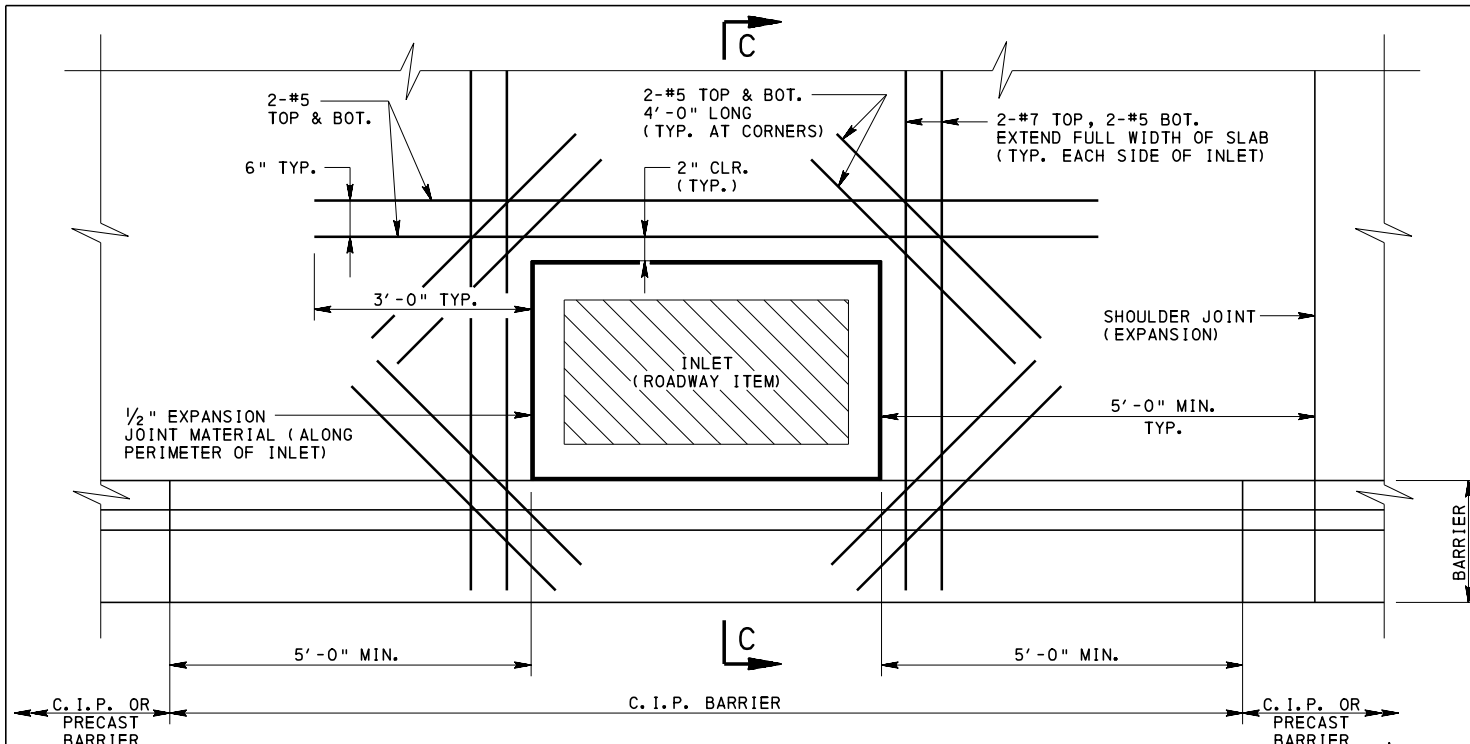
STANDARD  
MOMENT SLABS

END TRANSITION

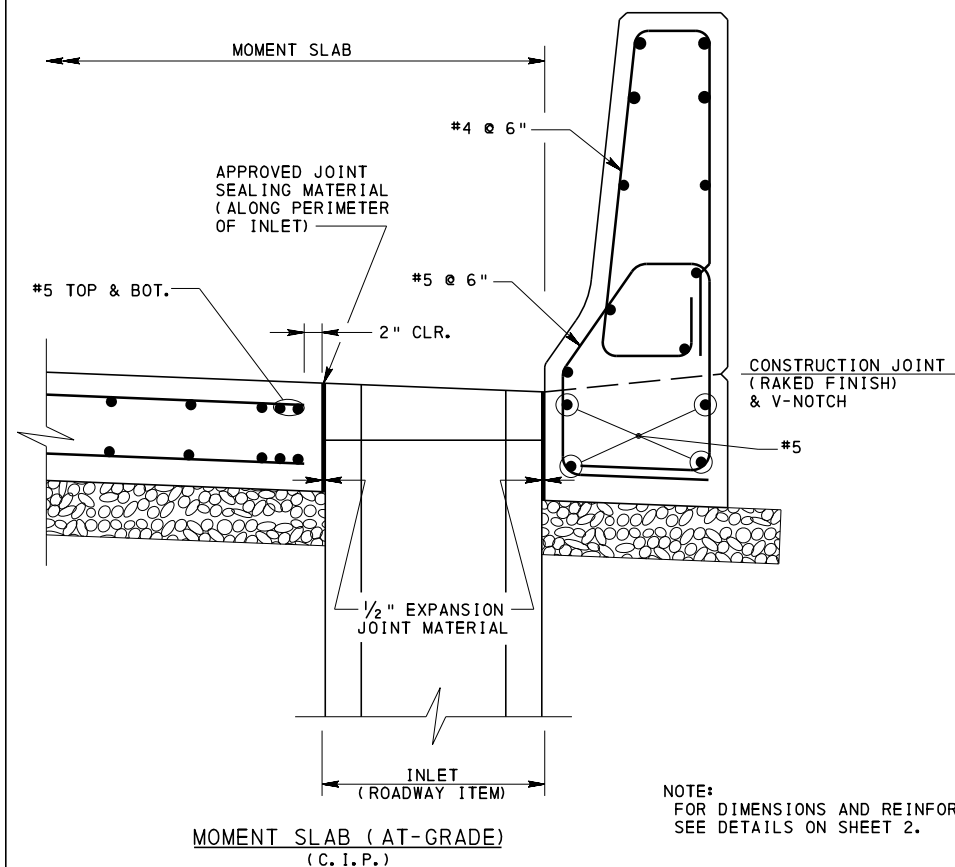
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RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

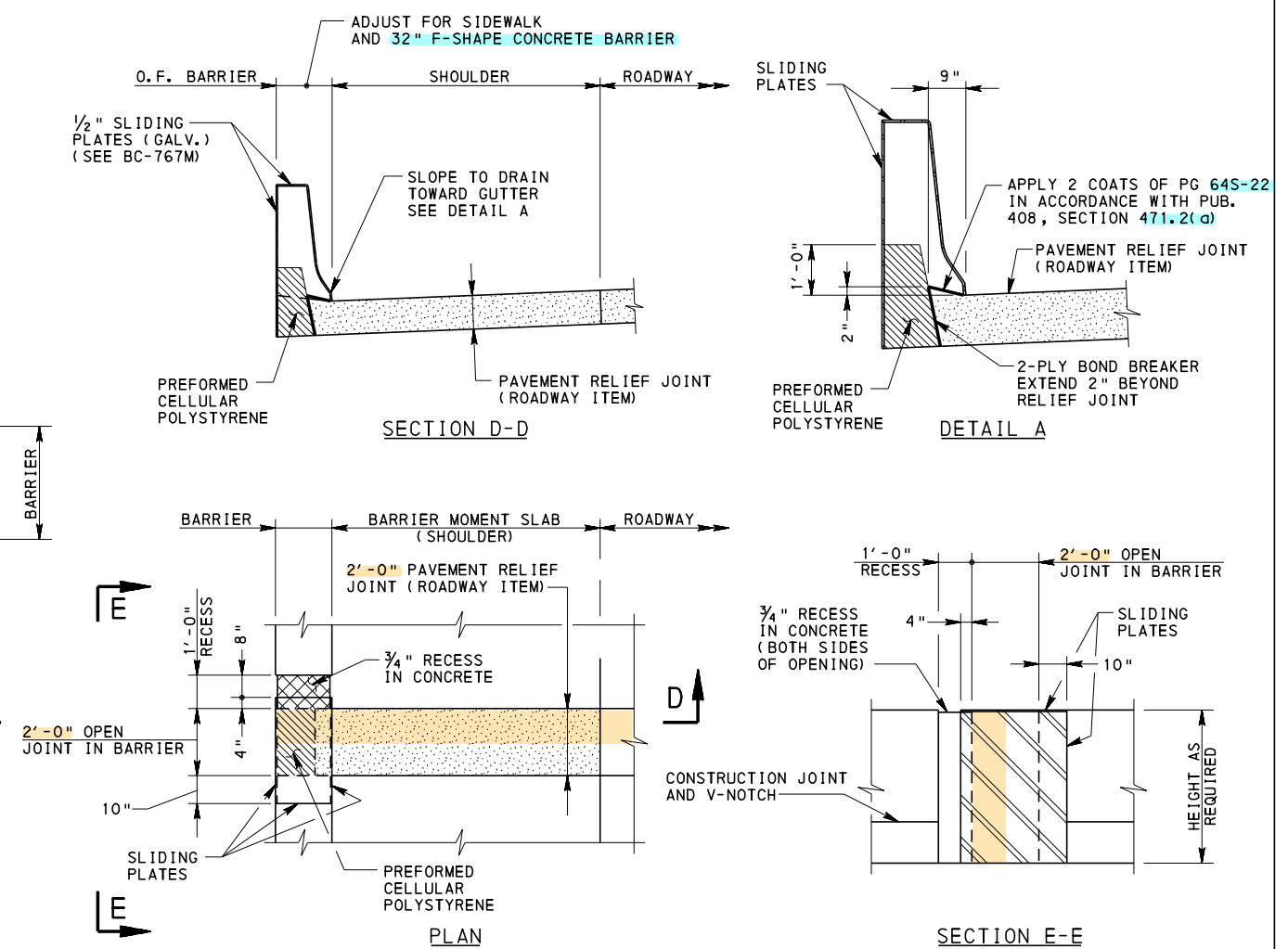
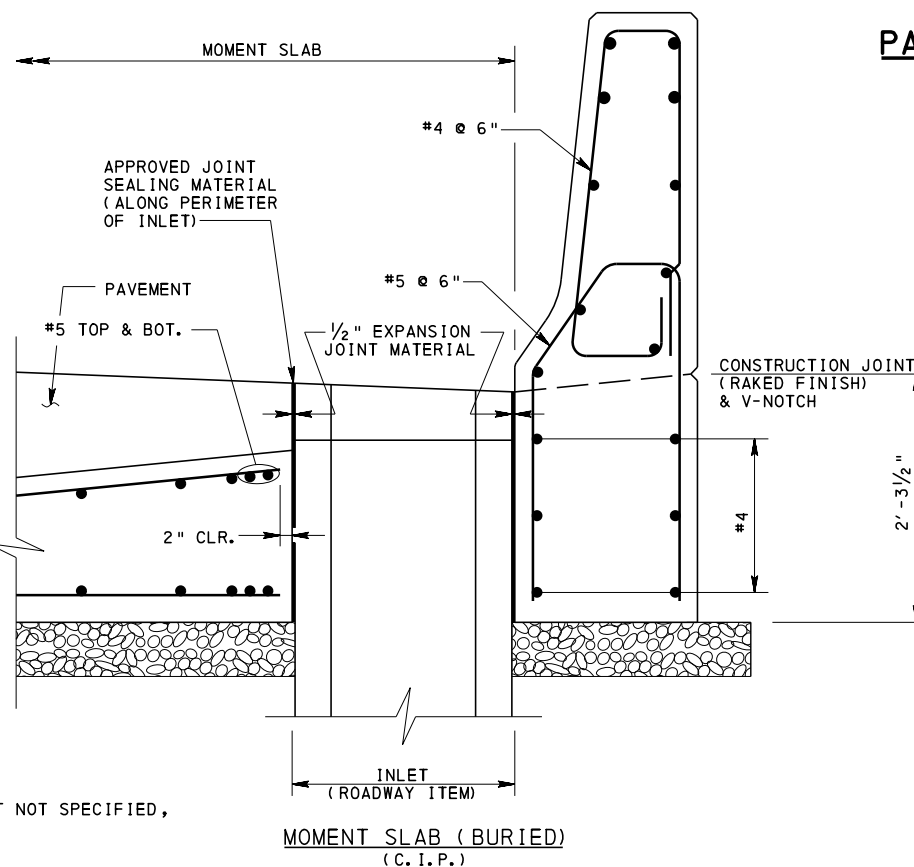
SHEET 7 OF 8  
BD-627M



**PLAN - SHOULDER DETAILS AT INLET**  
(ADDITIONAL REINFORCEMENT AT INLETS)



**SECTION C-C**



**PAVEMENT RELIEF JOINT DETAILS**

**NOTES**

1. FOR NOTES, SEE SHEET 1.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

**STANDARD**  
**MOMENT SLABS**  
**PAVEMENT RELIEF JOINT AND**  
**INLET INSTALLATION**

RECOMMENDED NOV. 23, 2022  
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CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 8 OF 8  
BD-627M

- CHANGE 2
- CHANGE 3
- CHANGE 5

GENERAL NOTES:

1. DESIGN SPECIFICATIONS:
- AASHTO, LRFD BRIDGE DESIGN SPECIFICATIONS AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.

• DESIGN IS IN ACCORDANCE WITH THE LOAD AND RESISTANCE FACTOR DESIGN METHOD (LRFD).
2. CONSTRUCTION SPECIFICATIONS AND **PERFORM WORK**:
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5M/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M FOR WELDING NOT COVERED IN AASHTO/AWD/D1.5M/D1.5.)
3. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
4. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
5. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
6. IF NEEDED DETAILS ARE NOT FOUND IN THIS STANDARD A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

| APPROACH SLAB TYPES |                                                                                             |
|---------------------|---------------------------------------------------------------------------------------------|
| TYPE                | DESCRIPTION                                                                                 |
| 1                   | CONCRETE APPROACH SLAB                                                                      |
| 2                   | CONCRETE APPROACH SLAB WITH SUPERPAVE ASPHALT OVERLAY                                       |
| 3                   | ABUTMENT WITH BACKWALL WITH ATTACHED CONCRETE APPROACH SLAB AND NEOPRENE STRIP SEAL DAM     |
| 4                   | ABUTMENT WITH BACKWALL WITH ATTACHED INTEGRAL CONCRETE DRAIN TROUGH AND TOOTH EXPANSION DAM |
| 5                   | CONCRETE APPROACH SLAB WITH INTEGRAL ABUTMENT                                               |

NOTE: ASPHALT OVERLAY IS NOT PERMITTED ON APPROACH SLAB TYPES 1, 3, 4 AND 5.

MATERIAL NOTES:

1. PROVIDE THE FOLLOWING CONCRETE CLASS:
- PROVIDE CLASS A CEMENT CONCRETE IN SUPPORT PEDESTALS BELOW THE BRIDGE SEAT CONSTRUCTION JOINT FOR TYPE 4 APPROACH SLAB.

• PROVIDE CLASS AA CEMENT CONCRETE IN APPROACH SLAB TYPES 1, 2 AND 4, SLEEPER SLABS, BARRIERS, SUPPORT PEDESTALS ABOVE THE BRIDGE SEAT CONSTRUCTION JOINT AND DRAIN TROUGH.

• PROVIDE CLASS AAAP CEMENT CONCRETE IN APPROACH SLAB TYPES 3 AND 5.

• A HIGHER CLASS OF CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS OF CONCRETE AT NO ADDITIONAL COST TO THE DEPARTMENT.
2. REINFORCEMENT STEEL:
- PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS UNLESS SPECIFIED. DO NOT USE RAIL STEEL A996 IN BARRIERS OR WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.

• EPOXY COAT ALL REINFORCEMENT BARS.

• PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH FOR REINFORCING BARS IN ACCORDANCE WITH BC-736M.
3. FABRICATED STRUCTURAL STEEL:
- PROVIDE STRUCTURAL STEEL CONFORMING TO AASHTO M270 GRADE 36 (**OR GRADE 50**) [ASTM A709, GRADE 36 **OR GRADE 50**] UNLESS NOTED OTHERWISE.
4. NEOPRENE COMPRESSION SEALS:
- PROVIDE MATERIALS AND DETAILS IN ACCORDANCE WITH BC-766M.
5. NEOPRENE STRIP SEAL DAMS:
- PROVIDE MATERIALS AND DETAILS IN ACCORDANCE WITH BC-767M.
6. TOOTH EXPANSION DAMS:
- PROVIDE MATERIALS AND DETAILS IN ACCORDANCE WITH BC-762M.

INDEX OF SHEETS

| SHEET NO. | SHEET TITLE                                                    |
|-----------|----------------------------------------------------------------|
| 1         | GENERAL NOTES - 1                                              |
| 2         | GENERAL NOTES - 2                                              |
| 3         | TYPE 1 AND TYPE 2 - SECTIONS AND DETAILS                       |
| 4         | TYPE 1 AND TYPE 2 - PLAN 1                                     |
| 5         | TYPE 1 AND TYPE 2 - PLAN 2                                     |
| 6         | TYPE 1 AND TYPE 2 - PLAN 3                                     |
| 7         | TYPE 1 AND TYPE 2 - PLAN 4                                     |
| 8         | TYPE 1 THRU TYPE 4 - TRANSVERSE SECTION WITH ATTACHED BARRIERS |
| 9         | TYPE 1, 2 AND 4 - DETAILS 1, 2 AND 3                           |
| 10        | TYPE 1 AND TYPE 2 - DETAIL 4                                   |
| 11        | TYPE 1 AND TYPE 2 - DETAIL 5                                   |
| 12        | TYPE 1 AND TYPE 2 - DETAIL 6                                   |
| 13        | TYPE 1 AND TYPE 2 - DETAIL 7                                   |
| 14        | TYPE 1 AND TYPE 2 - DETAIL 8                                   |
| 15        | TYPE 1 AND TYPE 2 - DETAIL 9                                   |
| 16        | TYPE 1 AND TYPE 2 - DETAIL 10                                  |
| 17        | TYPE 1 AND TYPE 2 - DETAIL 11                                  |
| 18        | TYPE 1 AND TYPE 2 - DETAIL 12                                  |
| 19        | TYPE 3 - PLAN 1 AND SECTION                                    |
| 20        | TYPE 3 - PLAN 2                                                |
| 21        | TYPE 3 - PLAN 3                                                |
| 22        | TYPE 3 AND TYPE 5 - DETAILS 13, 14 AND 15                      |
| 23        | TYPE 5 - DETAILS 16, 17 AND 18                                 |
| 24        | TYPE 3 - DETAILS 19 AND 20                                     |
| 25        | TYPE 3 - DETAILS 21 AND 22                                     |
| 26        | TYPE 4 - PLAN 1 AND SECTION                                    |
| 27        | TYPE 4 - PLAN 2                                                |
| 28        | TYPE 4 - PLAN 3                                                |
| 29        | TYPE 4 - DETAIL 23                                             |
| 30        | TYPE 4 - DETAIL 24                                             |
| 31        | TYPE 4 - DETAIL 25                                             |
| 32        | TYPE 4 - DETAIL 26                                             |
| 33        | TYPE 4 - DRAIN TROUGH DETAILS 1                                |
| 34        | TYPE 4 - DRAIN TROUGH DETAILS 2                                |
| 35        | TYPE 5 - PLAN AND SECTION                                      |

|  |         |                                                        |
|--|---------|--------------------------------------------------------|
|  | BC-788M | TYPICAL WATERPROOFING AND EXPANSION DETAILS            |
|  | BC-799M | MECHANICALLY STABILIZED EARTH RETAINING WALLS          |
|  | BD-601M | CONCRETE DECK SLAB                                     |
|  | BD-610M | PA BRIDGE BARRIER                                      |
|  | BD-611M | CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES |
|  | BD-617M | PA TYPE 10M BRIDGE BARRIER                             |
|  | BD-618M | <b>VERTICAL WALL CONCRETE BRIDGE BARRIER</b>           |
|  | BD-621M | REINFORCED CONCRETE ABUTMENTS                          |
|  | BD-622M | R.C. ABUTMENTS WITH BACKWALL                           |
|  | BD-624M | R.C. ABUTMENTS WITHOUT BACKWALL                        |
|  | BD-627M | MOMENT SLABS                                           |
|  | BD-655M | TYPICAL SUPERSTRUCTURE SECTIONS                        |
|  | BD-656M | TYPICAL LONGITUDINAL SECTIONS                          |
|  | BD-661M | BOX BEAM REINFORCEMENT DETAILS                         |
|  | BD-662M | I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS      |
|  | BD-667M | INTEGRAL ABUTMENTS                                     |
|  | BD-679M | STRUCTURE MOUNTED SOUND BARRIER WALLS                  |
|  |         |                                                        |

|         |                                                                           |
|---------|---------------------------------------------------------------------------|
| RC-12M  | BACKFILL AT STRUCTURES                                                    |
| RC-20M  | CONCRETE PAVEMENT JOINTS                                                  |
| RC-24M  | PAVEMENT RELIEF JOINT                                                     |
| RC-30M  | SUBSURFACE DRAINS                                                         |
| RC-50M  | GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS                                  |
| BC-709M | PA TYPE 10M BRIDGE BARRIER                                                |
| BC-713M | PA BRIDGE BARRIER                                                         |
| BC-735M | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS                             |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                                     |
| BC-752M | CONCRETE DECK SLAB DETAILS                                                |
| BC-762M | TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES       |
| BC-766M | PREFORMED NEOPRENE COMPRESSION SEAL JOINT FOR APPROACH SLABS              |
| BC-767M | NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL I-BEAM BRIDGES |
| BC-775M | MISCELLANEOUS PRESTRESS DETAILS                                           |

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
BRIDGE APPROACH SLABS  
GENERAL NOTES - 1

|                                                                                       |               |                                                                                       |               |               |
|---------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------|---------------|---------------|
| RECOMMENDED                                                                           | NOV. 23, 2022 | RECOMMENDED                                                                           | NOV. 23, 2022 | SHEET 1 OF 35 |
|  |               |  |               | BD-628M       |
| CHIEF BRIDGE ENGINEER                                                                 |               | CHIEF ENGINEER, HIGHWAY ADMINISTRATION                                                |               |               |

INSTRUCTIONS TO DESIGNER NOTES

1. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE CONTRACT DRAWINGS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL REQUIRED DETAILS AND NOTES.
2. APPROACH SLAB SKEW ANGLE TO MATCH BRIDGE SKEW ANGLE. BRIDGE SKEW ANGLE MUST BE GREATER THAN OR EQUAL TO 45 DEGREES. IF THE BRIDGE SKEW ANGLE IS LESS THAN 45 DEGREES THE DESIGNER MUST DISCUSS ALTERNATE DETAILS WITH THE BRIDGE DESIGN AND TECHNOLOGY DIVISION. FOR CONCRETE PAVEMENT THE MINIMUM APPROACH SLAB SKEW IS 60 DEGREES.
3. DESIGNER TO DETERMINE AND SPECIFY THE APPROPRIATE TYPE OF APPROACH SLAB REQUIRED ON THE TS&L DRAWINGS FOR APPROVAL BY PENNDOT.
4. REFER TO APPROACH SLAB SELECTION CRITERIA TABLE FOR ADDITIONAL INFORMATION.
5. DIFFERENT APPROACH SLAB TYPES ARE PERMITTED ON THE SAME BRIDGE.
6. APPROACH SLABS ARE PERMITTED TO BE USED ON CURVED HORIZONTAL ALIGNMENTS. DESIGNER TO DETERMINE IF THESE DETAILS ARE APPROPRIATE FOR EACH INDIVIDUAL SITUATION.
7. CONTRACT DRAWINGS:
- PROVIDE COMPLETE DETAILS AND NOTES AS REQUIRED.
  - PROVIDE COMPLETE REINFORCEMENT BAR DETAILS AND BAR SCHEDULE.
  - PROVIDE FINISHED TOP OF CONCRETE ELEVATIONS AT THE BEGIN AND END OF SLABS AND AT 10 FOOT INTERVALS. PROVIDE ELEVATIONS AT THE BASELINE, GUTTER LINES, AND AT BREAKS IN SLOPES.
8. APPROACH SLAB PER RC-23M:
- APPROACH SLAB DETAILS SHOWN ON RC-23M ARE ONLY PERMITTED WHEN THE BRIDGE IS DESIGNED USING BRADD, UNLESS OTHERWISE DIRECTED.
  - APPROACH SLAB DETAILS ARE NOT REQUIRED ON THE CONTRACT DRAWINGS WHEN THE BRIDGE IS DESIGNED USING BRADD, UNLESS OTHERWISE DIRECTED.
  - IF THE APPROACH SLAB IS CONSTRUCTED IN ACCORDANCE WITH RC-23M, THE APPROACH SLAB IS A ROADWAY ITEM, UNLESS OTHERWISE DIRECTED.
9. BRIDGE PAY ITEMS:
- BRIDGE APPROACH SLABS ARE TO BE INCLUDED AS PART OF THE LUMP SUM STRUCTURE AND SEPARATED INTO INDIVIDUAL ITEMS, UNLESS OTHERWISE DIRECTED.
  - PROVIDE SEPARATE COLUMNS IN THE QUANTITY BLOCK FOR EACH APPROACH SLAB. (APPROACH SLAB AT ABUTMENT 1 / APPROACH SLAB AT ABUTMENT 2)
  - PROVIDE SEPARATE ITEMS AND INDICATE THE APPROXIMATE QUANTITY FOR CONCRETE, REINFORCEMENT, NEOPRENE STRIP SEAL DAMS, TOOTH EXPANSION DAMS, COMPRESSION SEALS, PROTECTIVE COATINGS AND ANY OTHER ITEM THAT MAY BE REQUIRED FOR THE CONSTRUCTION OF THE APPROACH SLAB.
  - WATERSTOPS, POLYETHYLENE SHEETING, CLOSED CELL NEOPRENE SPONGE, EPOXY BONDING COMPOUND, SAWING AND SEALING JOINTS, BACKER ROD, AND ASPHALT-SATURATED PAPER ITEMS ARE INCIDENTAL TO THE APPROACH SLAB CONCRETE.
  - END COVER PLATES, BOLTS, WASHERS AND THREADED INSERTS FOR TYPE 3 AND 5 APPROACH SLABS ARE INCIDENTAL TO THE NEOPRENE STRIP SEAL DAM.
  - STAINLESS STEEL PLATES, RUBBERIZED TROUGH MATERIAL, GALVANIZED STEEL BARS, STAINLESS STEEL SCREWS, NON SHRINK GROUT, STUDS AND ANCHOR BOLTS REQUIRED FOR THE DRAIN TROUGH FOR TYPE 4 APPROACH SLAB ARE INCIDENTAL TO THE TOOTH EXPANSION DAM PAY ITEM.
  - TYPE 5 APPROACH SLABS: PROVIDE STRUCTURAL BACKFILL IN ACCORDANCE WITH RC-12M. SUBBASE MATERIAL NOT REQUIRED.
10. ROADWAY PAY ITEMS:
- SUPERPAVE ASPHALT OVERLAY, ROADWAY PAVEMENT, PAVEMENT RELIEF JOINT, DUCTILE IRON PIPE, INLETS, EXCAVATION, SUBBASE MATERIAL AND SUBGRADE DRAINS ARE ROADWAY PAY ITEMS.
  - SUBBASE THICKNESS BENEATH THE APPROACH SLABS AND SLEEPER SLABS MUST MATCH THE ROADWAY SUBBASE THICKNESS.
11. SUPERPAVE ASPHALT OVERLAY:
- THE TYPE OF SUPERPAVE ASPHALT MIXTURE DESIGNS PLACED ON TOP OF THE APPROACH SLAB MUST MATCH THE TYPE OF SUPERPAVE ASPHALT MIXTURE DESIGNS USED ON THE ADJACENT ROADWAY.
  - DESIGNER TO SPECIFY THE REQUIRED SUPERPAVE ASPHALT MIXTURE DESIGNS, FOR THE WEARING AND BASE COURSES, ON THE CONTRACT PLANS. THE DEPTH OF THE COURSES MUST EQUAL 5".
  - ASPHALT OVERLAY IS ONLY PERMITTED ON TYPE 2 APPROACH SLAB.
12. PAVEMENT SUBGRADE DRAIN:
- PROVIDE SUBGRADE DRAIN, REFER TO RC-30M, ON THE LOW SIDE OF THE SLEEPER SLAB.
13. PROTECTIVE COATINGS:
- APPLY A PROTECTIVE COATING FOR REINFORCED CONCRETE SURFACES (PENETRATING SEALER, BRIDGE SUPERSTRUCTURE) IN ACCORDANCE WITH PUBLICATION 408, SECTION 1019 TO THE TOP SURFACE OF APPROACH SLAB, EXPOSED SURFACES OF THE SLEEPER SLAB AND TO THE FACE AND TOP SURFACES OF THE BARRIERS. DO NOT PLACE PENETRATING SEALERS ON TOP OF ANY SURFACE THAT RECEIVES ASPHALT OVERLAY.

14. GENERAL INFORMATION:
- PROVIDE PAVING NOTCH OUT-TO-OUT.
  - THE DETAILS PRESENTED IN THIS STANDARD SHOW A 45" F-SHAPE CONCRETE BARRIER. DESIGNER IS RESPONSIBLE TO PROVIDE THE APPROPRIATE DETAILS FOR THE TYPE OF BARRIER REQUIRED.
  - THE DIAPHRAGM REINFORCEMENT CONNECTING THE TYPE 3 APPROACH SLAB TO THE BRIDGE STRUCTURE WAS DEVELOPED BASED ON A HORIZONTAL LOAD EQUAL TO A FRICTION FACTOR OF 0.60 X DEADLOAD OF APPROACH SLAB
  - DESIGN OF ABUTMENTS AND BEARINGS WITH STRUCTURE SUPPORTED APPROACH SLAB: DESIGNER TO INCLUDE THE FOLLOWING ADDITIONAL VERTICAL LOADS INCURRED FROM THE APPROACH SLAB WHEN DESIGNING THE ABUTMENTS AND BEARINGS.
    - VERTICAL REACTION = 1/2 DEADLOAD OF APPROACH SLAB + PHL-93 LANE LOAD REACTION FROM APPROACH SLAB.
    - PHL-93 LANE LOAD REACTION IS OBTAINED BY TREATING THE BRIDGE APPROACH SLAB AS A SIMPLE BEAM WHICH SPANS FROM STRUCTURE TO SLEEPER SLAB. DESIGNER MUST DETERMINE MAXIMUM REACTION BASED ON LENGTH OF THE APPROACH SLAB.
  - DESIGN OF BACKWALL WITH BACKWALL SUPPORTED APPROACH SLAB: DESIGNER TO INCLUDE 1/2 DEADLOAD OF THE APPROACH SLAB, MAXIMUM PHL-93 LIVE LOAD REACTION (AXLES PLUS LANE LOAD) AND BRAKING FORCE WHEN DESIGNING THE BACKWALL.
  - DESIGN OF ABUTMENTS: DESIGNER TO INCLUDE 3'-0" LIVE LOAD SURCHARGE IN THE DESIGN OF THE ABUTMENT TO ACCOUNT FOR FUTURE CONDITION WITHOUT APPROACH SLABS (I.E. OMIT APPROACH SLAB DEADLOAD AND LIVE LOAD).
15. PLACE ROADWAY INLETS OUTSIDE THE LIMITS OF THE APPROACH SLAB OR SLEEPER SLABS.
16. OPENINGS IN BARRIERS AT BRIDGE / APPROACH SLAB INTERFACE ARE TO BE 1/2" OPEN JOINTS IN ACCORDANCE WITH BC-752M, PLACED PARALLEL TO THE CENTERLINE OF BEARINGS.
17. OPENINGS IN BARRIERS AT EXPANSION DEVICE (ROADWAY END OF APPROACH SLAB):
- BRIDGE SKEWS GREATER THAN OR EQUAL TO 75 DEGREES: PROVIDE OPENINGS PARALLEL TO CENTERLINE OF BEARINGS.
  - BRIDGE SKEWS LESS THAN 75 DEGREES: PROVIDE OPENINGS PERPENDICULAR TO THE ROADWAY.
18. PRESTRESSED CONCRETE BEAMS:
- BEAM NOTCHES: DEPTH OF BEAM NOTCH IS MODIFIED TO ACCOMMODATE THE DEPTH OF THE APPROACH SLABS IN ACCORDANCE WITH THE DETAILS SHOWN. SHOW BEAM NOTCH DIMENSIONS ON THE CONTRACT DRAWINGS.
  - STRAND PATTERN: STRAIGHT OR DEBONDED STRAND PATTERN IS PREFERRED OVER A DRAPED STRAND PATTERN TO INSURE PATTERN DOES NOT CONFLICT WITH THE INCREASED BEAM NOTCH DEPTH. DESIGNER TO INSURE THAT THE STRAND PATTERN DOES NOT CONFLICT WITH THE BEAM NOTCH.
19. STEEL BEAMS:
- BEAM NOTCHES: PROVIDE BEAM NOTCH IN ACCORDANCE WITH THE DETAILS SHOWN. SHOW BEAM NOTCH DIMENSIONS ON THE CONTRACT DRAWINGS.
20. ROADWAY INLETS ARE TO BE LOCATED AT A MINIMUM OF 10'-0" FROM THE END OF MOMENT SLABS OR SLEEPER SLABS, MEASURED PERPENDICULAR TO SLABS.
21. GEOSYNTHETIC STABILIZED BRIDGE APPROACH:
- THE DESIGNER MAY CHOOSE TO SPECIFY A RESILIENT SUBGRADE FOR A BRIDGE APPROACH PAVEMENT, APPROACH SLAB AND SLEEPER SLAB SUBGRADE AS SHOWN ON RC-15M AND AS SPECIFIED IN PUBLICATION 408, SECTION 224. A RESILIENT SUBGRADE IS JUSTIFIED FOR THE FOLLOWING CASES:
    - SITES HAVING RISK OF SEVERE EMBANKMENT EROSION DUE TO FLOOD OVERTOPPING OF APPROACH EMBANKMENT.
    - SITE HAVING RISK OF SETTLEMENT OF STRUCTURE BACKFILL WHERE ADDITIONAL RESISTANCE TO POSSIBLE SETTLEMENT OF THE APPROACH PAVEMENT IS WARRANTED.

APPROACH SLAB GUIDELINE NOTES

THE FOLLOWING GUIDELINES ARE PROVIDED IN ORDER TO HELP THE DESIGNER DETERMINE THE APPROPRIATE TYPE OF APPROACH SLAB TO BE SPECIFIED ON THE CONTRACT DRAWINGS. DESIGNER TO DISCUSS OPTIONS WITH PENNDOT PRIOR TO TS&L SUBMISSION.

1. BRADD BRIDGES:
- REFER TO RC-23M, APPROACH SLAB DETAILS ARE NOT REQUIRED ON THE CONTRACT DRAWINGS, UNLESS OTHERWISE DIRECTED.
2. TYPE 1 APPROACH SLAB:
- PROVIDE TYPE 1 APPROACH SLAB WHEN CONCRETE OR FLEXIBLE PAVEMENT IS SPECIFIED. THE BARRIERS MUST BE CONNECTED TO THE APPROACH SLAB DIRECTLY OR USE MOMENT SLABS CONNECTED TO THE APPROACH SLAB.
3. TYPE 2 APPROACH SLAB:
- PROVIDE TYPE 2 APPROACH SLAB WHEN FLEXIBLE PAVEMENT IS SPECIFIED. THE BARRIERS MUST BE CONNECTED TO THE APPROACH SLAB, DIRECTLY OR USE MOMENT SLABS CONNECTED TO THE APPROACH SLAB.
4. TYPE 3 APPROACH SLAB:
- TYPE 3 APPROACH SLABS CONNECT THE BRIDGE SUPERSTRUCTURE AND BARRIERS WITH THE APPROACH SLAB.
  - PROVIDE TYPE 3 APPROACH SLAB WHEN AN EXPANSION DEVICE IS REQUIRED AND THE DEPARTMENT DIRECTS THE DESIGNER TO RELOCATE THE EXPANSION DEVICE FROM ON THE BRIDGE TO THE END OF THE APPROACH SLAB.
  - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN MANUAL , PART 4.
5. TYPE 4 APPROACH SLAB:
- PROVIDE TYPE 4 APPROACH SLAB WHEN AN EXPANSION DEVICE IS REQUIRED AND THE ANTICIPATED JOINT MOVEMENT IS OVER 4". EXTEND THE DECK SLAB CONTINUOUS OVER THE BACKWALL TO THE EXPANSION DEVICE SUPPORTED BY AN INTEGRAL DRAIN TROUGH.
  - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN MANUAL , PART 4.

6. TYPE 5 APPROACH SLAB:
- PROVIDE TYPE 5 APPROACH SLAB WHEN INTEGRAL ABUTMENTS ARE SPECIFIED.
  - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN MANUAL , PART 4, APPENDIX G, SECTION 1.6.
7. TYPE 3 AND 5 APPROACH SLABS ARE NOT PERMITTED IF MECHANICALLY STABILIZED EARTH (MSE) ABUTMENTS AND/OR RETAINING WALLS ARE SPECIFIED. MSE RETAINING WALLS ARE PERMITTED BEYOND THE END OF THE SLEEPER SLAB.
8. REFER TO THE DETAILS FOR BEAM DEPTH LIMITATIONS.

APPROACH SLAB SELECTION CRITERIA TABLE

| APPROACH SLAB TYPE | ROADWAY PAVEMENT TYPE | MINIMUM SKEW ANGLE (DEGREES) | ABUTMENT WITH BACKWALL? | APPROACH SLAB CONNECTED TO SUPERSTRUCTURE? | SUPERPAVE ASPHALT OVERLAY ON APPROACH SLAB? | EXPANSION JOINT AT END OF APPROACH SLAB |
|--------------------|-----------------------|------------------------------|-------------------------|--------------------------------------------|---------------------------------------------|-----------------------------------------|
| 1                  | CONCRETE              | 60                           | N/A                     | NO                                         | NO                                          | N/A                                     |
|                    | FLEXIBLE              | 45                           |                         |                                            |                                             |                                         |
| 2                  | FLEXIBLE              | 45                           | N/A                     | NO                                         | YES                                         | N/A                                     |
| 3                  | CONCRETE              | 60                           | YES                     | YES                                        | NO                                          | NEOPRENE STRIP SEAL                     |
|                    | FLEXIBLE              | 45                           |                         |                                            |                                             |                                         |
| 4                  | CONCRETE              | 60                           | YES                     | YES                                        | NO                                          | TOOTH EXPANSION DAM                     |
|                    | FLEXIBLE              | 45                           |                         |                                            |                                             |                                         |
| 5 (SEE NOTE 1)     | CONCRETE              | 60                           | N/A                     | YES                                        | NO                                          | NEOPRENE STRIP SEAL ( IF REQUIRED)      |
|                    | FLEXIBLE              | 45                           |                         |                                            |                                             |                                         |

NOTES:

1. SKEW LIMITATIONS PER DESIGN MANUAL , PART 4, APPENDIX G, SECTION 1.2.2 MUST ALSO BE MET IN ORDER TO USE INTEGRAL ABUTMENTS.
2. IF BRIDGE SKEW ANGLE IS LESS THAN 45 DEGREES THE DESIGNER MUST DISCUSS ALTERNATE DETAILS WITH THE BRIDGE OFFICE.

CONTRACT DRAWINGS NOTES

THE FOLLOWING NOTES ARE TO BE PLACED ON THE CONTRACT DRAWINGS:

1. CONSTRUCT BRIDGE APPROACH SLAB AFTER THE BRIDGE DECK SLAB IS CONSTRUCTED.
2. PLACE CONCRETE IN ONE CONTINUOUS OPERATION, UNLESS OTHERWISE INDICATED OR DIRECTED.
3. TRANSVERSE CONSTRUCTION JOINTS ARE NOT PERMITTED IN THE CONCRETE APPROACH SLAB OR SLEEPER SLAB, UNLESS OTHERWISE INDICATED.
4. PROVIDE ANY OTHER NOTES AS REQUIRED.

COMMONWEALTH OF PENNSYLVANIA  
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BRIDGE OFFICE

STANDARD  
BRIDGE APPROACH SLABS  
GENERAL NOTES - 2

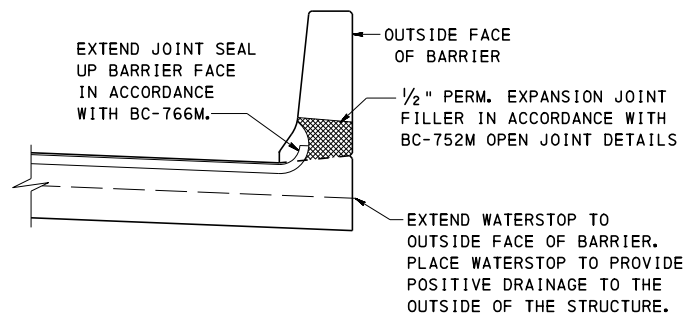
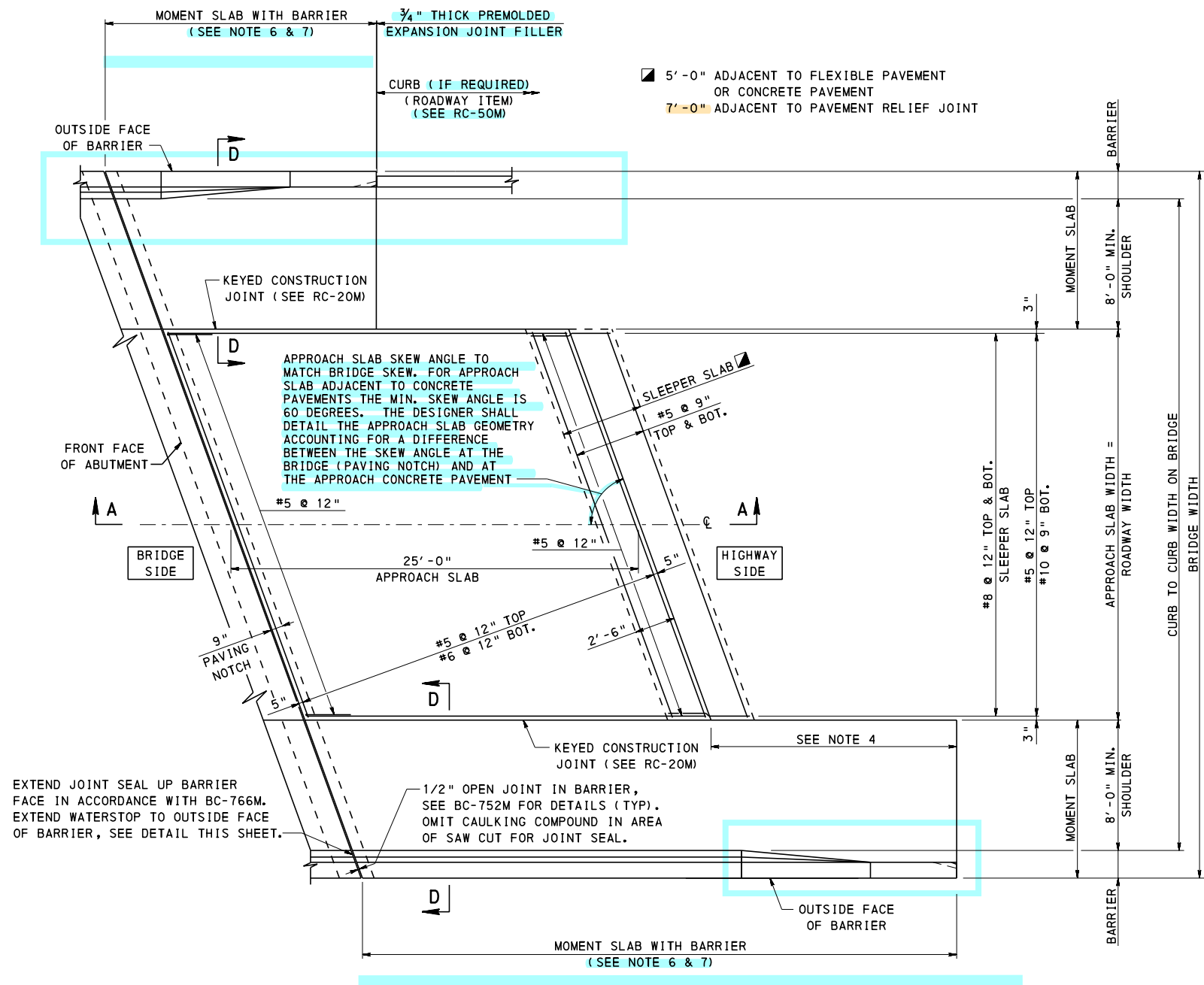
RECOMMENDED NOV. 23, 2022  
L. L. W. B.  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 2 OF 35  
BD-628M

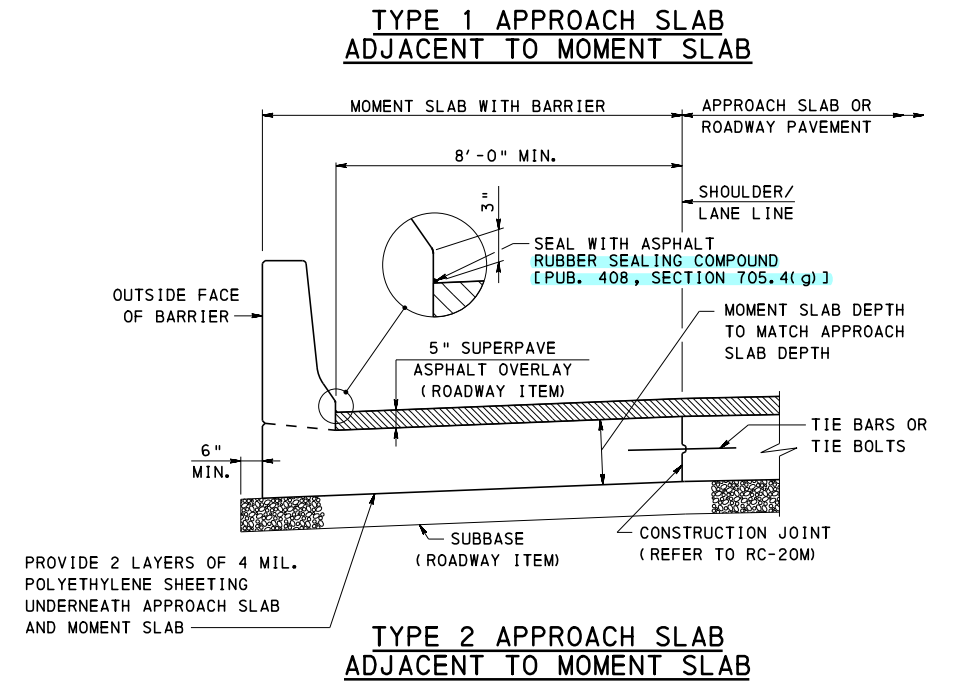
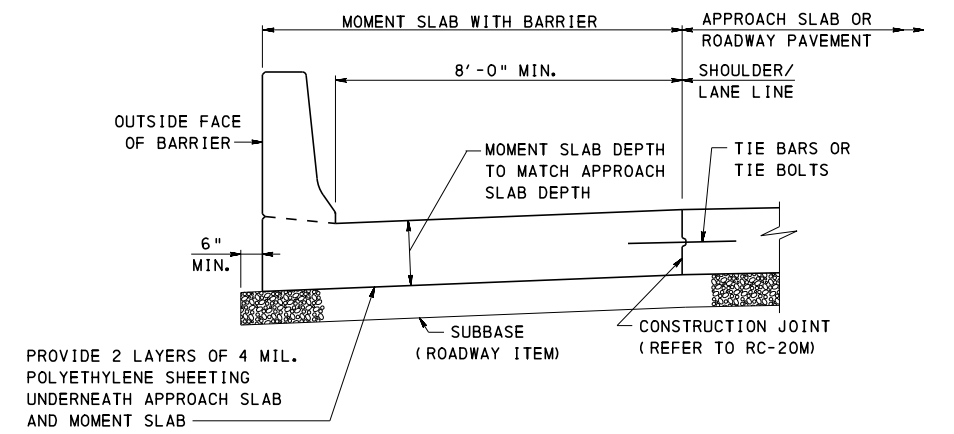






#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
4. ELIMINATE THE TIE BARS OR TIE BOLTS ALONG LENGTH INDICATED.
5. PROVIDE PAVING NOTCH OUT TO OUT.
6. 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.
7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16'-0" MINIMUM PER BD-627M.
8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, SEE BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.



#### SECTION D-D

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

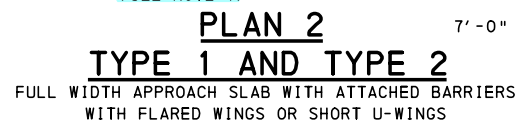
**STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - PLAN 1**

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 CHIEF ENGINEER, HIGHWAY ADMIN

SHEET 4 OF 35  
 BD-628M

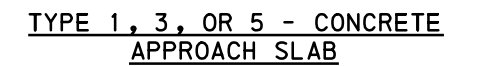




NOTE: TOP REINFORCEMENT NOT CONTINUOUS THRU JOINT.  
BOTTOM REINFORCEMENT CONTINUOUS THRU JOINT.  
MECHANICAL SPLICES ARE PERMITTED AS AN OPTION  
FOR BOTTOM REINFORCEMENT.



NOTE: TOP REINFORCEMENT NOT CONTINUOUS THRU JOINT.  
BOTTOM REINFORCEMENT CONTINUOUS THRU JOINT.

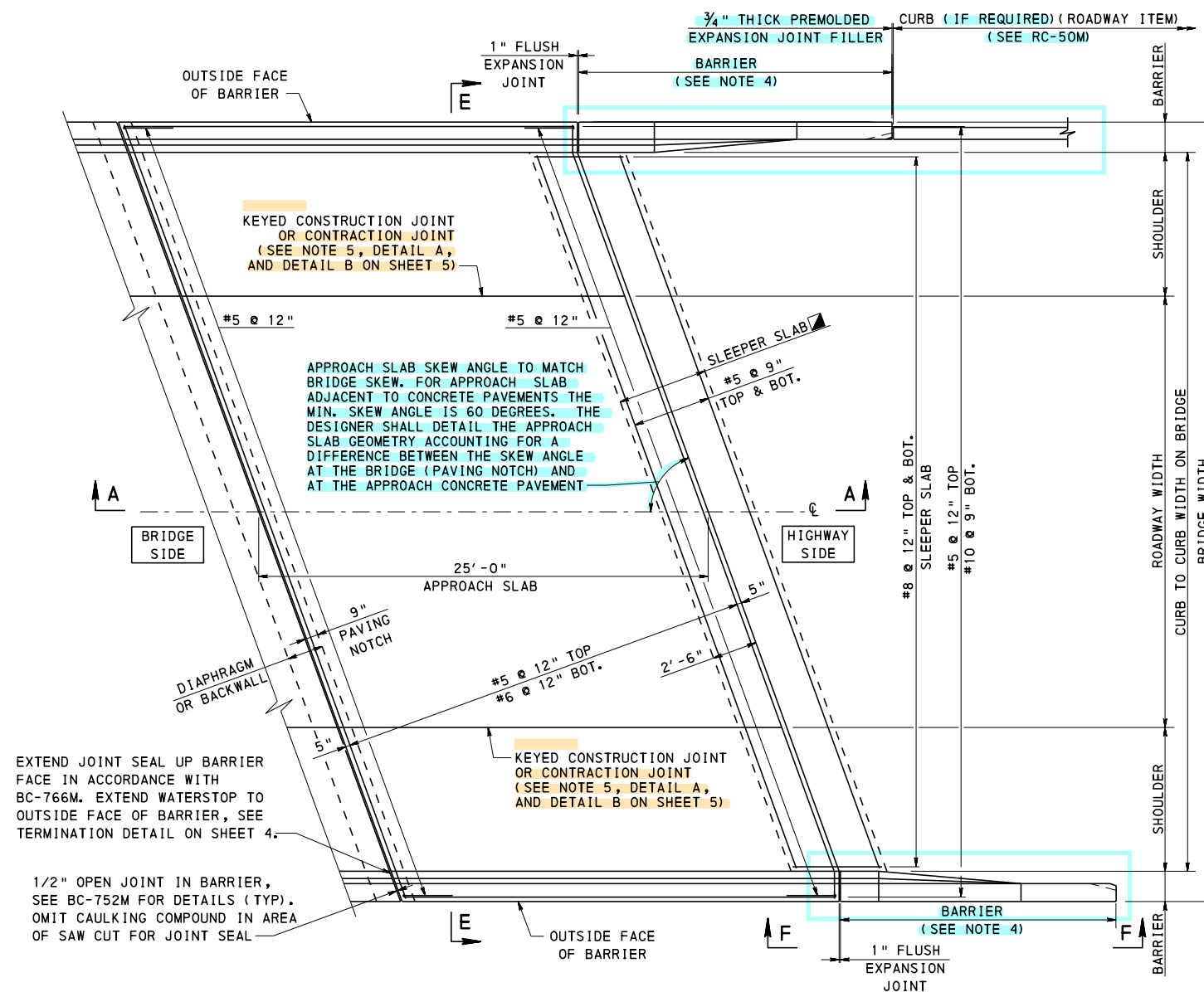


1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR SECTION E-E, SEE SHEET 8.
4. TYPE 1 AND TYPE 3 APPROACH SLAB: SUBBASE (ROADWAY ITEM)  
TYPE 5 APPROACH SLAB: STRUCTURAL BACKFILL, REFER TO RC-12M.
5. CONSTRUCTION/CONTRACTION JOINT REQUIREMENTS:  
(CONTRACTION JOINT APPLIES WHERE ENTIRE APPROACH SLAB WIDTH  
IS CONSTRUCTED AT ONE TIME).
  - NOT REQUIRED IF APPROACH SLAB WIDTH IS  $\leq 30$  FT.
  - MINIMUM ONE JOINT IF APPROACH SLAB WIDTH IS  $> 30$  FT. AND  $\leq 60$  FT.
  - MINIMUM TWO JOINTS IF APPROACH SLAB WIDTH IS  $> 60$  FT.
  - MAXIMUM JOINT SPACING IS LIMITED TO 24 FT. IF SKEW ANGLE IS  $< 60$  DEGREES.PREFERRED INSTALLED LOCATION OF THE CONSTRUCTION AND CONTRACTION JOINTS:
  - BREAK LINE OF LANES AND/OR LANE SHOULDER.
  - NEAR MIDDLE OF THE SECTION. AVOID WHEEL PATHS.
6. FOR JOINT MATERIAL, REFER TO PUB. 408, SECTION 705.4(a) OR (b).
7. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
8. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - PLAN 2

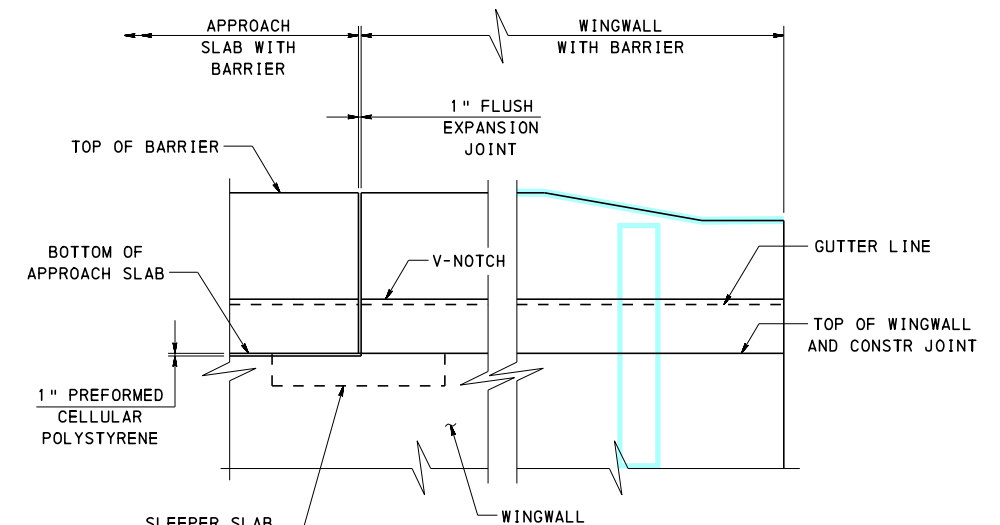
SHEET 5 OF 35

3D-628M



**PLAN 3**  
**TYPE 1 AND TYPE 2**  
 FULL WIDTH APPROACH SLAB WITH  
 ATTACHED BARRIERS WITH LONG U-WINGS

- 5'-0" ADJACENT TO FLEXIBLE PAVEMENT OR CONCRETE PAVEMENT
- 7'-0" ADJACENT TO PAVEMENT RELIEF JOINT



**SECTION F-F**

**NOTES**

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR SECTION E-E, SEE SHEET 8.
4. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
5. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

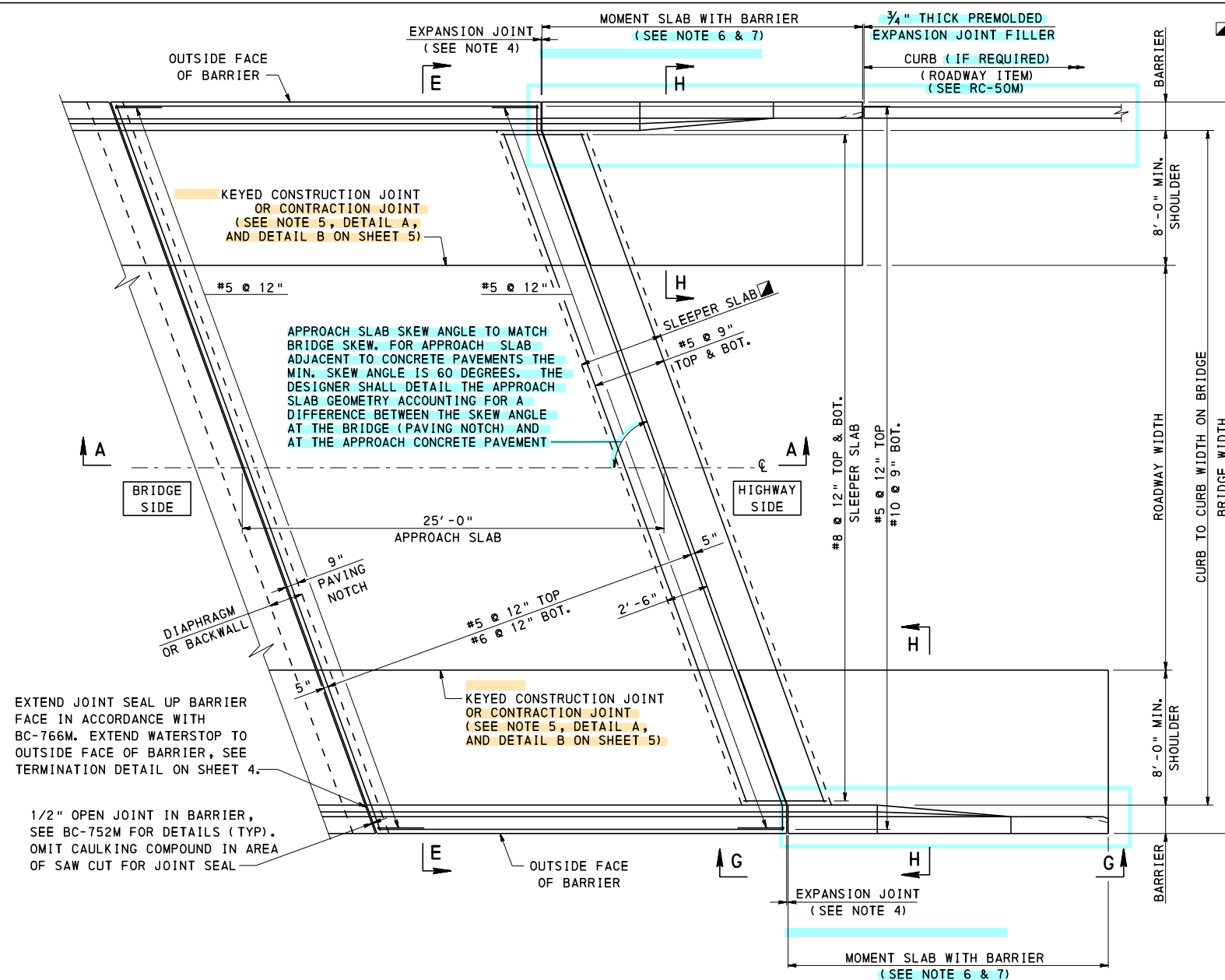
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**DEPARTMENT OF TRANSPORTATION**  
 BRIDGE OFFICE

STANDARD  
 BRIDGE APPROACH SLABS  
 TYPE 1 AND TYPE 2 - PLAN 3

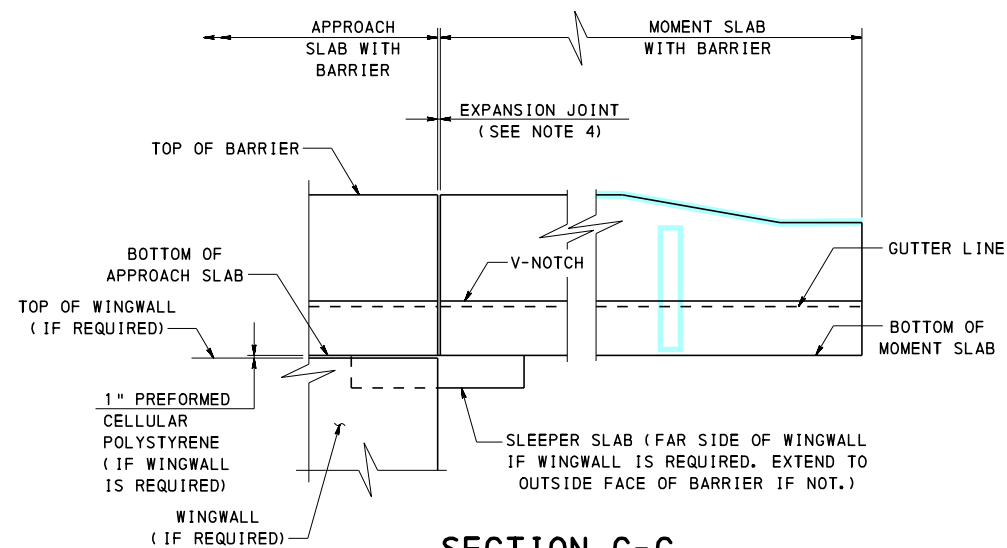
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*[Signature]*  
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
 CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 35  
 BD-628M



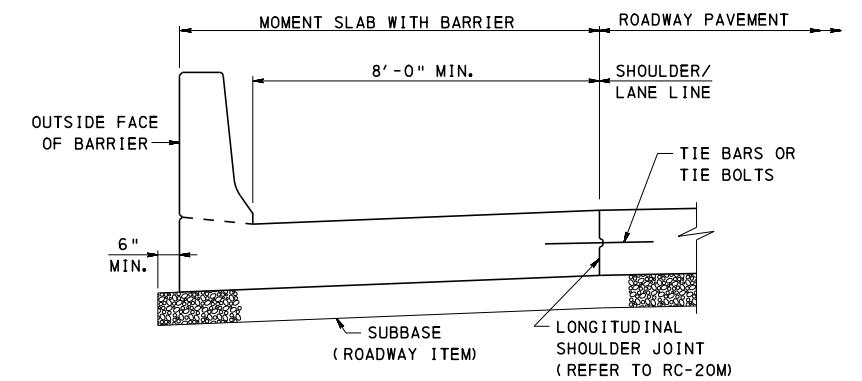
**PLAN 4**  
**TYPE 1 AND TYPE 2**  
 FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS  
 WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS



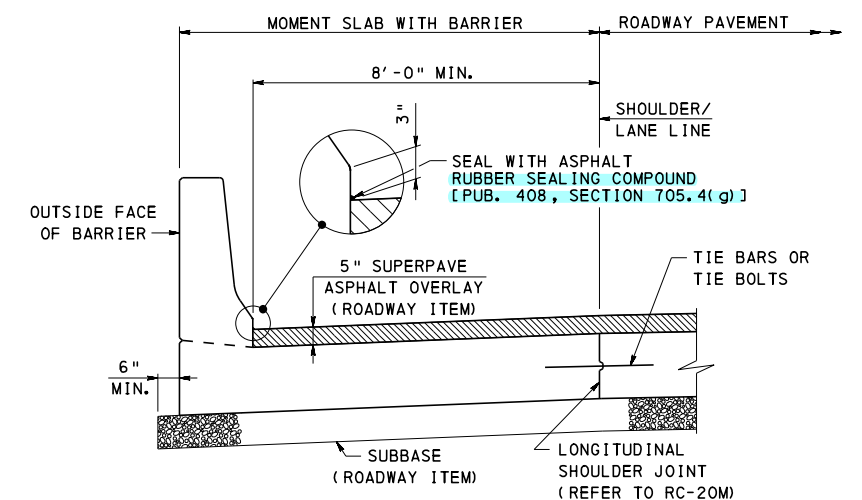
**SECTION G-G**

**NOTES**

- FOR NOTES, SEE SHEETS 1 AND 2.
- FOR SECTION A-A, SEE SHEET 3.
- FOR SECTION E-E, SEE SHEET 8.
- PROVIDE THE FOLLOWING JOINT OPENINGS:
  - APPROACH SLAB ADJACENT TO CONCRETE OR FLEXIBLE PAVEMENT: 1" FLUSH EXPANSION JOINT
  - APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT: 2'-0" AND PROVIDE SLIDING PLATE IN ACCORDANCE WITH THE DETAILS SHOWN ON BD-627M.
- FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
- 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.
- LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16'-0" MINIMUM PER BD-627M.
- FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.



**MOMENT SLAB ADJACENT TO  
 TYPE 1 APPROACH SLAB**



**MOMENT SLAB ADJACENT TO  
 TYPE 2 APPROACH SLAB**

**SECTION H-H**

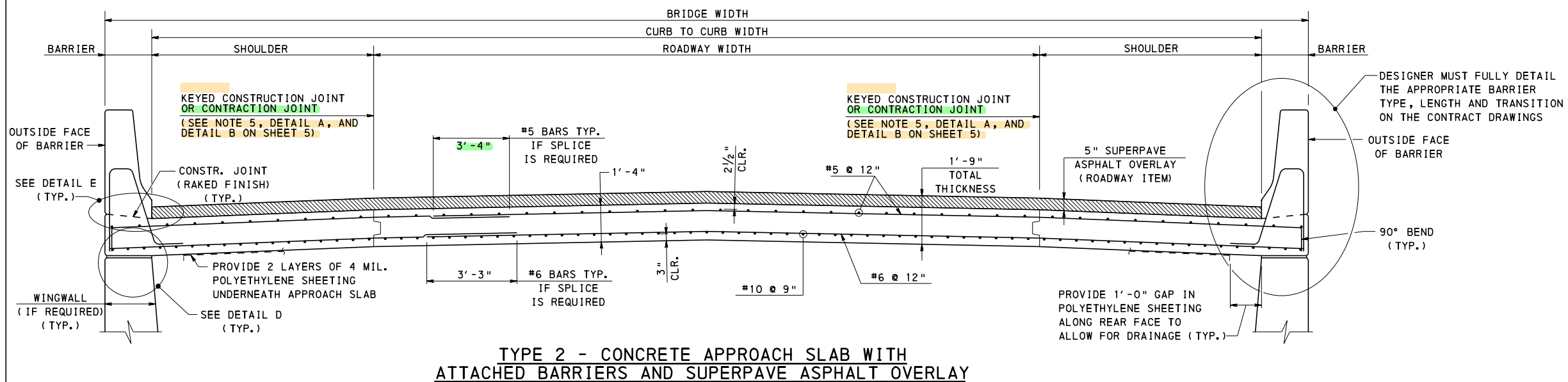
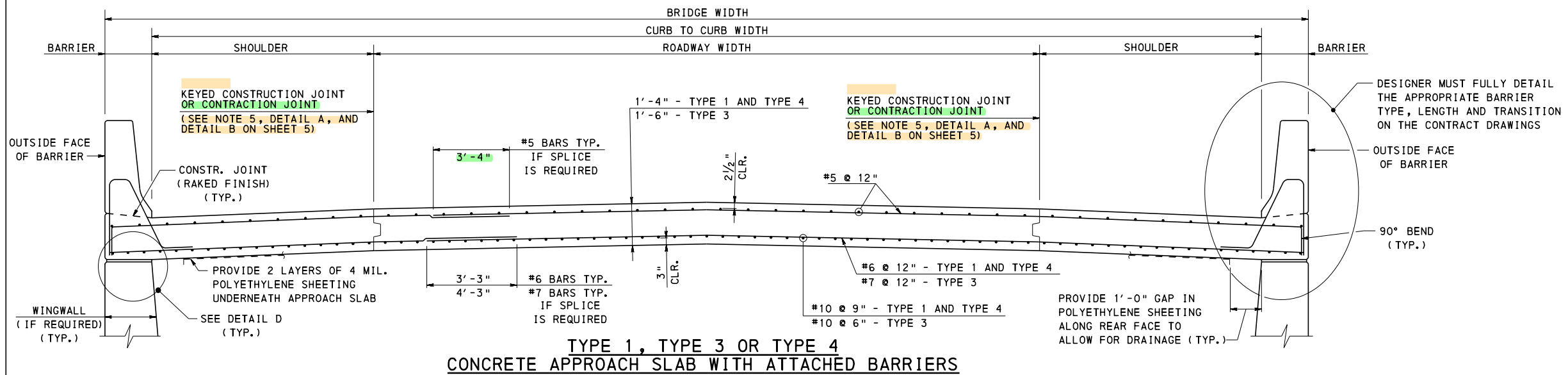
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 BRIDGE OFFICE

**STANDARD**  
**BRIDGE APPROACH SLABS**  
**TYPE 1 AND TYPE 2 - PLAN 4**

RECOMMENDED NOV. 23, 2022  
 L. W. Gray  
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RECOMMENDED NOV. 23, 2022  
 Gavin E. Gray  
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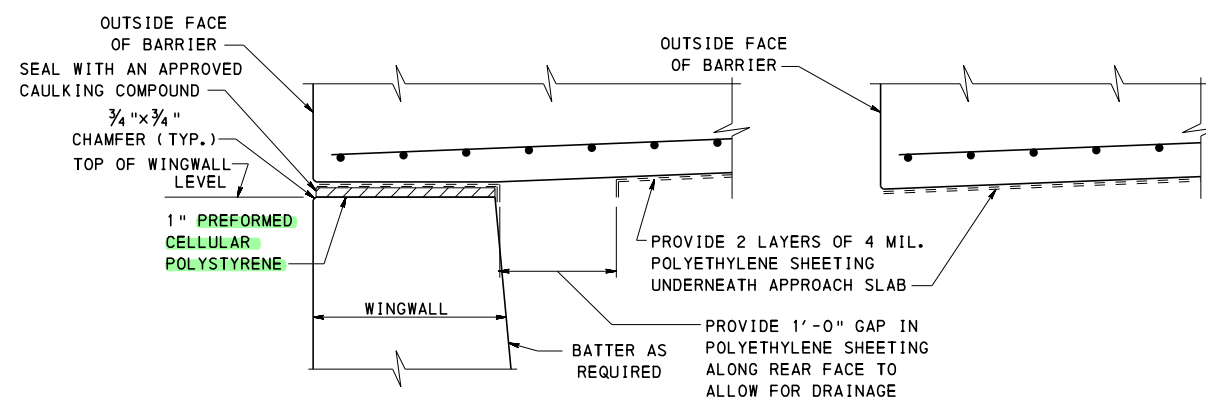
SHEET 7 OF 35  
 BD-628M



## SECTION E-E

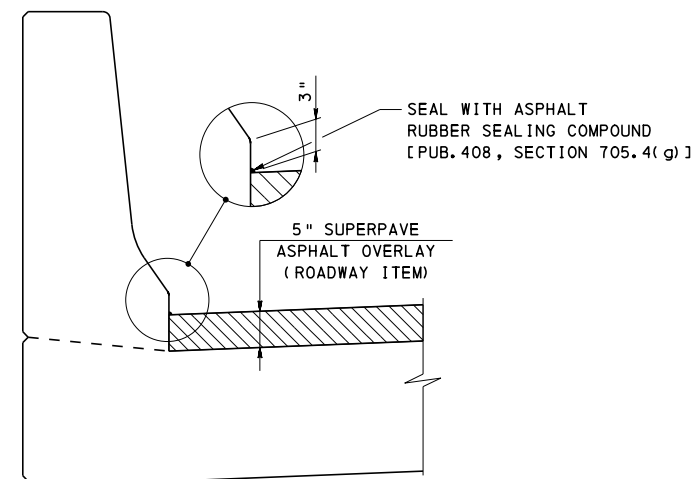
### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.



**DETAIL D**  
WITH WINGWALL

**DETAIL D**  
WITHOUT WINGWALL



**DETAIL E**

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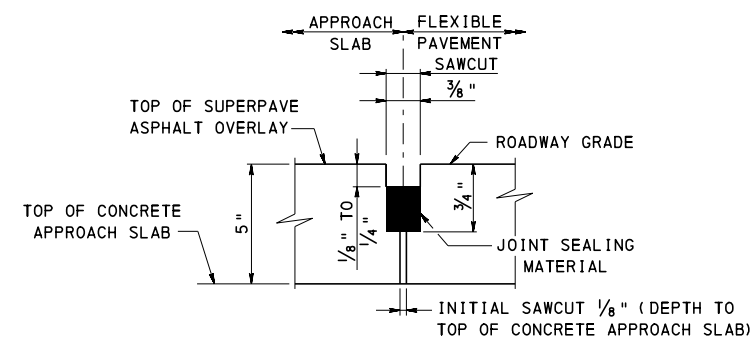
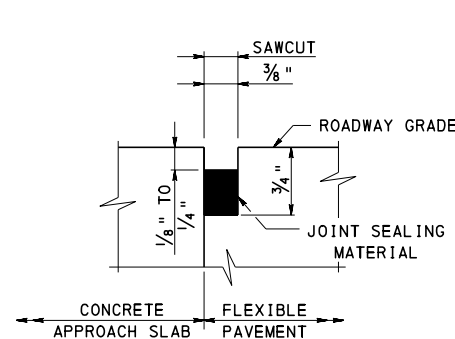
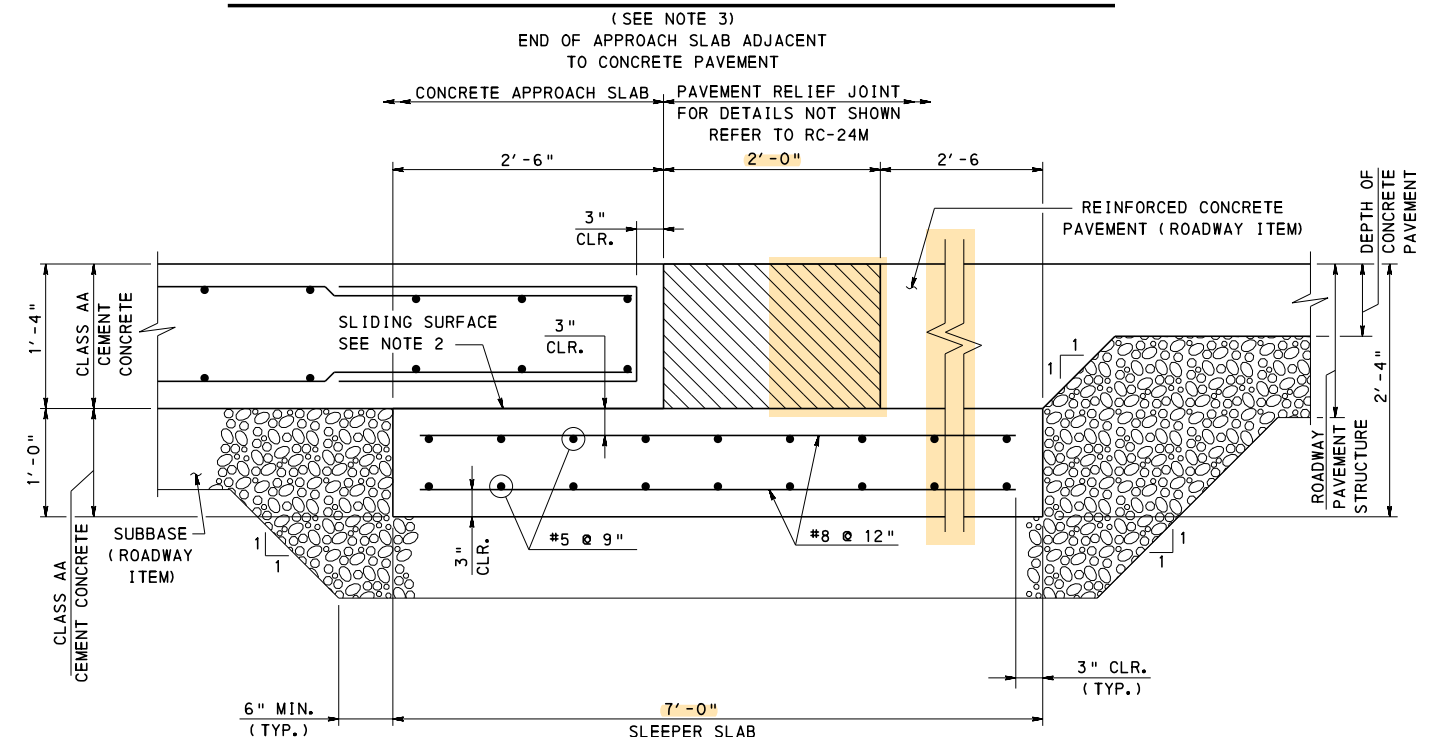
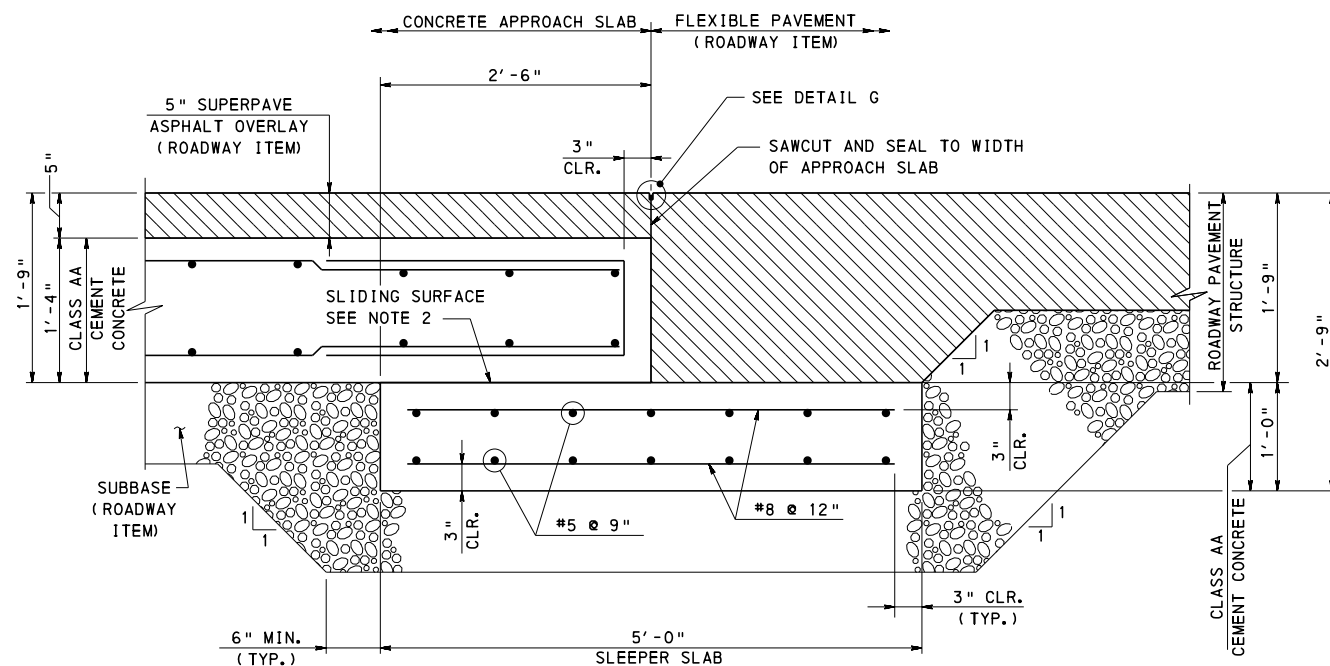
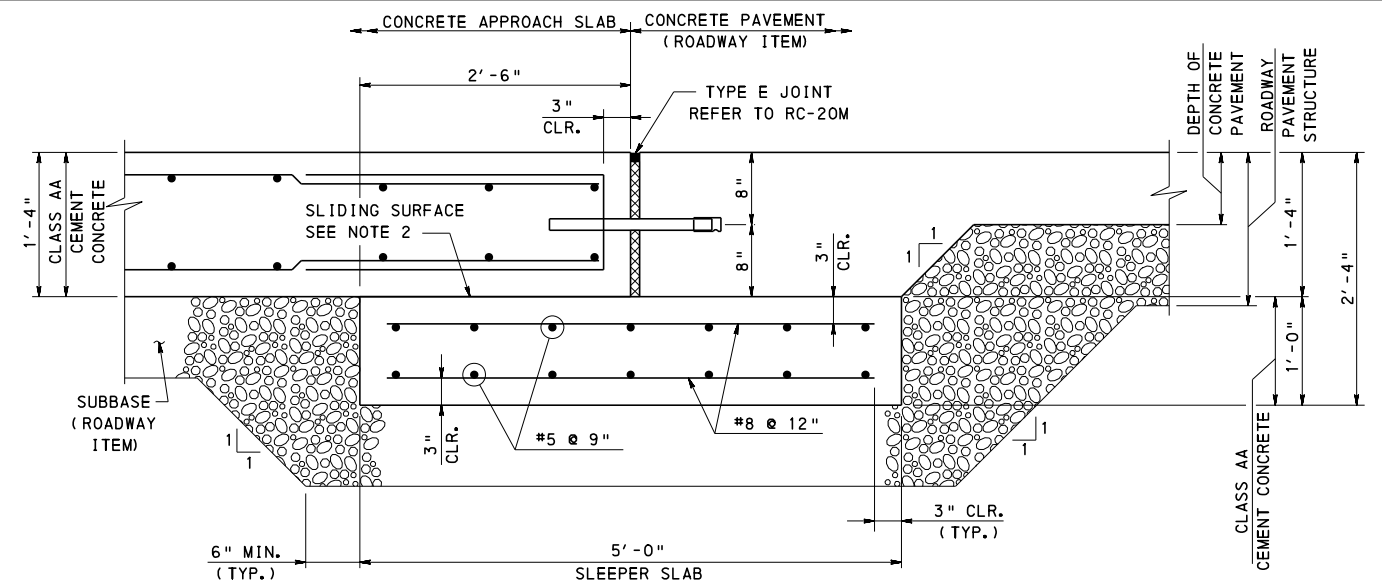
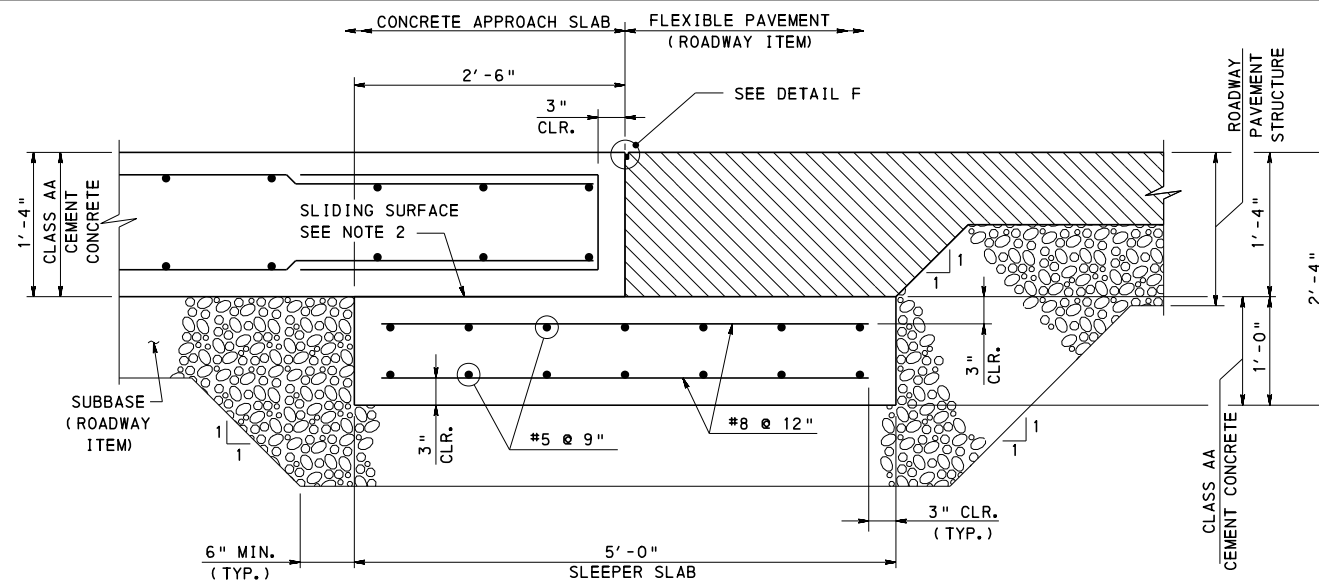
**STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 THRU TYPE 4 - TRANSVERSE SECTION  
WITH ATTACHED BARRIERS**

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SHEET 8 OF 35  
BD-628M






- ## NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. TROWEL SMOOTH AND PLACE 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING AS BOND BREAKER.
3. USE DETAIL 2 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 3. REFER TO RC-24M FOR ADDITIONAL INFORMATION.

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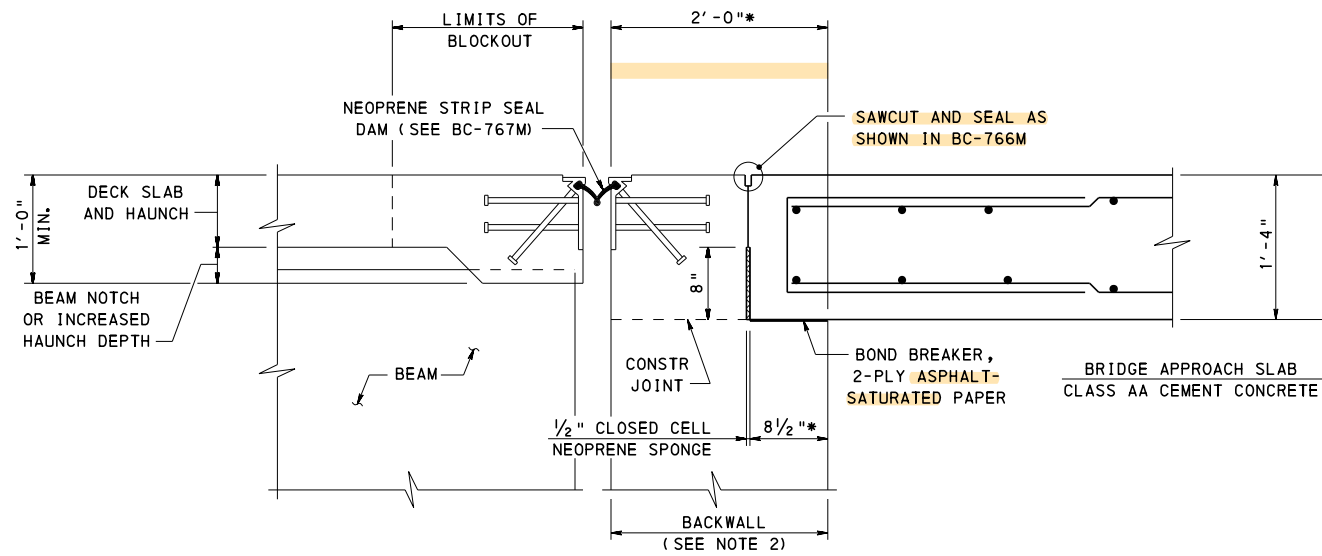
STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1, 2 AND 4 - DETAILS 1, 2 AND 3  
(ADJACENT TO ROADWAY)

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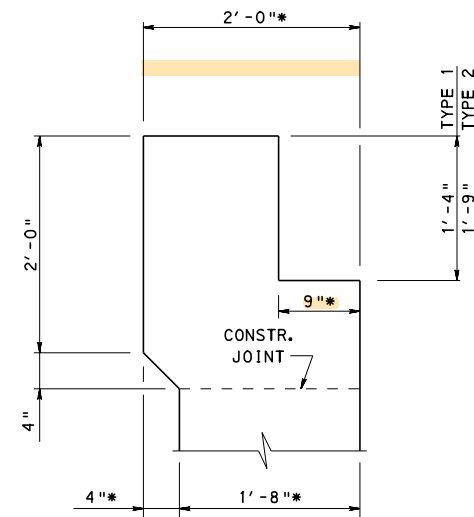
3D-628M



\* MEASURED NORMAL TO ABUTMENT

#### TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 4

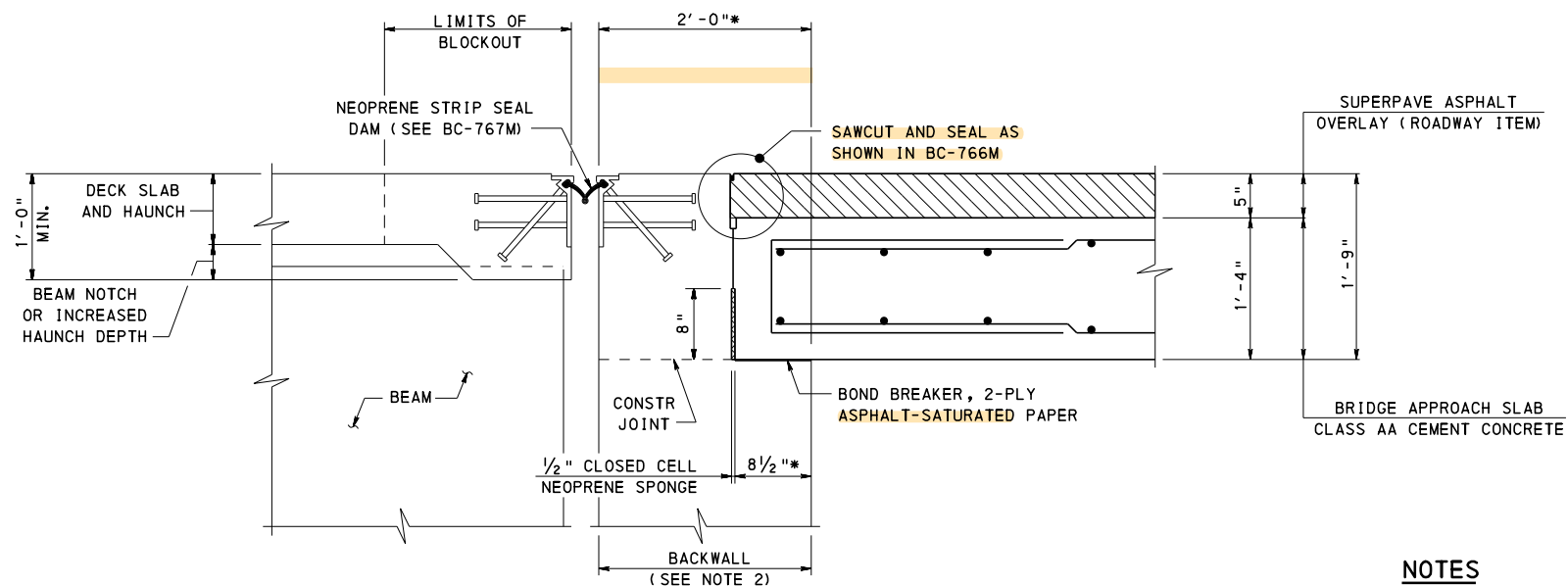
APPROACH SLAB SUPPORTED ON ABUTMENT  
BACKWALL WITH NEOPRENE STRIP SEAL DAM



\* MEASURED NORMAL TO ABUTMENT

#### OPTIONAL BACKWALL

(SEE NOTE 2)



\* MEASURED NORMAL TO ABUTMENT

#### TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 4

APPROACH SLAB SUPPORTED ON ABUTMENT  
BACKWALL WITH NEOPRENE STRIP SEAL DAM

#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. DESIGNER TO DETERMINE BACKWALL SHAPE, REFER TO BD-621M, SHEET 2.
3. FOR PAVING NOTCH FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

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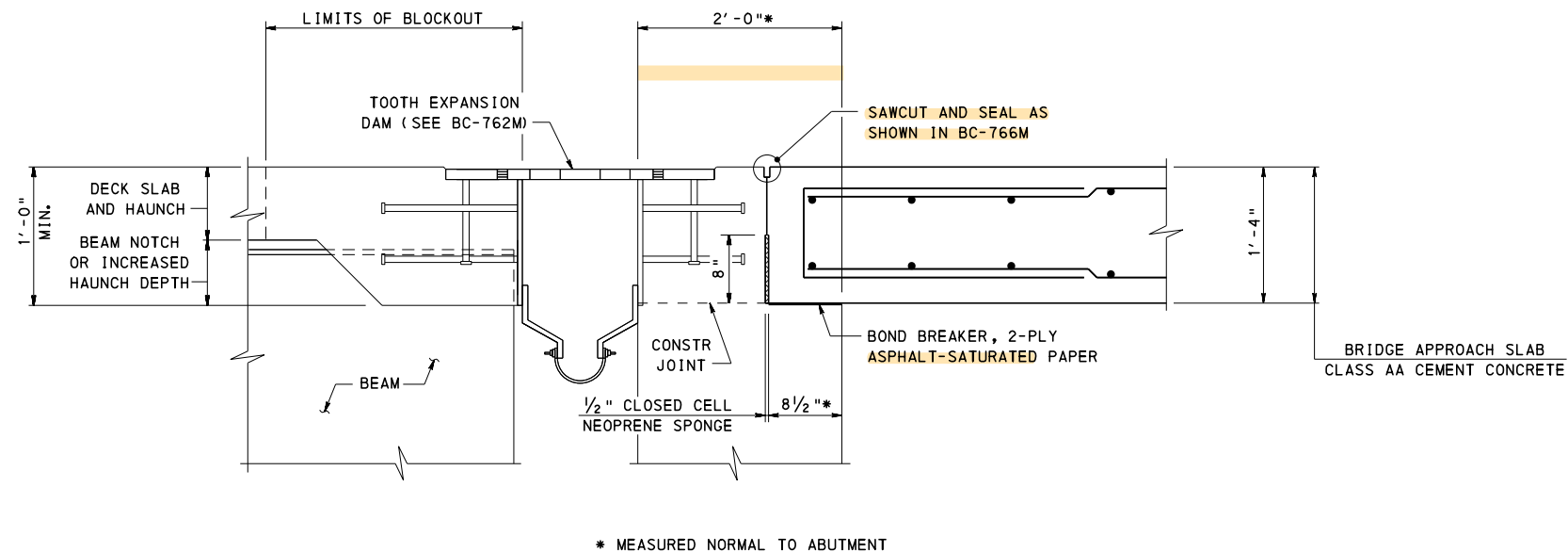
STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 4  
(NEOPRENE STRIP SEAL DAM WITH BACKWALL)

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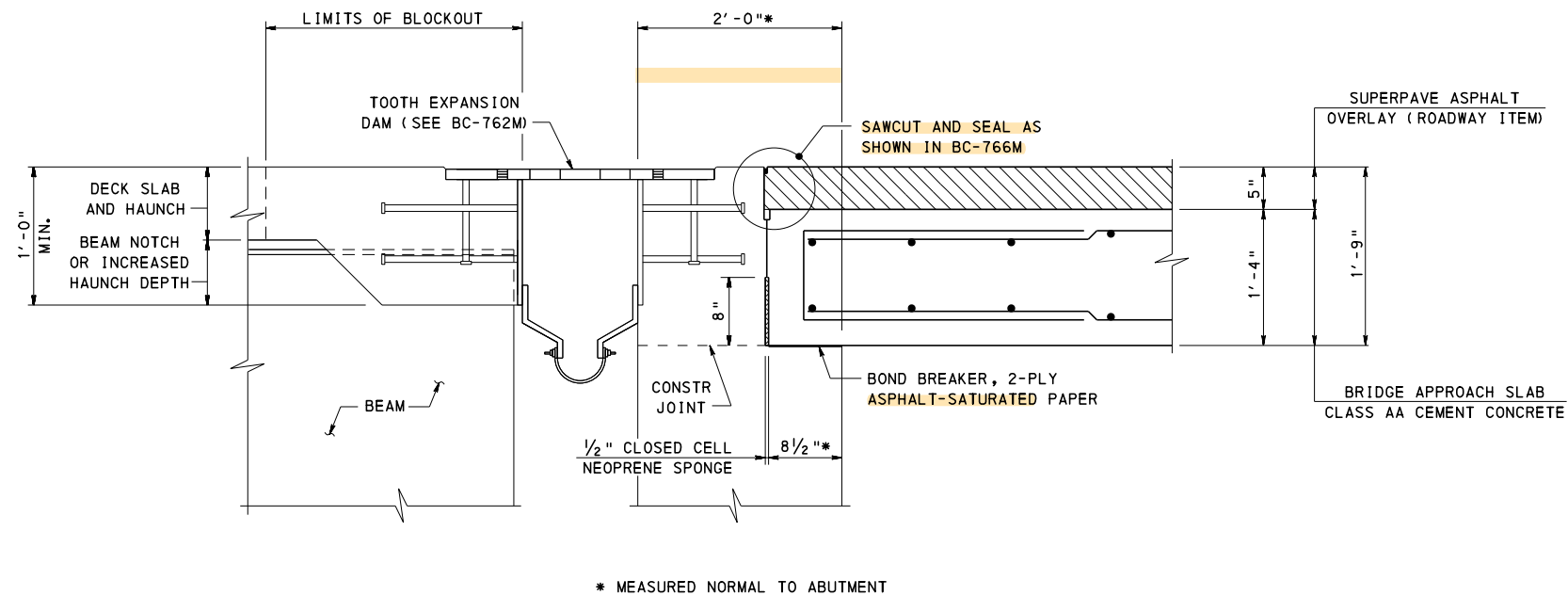
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SHEET 10 OF 35  
BD-628M





**TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 5**  
APPROACH SLAB SUPPORTED ON ABUTMENT  
BACKWALL WITH TOOTH EXPANSION DAM



**TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 5**  
APPROACH SLAB SUPPORTED ON ABUTMENT  
BACKWALL WITH TOOTH EXPANSION DAM

- NOTES**
1. FOR NOTES, SEE SHEETS 1 AND 2.
  2. FOR PAVING NOTCH FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

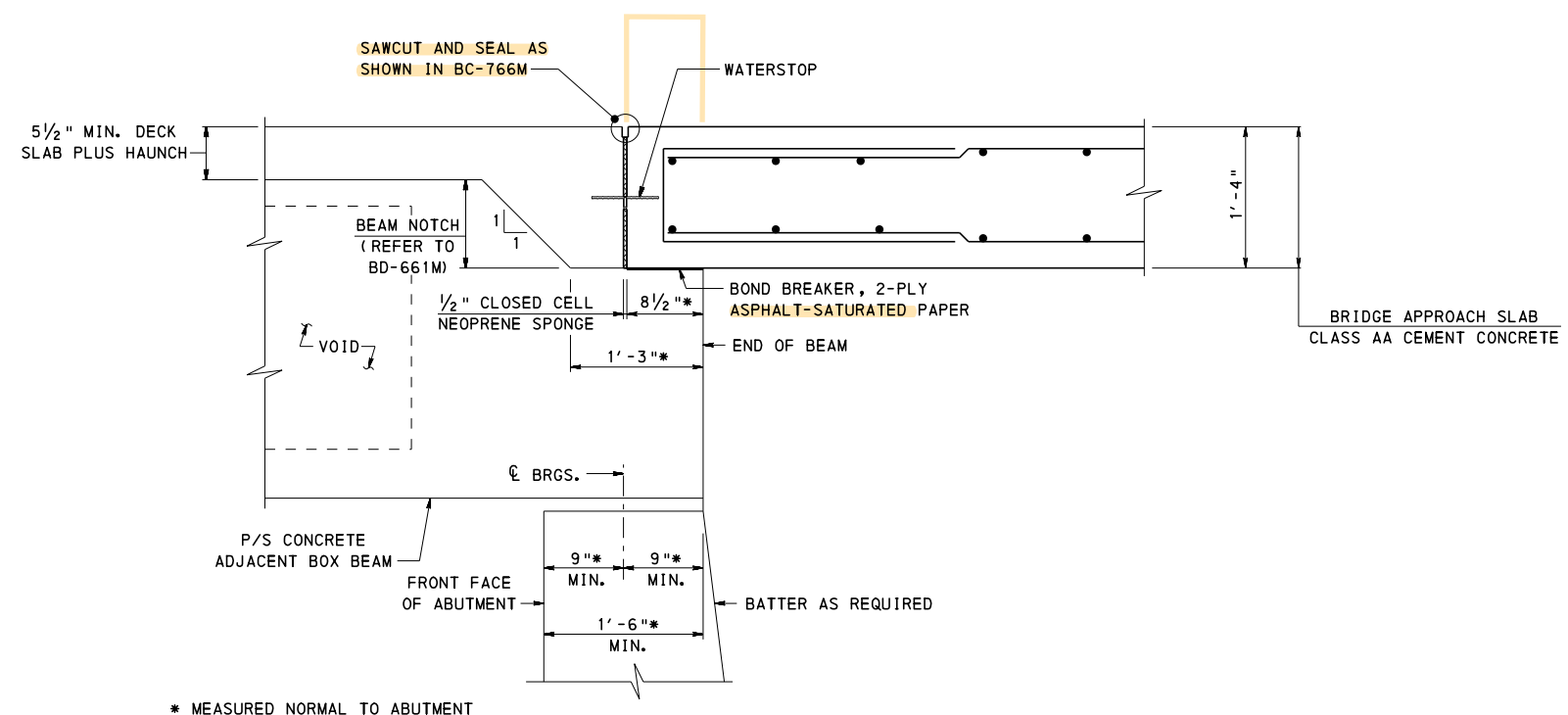
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 5  
(TOOTH EXPANSION DAM WITH BACKWALL)

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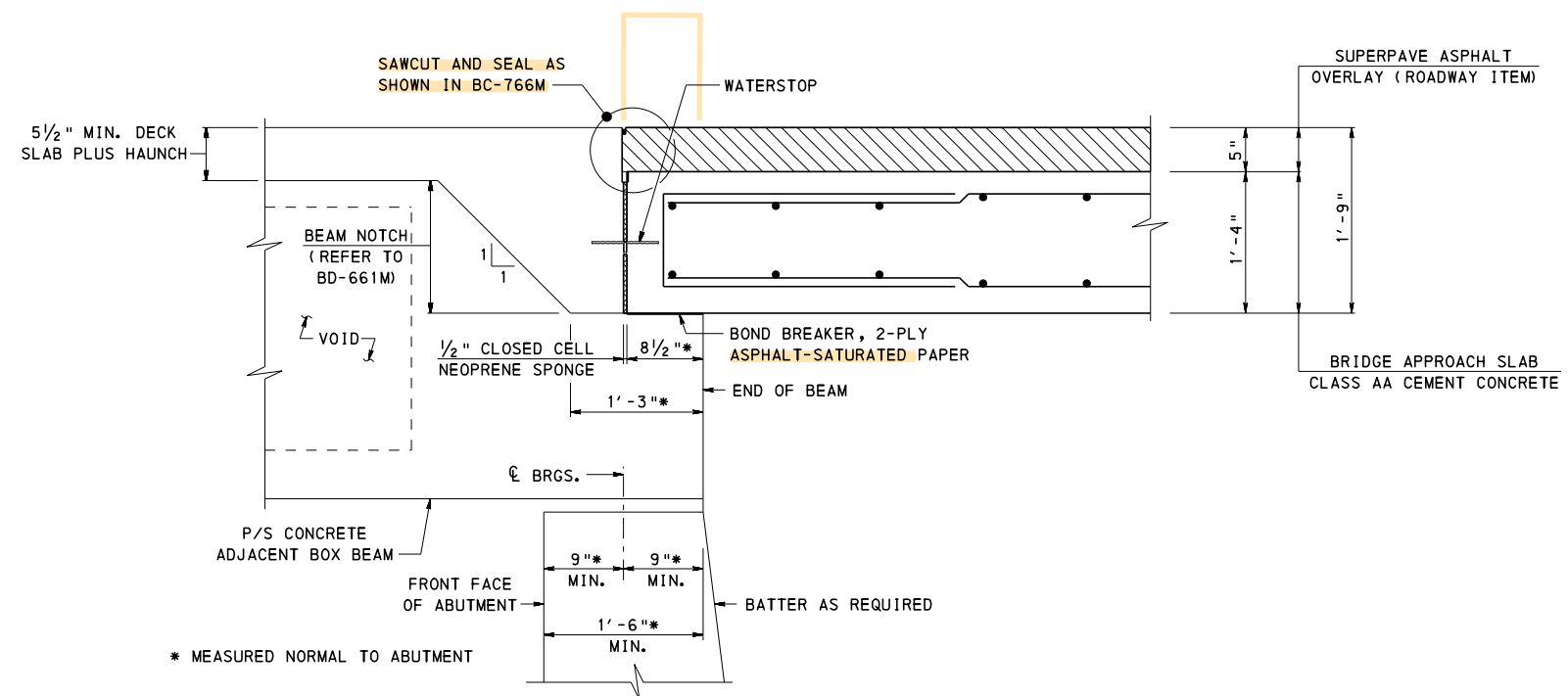
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SHEET 11 OF 35  
BD-628M



## TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 6

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE  
ADJACENT BOX BEAMS FOR BEAM DEPTHS 27" AND GREATER



## TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 6

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE  
ADJACENT BOX BEAMS FOR BEAM DEPTHS 30" AND GREATER

### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED REFER TO DETAIL 10.
4. FOR PAVING NOTCH FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

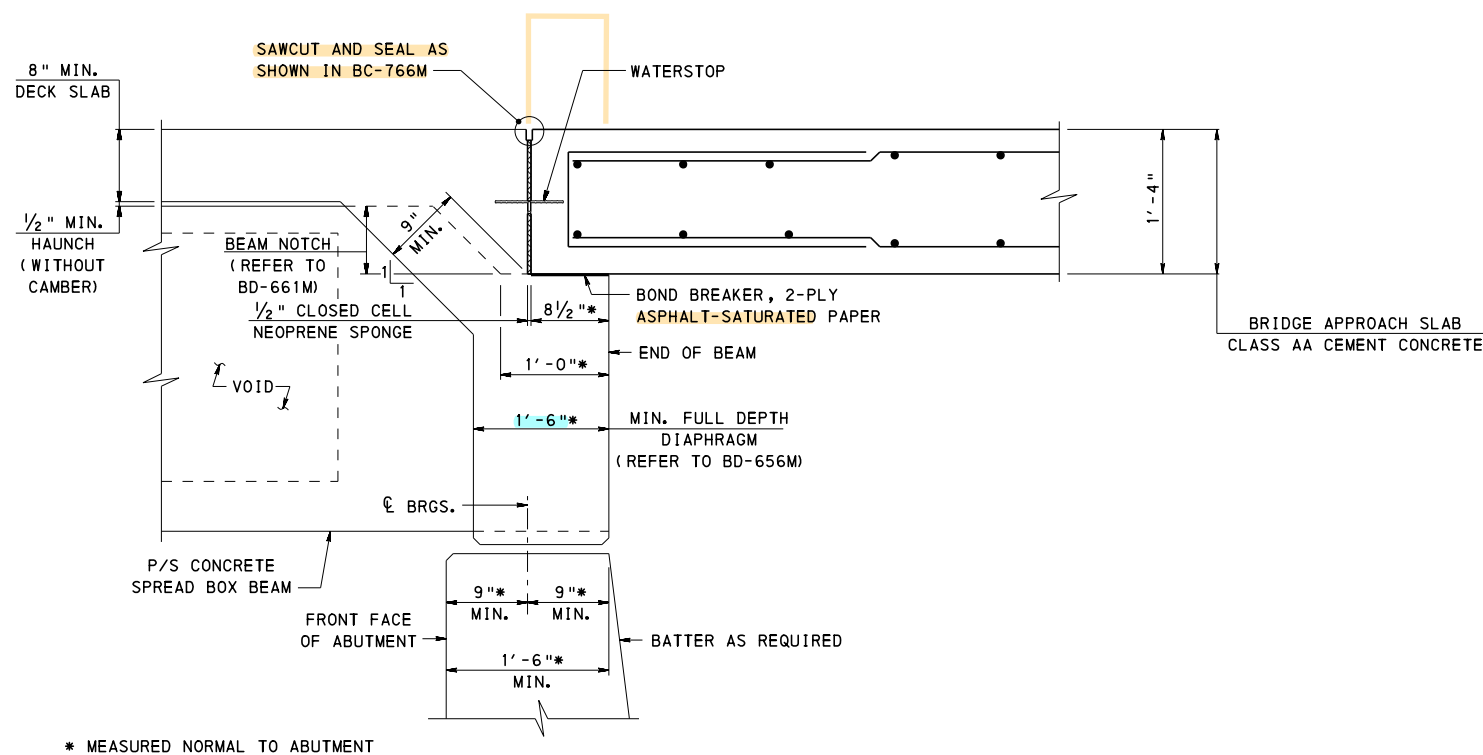
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 6  
(P/S CONCRETE ADJACENT BOX BEAMS  
WITHOUT BACKWALL)

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SHEET 12 OF 35  
BD-628M

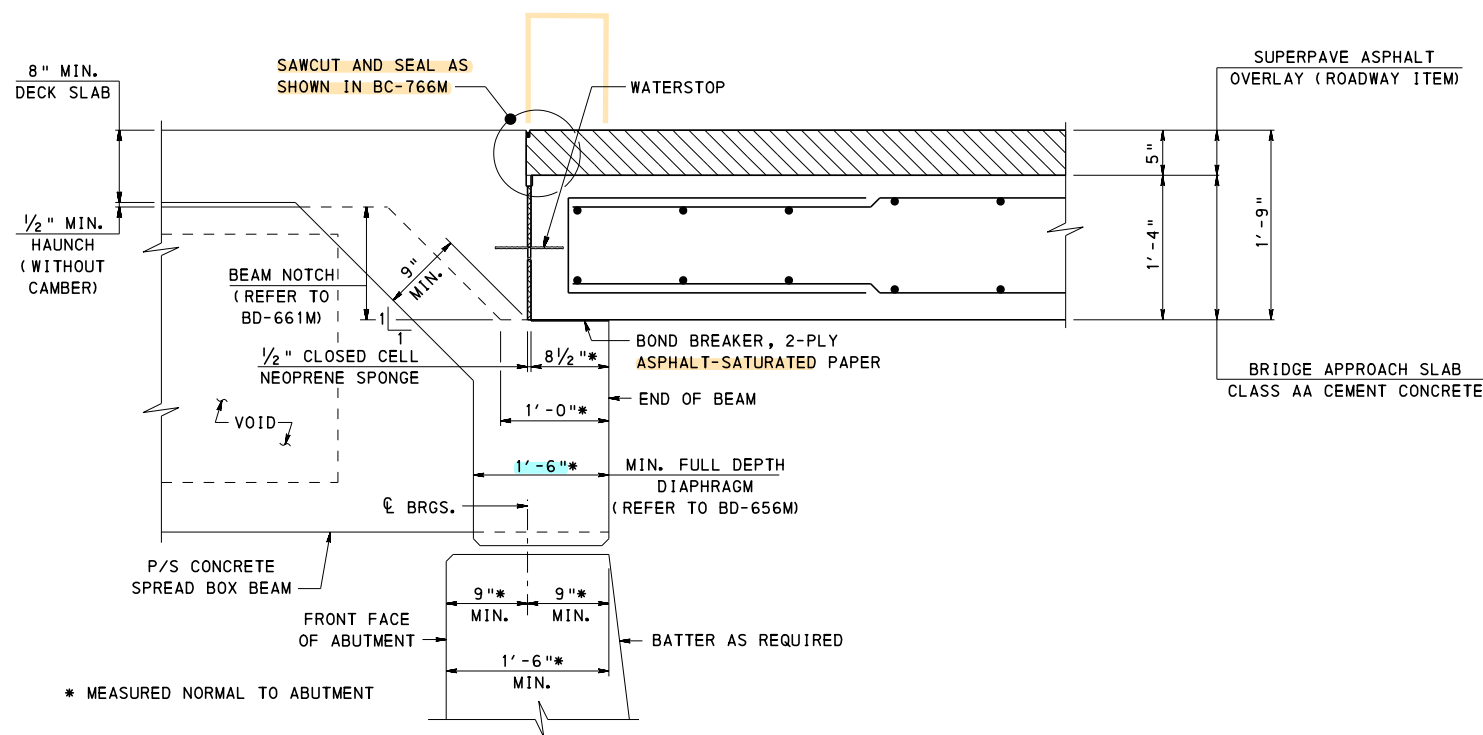


### TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 7

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS 24" AND GREATER

### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED REFER TO DETAIL 11.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.



### TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 7

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS 30" AND GREATER

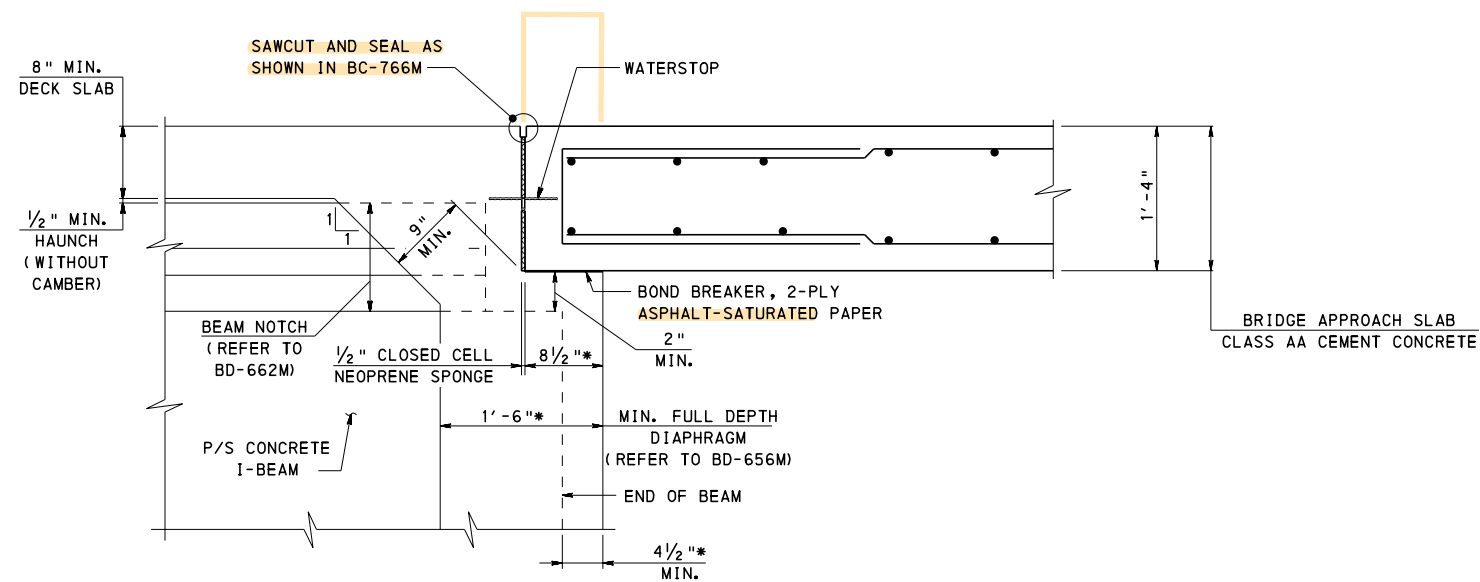
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 7  
(P/S CONCRETE SPREAD BOX BEAMS  
WITHOUT BACKWALL)

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SHEET 13 OF 35  
BD-628M



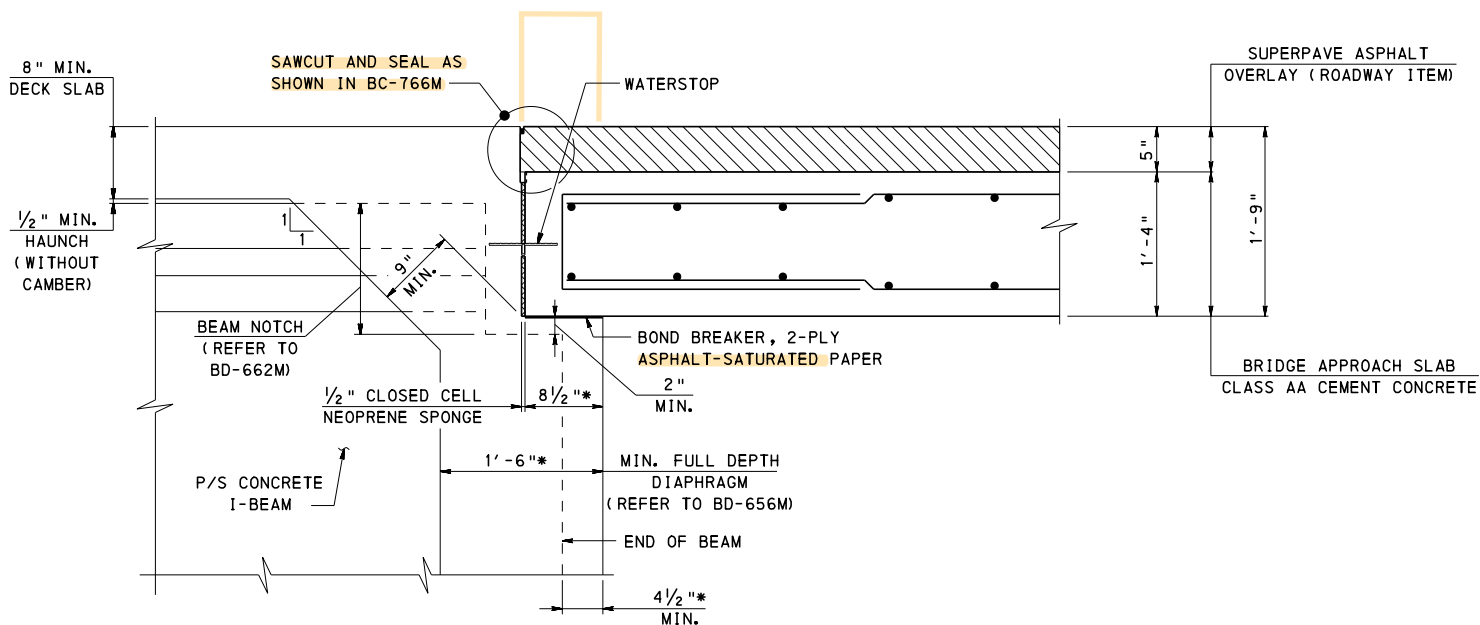
\* MEASURED NORMAL TO ABUTMENT

### TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 8

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE  
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS

#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.



\* MEASURED NORMAL TO ABUTMENT

### TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 8

APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE  
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS

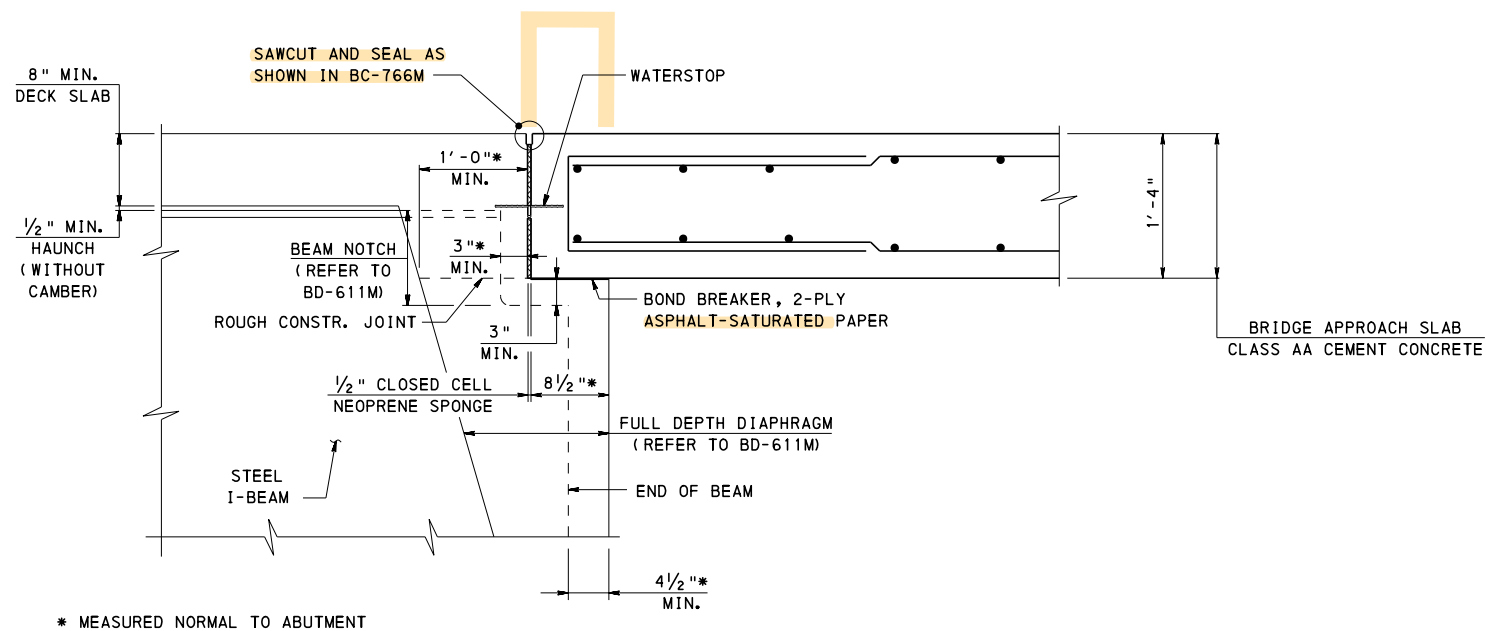
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 8  
(P/S CONCRETE I-BEAMS WITHOUT BACKWALL)

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SHEET 14 OF 35  
BD-628M

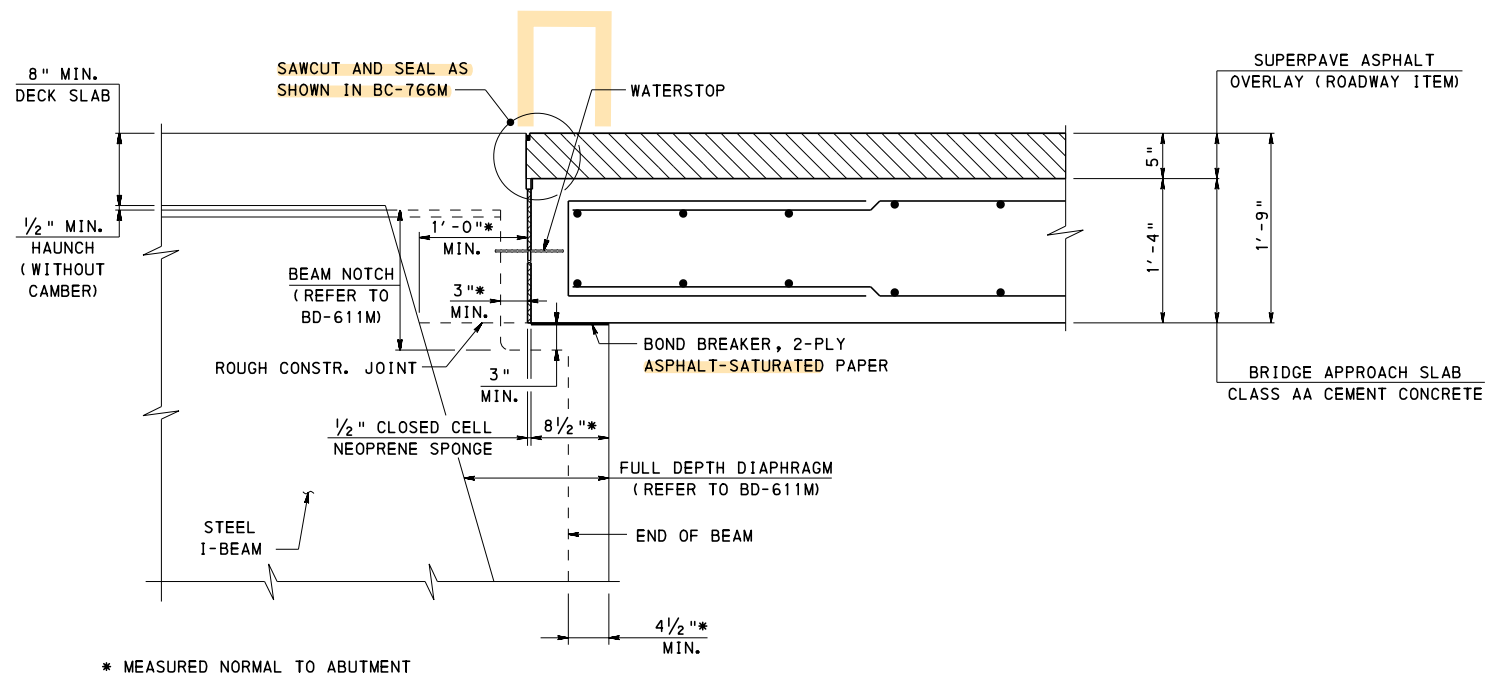


### TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 9

APPROACH SLAB SUPPORTED ON STEEL  
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS  
FOR BEAM DEPTHS 2'-1 1/2" AND GREATER

#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED, REFER TO DETAIL 12.
3. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.



### TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 9

APPROACH SLAB SUPPORTED ON STEEL  
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS  
FOR BEAM DEPTHS 2'-6 1/2" AND GREATER

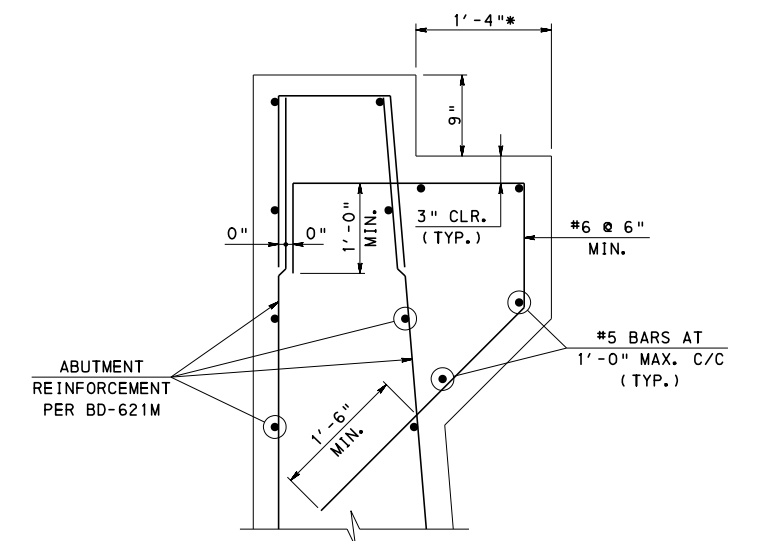
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 9  
(STEEL BEAMS WITHOUT BACKWALL)

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SHEET 15 OF 35  
BD-628M




APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE  
ADJACENT BOX BEAMS FOR BEAM DEPTHS LESS THAN 27"

1. FOR NOTES, SEE SHEETS 1 AND 2.  
2. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE  
ADJACENT BOX BEAMS FOR BEAM DEPTHS LESS THAN 30"

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BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 10  
(P/S CONCRETE ADJACENT BOX BEAMS  
WITH ABUTMENT CORBEL)

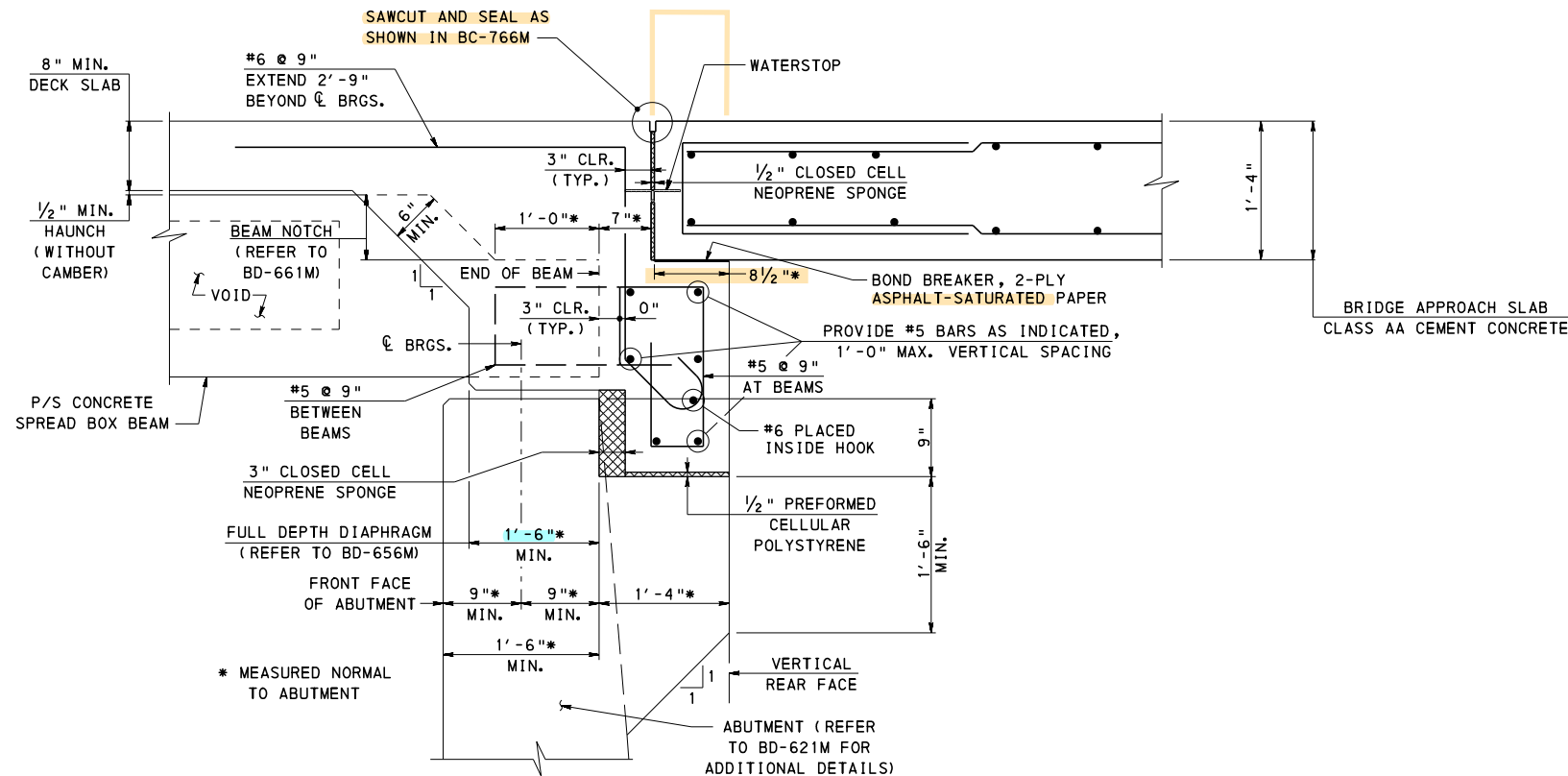
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 CHIEF BRIDGE ENGINEER

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CHIEF ENGINEER, HIGHWAY ADMIN.

HEET 16 OF 35

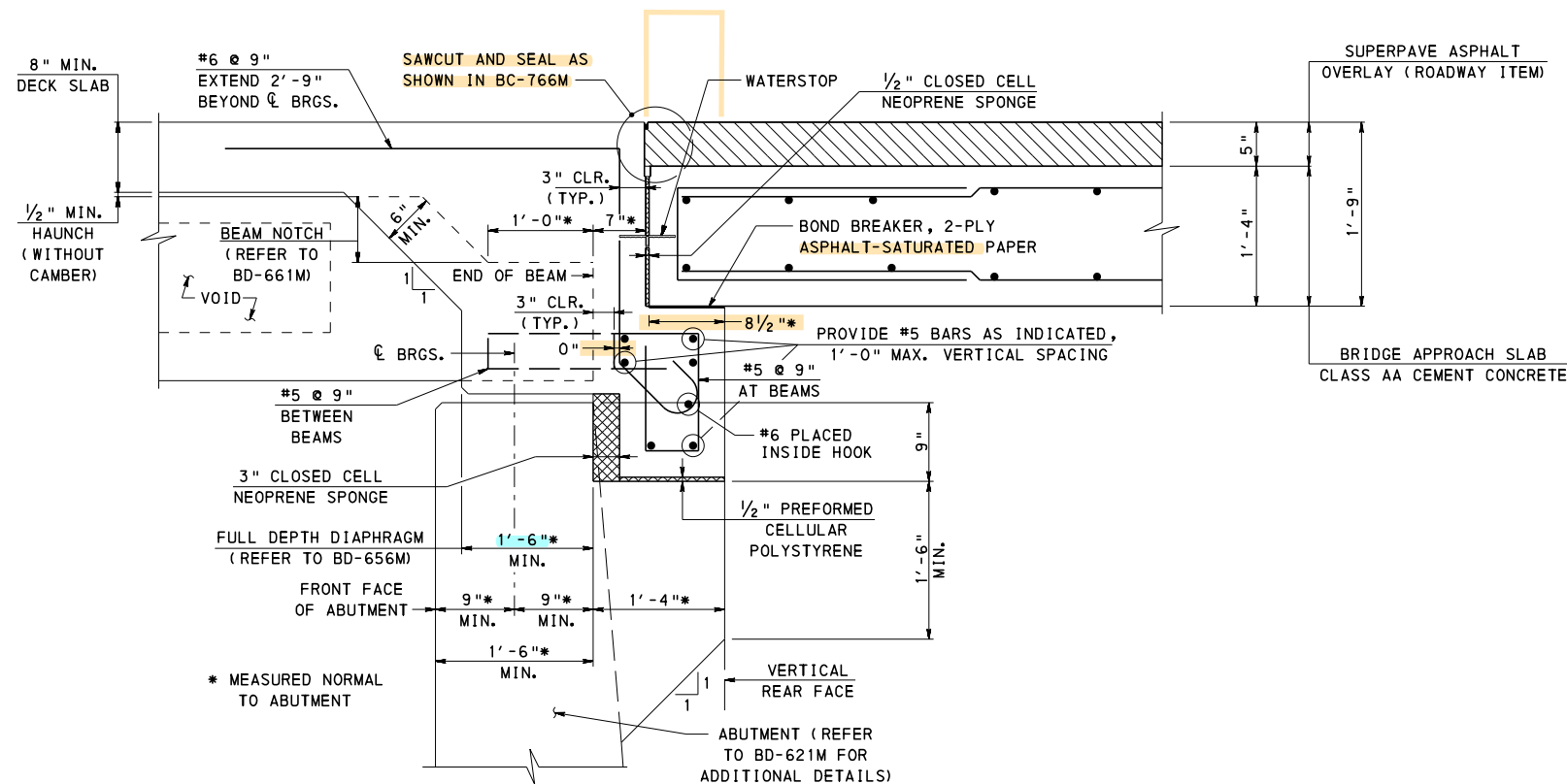
BD-628M





### TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 11

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS LESS THAN 24"



### TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 11

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS LESS THAN 30"

#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
3. FOR ABUTMENT CORBEL REINFORCEMENT DETAIL, SEE SHEET 16.

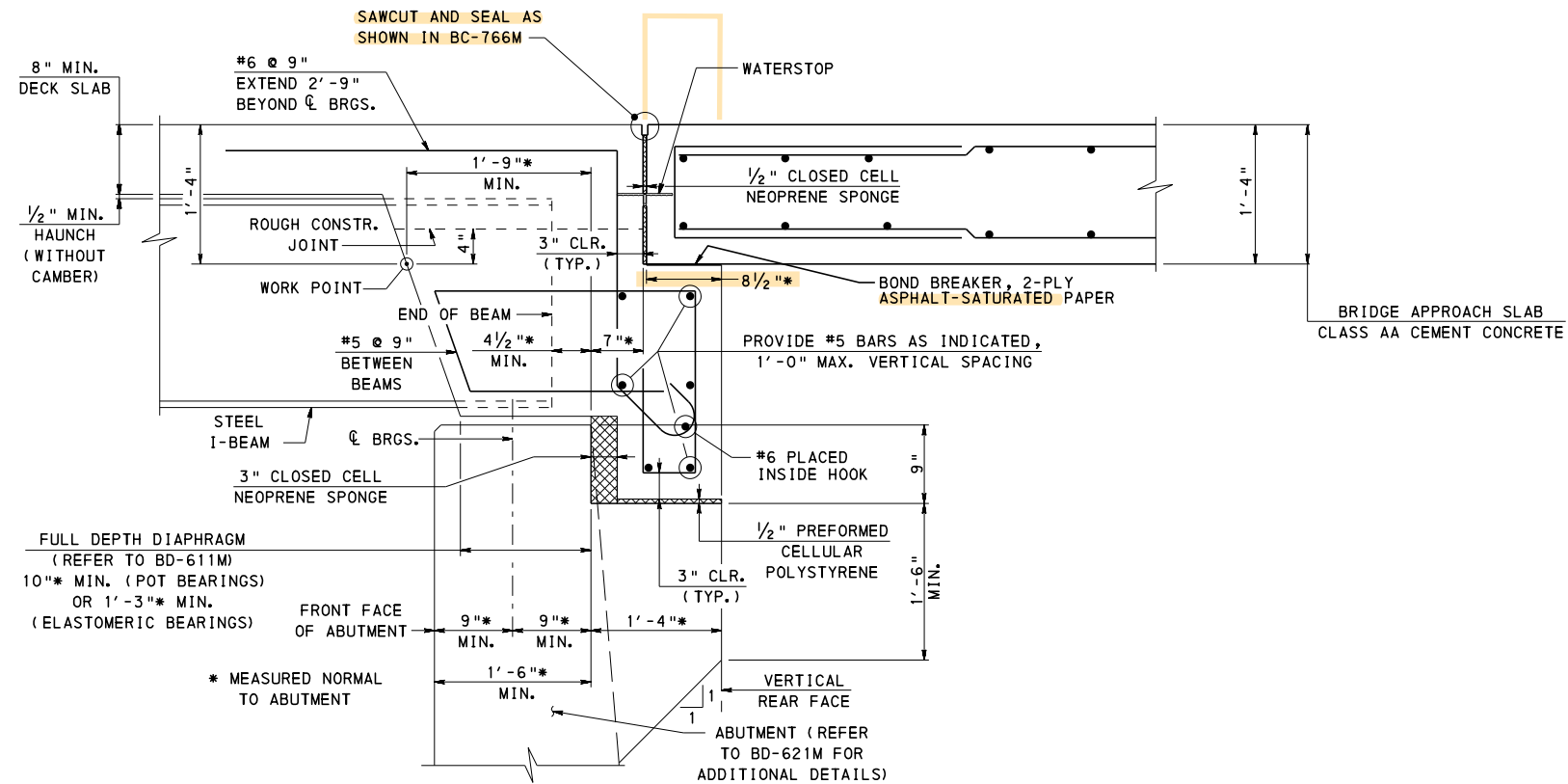
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 11  
(P/S CONCRETE SPREAD BOX BEAMS  
WITH ABUTMENT CORBEL)

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SHEET 17 OF 35  
BD-628M

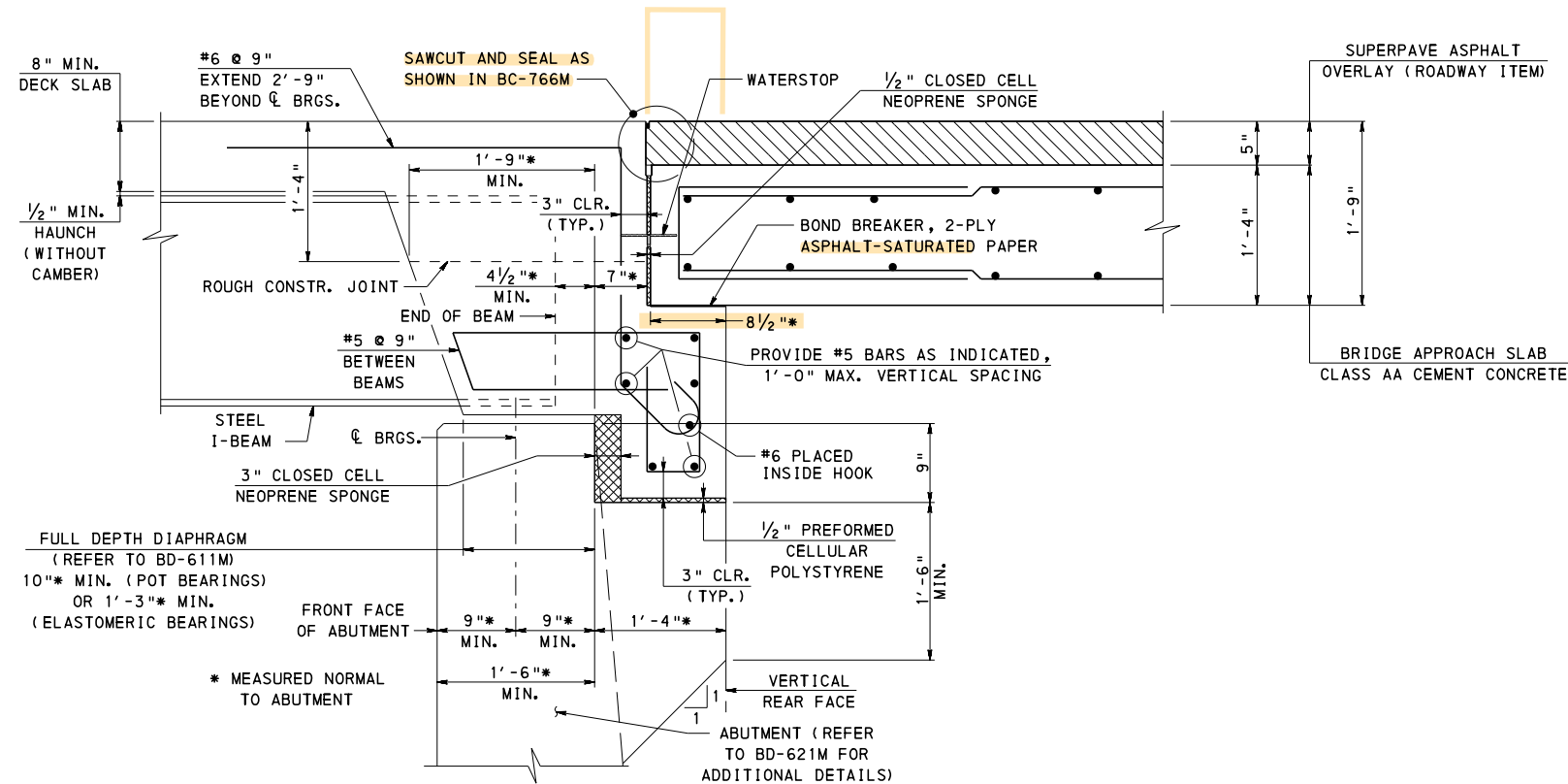


### TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 12

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS LESS THAN 2'-1 1/2"

#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
3. FOR ABUTMENT CORBEL REINFORCEMENT DETAIL, SEE SHEET 16.



### TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 12

APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS LESS THAN 2'-6 1/2"

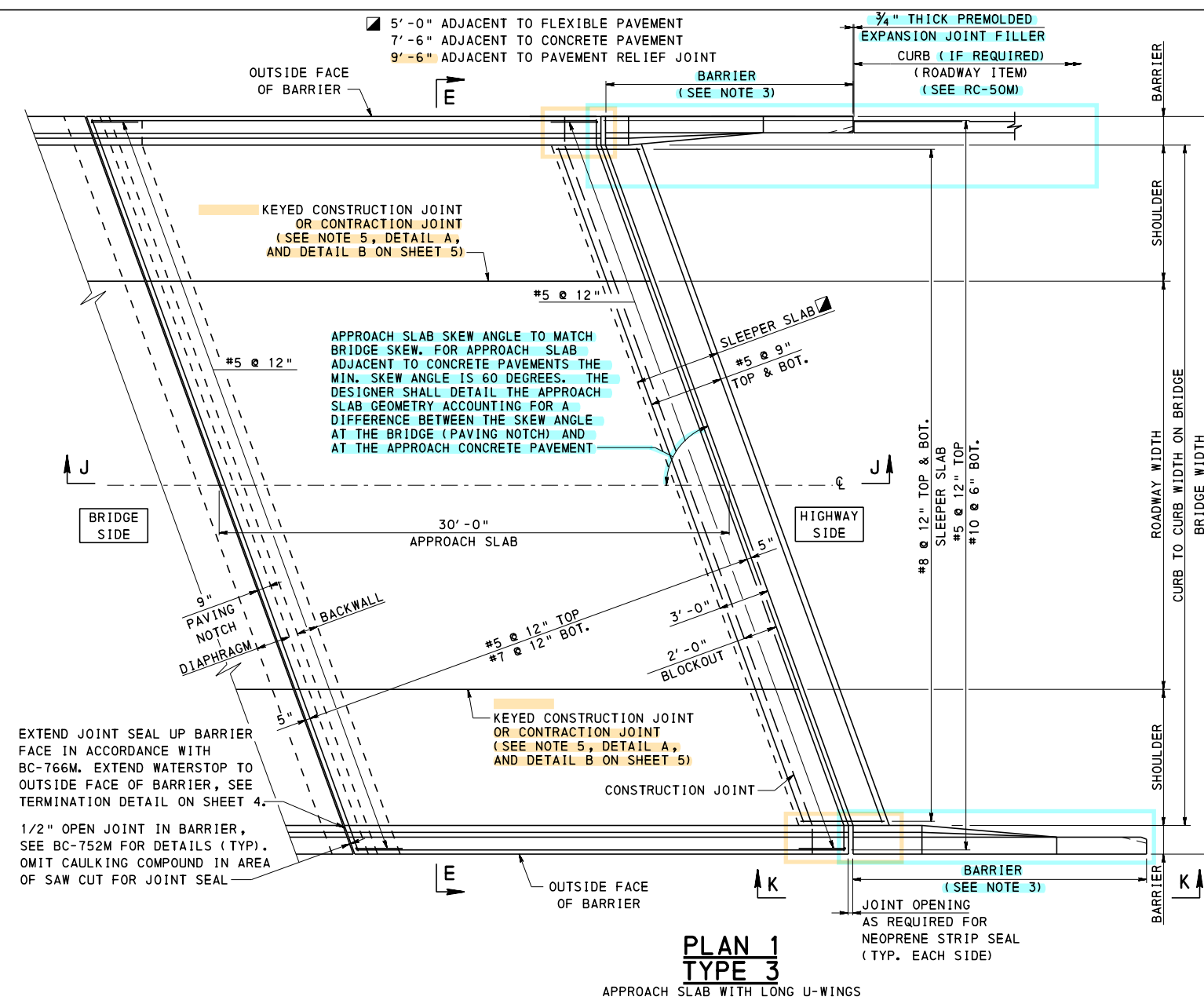
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 1 AND TYPE 2 - DETAIL 12  
(STEEL BEAMS WITH ABUTMENT CORBEL)

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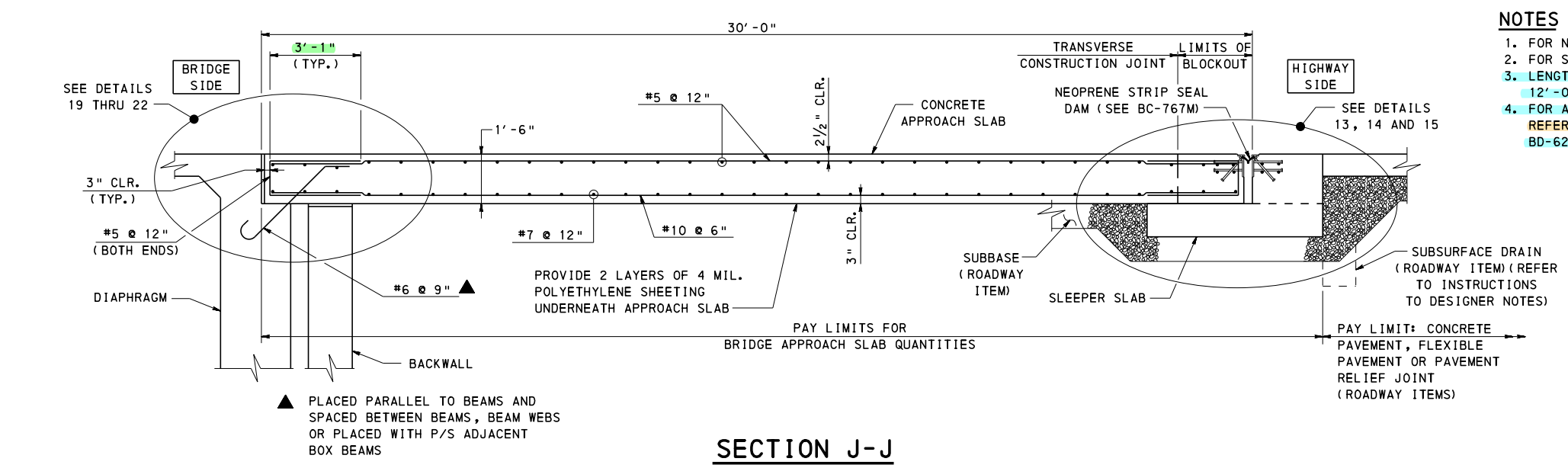
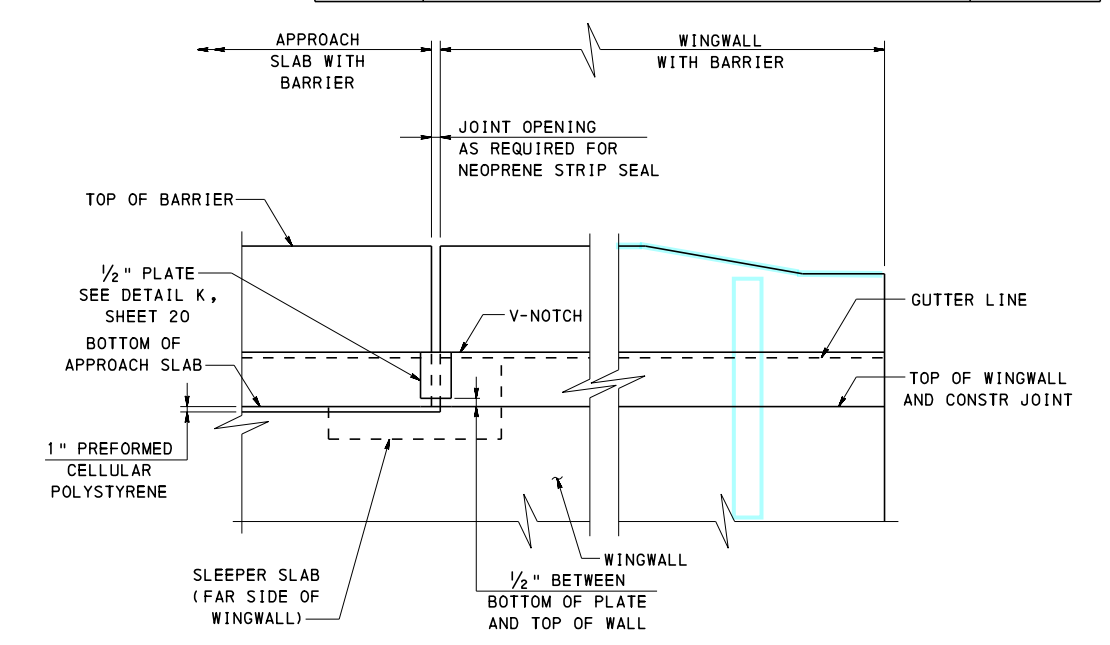
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SHEET 18 OF 35  
BD-628M



| DESCRIPTION OF PLANS FOR TYPE 3 APPROACH SLABS |                                                                    |           |
|------------------------------------------------|--------------------------------------------------------------------|-----------|
| PLAN                                           | DESCRIPTION                                                        | SHEET NO. |
| 1                                              | APPROACH SLAB WITH LONG U-WINGS                                    | 19        |
| 2                                              | APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS | 20        |
| 3                                              | APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS                   | 21        |

| DESCRIPTION OF DETAILS FOR TYPE 3 APPROACH SLAB |                                                                                                                                 |           |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------|
| DETAIL                                          | DESCRIPTION                                                                                                                     | SHEET NO. |
| 13                                              | END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT                                                 | 22        |
| 14                                              | END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT                                                 | 22        |
| 15                                              | END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT                                             | 22        |
| 19                                              | APPROACH SLAB CONNECTED TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL                                                | 24        |
| 20                                              | APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL | 24        |
| 21                                              | APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL          | 25        |
| 22                                              | APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL                         | 25        |



- NOTES**
1. FOR NOTES, SEE SHEETS 1 AND 2.
  2. FOR SECTION E-E, SEE SHEET 8.
  3. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
  4. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

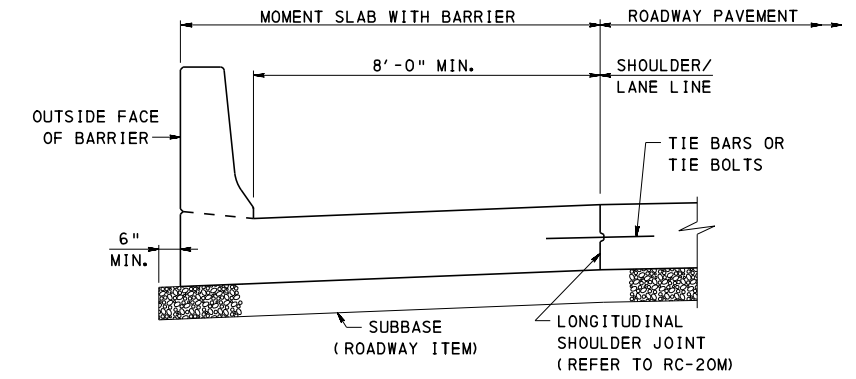
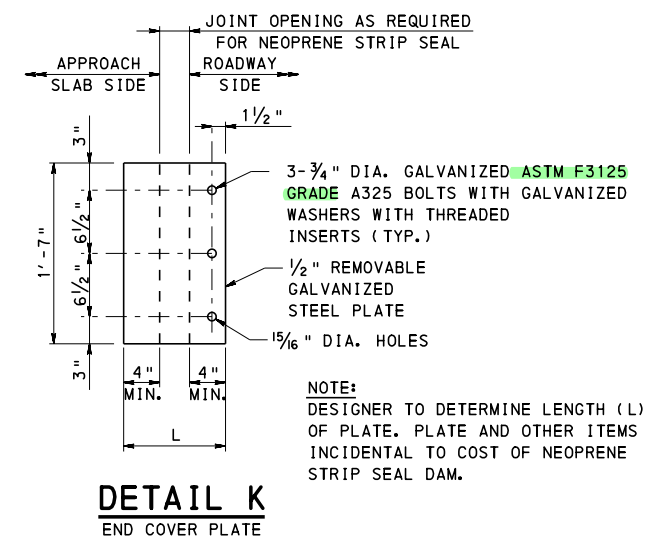
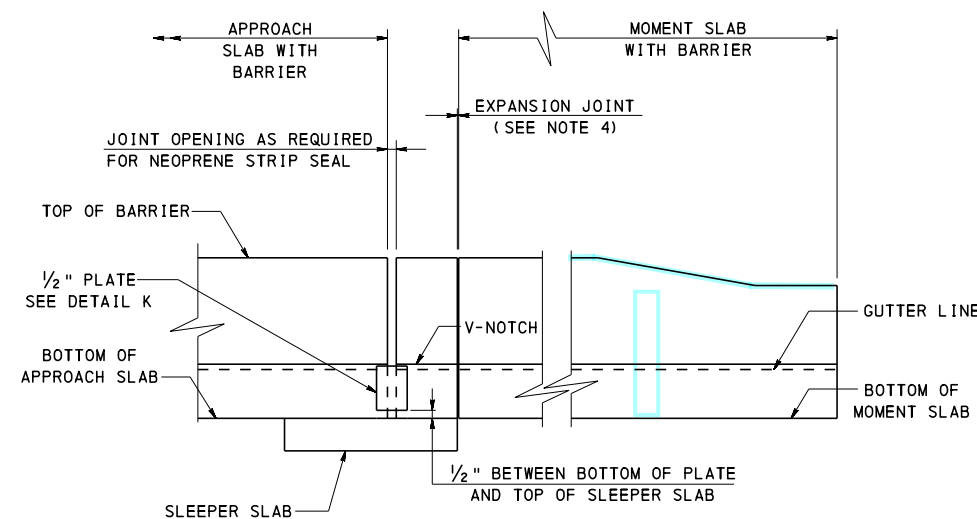
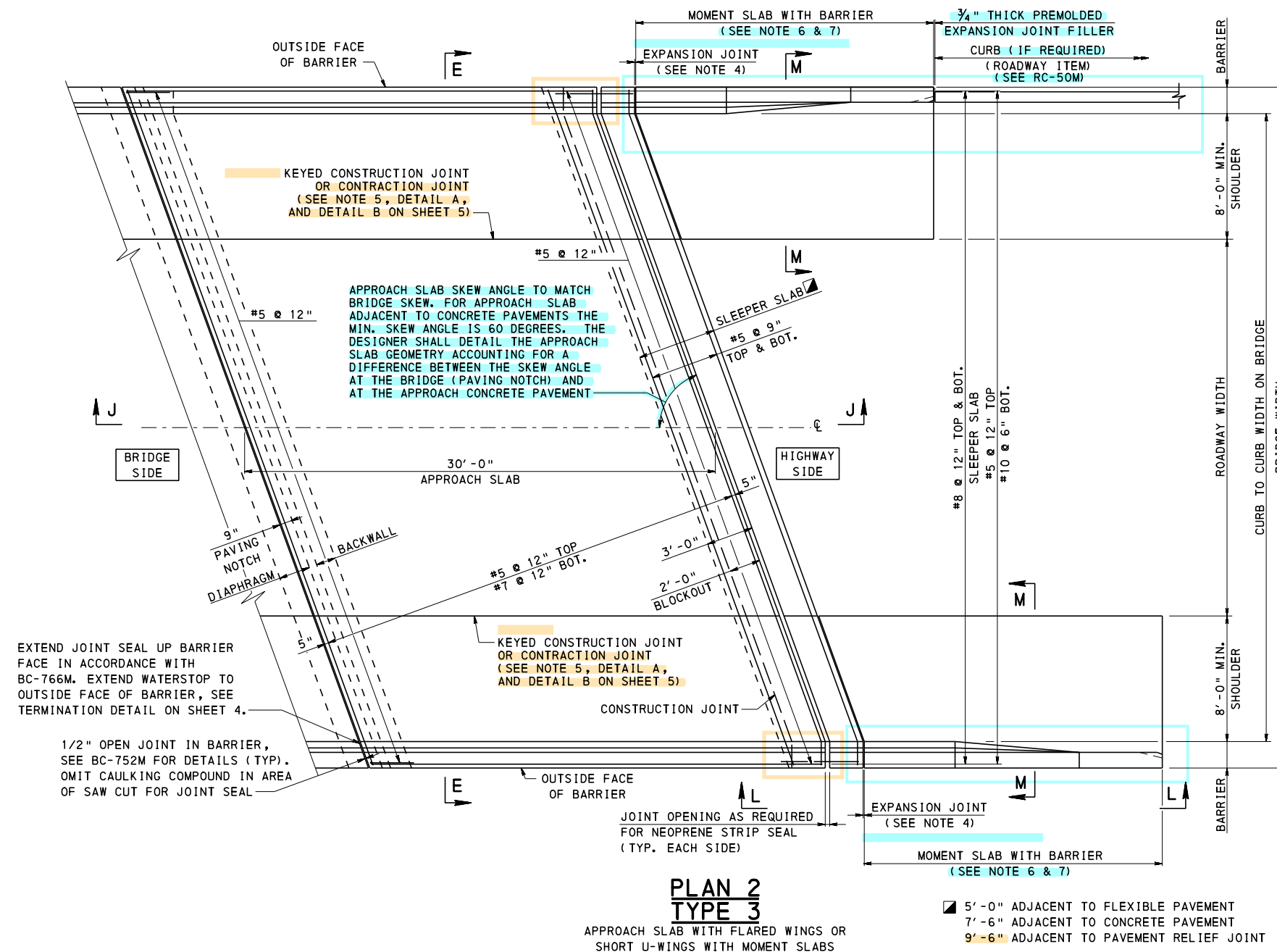
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 3 - PLAN 1 AND SECTION

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SHEET 19 OF 35  
BD-628M



#### NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- FOR SECTION E-E, SEE SHEET 8.
- FOR SECTION J-J, SEE SHEET 19.
- PROVIDE THE FOLLOWING JOINT OPENINGS:
  - APPROACH SLAB ADJACENT TO CONCRETE OR FLEXIBLE PAVEMENT: 1" FLUSH EXPANSION JOINT
  - APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT: 2'-0" AND PROVIDE SLIDING PLATE IN ACCORDANCE WITH THE DETAILS SHOWN ON BD-627M.
- FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
- 45" F-SHAPE CONCRETE BARRIER IS NOT PERMITTED ON MOMENT SLABS.
- LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 16'-0" MINIMUM PER BD-627M.
- FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

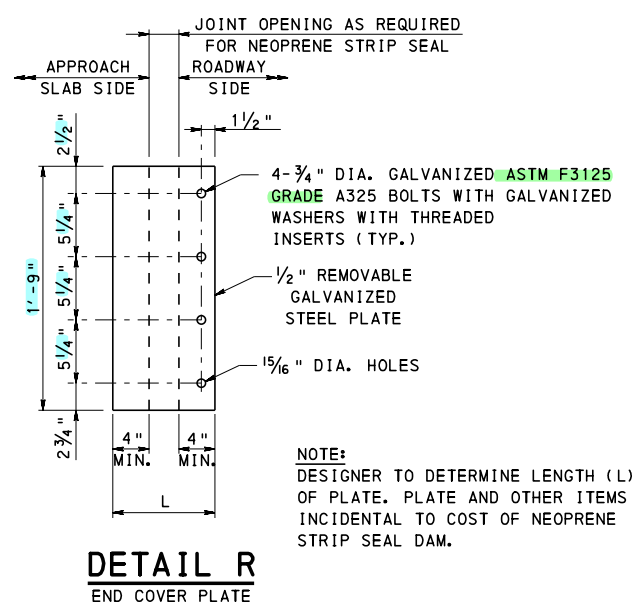
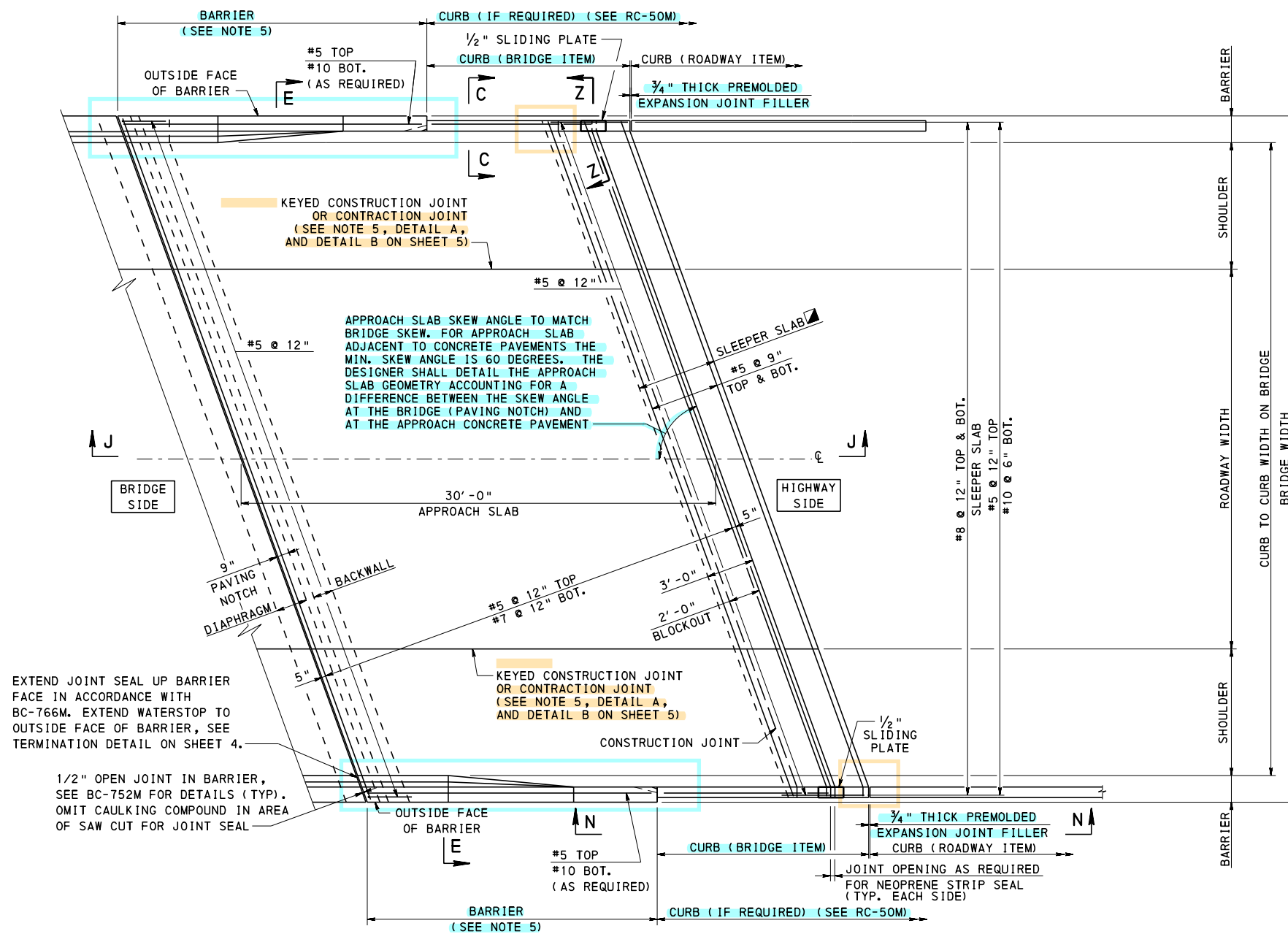
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STANDARD  
BRIDGE APPROACH SLABS  
TYPE 3 - PLAN 2

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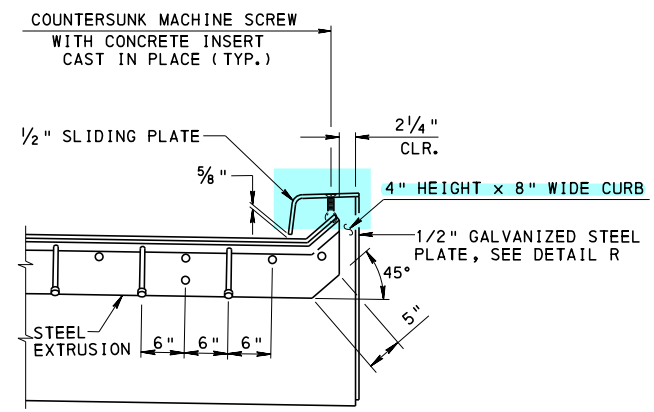
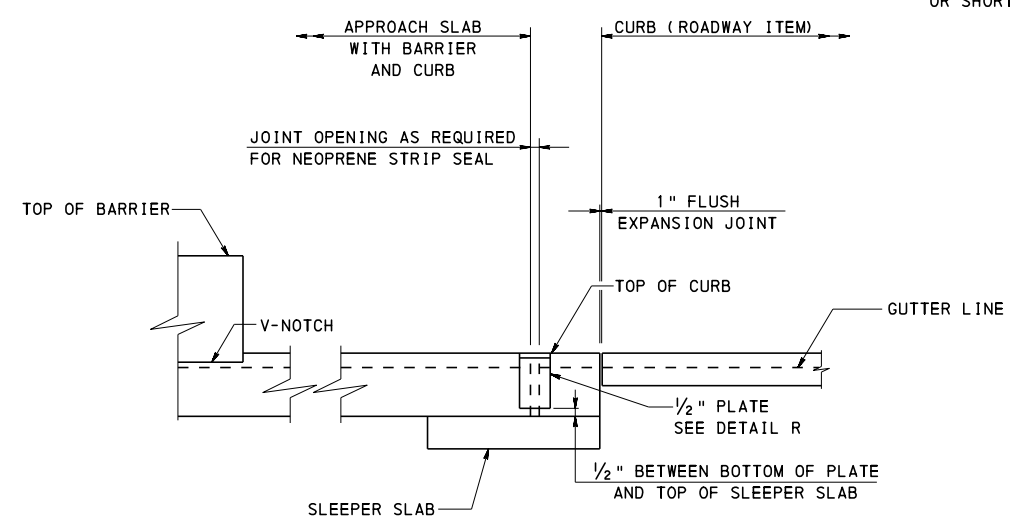
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Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 20 OF 35  
BD-628M



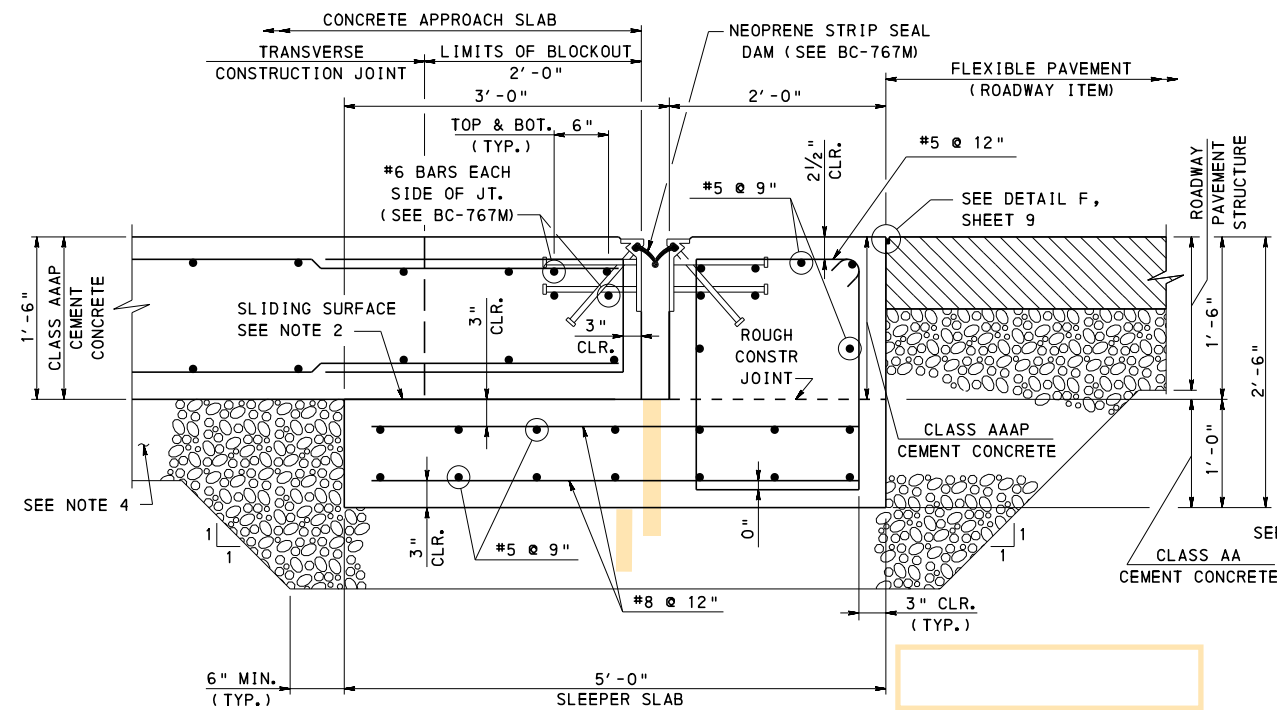
- NOTES**
1. FOR NOTES, SEE SHEETS 1 AND 2.
  2. FOR SECTION C-C, SEE SHEET 5.
  3. FOR SECTION E-E, SEE SHEET 8.
  4. FOR SECTION J-J, SEE SHEET 19.
  5. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
  6. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

- 5'-0" ADJACENT TO FLEXIBLE PAVEMENT
- 7'-6" ADJACENT TO CONCRETE PAVEMENT
- 9'-6" ADJACENT TO PAVEMENT RELIEF JOINT



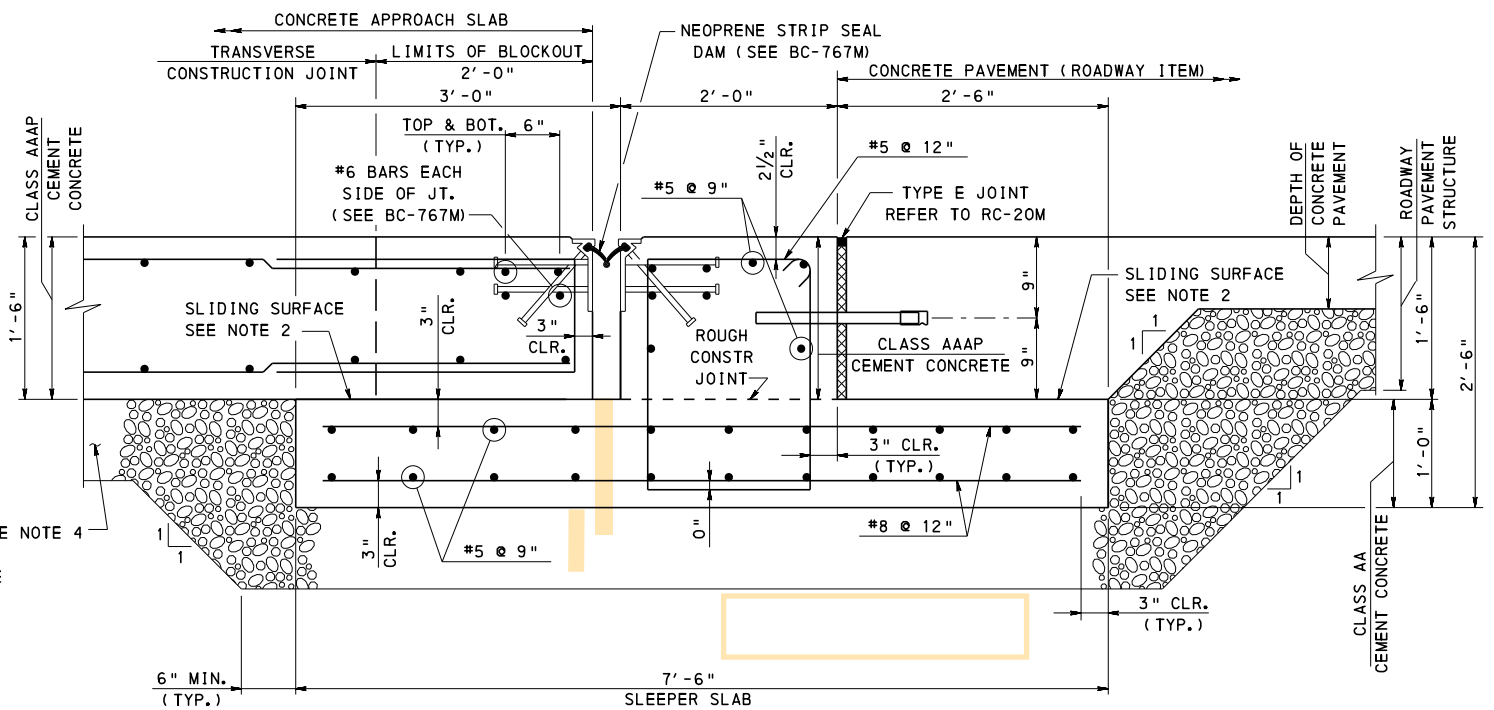
|                                                                                             |                                                                         |                           |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------------|
| <b>COMMONWEALTH OF PENNSYLVANIA</b><br><b>DEPARTMENT OF TRANSPORTATION</b><br>BRIDGE OFFICE |                                                                         |                           |
| STANDARD<br>BRIDGE APPROACH SLABS<br>TYPE 3 - PLAN 3                                        |                                                                         |                           |
| RECOMMENDED NOV. 23, 2022<br><br>CHIEF BRIDGE ENGINEER                                      | RECOMMENDED NOV. 23, 2022<br><br>CHIEF ENGINEER, HIGHWAY ADMINISTRATION | SHEET 21 OF 35<br>BD-628M |





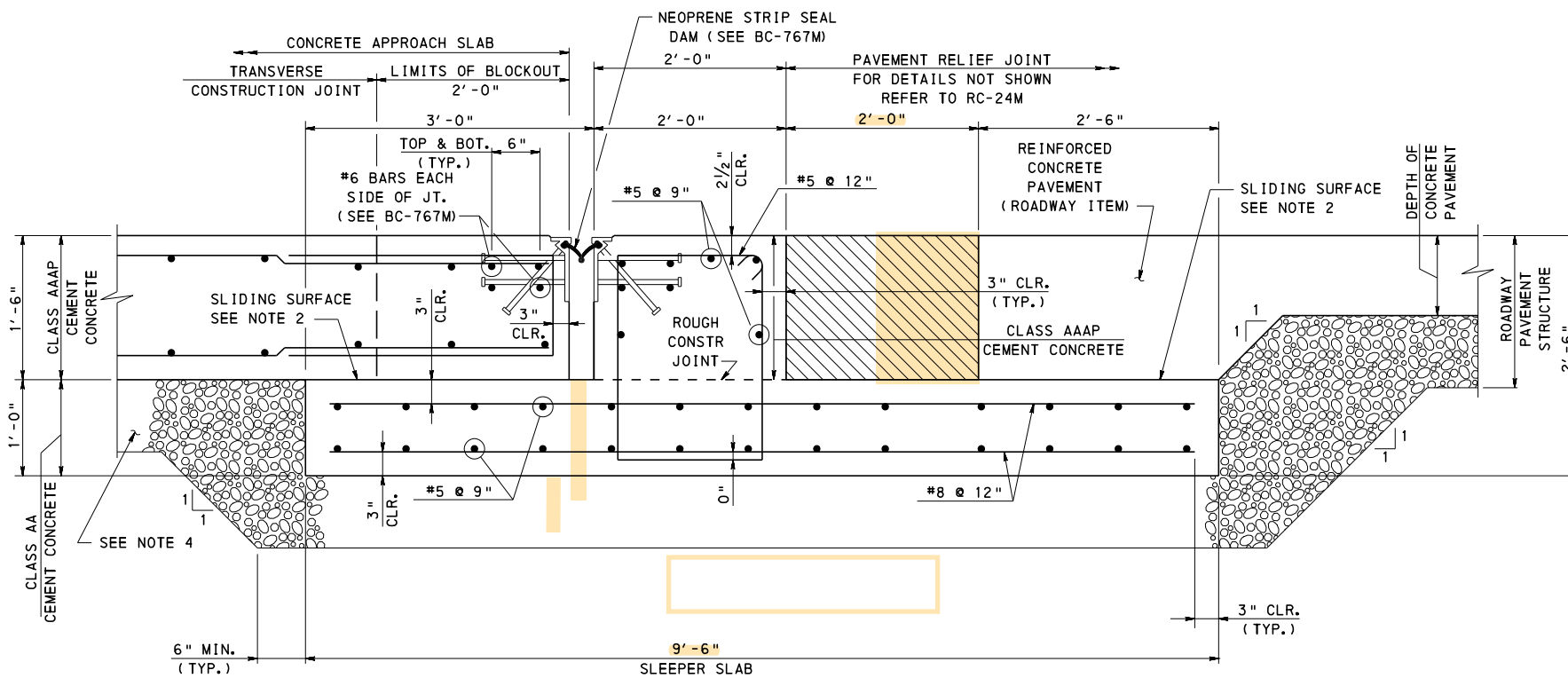
**TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 13**

END OF APPROACH SLAB WITH NEOPRENE  
STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT



**TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 14**

END OF APPROACH SLAB WITH NEOPRENE  
STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT  
(SEE NOTE 3)



**TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 15**

END OF APPROACH SLAB WITH NEOPRENE  
STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT

**NOTES**

- FOR NOTES, SEE SHEETS 1 AND 2.
- TROWEL SMOOTH AND PLACE 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING AS BOND BREAKER.
- USE DETAIL 14 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 15. REFER TO RC-24M FOR ADDITIONAL INFORMATION.
- TYPE 3 APPROACH SLAB; SUBBASE (ROADWAY ITEM)  
TYPE 5 APPROACH SLAB; STRUCTURAL BACKFILL, REFER TO RC-12M.

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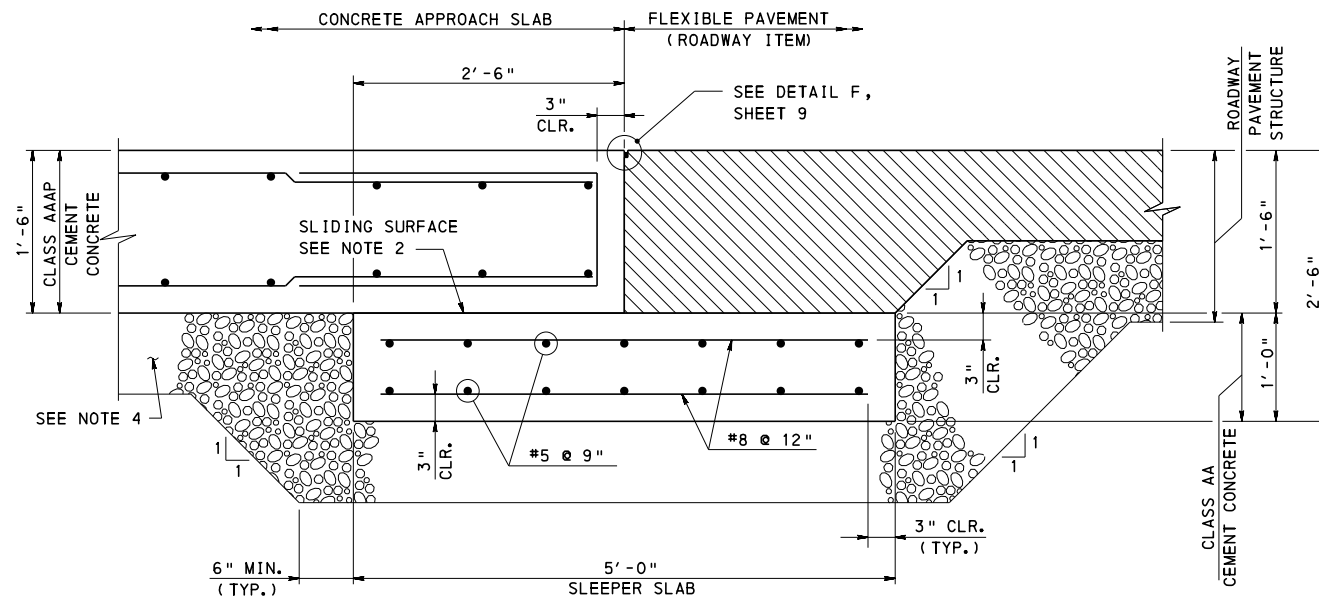
STANDARD  
BRIDGE APPROACH SLABS  
TYPE 3 & TYPE 5 - DETAILS 13, 14 AND 15  
(ADJACENT TO ROADWAY)

RECOMMENDED NOV. 23, 2022  
*L. L. W. B.*  
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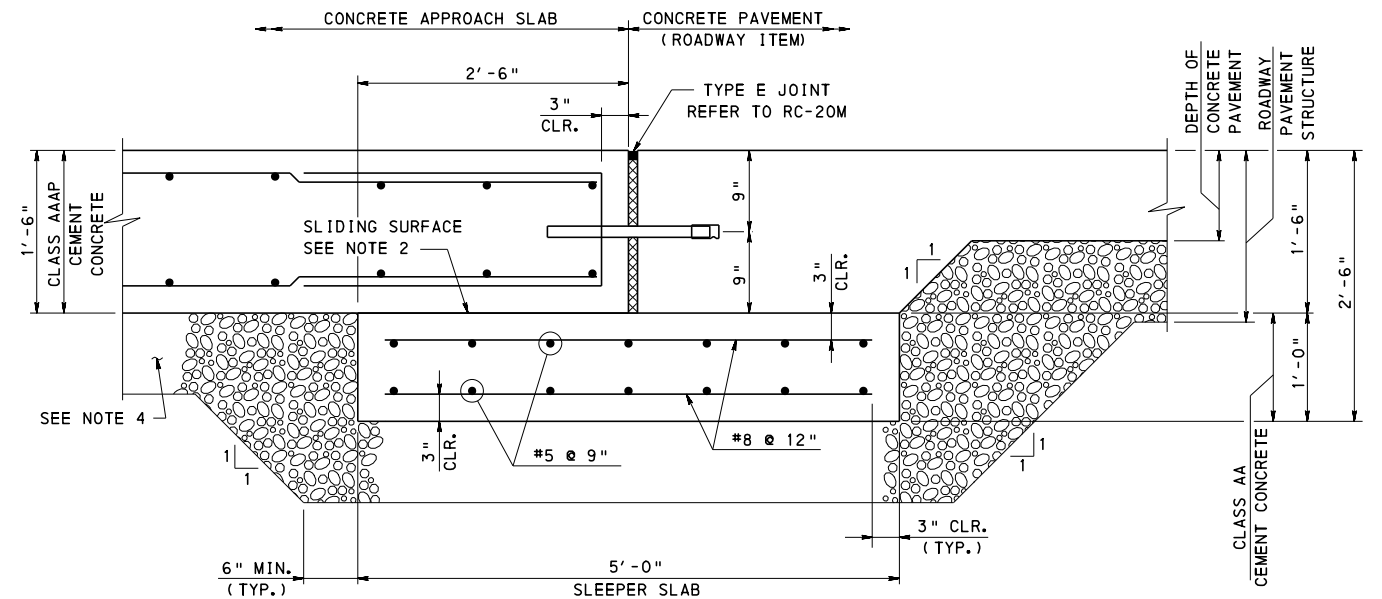
SHEET 22 OF 35  
BD-628M





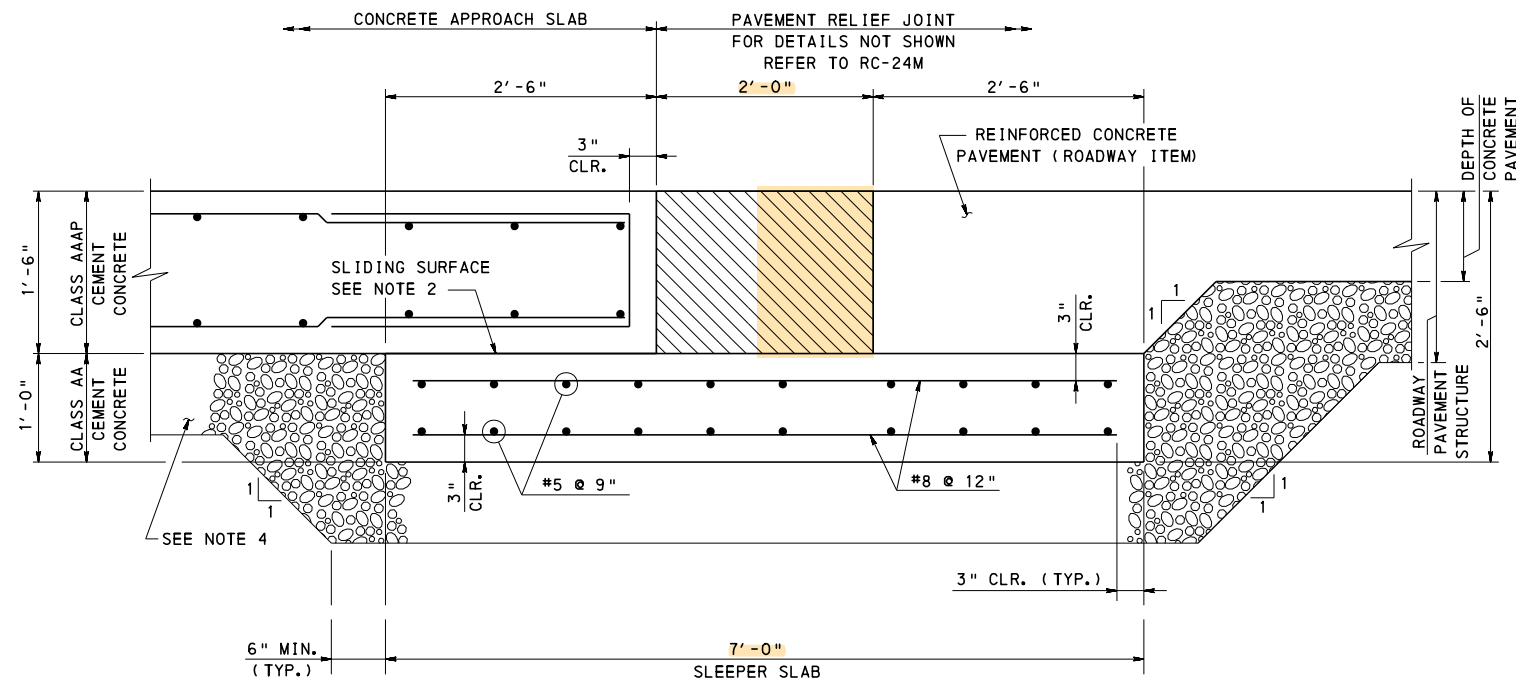
**TYPE 5 APPROACH SLAB - DETAIL 16**

END OF APPROACH SLAB  
ADJACENT TO FLEXIBLE PAVEMENT



**TYPE 5 APPROACH SLAB - DETAIL 17**

END OF APPROACH SLAB  
ADJACENT TO CONCRETE PAVEMENT  
(SEE NOTE 3)



**TYPE 5 APPROACH SLAB - DETAIL 18**

END OF APPROACH SLAB  
ADJACENT TO PAVEMENT RELIEF JOINT

**NOTES**

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. TROWEL SMOOTH AND PLACE 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING AS BOND BREAKER.
3. USE DETAIL 17 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 18. REFER TO RC-24M FOR ADDITIONAL INFORMATION.
4. STRUCTURAL BACKFILL, REFER TO RC-12M.

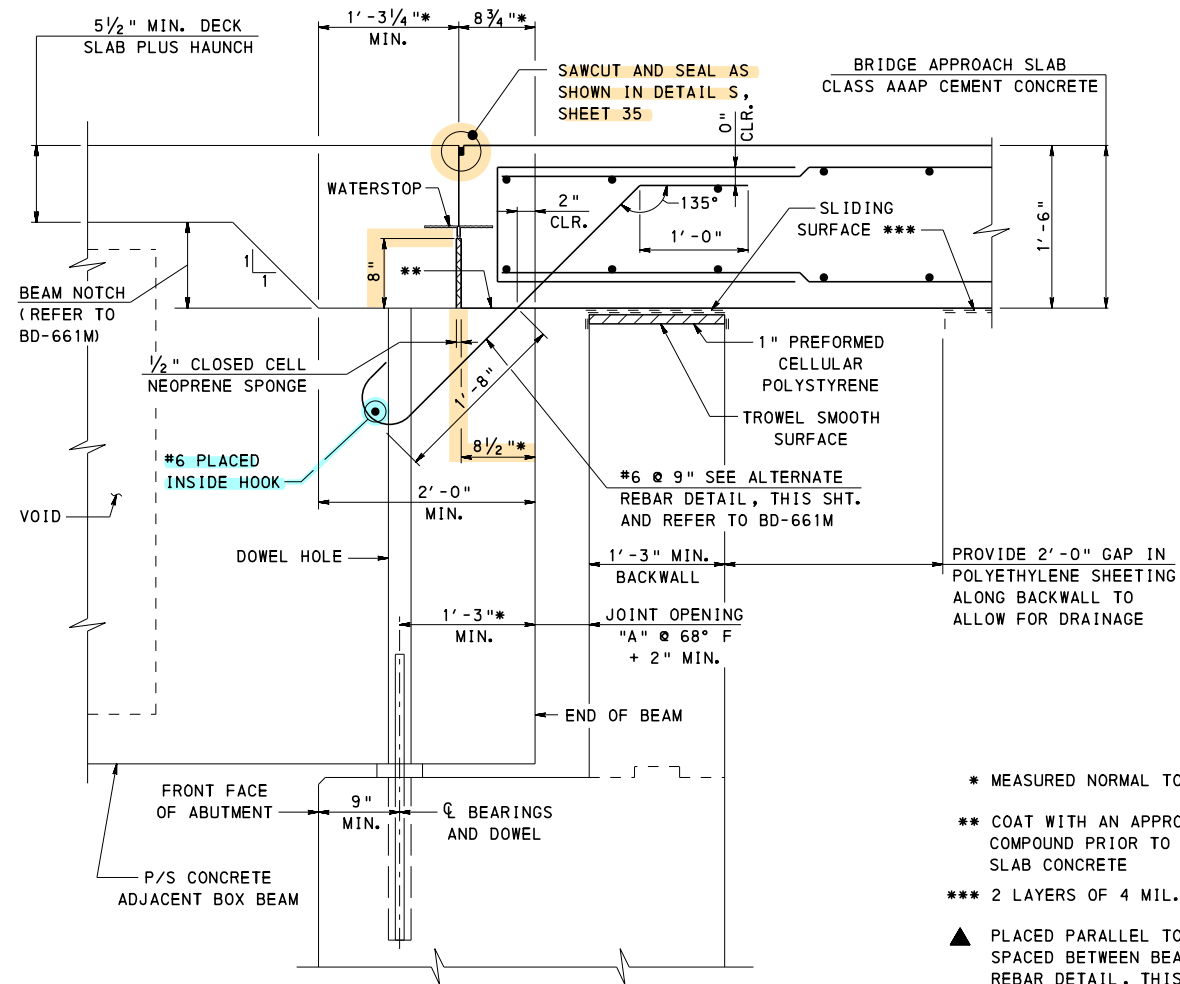
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BRIDGE OFFICE**

**STANDARD**  
**BRIDGE APPROACH SLABS**  
**TYPE 5 - DETAILS 16, 17 AND 18**  
**(ADJACENT TO ROADWAY)**

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*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

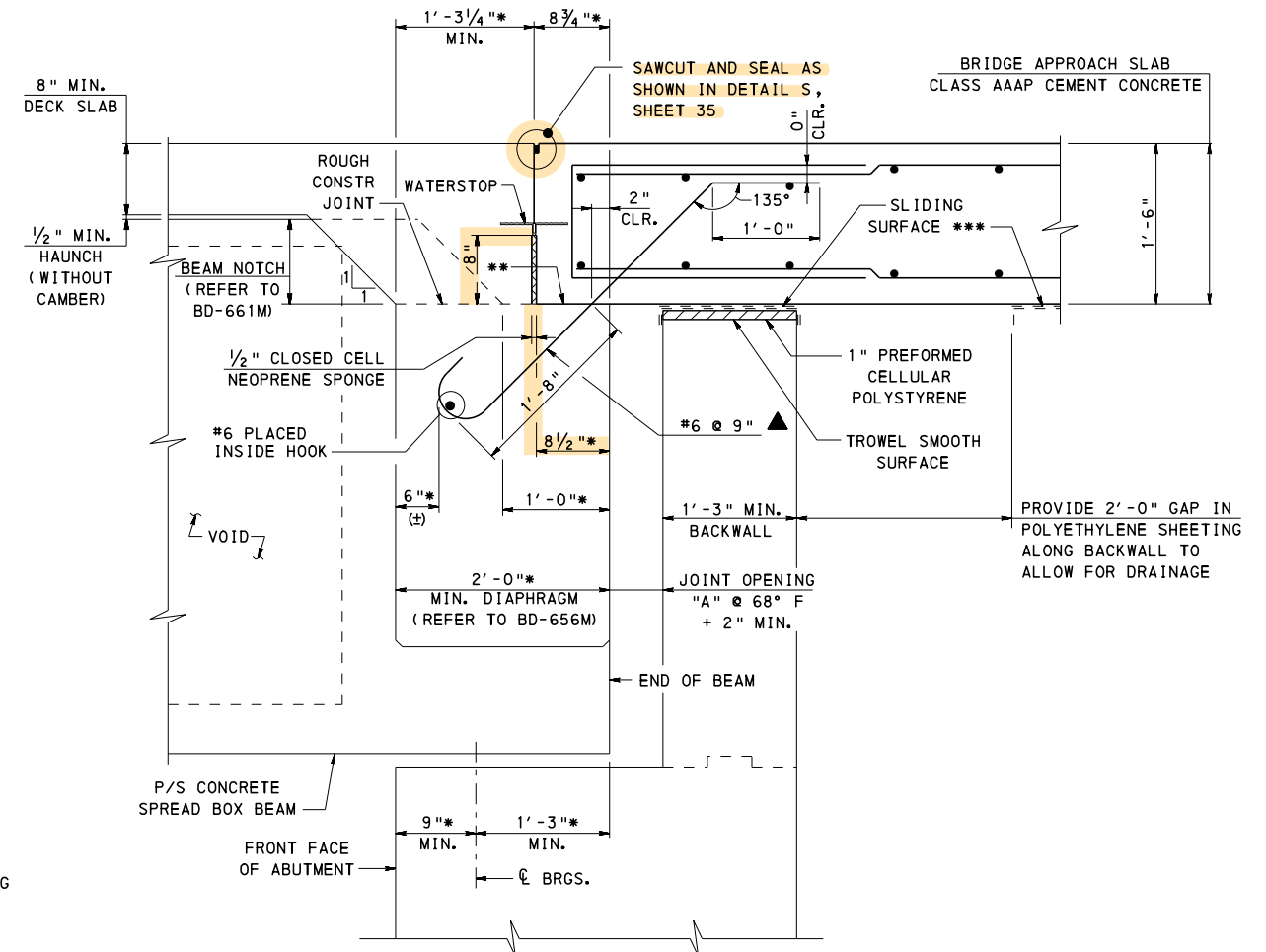
SHEET 23 OF 35  
**BD-628M**



- \* MEASURED NORMAL TO ABUTMENT
- \*\* COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING APPROACH SLAB CONCRETE
- \*\*\* 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING
- ▲ PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS, SEE ALTERNATE REBAR DETAIL, THIS SHEET.

### TYPE 3 APPROACH SLAB - DETAIL 19

APPROACH SLAB CONNECTED TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL, FOR BEAM DEPTHS 33" AND GREATER

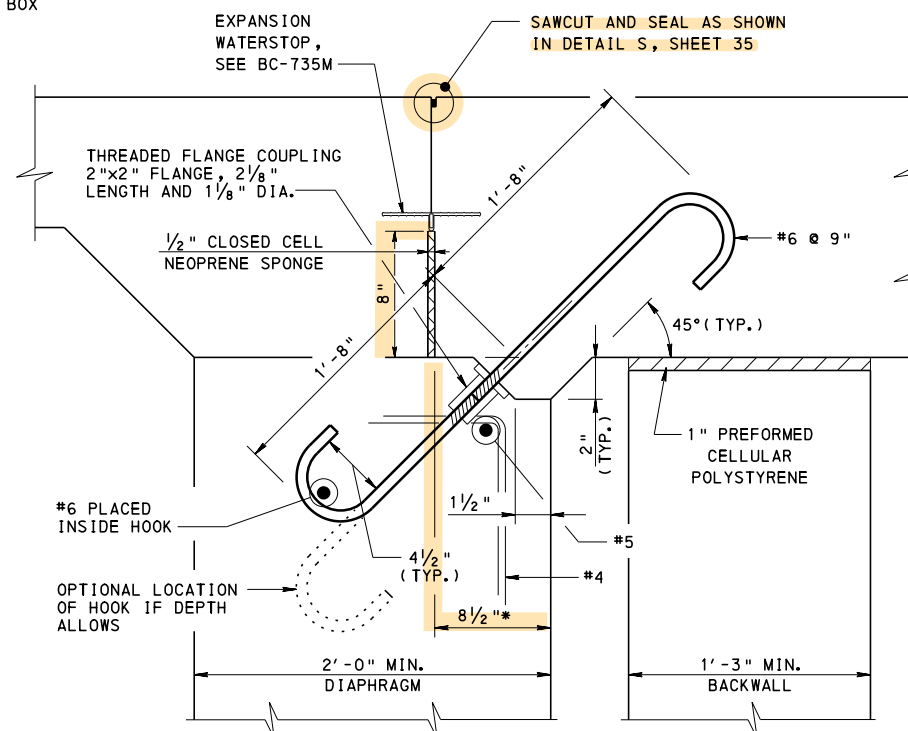


### TYPE 3 APPROACH SLAB - DETAIL 20

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL, FOR BEAM DEPTHS 39" AND GREATER

#### NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
5. SEE BC-767M FOR JOINT OPENING "A".



#### ALTERNATE REBAR DETAIL

END OF BOX BEAM TO MATCH NOTCH SHOWN ABOVE FOR THIS ALTERNATE.

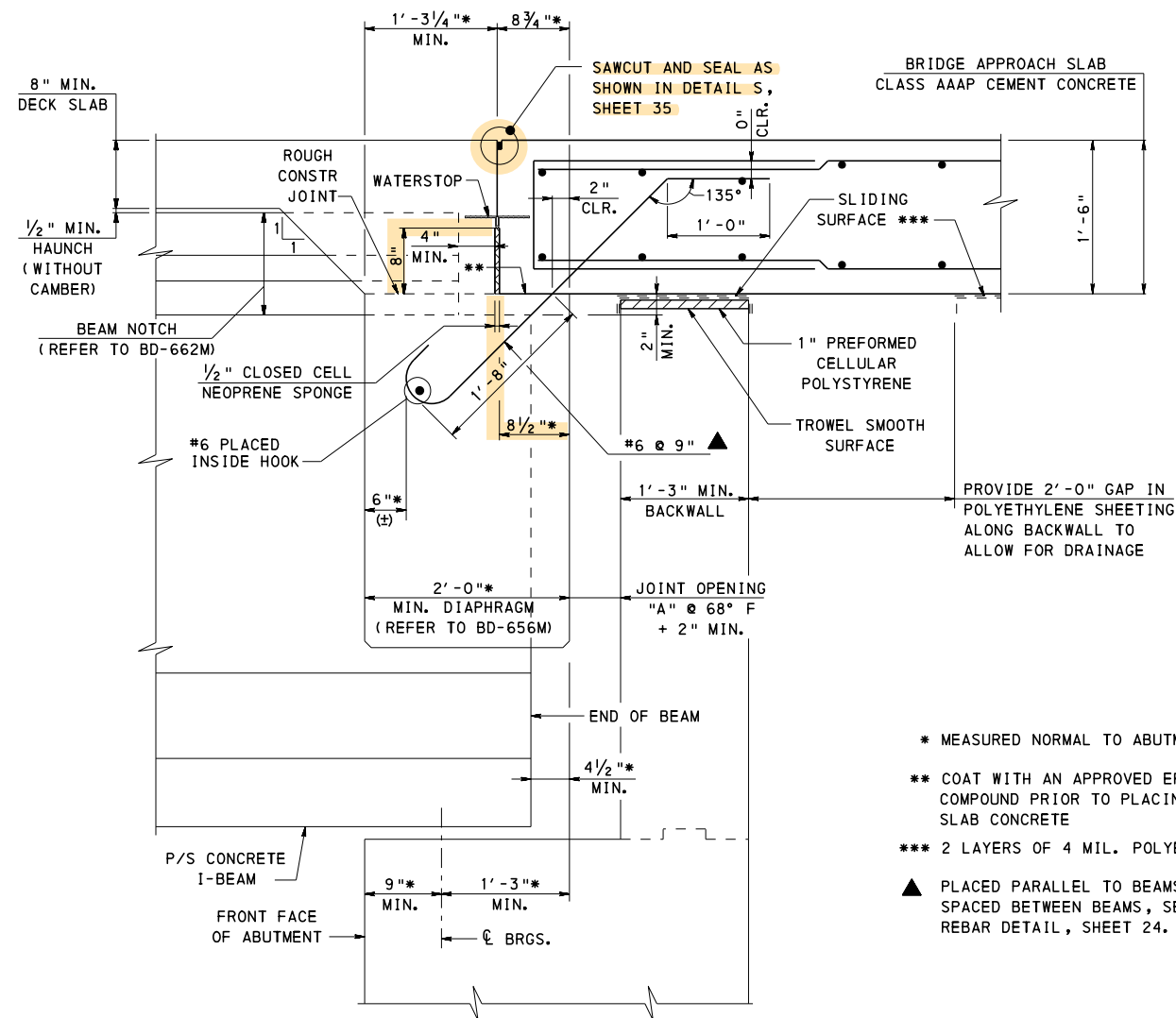
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
BRIDGE APPROACH SLABS  
TYPE 3 - DETAILS 19 AND 20  
(P/S CONCRETE BOX BEAMS WITH BACKWALL)

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CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 24 OF 35  
BD-628M

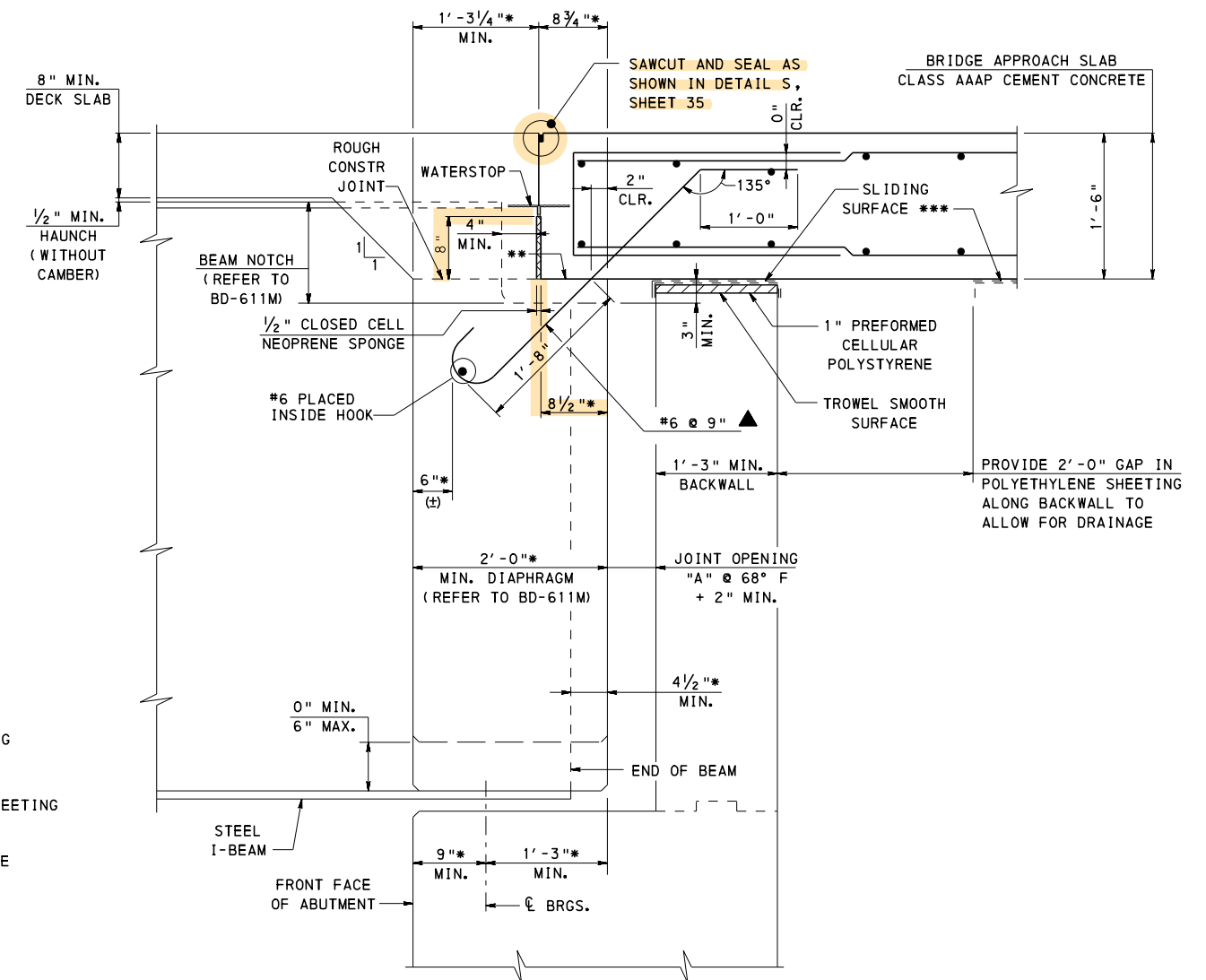


**TYPE 3 APPROACH SLAB - DETAIL 21**

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE  
(PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS)  
WITH BACKWALL - SEE TABLE A FOR MINIMUM BEAM DEPTHS

| TABLE A             |                     |
|---------------------|---------------------|
| BEAM TYPE           | MINIMUM BEAM DEPTHS |
| AASHTO TYPE I-BEAMS | 63"                 |
| PA BULB-TEE BEAMS   | 47.25"              |
| PA I-BEAMS          | ①                   |

① THE FOLLOWING BEAMS ARE PERMITTED:  
26/54, 24/60, 26/60  
24/63, AND 26/63



**TYPE 3 APPROACH SLAB - DETAIL 22**

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE  
(STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL  
FOR BEAM DEPTHS 40" AND GREATER

**NOTES**

- FOR NOTES, SEE SHEETS 1 AND 2.
- BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
- DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL OR EXCEEDS THE DEPTHS INDICATED IN TABLE A. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
- FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.
- SEE BC-767M FOR JOINT OPENING "A".

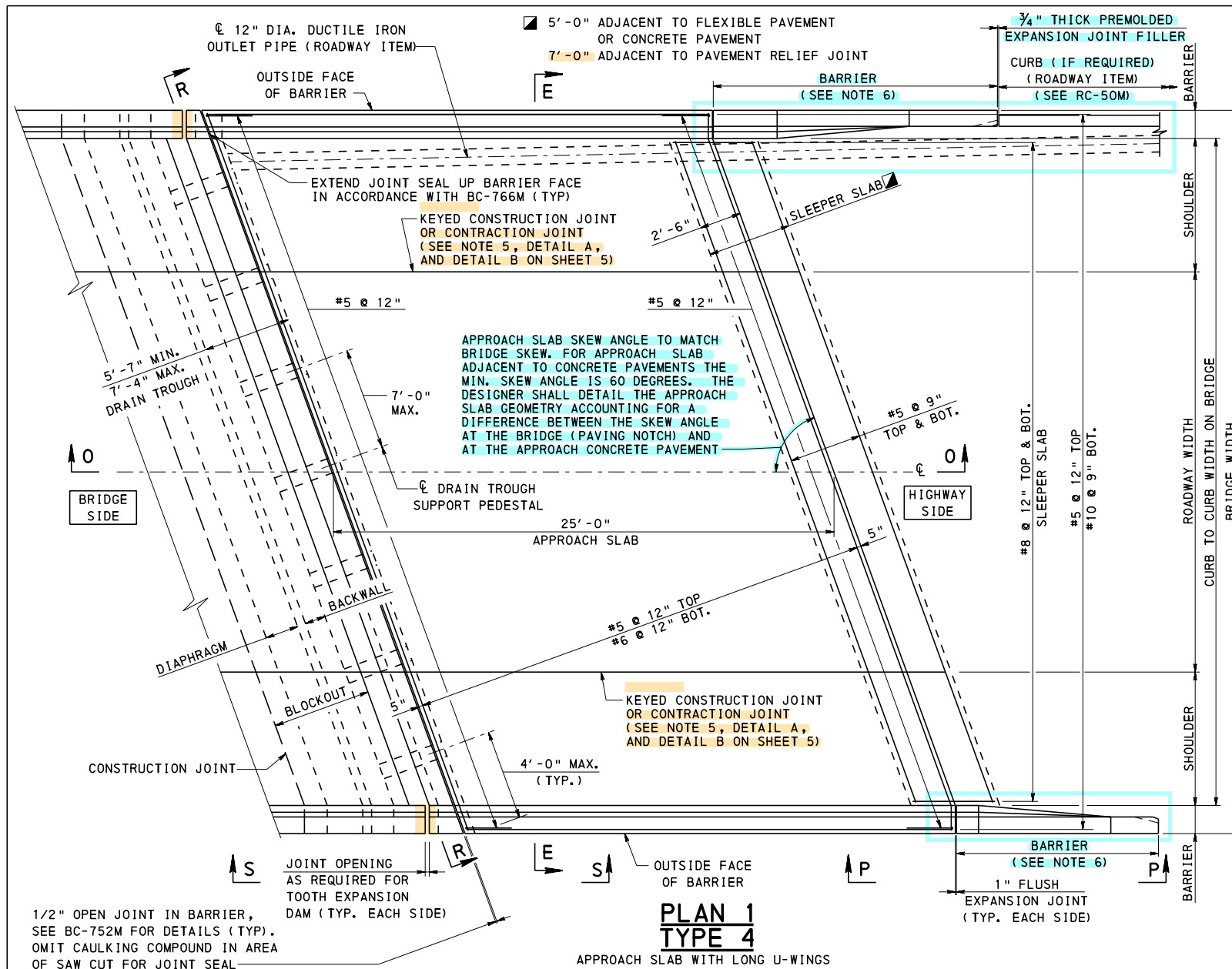
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

STANDARD  
BRIDGE APPROACH SLABS  
TYPE 3 - DETAILS 21 AND 22  
(I-BEAMS WITH BACKWALL)

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

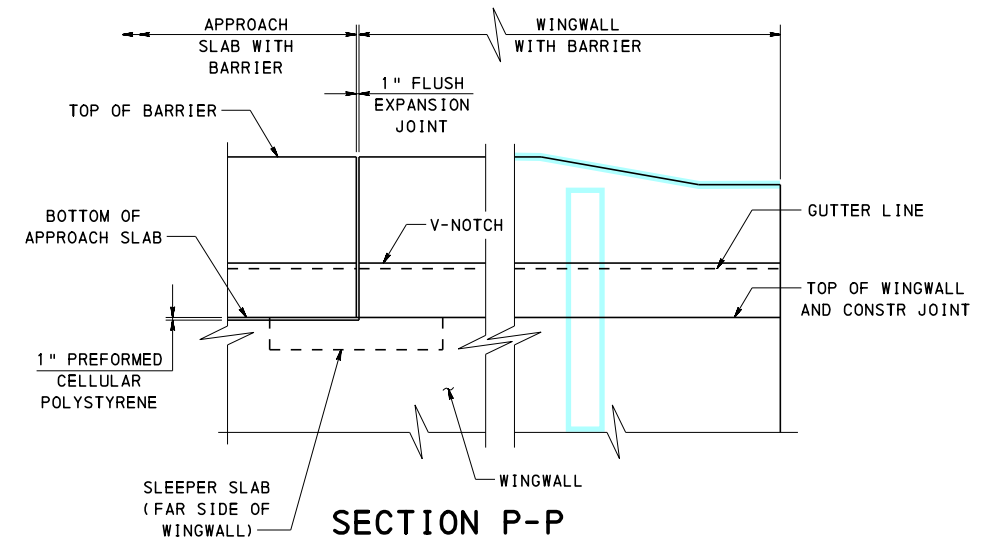
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 25 OF 35  
BD-628M

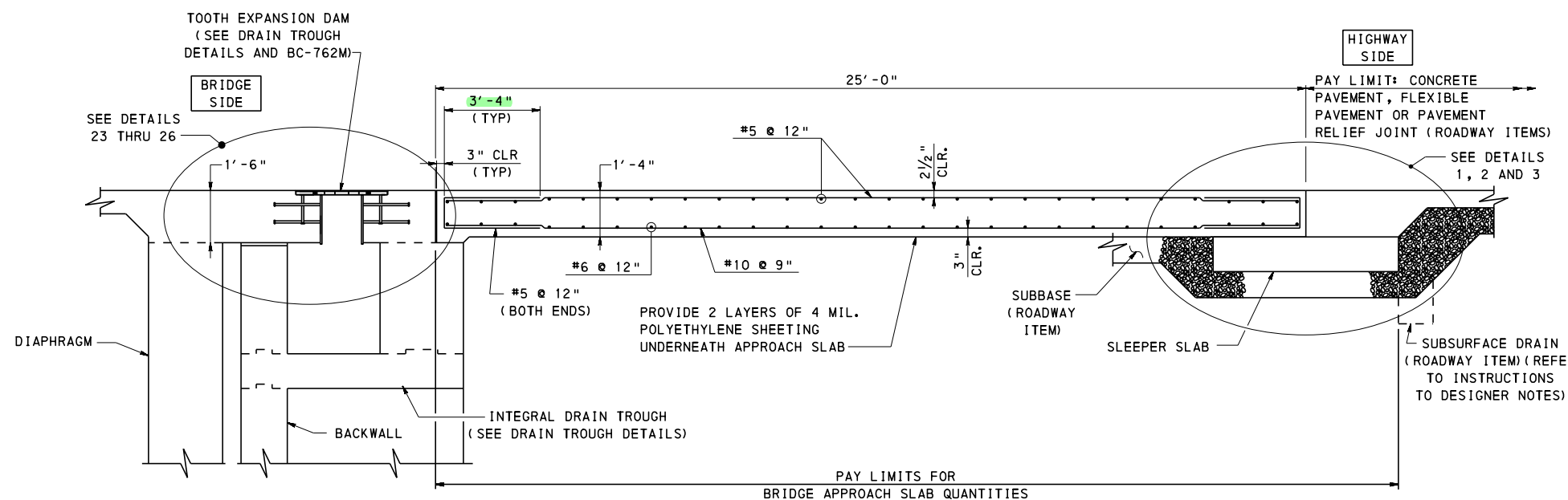


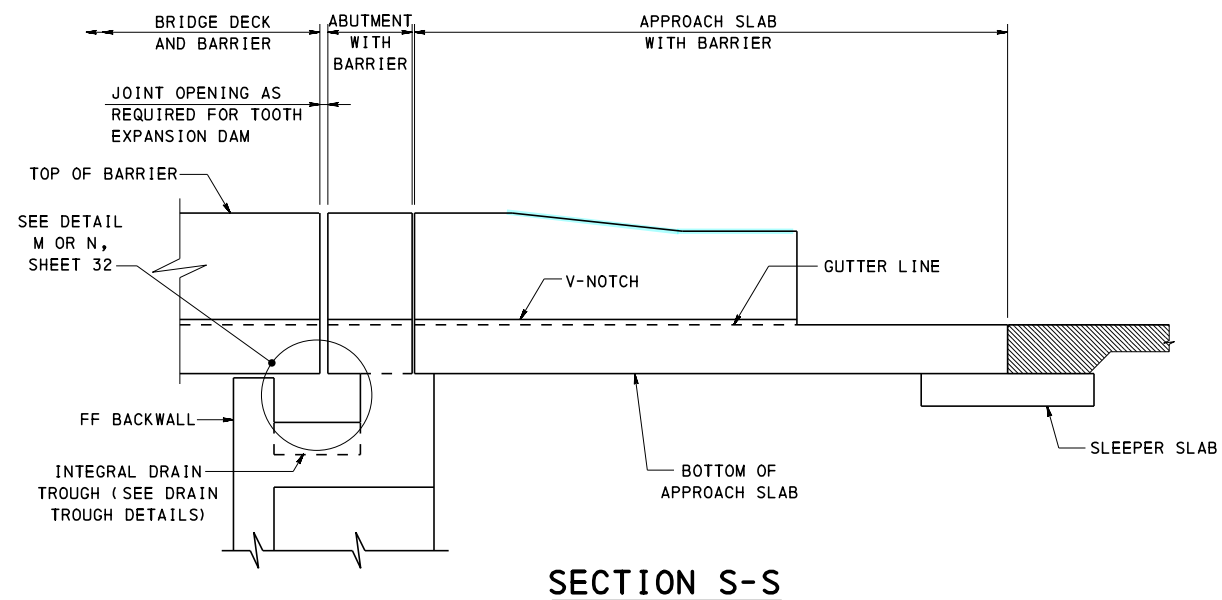
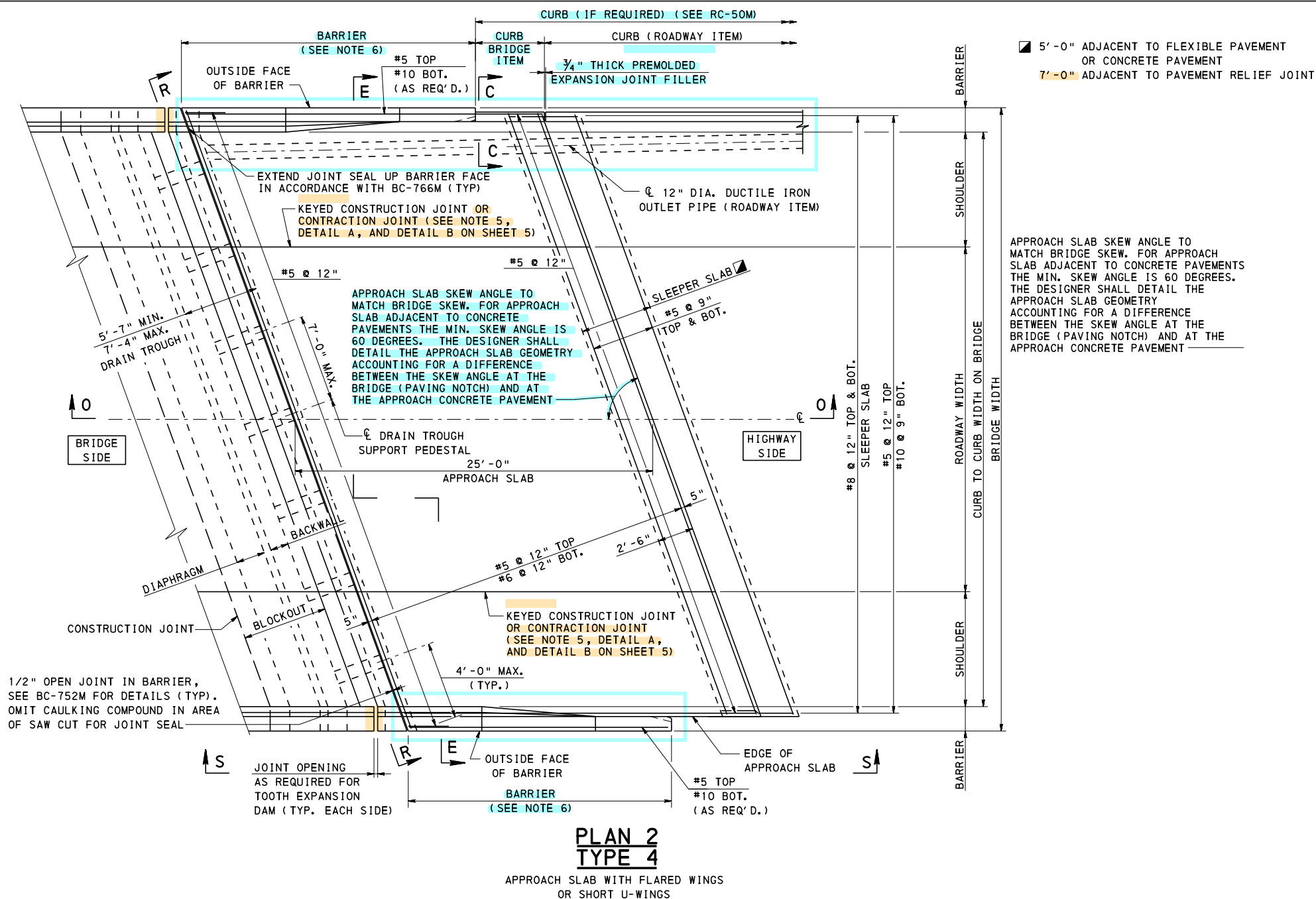
| PLAN | DESCRIPTION                                                                   | SHEET NO. |
|------|-------------------------------------------------------------------------------|-----------|
| 1    | INTEGRAL DRAIN TROUGH WITH APPROACH SLAB AND LONG U-WINGS                     | 26        |
| 2    | INTEGRAL DRAIN TROUGH WITH APPROACH SLAB AND FLARED WINGS OR SHORT U-WINGS    | 27        |
| 3    | INTEGRAL DRAIN TROUGH WITHOUT APPROACH SLAB AND FLARED WINGS OR SHORT U-WINGS | 28        |

| DETAIL | DESCRIPTION                                                                                                                                       | SHEET NO. |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1      | APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT                                                                                                       | 9         |
| 2      | APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT                                                                                                       | 9         |
| 3      | APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT                                                                                                   | 9         |
| 23     | PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND NO APPROACH SLAB                                | 29        |
| 24     | PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND APPROACH SLAB SUPPORT | 30        |
| 25     | PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND NO APPROACH SLAB               | 31        |
| 26     | STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND APPROACH SLAB SUPPORT                         | 32        |



- NOTES:**
- FOR NOTES, SEE SHEETS 1 AND 2.
  - FOR SECTION E-E, SEE SHEET 8.
  - FOR SECTION S-S, SEE SHEET 27.
  - FOR SECTION R-R, SEE SHEET 33.
  - FOR DRAIN TROUGH DETAILS, SEE SHEETS 28 - 34.
  - LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
  - FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.





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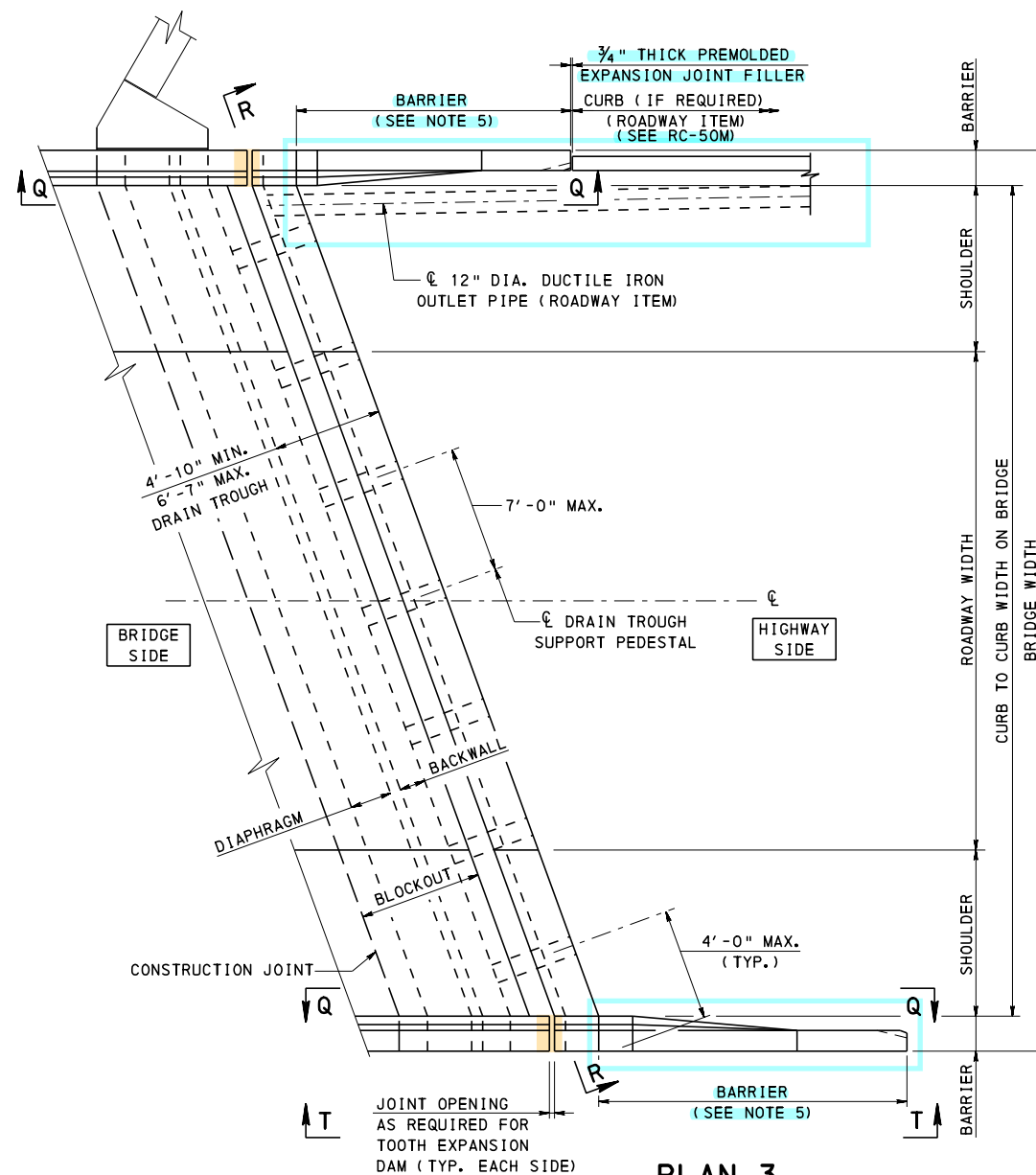
STANDARD  
BRIDGE APPROACH SLABS  
TYPE 4 - PLAN 2

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CHIEF BRIDGE ENGINEER

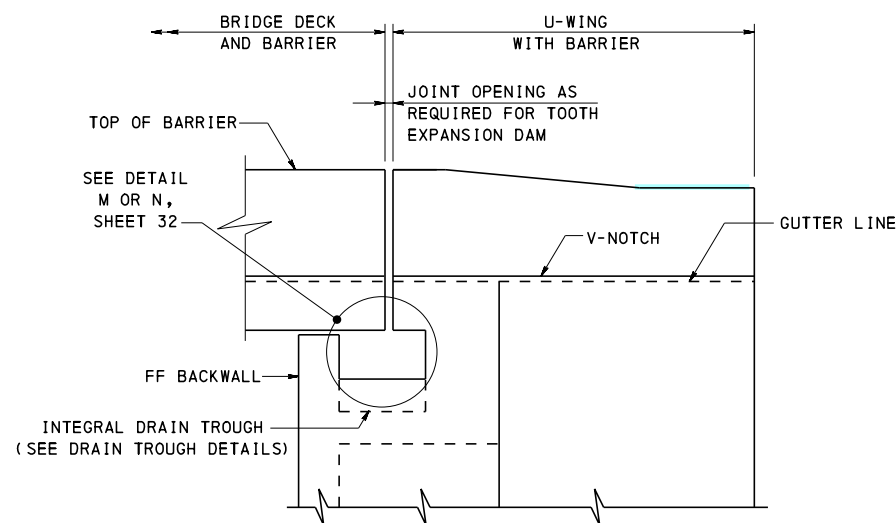
RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 27 OF 35  
BD-628M

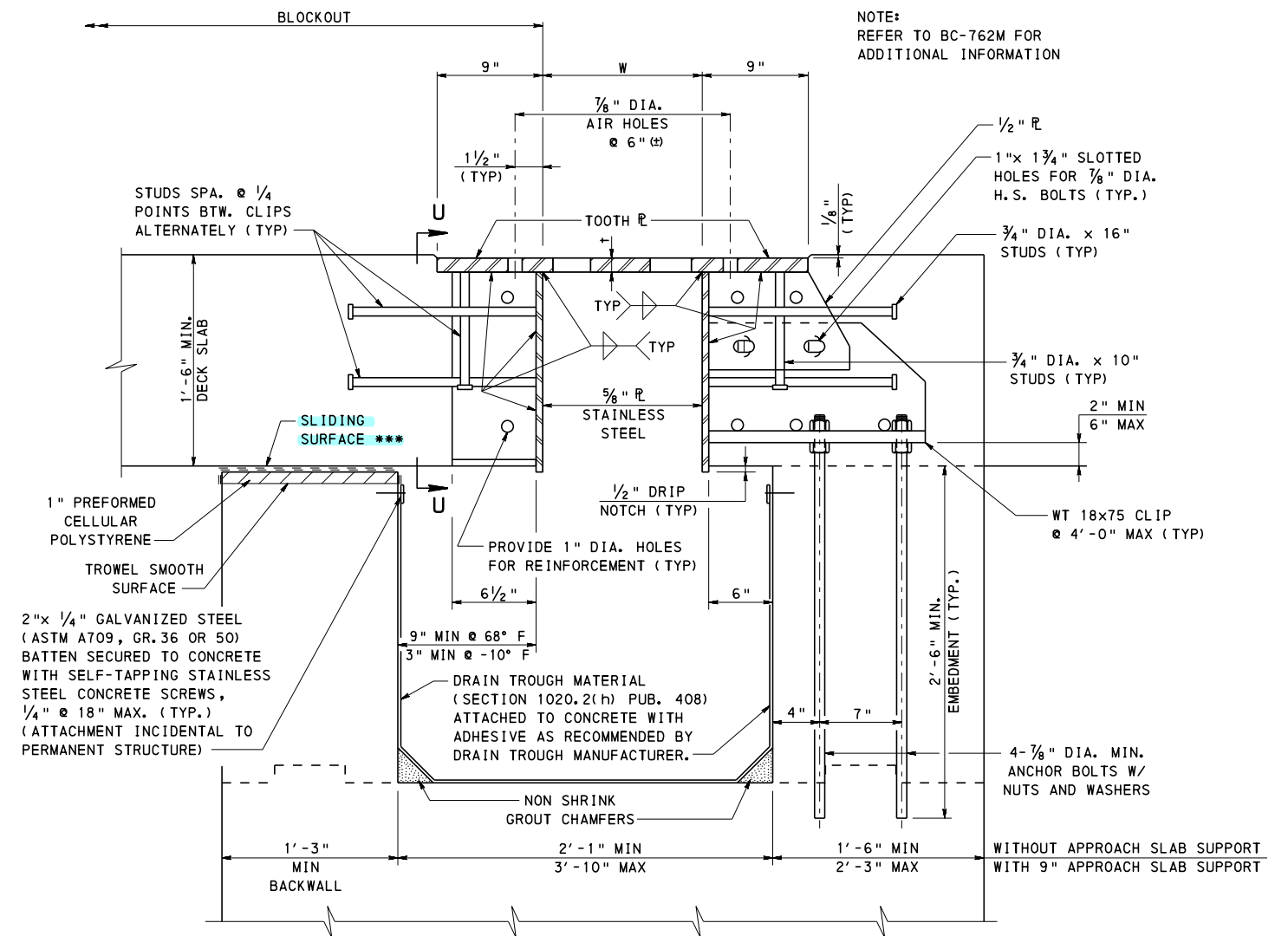




NO APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS

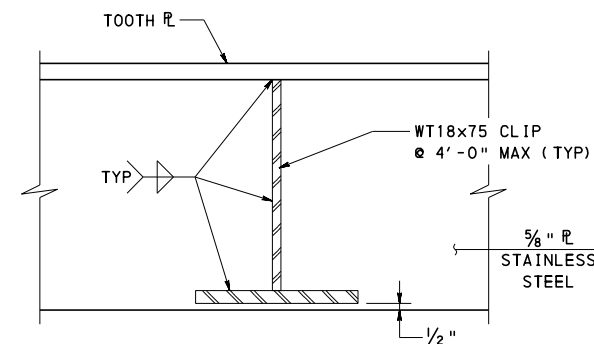


SECTION T-T



TOOTH EXPANSION DAM ANCHORAGE DETAIL

\*\*\* 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING.



SECTION U-U

NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- FOR SECTIONS R-R, SEE SHEET 33.
- FOR SECTIONS Q-Q, SEE SHEET 34.
- FOR DRAIN TROUGH DETAILS, SEE SHEETS 28 - 34.
- LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
- FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M AND RC-50M.

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BRIDGE OFFICE

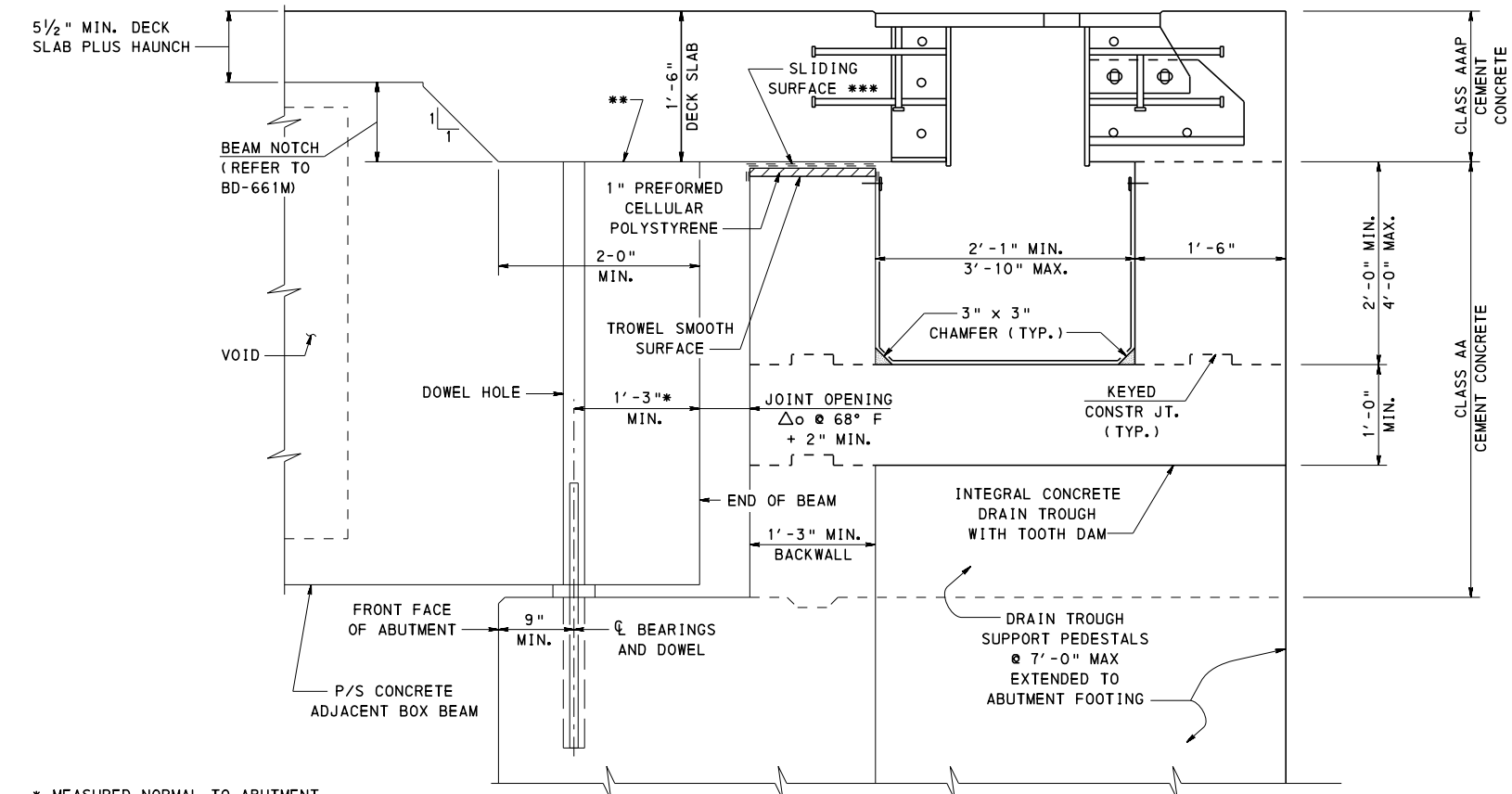
STANDARD  
BRIDGE APPROACH SLABS  
TYPE 4 - PLAN 3

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CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
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CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 28 OF 35  
BD-628M

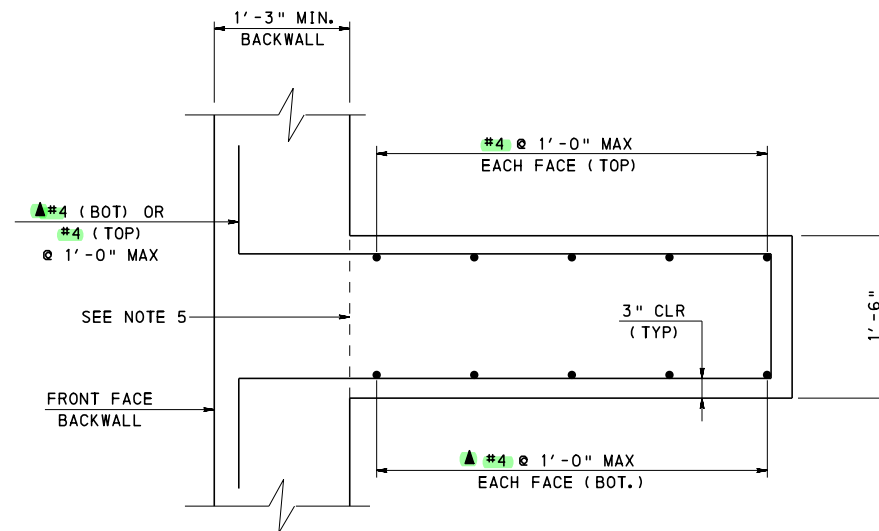




\* MEASURED NORMAL TO ABUTMENT  
 \*\* COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE  
 \*\*\* 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

### TYPE 4 APPROACH SLAB - DETAIL 23

PRESTRESSED CONCRETE ADJACENT BOX BEAMS WITH BACKWALL  
 FOR BEAM DEPTHS 33" AND GREATER  
 (SHOWN WITH FLEXIBLE PAVEMENT ADJACENT TO TOOTH DAM)

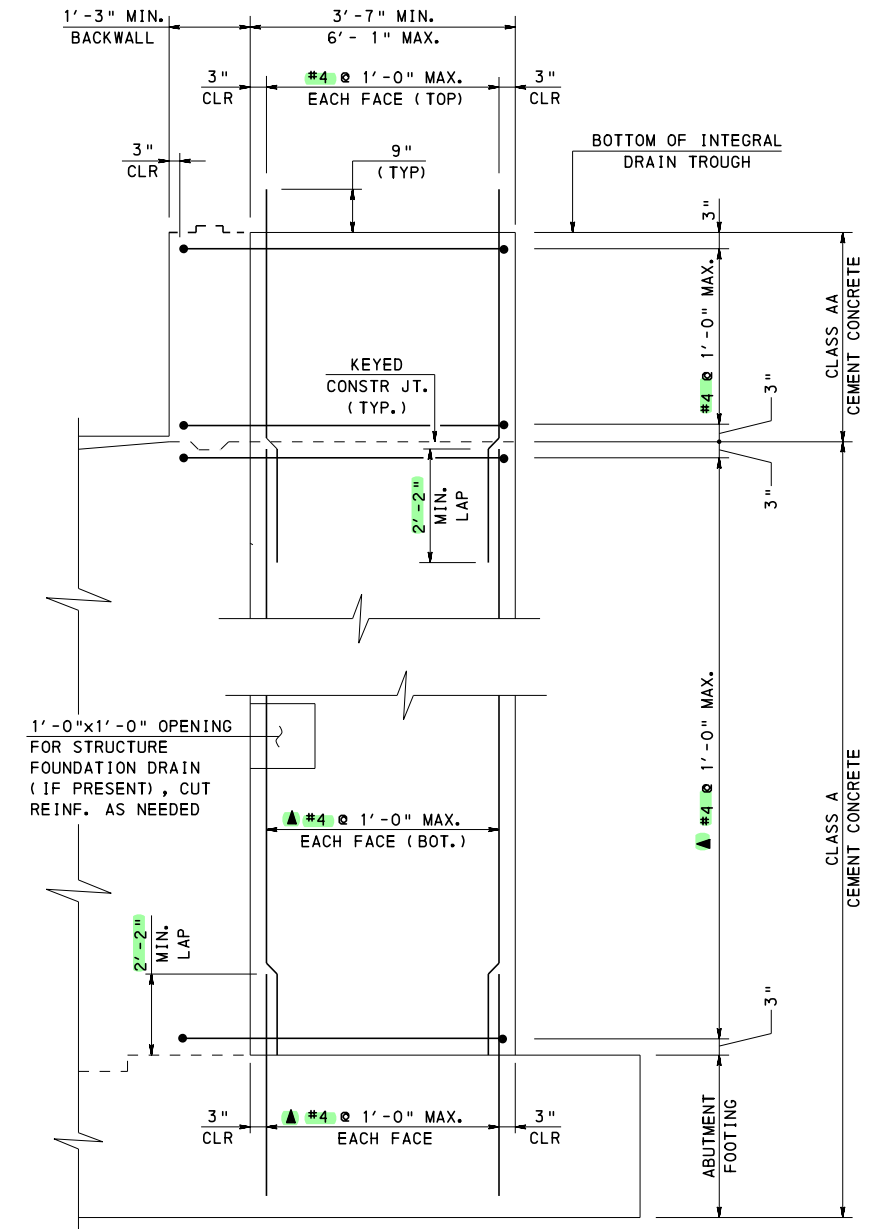


### PEDESTAL REINFORCEMENT SECTION

▲ REINFORCEMENT BARS BELOW BEAM SEAT  
 DO NOT NEED TO BE EPOXY-COATED

### NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
- DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
- SEE BC-762M FOR JOINT OPENING  $\Delta \phi$ .
- CONTRACTOR HAS THE OPTION OF FORMING AND POURING THE SUPPORT PEDESTALS INTEGRAL WITH THE ABUTMENT STEM OR PROVIDING A CONSTRUCTION JOINT WITH PROJECTING REINFORCEMENT.



### PEDESTAL REINFORCEMENT ELEVATION

▲ REINFORCEMENT BARS BELOW BEAM SEAT  
 DO NOT NEED TO BE EPOXY-COATED

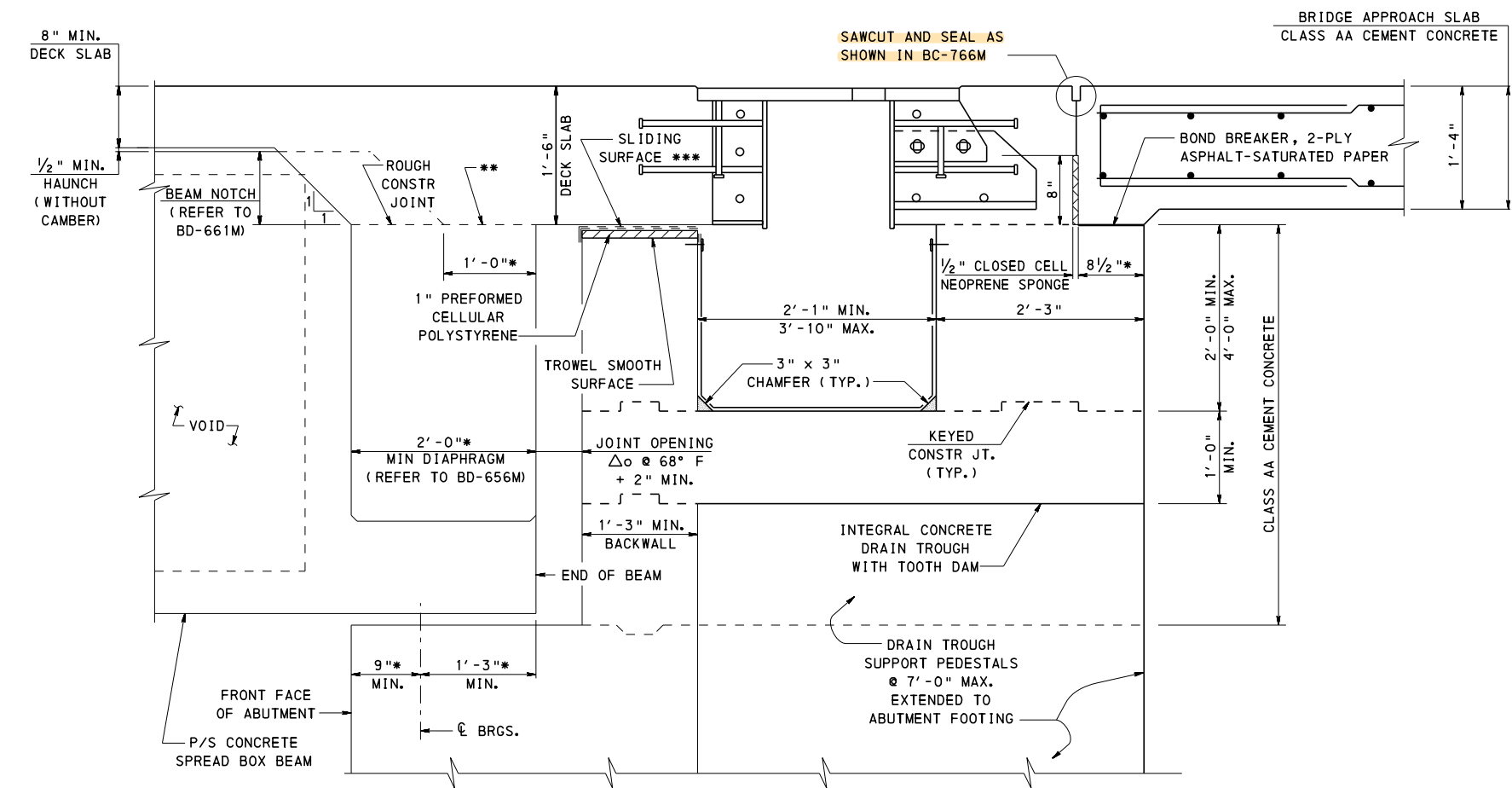
COMMONWEALTH OF PENNSYLVANIA  
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 BRIDGE OFFICE

STANDARD  
 BRIDGE APPROACH SLABS  
 TYPE 4 - DETAIL 23  
 (P/S CONCRETE BOX BEAMS WITH BACKWALL)

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 CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 29 OF 35  
 BD-628M



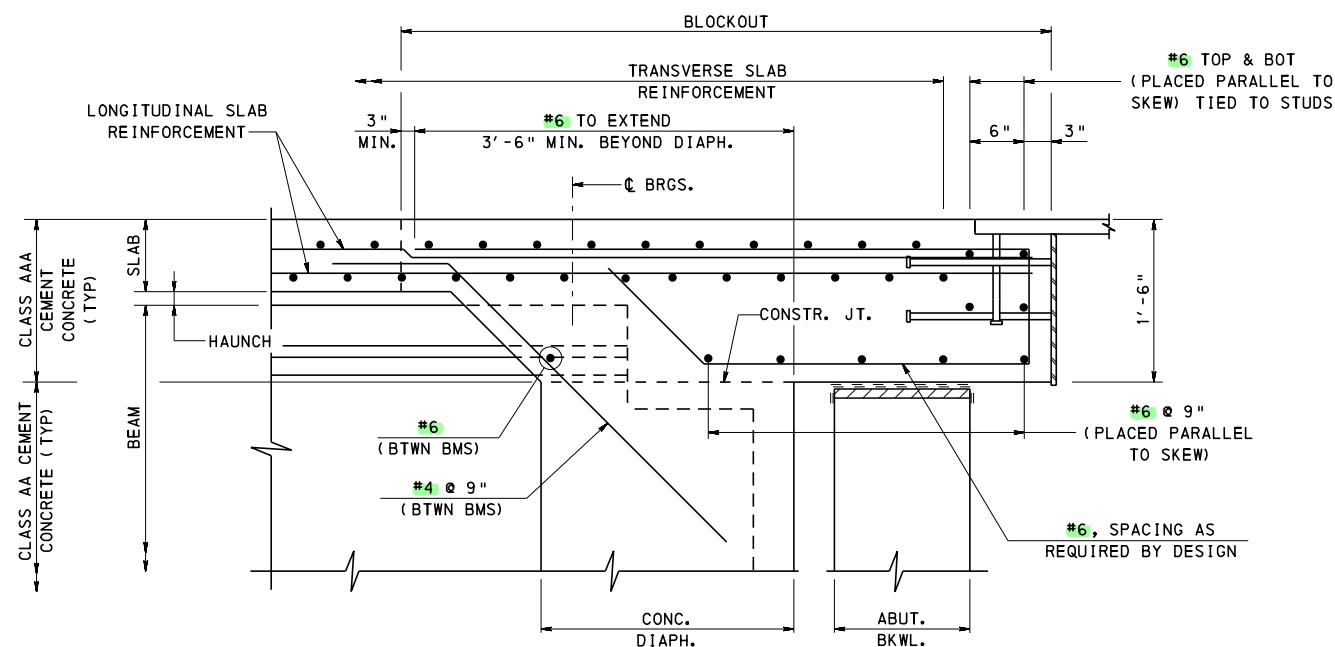
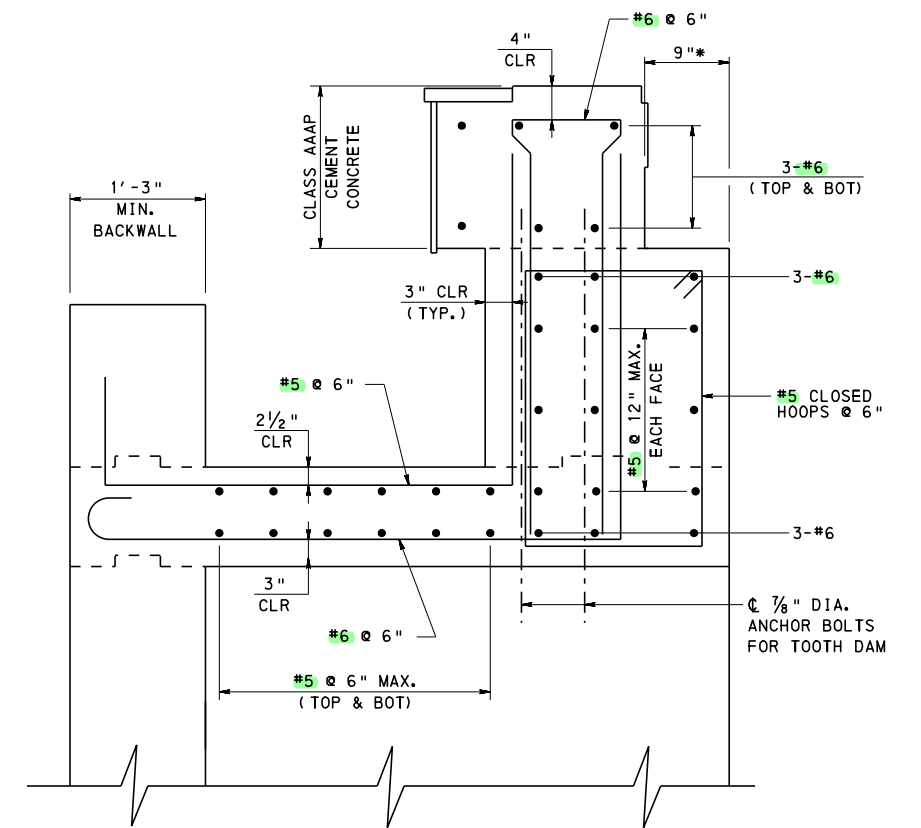
- \* MEASURED NORMAL TO ABUTMENT
- \*\* COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE
- \*\*\* 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

### TYPE 4 APPROACH SLAB - DETAIL 24

PRESTRESSED CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL FOR BEAM DEPTHS 39" AND GREATER (SHOWN WITH APPROACH SLAB ADJACENT TO TOOTH DAM)

### DRAIN TROUGH REINFORCEMENT DETAIL

(SHOWN WITH APPROACH SLAB SUPPORT / PAVING NOTCH)



### DECK SLAB REINFORCEMENT DETAIL

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

### NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
- DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
- SEE BC-762M FOR JOINT OPENING  $\Delta \phi$ .

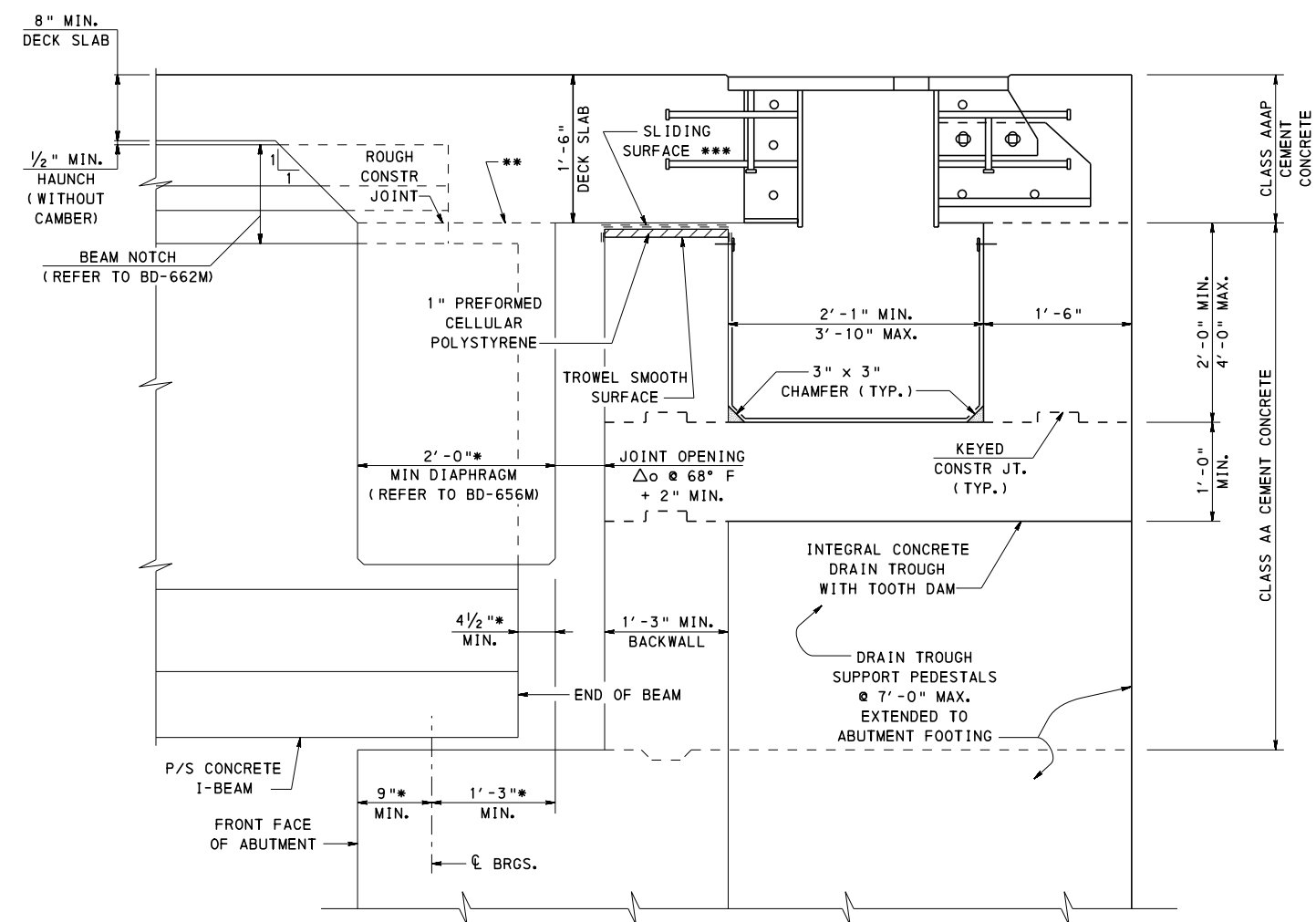
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
BRIDGE APPROACH SLABS  
TYPE 4 - DETAIL 24  
(P/S CONCRETE BOX BEAMS WITH BACKWALL)

RECOMMENDED NOV. 23, 2022  
L. L. W. G.  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 30 OF 35  
BD-628M



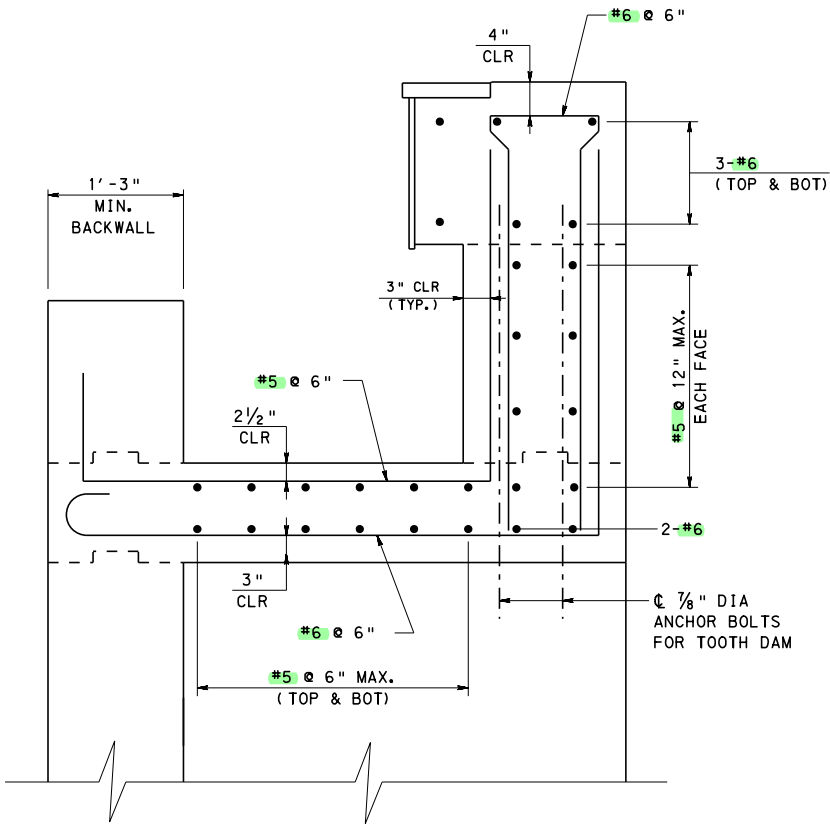
### TYPE 4 APPROACH SLAB - DETAIL 25

PRESTRESSED CONCRETE I-BEAMS AND CONCRETE END DIAPHRAGMS  
WITH BACKWALL - SEE TABLE A FOR MINIMUM BEAM DEPTHS  
(SHOWN WITH FLEXIBLE PAVEMENT ADJACENT TO TOOTH DAM)

| TABLE A             |                        |
|---------------------|------------------------|
| BEAM TYPE           | MINIMUM<br>BEAM DEPTHS |
| AASHTO TYPE I-BEAMS | 63"                    |
| PA BULB-TEE BEAMS   | 47.25"                 |
| PA I-BEAMS          | ①                      |

① THE FOLLOWING BEAMS ARE PERMITTED:  
26/54, 24/60, 26/60,  
24/63, AND 26/63

- \* MEASURED NORMAL TO ABUTMENT
- \*\* COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE
- \*\*\* 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING



### DRAIN TROUGH REINFORCEMENT DETAIL

(SHOWN WITHOUT APPROACH SLAB SUPPORT / PAVING NOTCH)

#### NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
- DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
- SEE BC-762M FOR JOINT OPENING  $\Delta o$ .

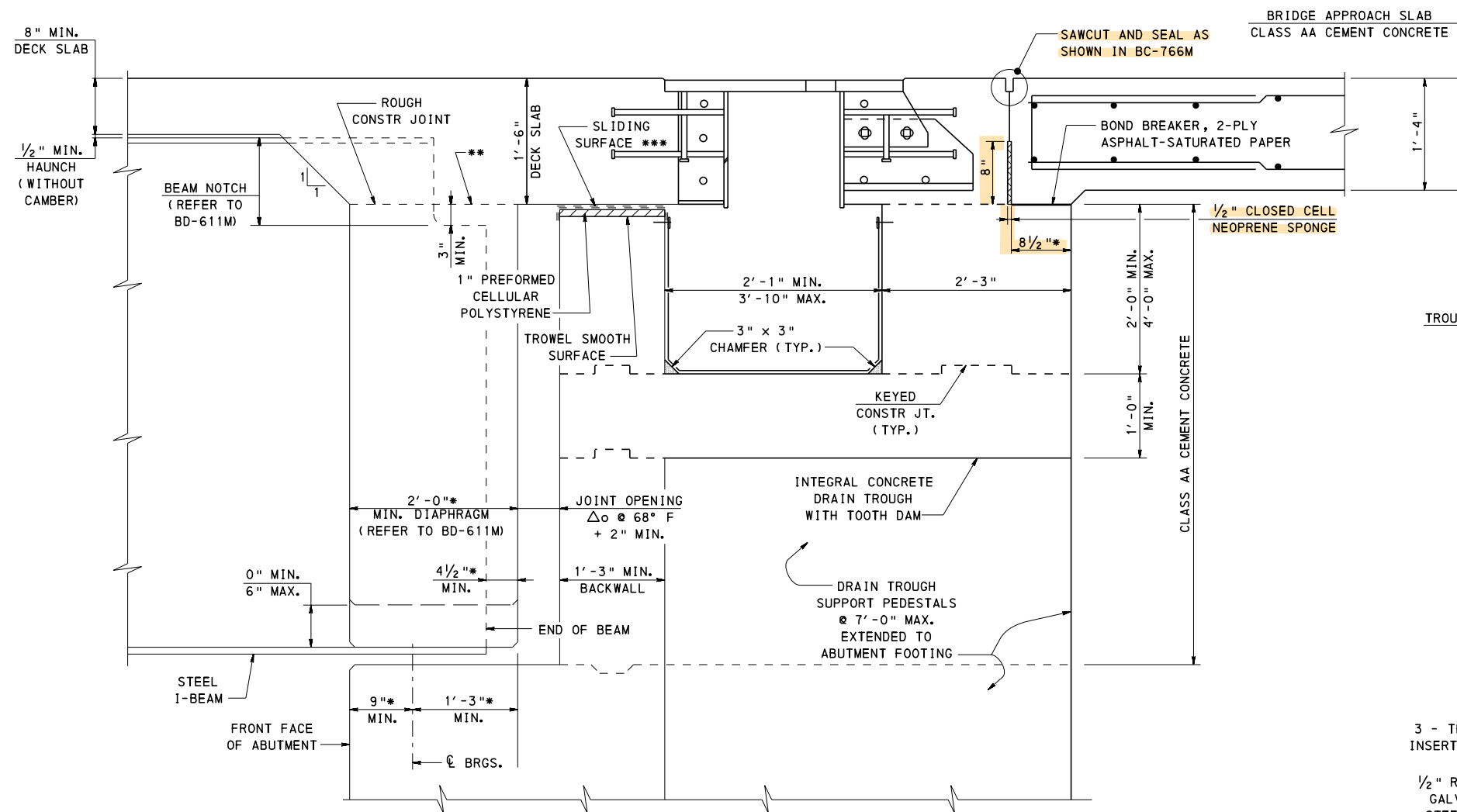
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

STANDARD  
BRIDGE APPROACH SLABS  
TYPE 4 - DETAIL 25  
(P/S CONCRETE I-BEAMS WITH BACKWALL)

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 31 OF 35  
BD-628M

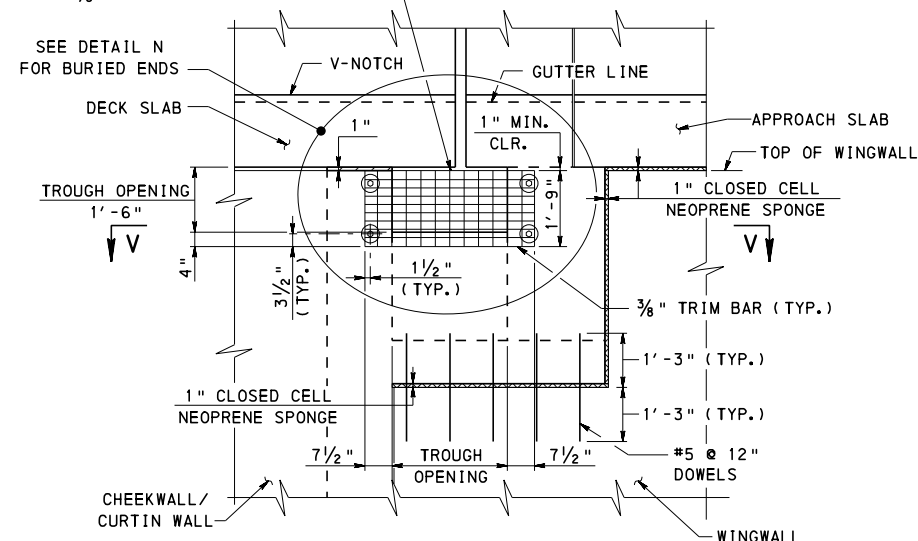


## TYPE 4 APPROACH SLAB - DETAIL 26

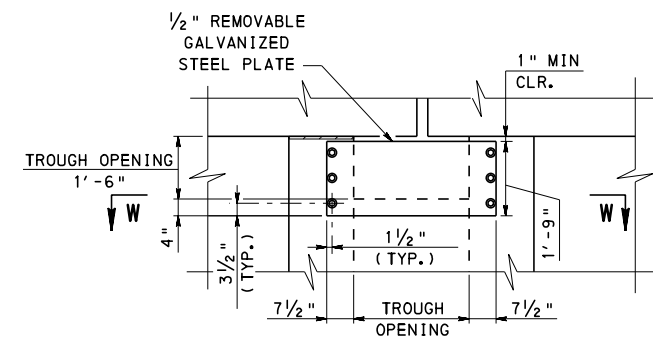
STEEL I-BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL FOR BEAM DEPTHS 40" AND GREATER (SHOWN WITH APPROACH SLAB ADJACENT TO TOOTH DAM)

- \* MEASURED NORMAL TO ABUTMENT
- \*\* COAT WITH AN APPROVED EPOXY BONDING COMPOUND PRIOR TO PLACING DECK SLAB CONCRETE
- \*\*\* 2 LAYERS OF 4 MIL. POLYETHYLENE SHEETING

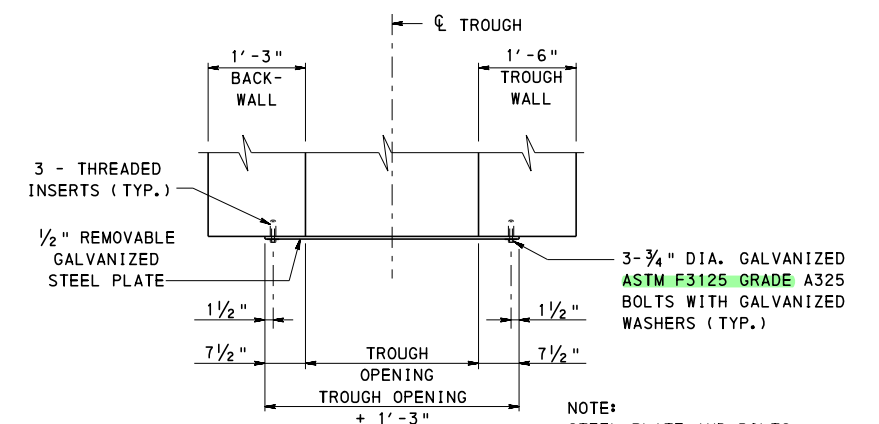
HEAVY WELDED GALVANIZED STEEL GRATE  
2 1/2" x 3/8" BARS @ 2 3/8" MAX. C-C  
WITH 3/8" DIA. CROSS BARS @ 4" C-C



**DETAIL M - DRAIN TROUGH END VIEW**  
(EXPOSED ENDS)



**DETAIL N - DRAIN TROUGH END VIEW**  
(BURIED ENDS)

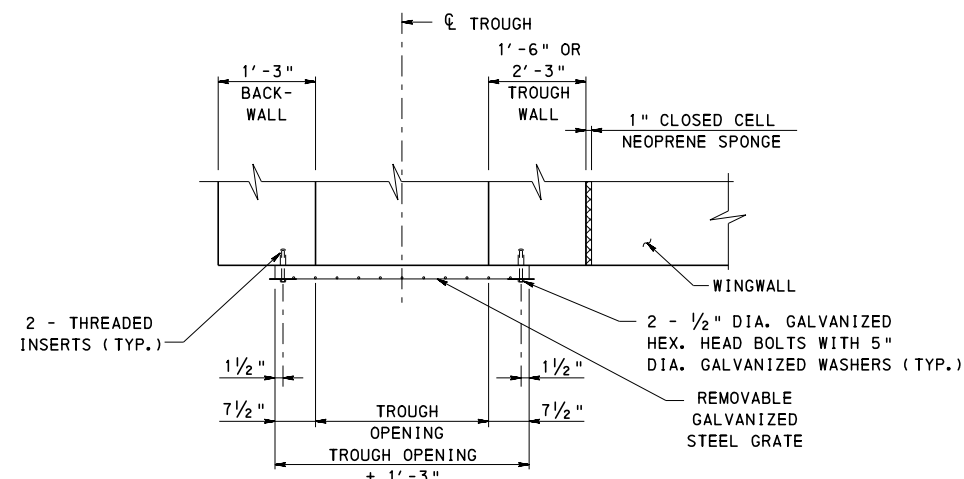


NOTE:  
STEEL PLATE AND BOLTS INCIDENTAL TO COST OF TOOTH EXPANSION DAM.

## SECTION W-W

### NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- DETAILS SHOWN MAY ONLY BE USED IF THE BEAM DEPTH IS EQUAL TO OR EXCEEDS THE DEPTHS INDICATED. IF REQUIRED BEAM DEPTH IS LESS THAN INDICATED PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
- SEE BC-762M FOR JOINT OPENING  $\Delta \phi$ .



NOTE:  
STEEL GRATE AND BOLTS INCIDENTAL TO COST OF TOOTH EXPANSION DAM.

## SECTION V-V

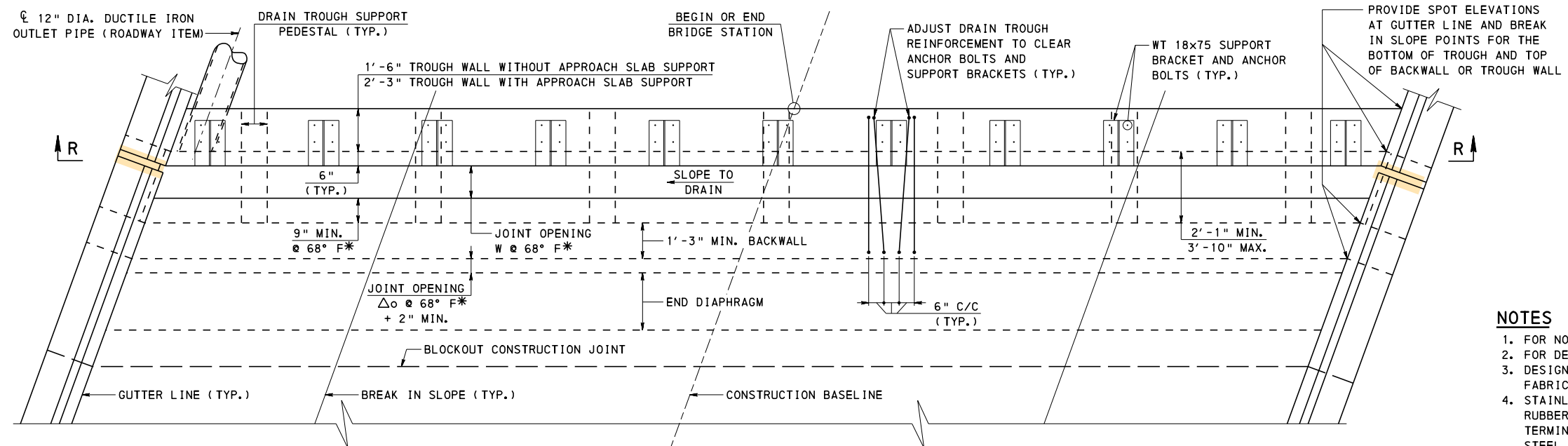
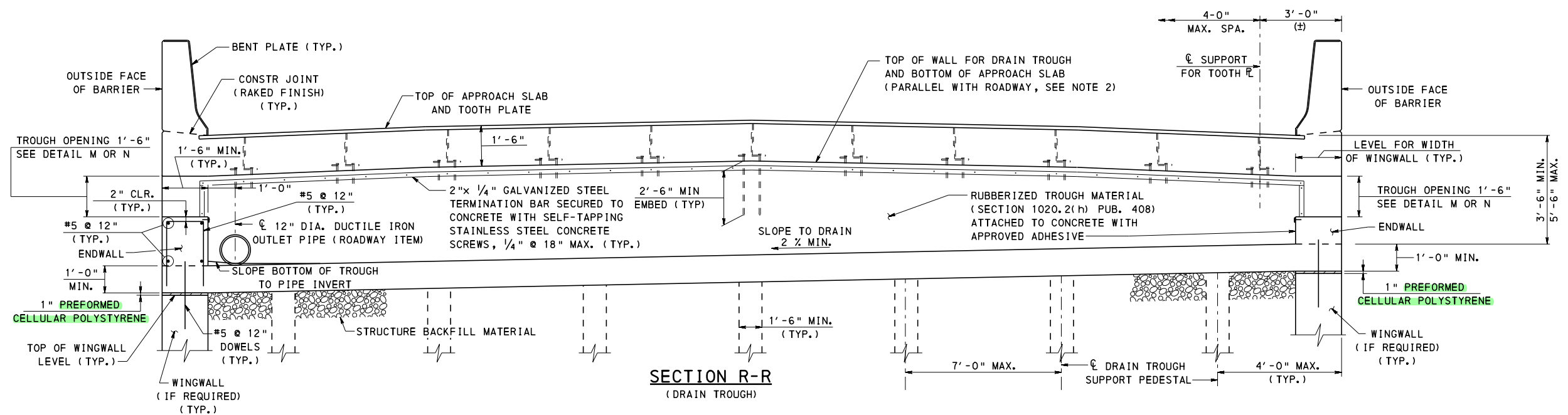
**COMMONWEALTH OF PENNSYLVANIA**  
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BRIDGE OFFICE

**STANDARD**  
**BRIDGE APPROACH SLABS**  
**TYPE 4 - DETAIL 26**  
**(STEEL BEAMS WITH BACKWALL)**

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CHIEF BRIDGE ENGINEER

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*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 32 OF 35  
BD-628M



\* TO BE ADJUSTED FOR INSTALLATION TEMPERATURE FOR SPECIFIED MOVEMENT CLASSIFICATION.

**TOOTH DAM SUPPORT PLAN**

**NOTES**

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR DETAILS M AND N, SEE SHEET 32.
3. DESIGNER MAY ADJUST AS REQUIRED TO SIMPLIFY FABRICATION AND CONSTRUCTION.
4. STAINLESS STEEL PLATE, STUDS, ANCHOR BOLTS, RUBBERIZED TROUGH MATERIAL, GALVANIZED STEEL TERMINATION BARS, SELF-TAPPING STAINLESS STEEL CONCRETE SCREWS, NON SHRINK GROUT AND ANY OTHER ITEMS SHOWN ARE INCIDENTAL TO THE COST OF THE TOOTH EXPANSION DAM.

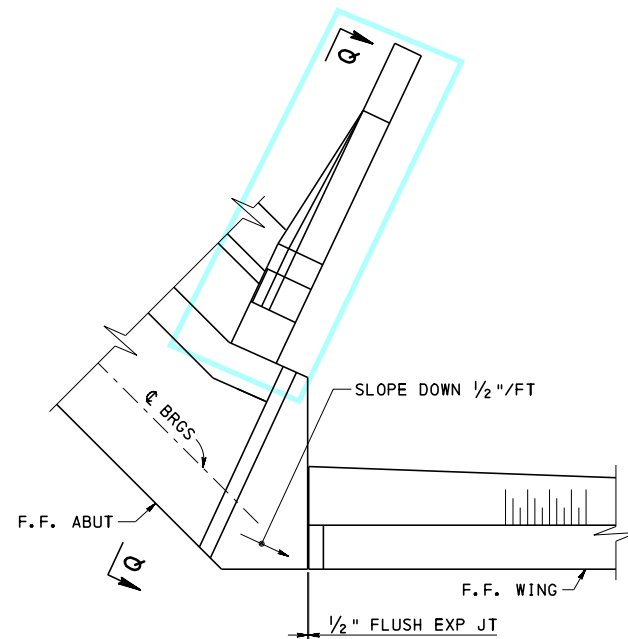
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BRIDGE OFFICE**

**STANDARD**  
**BRIDGE APPROACH SLABS**  
**TYPE 4 - DRAIN TROUGH DETAILS 1**

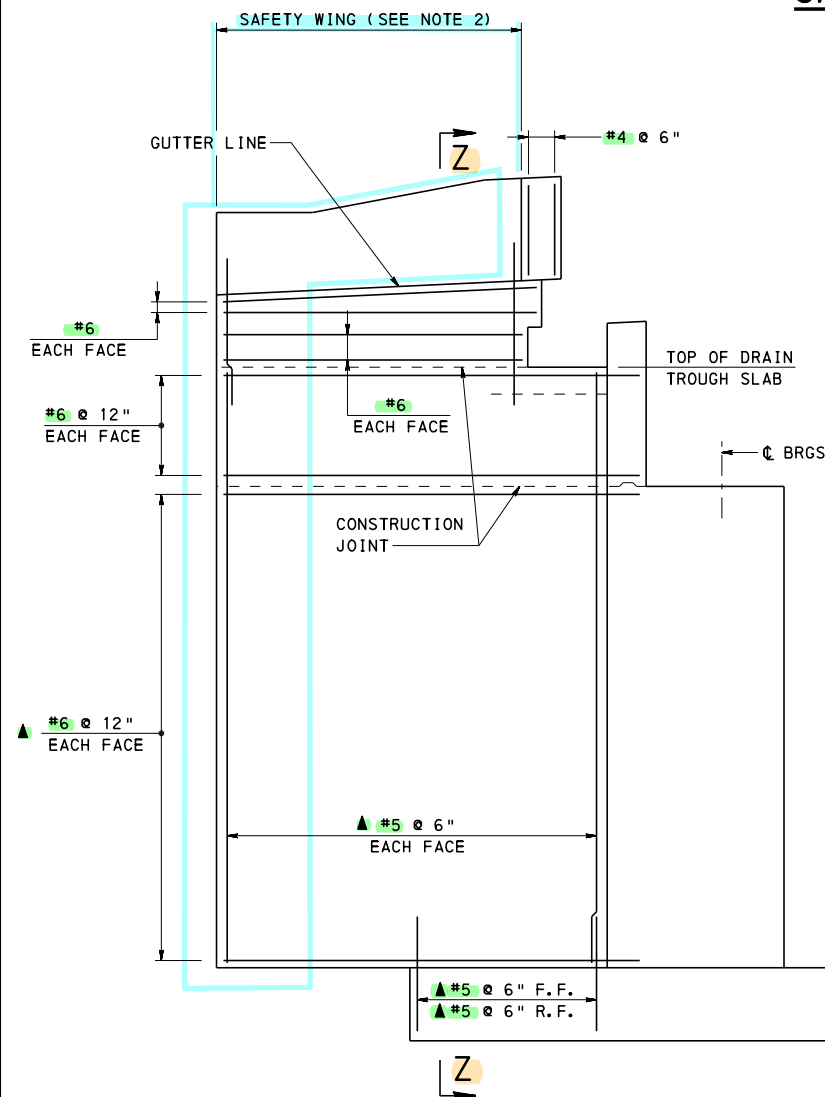
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RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

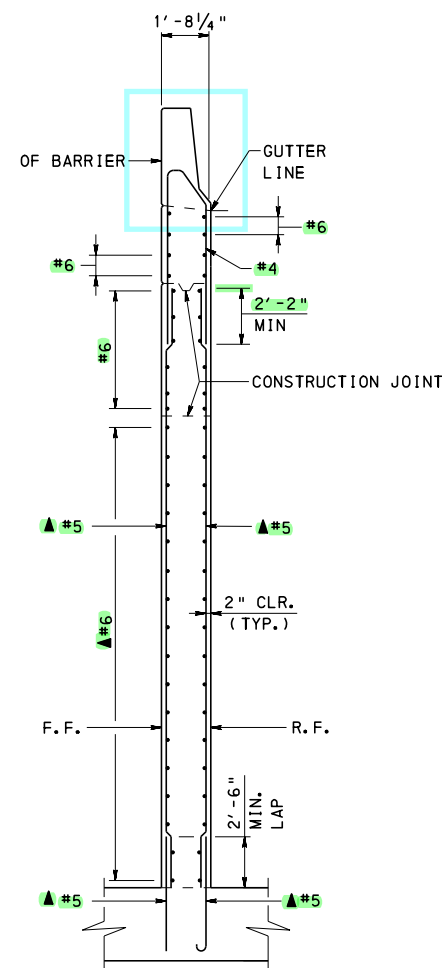
SHEET 33 OF 35  
**BD-628M**



**SAFETY WING PLAN**

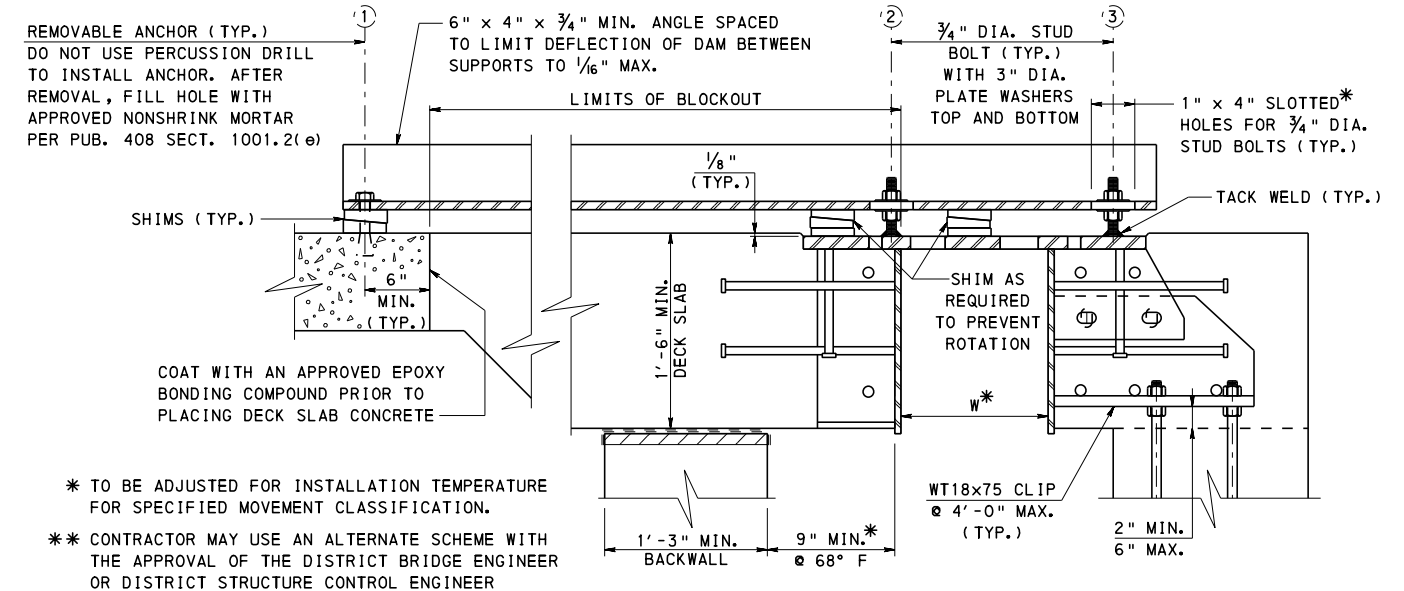


**SECTION Q-Q**



**SECTION Z-Z**

▲ REINFORCEMENT BARS BELOW BEAM SEAT  
DO NOT NEED TO BE EPOXY-COATED



**CONCEPTUAL INSTALLATION SCHEME\*\***

**JOINT INSTALLATION NOTES:**

1. CAST ANCHOR BOLTS INTO INTEGRAL CONCRETE DRAIN TROUGH.
2. INSTALL AND ADJUST FIXED PORTION OF TOOTH DAM ON TROUGH WALL TO THE PROPER LINE AND GRADE.
3. THE SURFACE OF THE BLOCKOUT MUST BE COMPLETELY CLEAN WHEN THE JOINT IS INSTALLED.
4. SUPPORT MOVEABLE PORTION OF TOOTH DAM IN THE BLOCKOUT FROM THE DECK SLAB AND FIXED PORTION OF THE TOOTH DAM (SEE CONCEPTUAL INSTALLATION SCHEME).
5. ADJUST MOVEABLE PORTION OF TOOTH DAM TO THE PROPER LINE AND GRADE WITH THE JOINT OPENING (W) SET WITH RESPECT TO THE INSTALLATION TEMPERATURE SHOWN ON THE PLANS.
6. DURING ASSEMBLY INSTALLATION TIGHTEN ANCHOR ① AND BOTH NUTS ON STUD BOLTS ② AND ③ MAKING SURE THE JOINT OPENING (W) REFLECTS THE INSTALLATION TEMPERATURE.
7. IMMEDIATELY AFTER BLOCKOUT IS CAST, LOOSEN TOP NUT ON STUD BOLT ③ TO PERMIT TEMPERATURE MOVEMENT IN THE ASSEMBLY. ALTERNATE THE PATTERN BETWEEN NEAR SIDE AND FAR SIDE OF JOINT ON SUCCESSIVE ASSEMBLIES, I.E. LOOSEN TOP NUT ON STUD BOLT ② IMMEDIATELY AFTER BLOCKOUT IS CAST TO PERMIT MOVEMENT.
8. PROVIDE LOW FRICTION INTERFACE BETWEEN BOTTOM NUT AND WASHER ON STUD BOLTS AND ANGLE.
9. AFTER THE CONCRETE OF THE BLOCKOUT ACHIEVES THE MINIMUM COMPRESSIVE STRENGTH SPECIFIED IN PUBLICATION 408, SECTION 1001.3(q) 1, REMOVE THE TEMPORARY SUPPORT ASSEMBLY AND GRIND OFF THE TACK WELDS UNTIL SMOOTH.
10. APPLY TOUCH-UP PAINT.

**NOTES**

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. REFER TO BD-622M OR BD-624M FOR REINFORCEMENT REQUIREMENTS.

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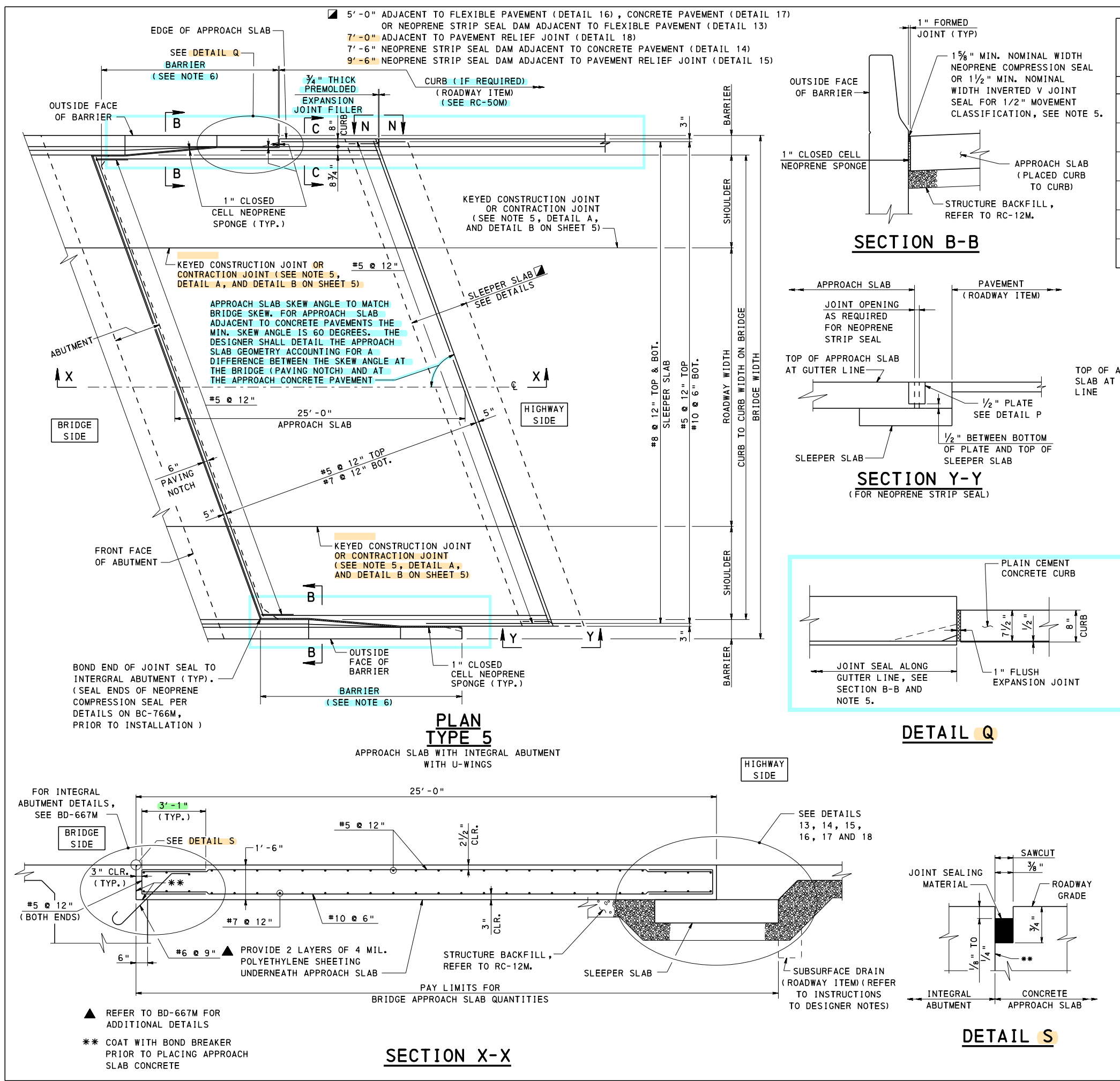
**STANDARD  
BRIDGE APPROACH SLABS  
TYPE 4 - DRAIN TROUGH DETAILS 2**

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CHIEF BRIDGE ENGINEER

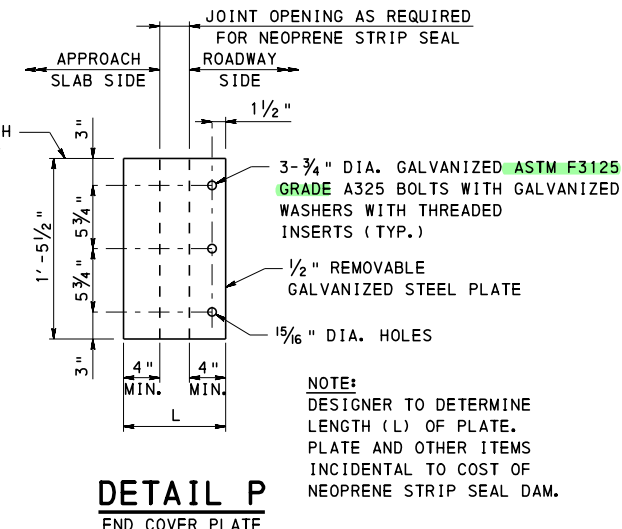
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*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 34 OF 35  
BD-628M





| DESCRIPTION OF DETAILS FOR TYPE 5 APPROACH SLAB |                                                                                     |           |
|-------------------------------------------------|-------------------------------------------------------------------------------------|-----------|
| DETAIL                                          | DESCRIPTION                                                                         | SHEET NO. |
| 13                                              | END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO FLEXIBLE PAVEMENT     | 22        |
| 14                                              | END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO CONCRETE PAVEMENT     | 22        |
| 15                                              | END OF APPROACH SLAB WITH NEOPRENE STRIP SEAL DAM ADJACENT TO PAVEMENT RELIEF JOINT | 22        |
| 16                                              | END OF APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT                                  | 23        |
| 17                                              | END OF APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT                                  | 23        |
| 18                                              | END OF APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT                              | 23        |



- NOTES**
1. FOR NOTES, SEE SHEETS 1 AND 2.
  2. FOR SECTION C-C, SEE SHEET 5.
  3. FOR SECTION N-N, SEE SHEET 21.
  4. PROVIDE PAVING NOTCH FROM CURB TO CURB.
  5. USE ONLY APPROVED SEALS, AS LISTED IN BULLETIN 15. INSTALL JOINT SEALS TO A UNIFORM DEPTH WITH THE TOP OF THE SEAL FROM 1/4" TO 1/2" BELOW THE LEVEL OF THE PAVEMENT SURFACE. MAKE THE TOP EDGES OF THE CONTACT SURFACES ON BOTH SIDES OF THE SEAL AT THE SAME ELEVATION.
  6. LENGTH AS REQUIRED FOR THE SELECTED BARRIER, 12'-0" MINIMUM FOR F-SHAPE CONCRETE BARRIER.
  7. FOR ADDITIONAL BARRIER END TRANSITION DETAILS, REFER TO BD-601M, BD-610M, BD-617M, BD-618M, BD-622M, BD-624M, BD-667M AND RC-50M.

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**STANDARD**  
**BRIDGE APPROACH SLABS**  
**TYPE 5 - PLAN AND SECTION**

|                                                                          |                                                                                           |                           |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------|
| RECOMMENDED NOV. 23, 2022<br><i>[Signature]</i><br>CHIEF BRIDGE ENGINEER | RECOMMENDED NOV. 23, 2022<br><i>[Signature]</i><br>CHIEF ENGINEER, HIGHWAY ADMINISTRATION | SHEET 35 OF 35<br>BD-628M |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------|

CHANGE 2

CHANGE 5

GENERAL NOTES

1. MATERIALS AND **WORK QUALITY** ARE TO BE IN ACCORDANCE WITH PUBLICATION 408.
2. PIER DIMENSIONS ARE DETERMINED BY DESIGN.
3. PROVIDE THE FOLLOWING MINIMUM CONCRETE COVER FOR REINFORCEMENT:

4" - CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH

3" - CONCRETE EXPOSED TO EARTH

2" - CONCRETE EXPOSED TO WEATHER

1½" - TO CROSS TIES IN COLUMNS

3" - SIDE COVER TO STIRRUPS IN PIER CAPS TO PROVIDE CONSTRUCTION TOLERANCE AND LONG TERM SERVICEABILITY
4. USE CLASS A CEMENT CONCRETE IN PIERS, FOOTINGS AND DRILLED SHAFTS.
5. USE CLASS C CEMENT CONCRETE BELOW BOTTOM OF FOOTINGS, IF SPECIFIED.
6. EPOXY COAT MAIN REINFORCEMENT BARS (J-BARS) PROTRUDING FROM PIER FOOTINGS INTO COLUMNS OR STEM AND CAP STEEL BELOW OPEN JOINTS.
7. FOR ADDITIONAL EPOXY COATED REINFORCEMENT BAR REQUIREMENTS, SEE DESIGN MANUAL, PART 4, CONCRETE STRUCTURES, SECTION D.5.4.3.6P.
8. KEY FOR CONSTRUCTION JOINT MAY BE FORMED INTO THE COLUMN OR INTO THE FOOTING.
9. SEE BC-736M FOR STANDARD SPLICE AND DEVELOPMENT LENGTHS.
10. PROVIDE ¾" V-NOTCH IN COLUMNS OF PIERS AT FINISH GROUND LINE FOR PIERS NEAR WATER.
11. FOR FOOTINGS FOUNDED ON BEDROCK A MINIMUM OF 1 FT. SOIL COVER IS PREFERRED BUT NOT REQUIRED. SOIL COVER MAY BE ANY DEPTH TO AVOID UNNECESSARY EXCAVATION.
12. FOR CHECKING CRACK CONTROL, THE SIDE CLEARANCE SHALL BE 2". A 3" COVER IS INDICATED TO PROVIDE CONSTRUCTION TOLERANCE AND LONG TERM SERVICEABILITY.
13. APPLY AN EPOXY RESIN COATING TO ENTIRE PIER COLUMN/WALL THAT ARE WITHIN SPLASH ZONE (14 FT. OF ROADWAY EDGE), TO PROTECT AGAINST SALT SPRAY.

DESIGN DATA

- UNIT WEIGHT OF BACKFILL MATERIAL = 120 lb/ft.³

• UNIT WEIGHT OF CONCRETE = 150 lb/ft.³

• EQUIVALENT FLUID EARTH PRESSURE = 35 psf/ft OF DEPTH

• FOR FOOTINGS USE A MINIMUM DEPTH INCREMENT OF 3"

• MINIMUM FOOTING THICKNESS: 2'-0" FOR SPREAD FOOTINGS  
2'-6" FOR FOOTINGS ON PILES
- SOLID PIERS SHALL HAVE A MINIMUM THICKNESS OF 2'-0" AND MAY BE WIDENED AT THE TOP TO ACCOMMODATE THE BRIDGE SEAT WHEN REQUIRED.

• FOR ROUND, SQUARE AND RECTANGULAR COLUMNS USE A 3'-0" MIN. COLUMN DIA./WIDTH. USE INCREMENTS OF 6" MINIMUM TO INCREASE COLUMN WIDTHS/DIA.

• SHRINKAGE KEYS MUST NOT BE USED IN PIER CAPS TO ELIMINATE PARTIAL OR TOTAL SHRINKAGE STRESSES.

• FOR COLUMNS OR PIER BENTS LOCATED IN THE SLOPED PORTION OF AN EMBANKMENT, INCREASE THE EARTH PRESSURE AGAINST THE BACK OF THE FOOTING AND COLUMN 100% TO INCLUDE THE EFFECT OF THE ADJACENT EMBANKMENT.

• PIERS LOCATED IN THE EMBANKMENT MUST BE INVESTIGATED FOR STABILITY NOT CONSIDERING SUPERSTRUCTURE LOADS.

• FOR STEEL BRIDGES WITH MULTIPLE FIXED PIERS AND CONTINUOUS DECK DESIGN, PROVIDE A TEMPERATURE/DISPLACEMENT TABLE FOR PLACEMENT AT OTHER THAN 70°F.

CONSTRUCTABILITY CONSIDERATIONS

- TO ALLOW PLACEMENT OF THE PIER CAP REINFORCEMENT CAGE:

- PROVIDE SPLICES IN COLUMN TIES WHICH EXTEND INTO THE PIER CAP.

- DO NOT EXTEND SPIRALS INTO THE PIER CAP. PROVIDE SPLICED TIES.

• FOR VERTICAL COLUMN REINFORCEMENT STABILITY, EXTEND VERTICAL COLUMN STEEL (J-BARS) TO BOTTOM MAT OF FOOTING REINFORCEMENT STEEL.

• COLUMN

- FOR STEPPED COLUMN, PROVIDE 6" MINIMUM / 2'-0" MAXIMUM WIDTH VARIANCE. CONSIDER USING COLUMN SEGMENT LENGTHS WITH 1'-0" INCREMENTS FOR ALL BUT TOP COLUMN SEGMENT. SEE ELEVATION ON SHEET 9, FOR GRAPHICAL REPRESENTATION.

- FOR ROUND COLUMNS, RECOMMENDED MAXIMUM COLUMN DIA. IS 8'-0".

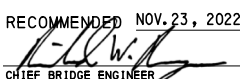
| INDEX OF DRAWINGS |                                                          |
|-------------------|----------------------------------------------------------|
| SHEET NO.         | DESCRIPTION                                              |
| 1                 | GENERAL NOTES AND DESIGN CRITERIA                        |
| 2                 | MULTI-COLUMN BENT - DETAILS                              |
| 3                 | MULTI-COLUMN BENT - COLUMN DETAILS                       |
| 4                 | MULTI-COLUMN BENT - COLUMN SECTIONS                      |
| 5                 | MULTI-COLUMN BENT - WALL PIER DETAILS                    |
| 6                 | HAMMERHEAD - DETAILS                                     |
| 7                 | HAMMERHEAD - COLUMN DETAILS AND SECTIONS                 |
| 8                 | SOLID SHAFT - DETAILS                                    |
| 9                 | SINGLE COLUMN - DETAILS                                  |
| 10                | SINGLE COLUMN - COLUMN DETAILS AND SECTIONS              |
| 11                | SINGLE DRILLED SHAFT - DETAILS                           |
| 12                | SINGLE DRILLED SHAFT - SHAFT/COLUMN DETAILS AND SECTIONS |
| 13                | TYPICAL FOOTING DETAILS                                  |
| 14                | TYPICAL CAP DETAILS                                      |
| 15                | REHABILITATION AND JACKING DETAILS                       |

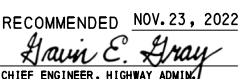
|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| BC-735M            | WALL CONSTR. & EXP. JOINT DETAILS                                                         |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                                                     |
| BC-751M            | BRIDGE DRAINAGE                                                                           |
| BC-755M            | BEARINGS                                                                                  |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS                                               |
| BD-613M            | HIGH LOAD MULTI-ROTATIONAL POT BEARINGS                                                   |
| BD-621M            | REINFORCED CONCRETE ABUTMENTS                                                             |
| BD-651M            | REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS |
| BD-653M            | TYPICAL FRAMING PLANS AND DETAILS                                                         |
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS                                                             |
| BD-658M            | SHEAR BLOCK DETAILS AT PIER - P/S CONCRETE I-BEAM AND BOX BEAM BRIDGES                    |
| BD-664M            | CONTINUITY FOR LIVE LOAD DETAILS - I-BEAM BRIDGES                                         |
| BD-665M            | CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES                                       |
| REFERENCE DRAWINGS |                                                                                           |

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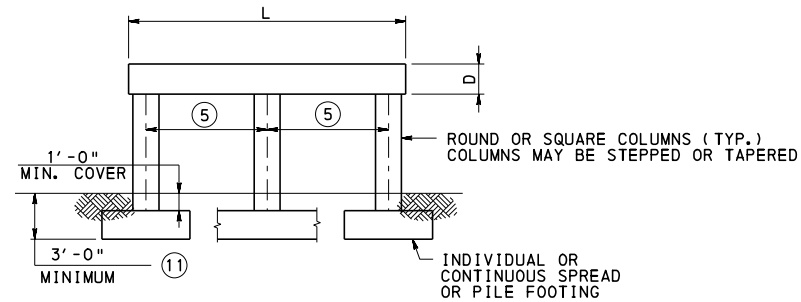
STANDARD  
REINFORCED CONCRETE PIERS

GENERAL NOTES AND DESIGN CRITERIA

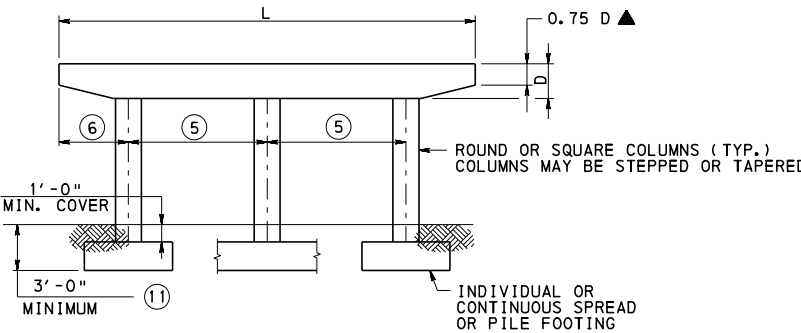
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CHIEF ENGINEER, HIGHWAY ADMIN

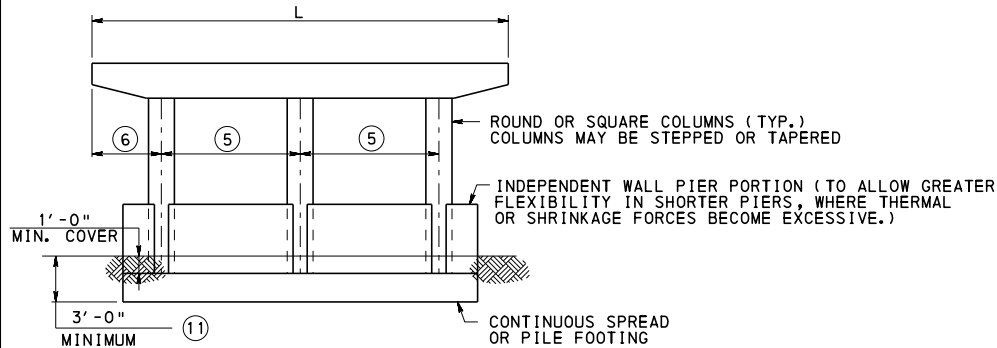
SHEET 1 OF 15  
BD-629M



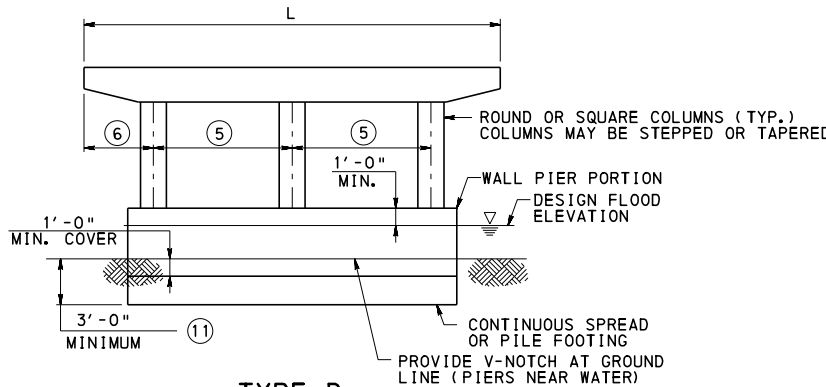
TYPE A



TYPE B

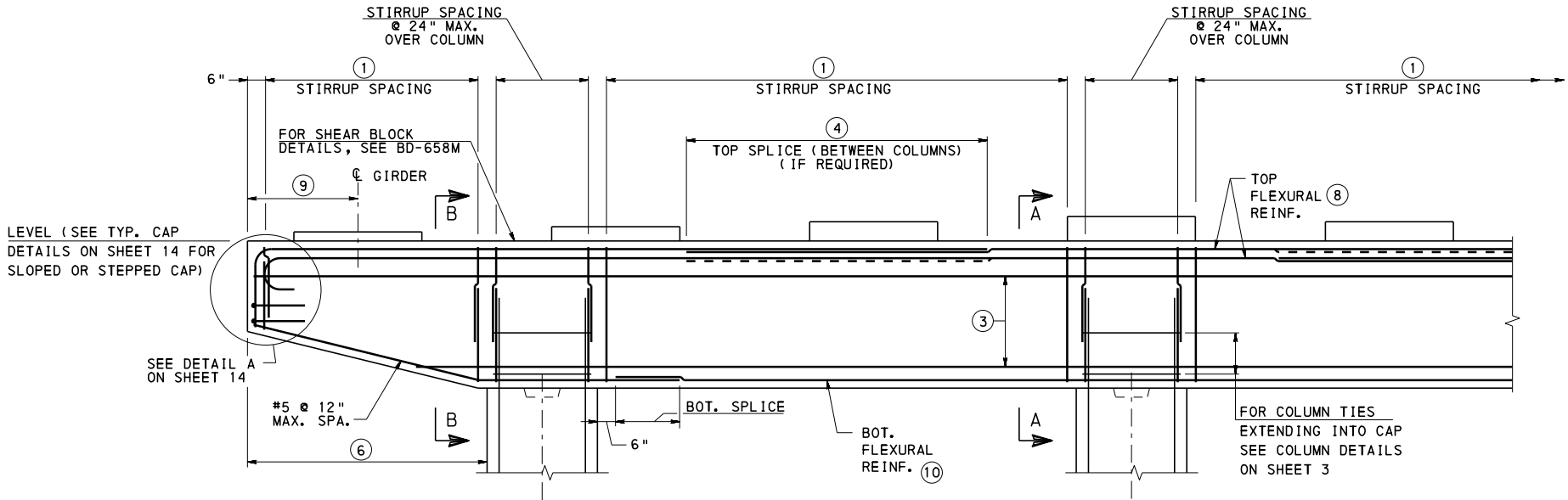


TYPE C

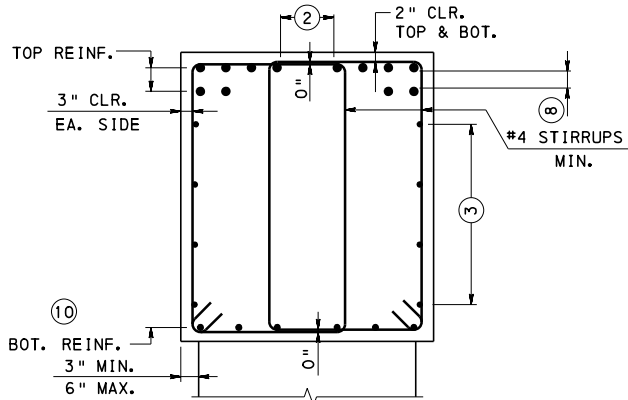


TYPE D

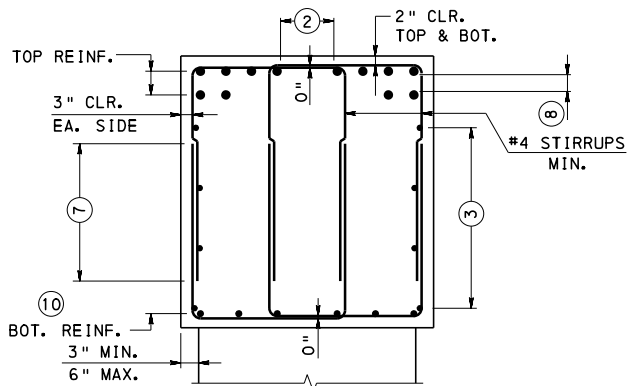
| RECOMMENDED MULTI-COLUMN BENT CONFIGURATIONS |                  |       |                                    |
|----------------------------------------------|------------------|-------|------------------------------------|
| PIER TYPE                                    | GRADE SEPARATION | RIVER | RAILROAD WITHIN 25 FT. OF CL TRACK |
| A                                            | X                |       |                                    |
| B                                            | X                |       |                                    |
| C                                            | X                |       | X                                  |
| D                                            | X                | X     | X                                  |



CAP ELEVATION



SECTION A-A  
(DOUBLE STIRRUPS WITH TWO LAYERS OF TOP REINFORCEMENT)



SECTION B-B  
(DOUBLE U-SHAPED STIRRUPS WITH TWO LAYERS OF TOP REINFORCEMENT)

▲ - DENOTES RECOMMENDED VALUE

NOTES:

- STIRRUPS TO BE SPACED AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT, EXCEPT LOCALIZED REGIONS (HIGH SHEAR STRESS ZONES) WHERE A SMALLER SPACING WILL NOT INTERFERE WITH VIBRATION OR CONCRETE PLACEMENT. MAX. SPACING IS 12".
- PROVIDE AT LEAST ONE SPACE AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT. FOR CAPS GREATER THAN 5'-0" WIDE PROVIDE TWO 9" CLEAR SPACES. PROVIDE 6" MIN. AT ALL OTHER SPACES. REINF. SPACING WILL NEED TO BE ADJUSTED TO CLEAR DOWELS OR ANCHOR BOLTS INCLUDING SLEEVES.
- PROVIDE #5 @ 12" MIN. OR IF EFFECTIVE DEPTH "d<sub>e</sub>" EXCEEDS 3'-0", PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4.
- ALTERNATE SPLICE LOCATIONS OF ADJACENT BARS.
- TYPICAL RANGE OF COLUMN SPACING, S IS 12' TO 20'. ▲
- WHEN POSSIBLE, ENDS OF PIER CAPS SHALL EXTEND S/3 TO S/2 TO BALANCE POSITIVE AND NEGATIVE MOMENTS IN THE CAP.
- FOR CONSTRUCTABILITY, PROVIDE STIRRUP SPLICE OVER COLUMNS AND CANTILEVER PORTIONS OF CAP.
- MULTI-LAYERS
  - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
  - CLEAR SPACING MUST BE 1/2" MINIMUM
- DIMENSION BASED ON THE FOLLOWING PARAMETERS: BEAM SIZE, BEARING SIZE, ANCHOR BOLT LOCATION/EDGE DISTANCES AND SKEW.
- COORDINATE BOTTOM FLEXURAL CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
- BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

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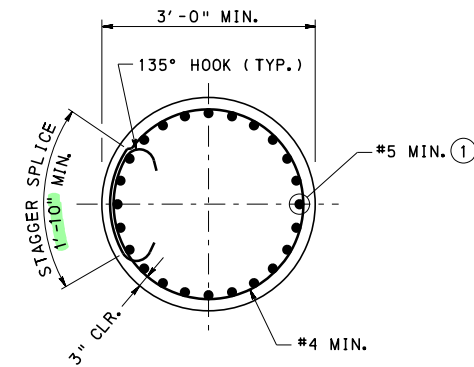
STANDARD  
REINFORCED CONCRETE PIERS  
MULTI-COLUMN BENT  
DETAILS

RECOMMENDED NOV. 23, 2022  
L. E. Gray  
CHIEF BRIDGE ENGINEER

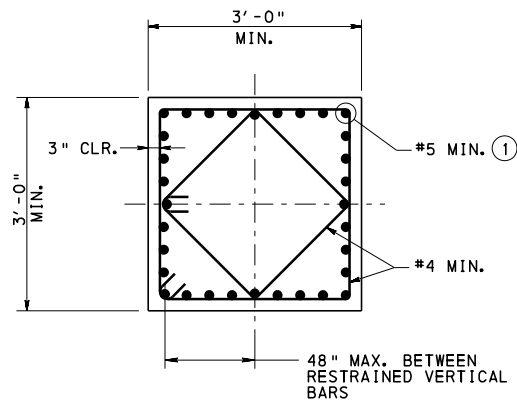
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CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 15  
BD-629M

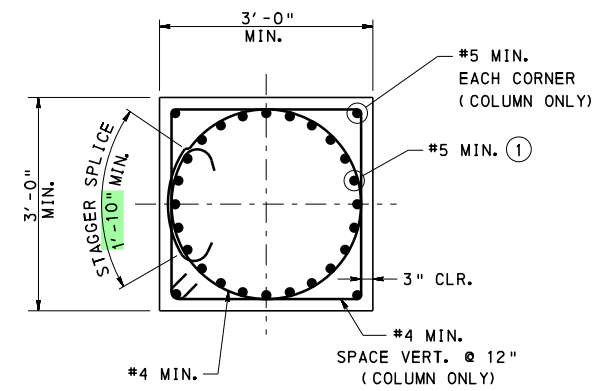




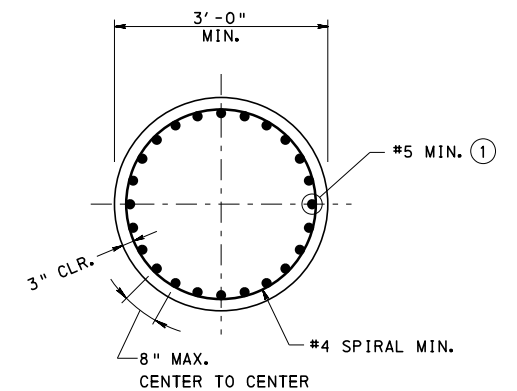
**ROUND COLUMN**



**SQUARE COLUMN**

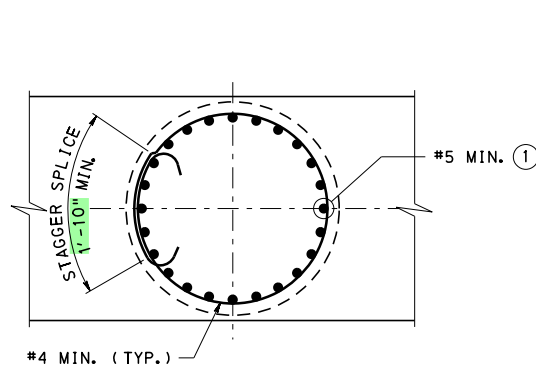


**SQUARE COLUMN**  
(DESIGNED AS ROUND)

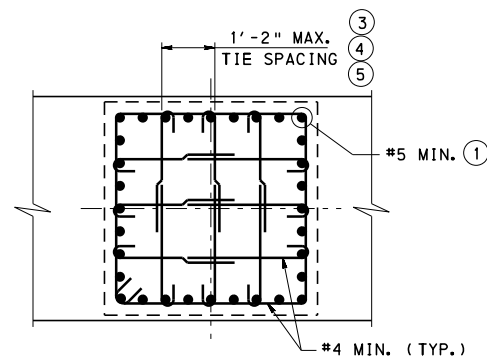


**SECTION D-D** ②  
(PLASTIC HINGE ZONE)

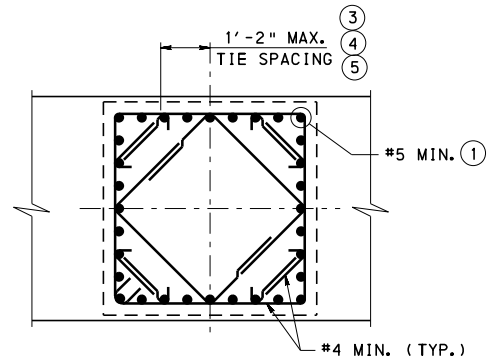
**SECTION A-A** ②



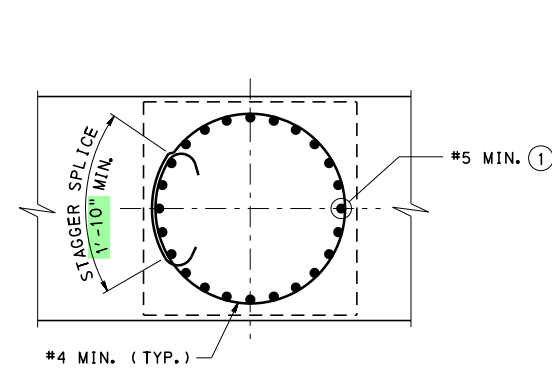
**ROUND COLUMN**



**SQUARE COLUMN**



**SQUARE COLUMN**  
(ALTERNATE TIE ARRANGEMENT)



**SQUARE COLUMN**  
(DESIGNED AS ROUND)

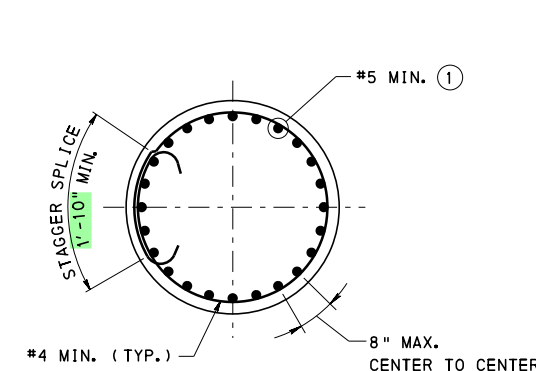
$$\text{SPIRAL LENGTH} = \sqrt{(\pi D)^2 + P^2} (H/P) + (3)(\pi D)$$
 (DOES NOT INCLUDE ADDITIONAL LENGTH FOR HOOKED ENDS)  
 D = DIAMETER  
 H = HEIGHT OF SPIRAL PIECE  
 P = PITCH (DISTANCE BETWEEN TURNS)  
 3 = 1½ TURNS TOP & BOTTOM

**SPIRAL SPLICES:**

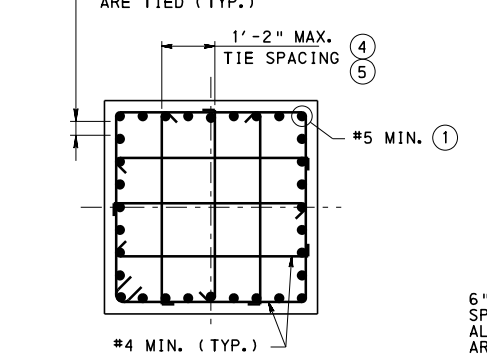
- THE TOTAL SPIRAL LENGTH CAN BE DIVIDED INTO SEPARATE PIECES. EACH PIECE MUST BE PROVIDED WITH 1½ EXTRA TURNS AND A 135 DEGREE HOOK AT EACH END. EACH HOOK MUST ENGAGE A VERTICAL REINFORCING BAR. THE MAXIMUM DISTANCE BETWEEN THE SPIRAL PIECES IS LIMITED TO THE PITCH OF THE SPIRAL.

• OR APPROVED MECHANICAL CONNECTORS.  
**SPIRAL ANCHORAGE:**  
 • 1½ EXTRA TURNS

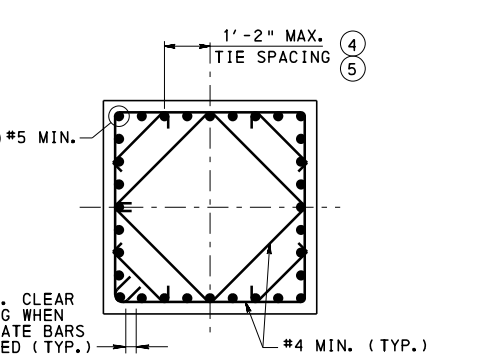
**SECTION B-B** ②



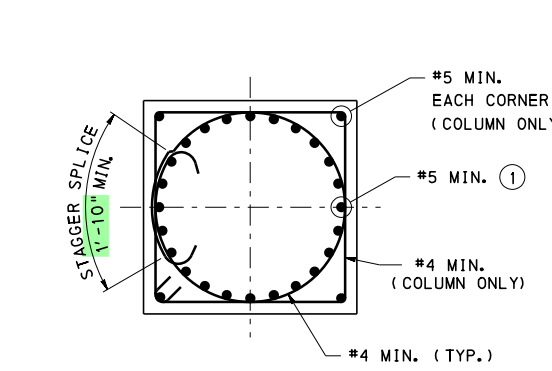
**ROUND COLUMN**



**SQUARE COLUMN**



**SQUARE COLUMN**  
(ALTERNATE TIE ARRANGEMENT)



**SQUARE COLUMN**  
(DESIGNED AS ROUND)

**SECTION C-C** ②  
(PLASTIC HINGE ZONE)

**NOTES:**

- COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM FLEXURAL CAP REINFORCEMENT TO AVOID INTERFERENCE.
- FOR LOCATION OF SECTIONS A-A, B-B, C-C & D-D, SEE COLUMN DETAILS SHEET NO. 3.
- CONTRACTOR MAY SUBSTITUTE SPLICED TIES AT NO ADDITIONAL COST TO THE DEPARTMENT.
- ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH VERTICALLY AND HORIZONTALLY.
- WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP SPLICED WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.

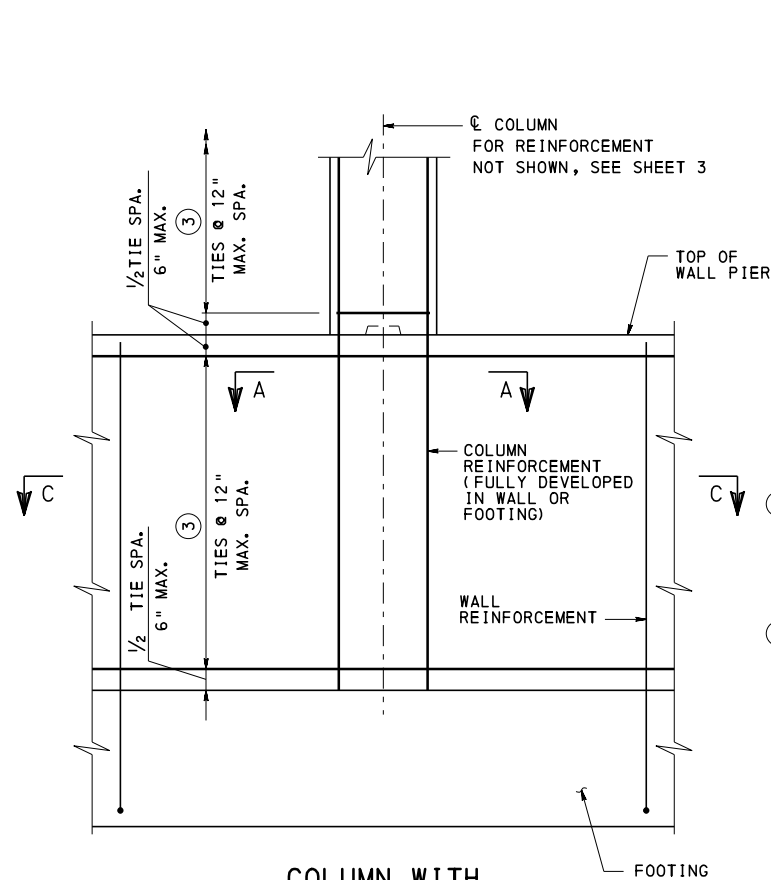
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BRIDGE OFFICE**

**STANDARD**  
**REINFORCED CONCRETE PIERS**  
**MULTI-COLUMN BENT**  
**COLUMN SECTIONS**

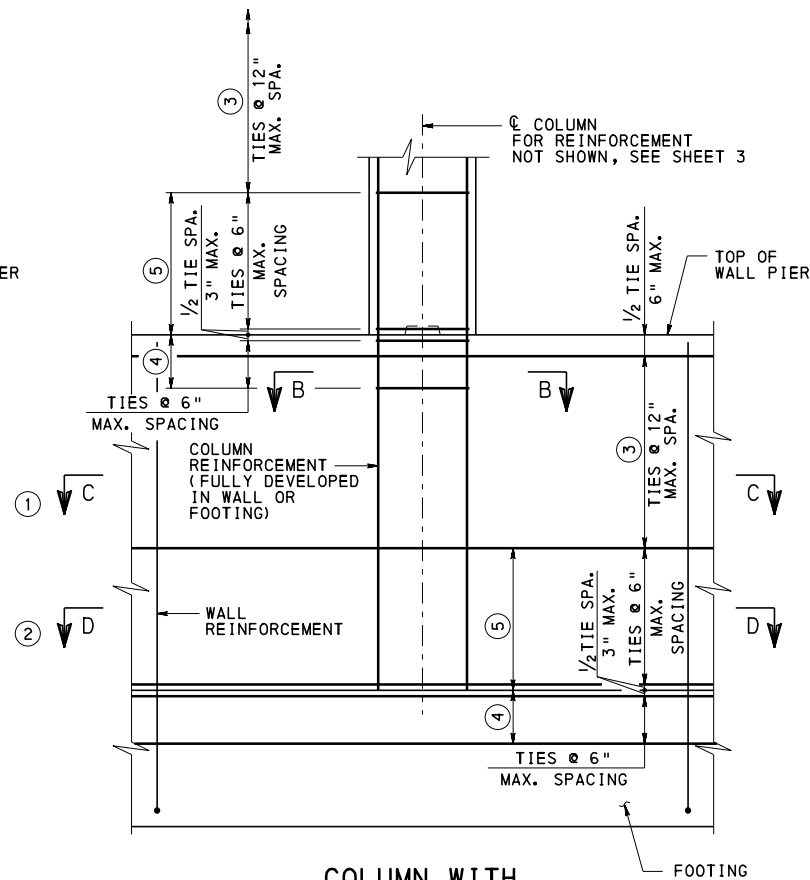
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

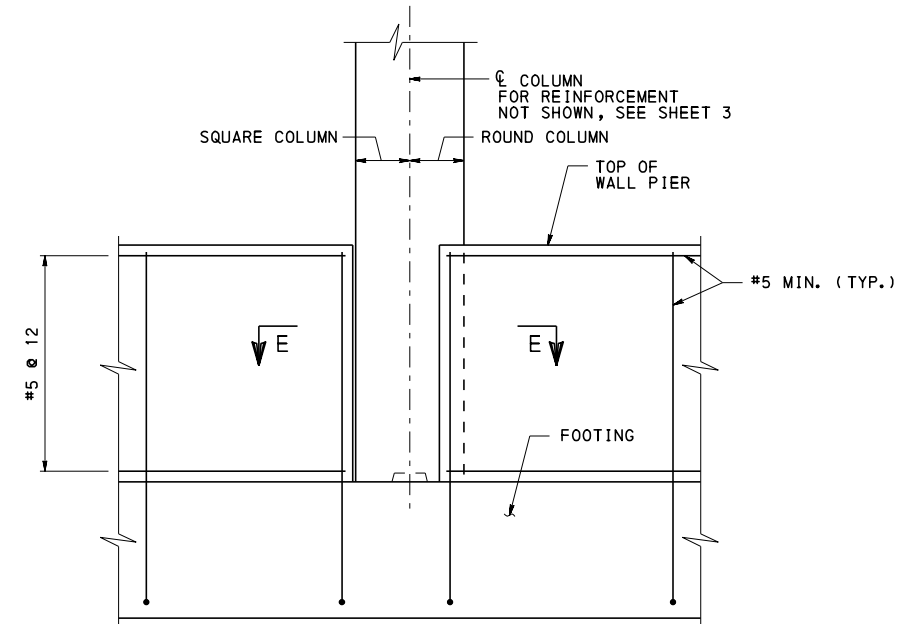
SHEET 4 OF 15  
**BD-629M**



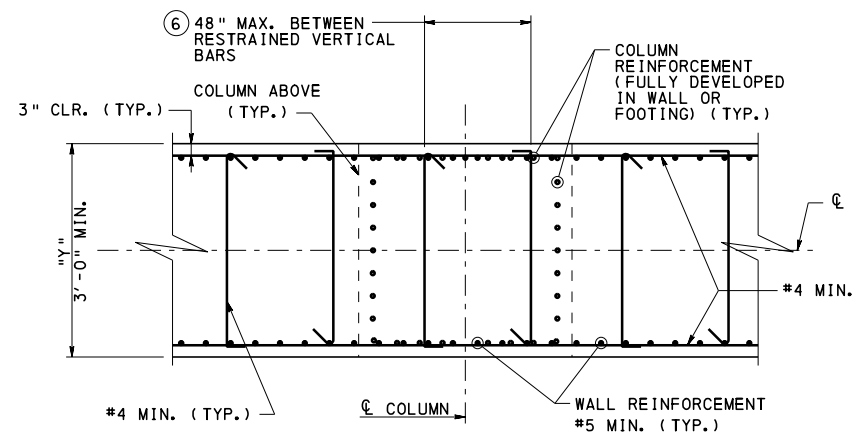
**COLUMN WITH  
INTEGRAL WALL PIER**  
(RESPONSE ACCELERATION  
COEFFICIENT,  $S_{D1}$ ,  
LESS THAN 0.10)



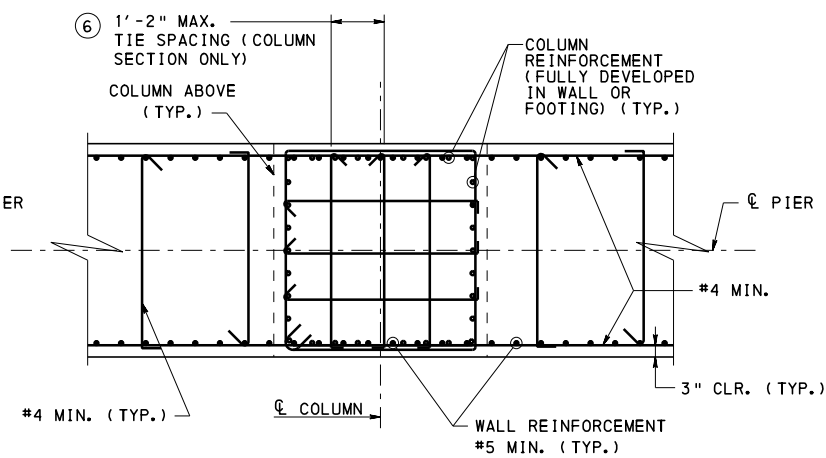
**COLUMN WITH  
INTEGRAL WALL PIER**  
(SITE CLASS E, F OR RESPONSE  
ACCELERATION COEFFICIENT,  $S_{D1}$ ,  
GREATER THAN OR EQUAL TO 0.10)



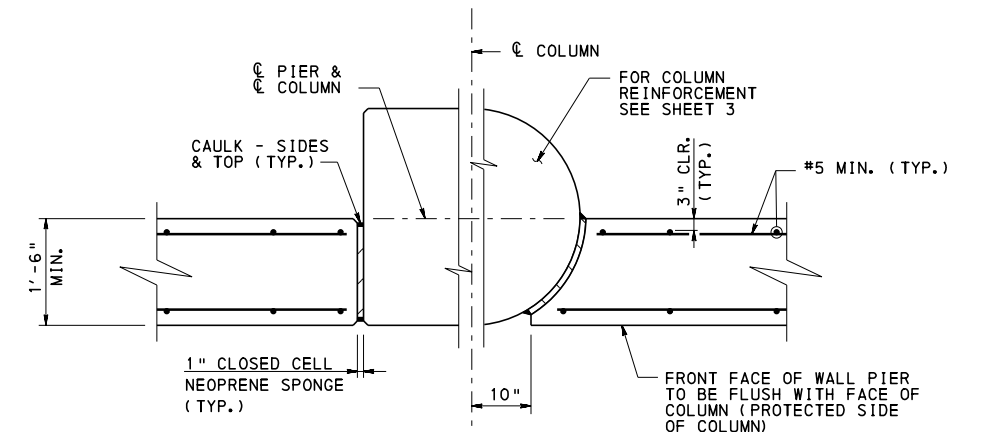
**COLUMN WITH  
INDEPENDANT WALL PIER**  
(SEISMIC DETAILING REQUIRED  
FOR COLUMN SECTION ONLY)



**SECTION A-A**



**SECTION B-B**



**SQUARE COLUMN**

**ROUND COLUMN**

**SECTION E-E**

**NOTES:**

- SECTION C-C IS SIMILAR TO SECTION A-A ON SOLID SHAFT DETAILS, SHEET 8.
- SECTION D-D IS SIMILAR TO SECTION C-C ON SOLID SHAFT DETAILS, SHEET 8.
- FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
- COLUMN CONNECTION GREATER OF:  $\frac{1}{2}$  MAX. COL. DIMENSION ( $\frac{1}{2}$  MAX. "Y" DIMENSION FOR WALL SECTION) OR 15"
- PLASTIC HINGE ZONE GREATER OF: MAX. COLUMN DIMENSION (MAX. "Y" DIMENSION FOR WALL SECTION),  $\frac{1}{6}$  CLR. HEIGHT OF COLUMN OR 18"
- ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH HORIZONTALLY AND VERTICALLY.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

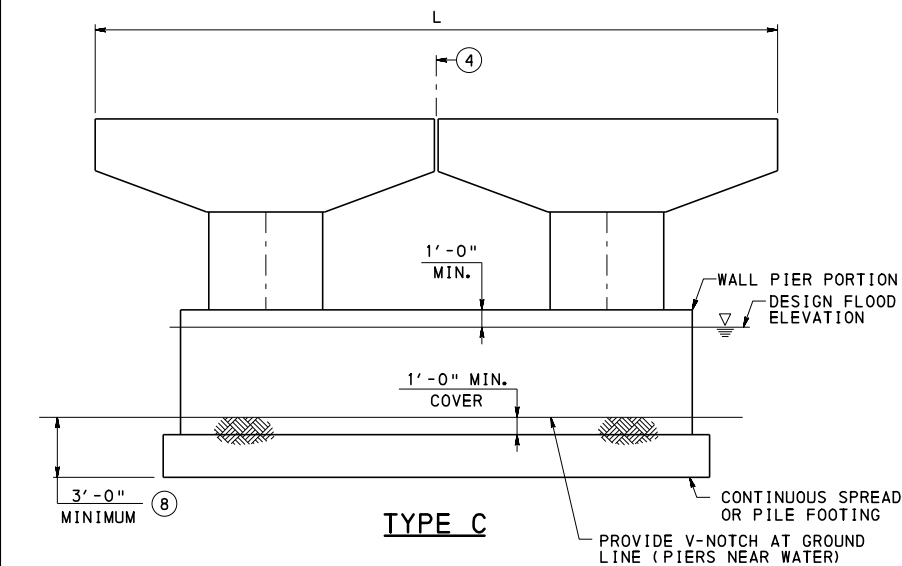
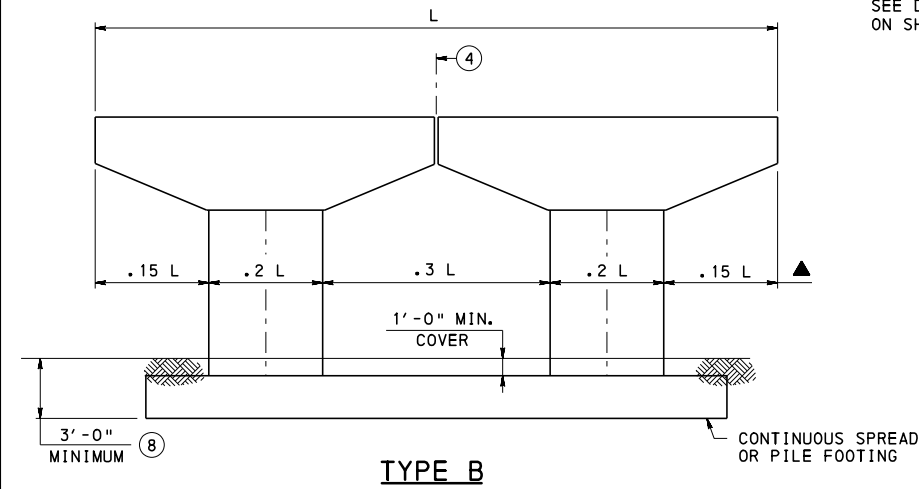
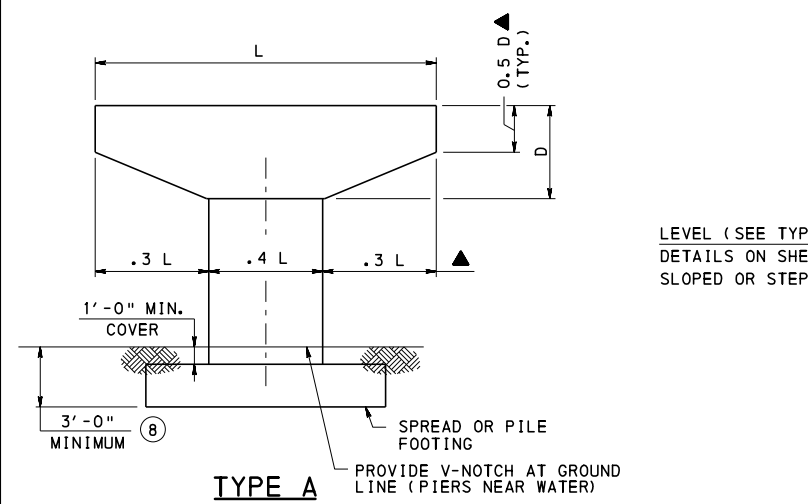
**STANDARD  
REINFORCED CONCRETE PIERS  
MULTI-COLUMN BENT  
WALL PIER DETAILS**

RECOMMENDED NOV. 23, 2022  
*L. L. W. Gray*  
CHIEF BRIDGE ENGINEER

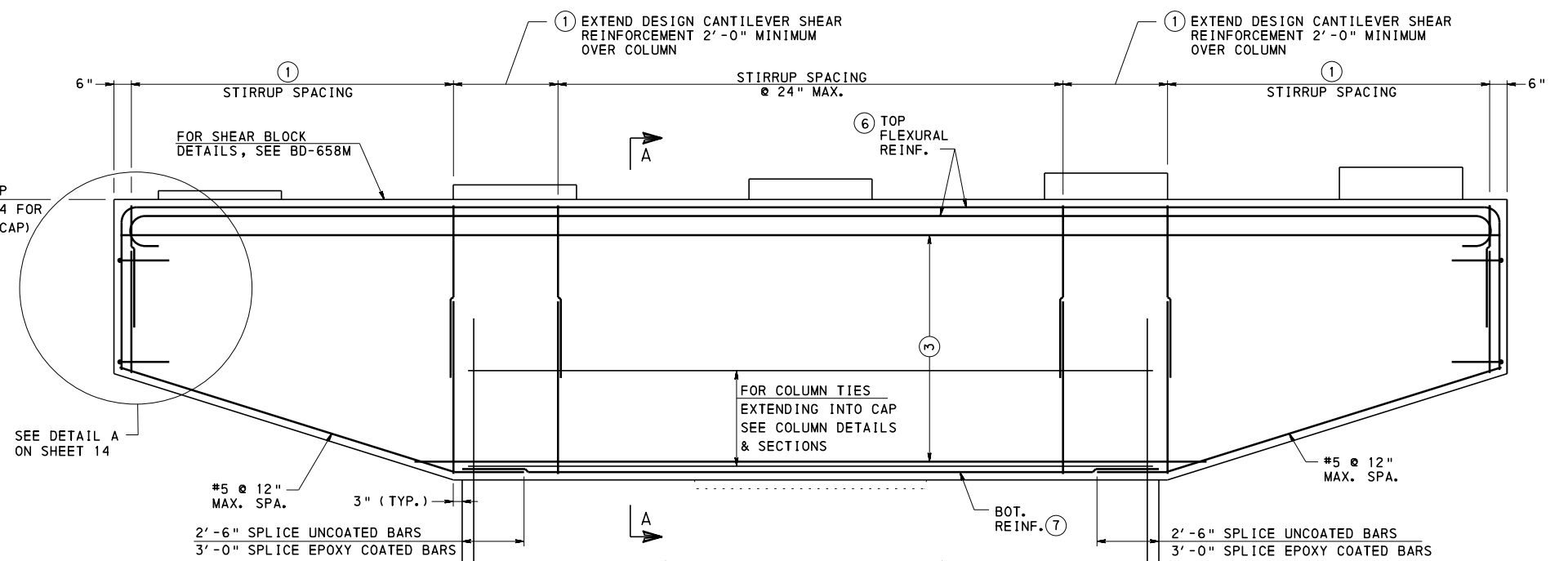
RECOMMENDED NOV. 23, 2022  
*Gray E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 15  
**BD-629M**

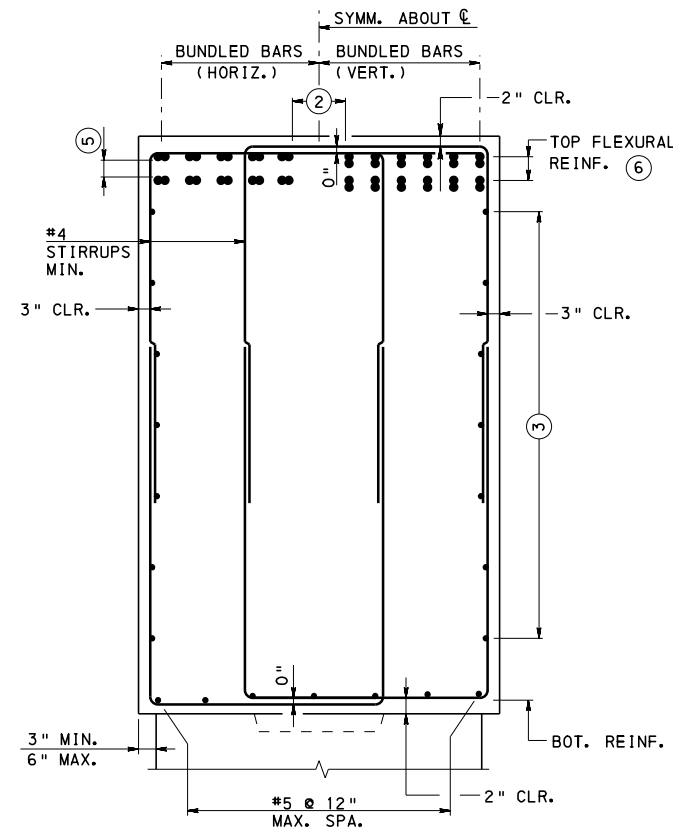




| RECOMMENDED HAMMERHEAD PIER CONFIGURATIONS |                  |       |                                    |
|--------------------------------------------|------------------|-------|------------------------------------|
| PIER TYPE                                  | GRADE SEPARATION | RIVER | RAILROAD WITHIN 25 FT. OF CL TRACK |
| A                                          | X                | X     | X                                  |
| B                                          | X                |       |                                    |
| C                                          | X                | X     | X                                  |



▲ - DENOTES RECOMMENDED VALUE



#### NOTES:

- STIRRUPS TO BE SPACED AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT, EXCEPT LOCALIZED REGIONS (HIGH SHEAR STRESS ZONES) WHERE A SMALLER SPACING WILL NOT INTERFERE WITH VIBRATION OR CONCRETE PLACEMENT. MAX. SPACING IS 12".
- PROVIDE AT LEAST ONE SPACE AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT. FOR CAPS GREATER THAN 5'-0" WIDE PROVIDE TWO 9" CLEAR SPACES. PROVIDE 6" MIN. AT ALL OTHER SPACES. REINFORCEMENT SPACING WILL NEED TO BE ADJUSTED TO CLEAR DOWELS OR ANCHOR BOLTS INCLUDING SLEEVES.
- PROVIDE #5 @ 12" MIN. OR IF EFFECTIVE DEPTH "d<sub>e</sub>" EXCEEDS 3'-0", PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4..
- FLUSH EXP. JT. - FOR DECKS WITH LONGITUDINAL EXPANSION JOINT.
- MULTI-LAYERS
  - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
  - CLEAR SPACING MUST BE 1/2" MINIMUM
- EXTEND ALL TOP FLEXURAL REINFORCEMENT THE ENTIRE LENGTH OF CAP.
- COORDINATE BOTTOM CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
- BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

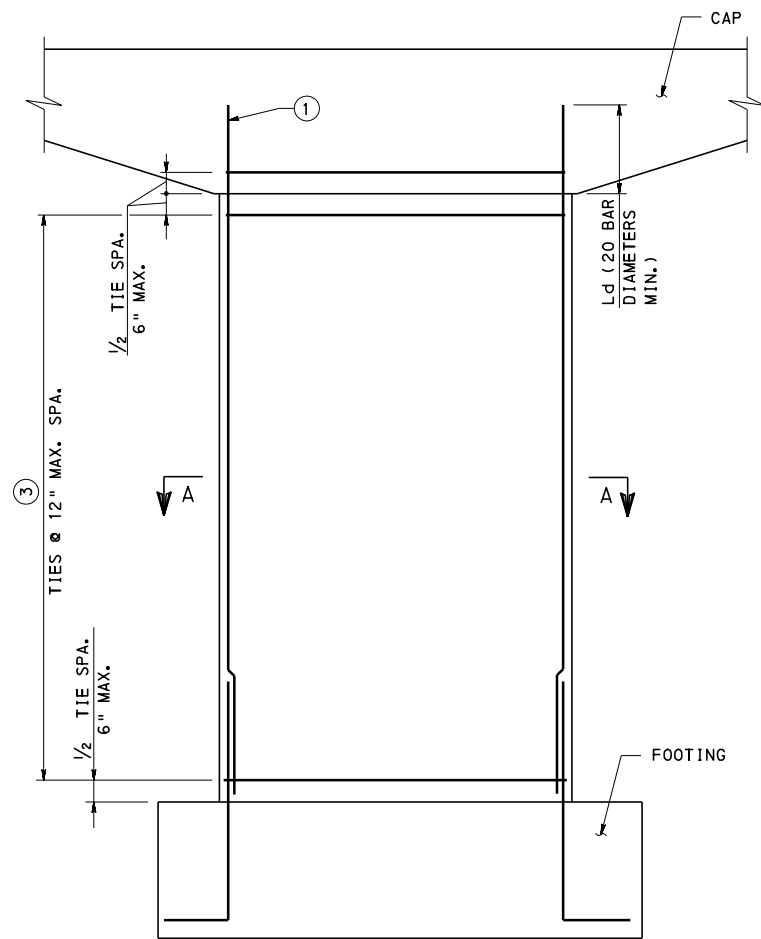
### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BRIDGE OFFICE

### STANDARD REINFORCED CONCRETE PIERS HAMMERHEAD DETAILS

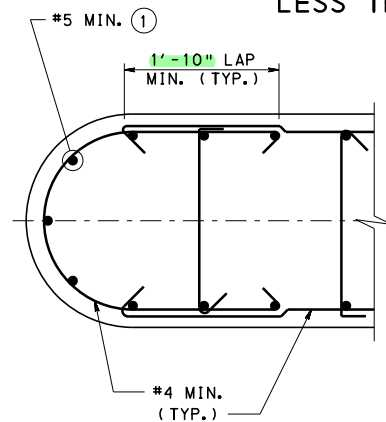
RECOMMENDED NOV. 23, 2022  
*L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gray E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

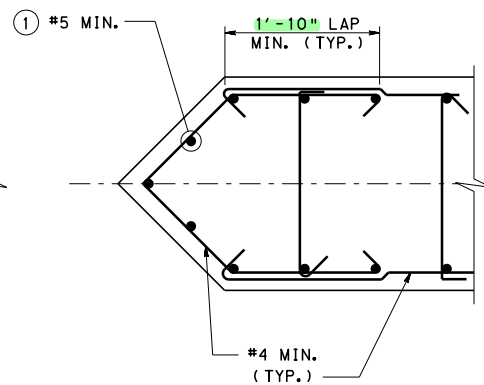
SHEET 6 OF 15  
BD-629M



**ELEVATION**  
(RESPONSE ACCELERATION  
COEFFICIENT,  $S_{D1}$ ,  
LESS THAN 0.10 )

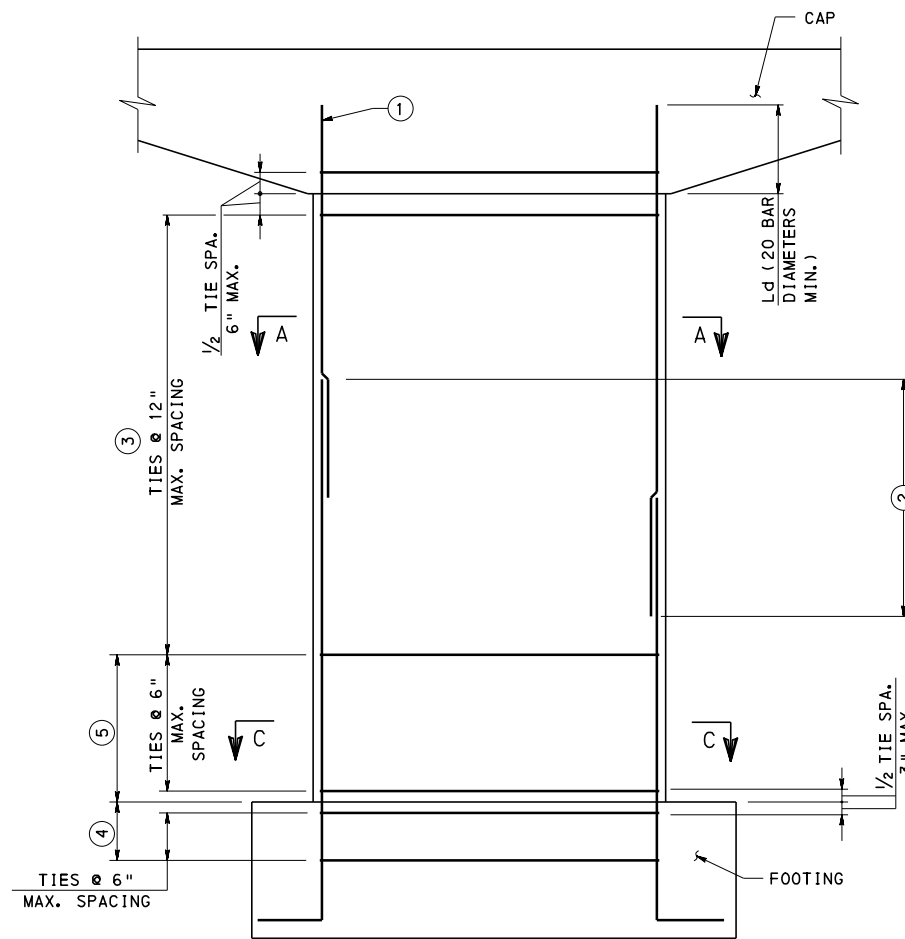


**ROADWAY, STREAMS  
OR RIVERS**



**STREAMS  
OR RIVERS**

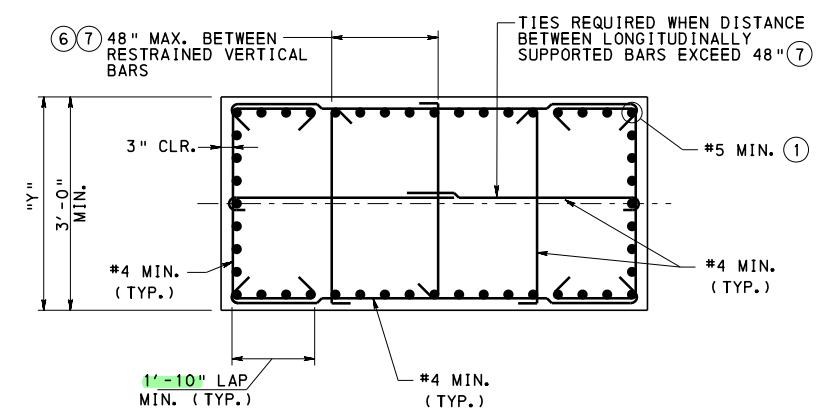
**OPTIONAL END TREATMENTS**



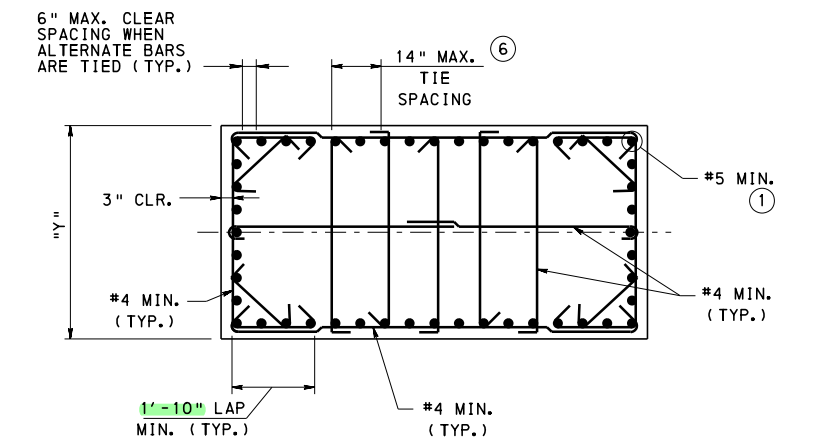
**ELEVATION**  
(SITE CLASS E, F OR RESPONSE  
ACCELERATION COEFFICIENT,  $S_{D1}$ ,  
GREATER THAN OR EQUAL TO 0.10 )

**NOTES:**

- ① COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT TO AVOID INTERFERENCE.
- ② FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
- ③ FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
- ④ COLUMN CONNECTION  
GREATER OF:  $\frac{1}{2}$  MAX. "Y" DIMENSION OR 15"
- ⑤ PLASTIC HINGE ZONE  
GREATER OF: MAX. "Y" DIMENSION,  $\frac{1}{6}$  CLR. HEIGHT OF COLUMN OR 18"
- ⑥ ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH VERTICALLY AND HORIZONTALLY.
- ⑦ WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP SPLICED WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.



**SECTION A-A**



**SECTION C-C**  
(PLASTIC HINGE ZONE)

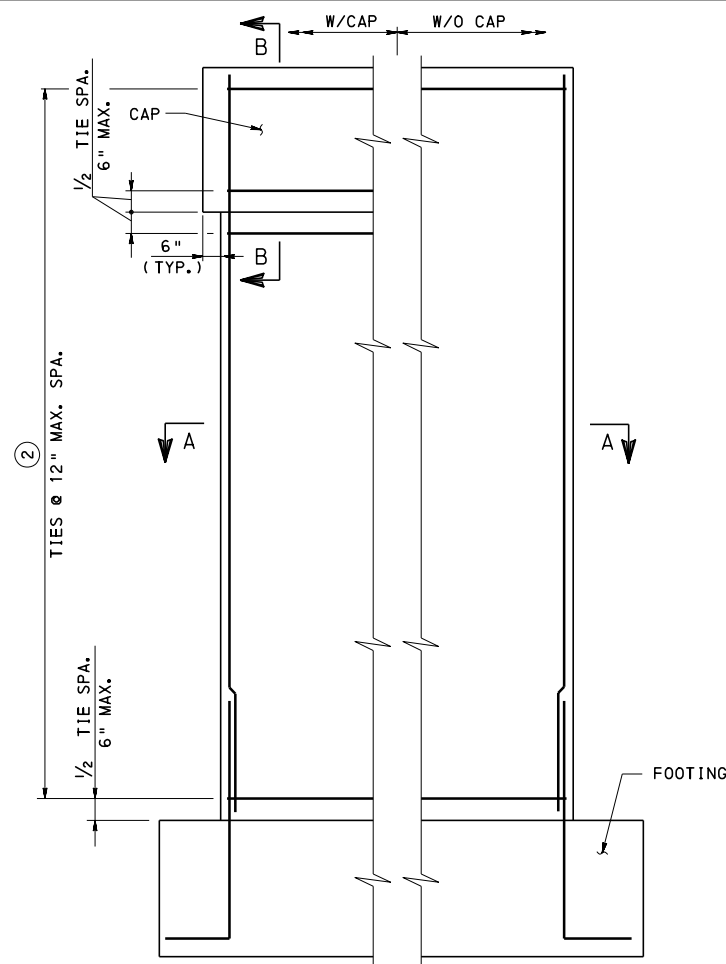
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BRIDGE OFFICE**

**STANDARD**  
**REINFORCED CONCRETE PIERS**  
**HAMMERHEAD**  
**COLUMN DETAILS AND SECTIONS**

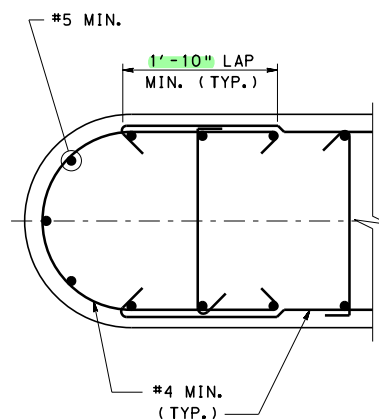
RECOMMENDED NOV. 23, 2022  
*L. L. W. G.*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

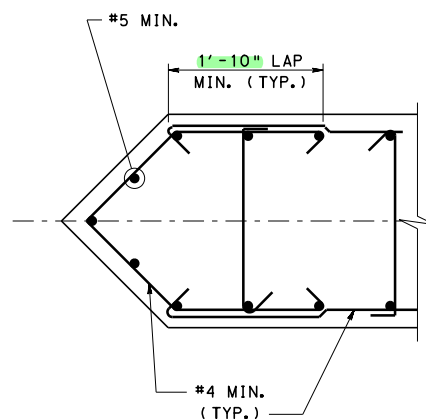
SHEET 7 OF 15  
**BD-629M**



**ELEVATION**  
(RESPONSE ACCELERATION  
COEFFICIENT,  $S_{D1}$ ,  
LESS THAN 0.10 )



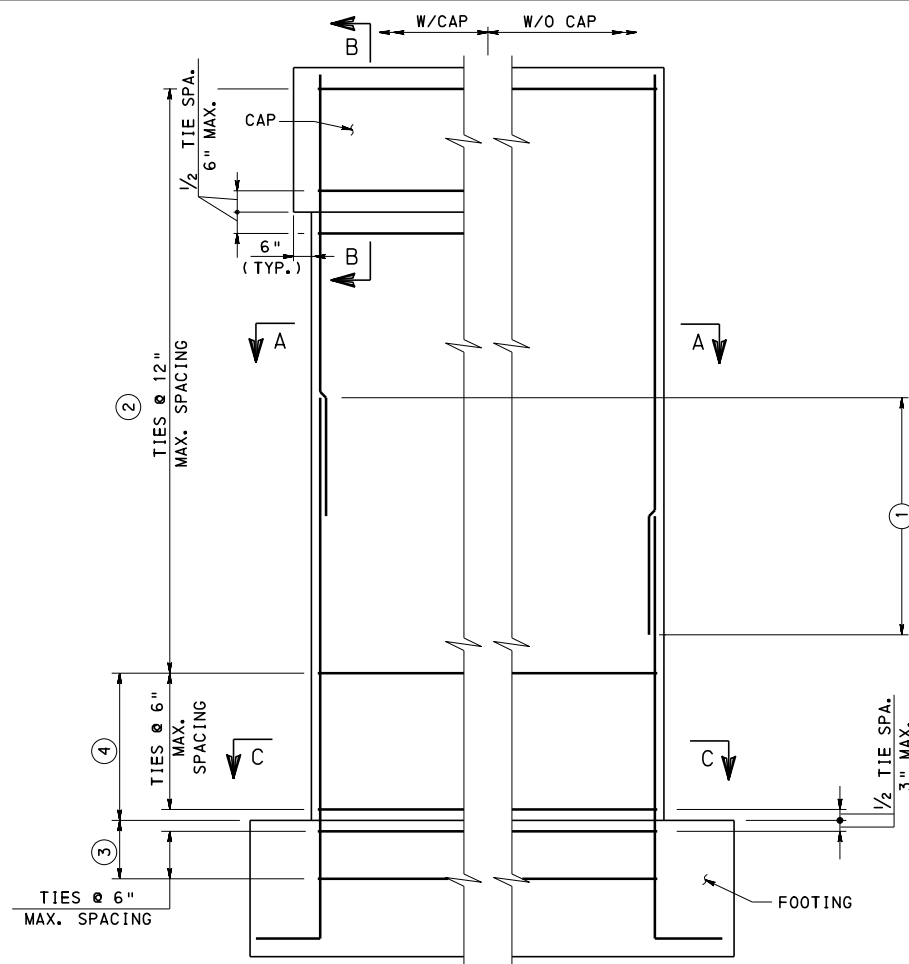
**ROADWAY, STREAMS  
OR RIVERS**



**STREAMS  
OR RIVERS**

**OPTIONAL END TREATMENTS**

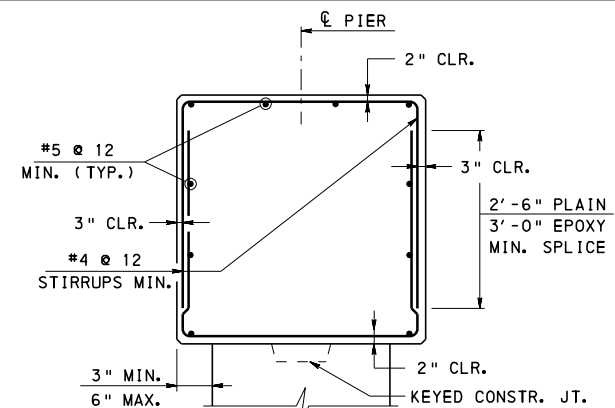
| RECOMMENDED SOLID SHAFT<br>CONFIGURATION |       |                                          |
|------------------------------------------|-------|------------------------------------------|
| GRADE<br>SEPARATION                      | RIVER | RAILROAD WITHIN<br>25 FT.<br>OF CL TRACK |
| X                                        | X     | X                                        |



**ELEVATION**  
(SITE CLASS E, F OR RESPONSE  
ACCELERATION COEFFICIENT,  $S_{D1}$ ,  
GREATER THAN OR EQUAL TO 0.10 )

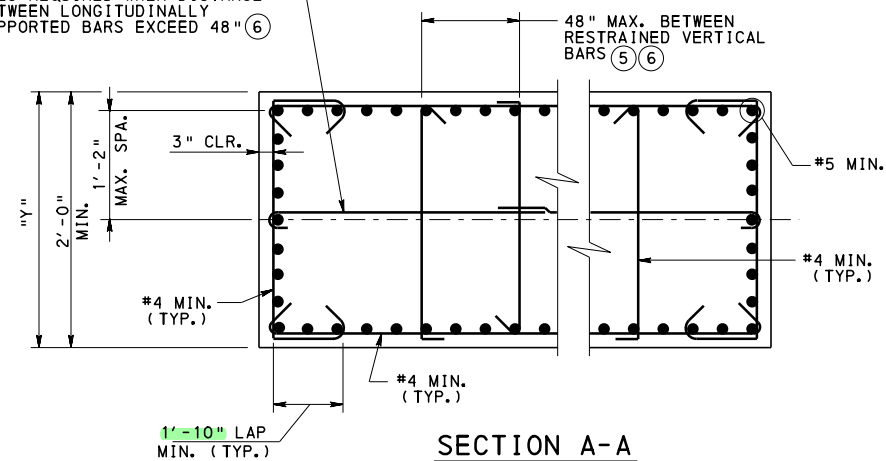
**NOTES:**

- FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
- FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
- COLUMN CONNECTION GREATER OF:  $\frac{1}{2}$  MAX. "Y" DIMENSION OR 15"
- PLASTIC HINGE ZONE GREATER OF: MAX. "Y" DIMENSION,  $\frac{1}{6}$  CLR. HEIGHT OF COLUMN OR 18"
- ALL HOOKS ON TIES MUST ENGAGE VERTICAL COLUMN REINFORCING STEEL. ALTERNATE 90° & 135° HOOKS ON CROSS TIES BOTH VERTICALLY AND HORIZONTALLY.
- WHERE NON-CONTINUOUS TIES ARE USED, THEY SHALL BE LAP SPliced WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.

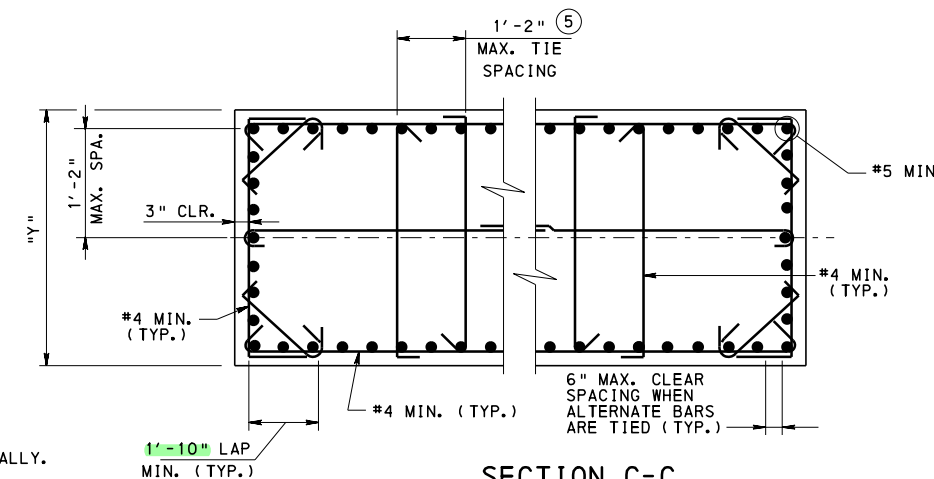


**SECTION B-B**

TIES REQUIRED WHEN DISTANCE  
BETWEEN LONGITUDINALLY  
SUPPORTED BARS EXCEED 48" (6)



**SECTION A-A**



**SECTION C-C**  
(PLASTIC HINGE ZONE)

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

**STANDARD  
REINFORCED CONCRETE PIERS  
SOLID SHAFT (WALL)  
DETAILS**

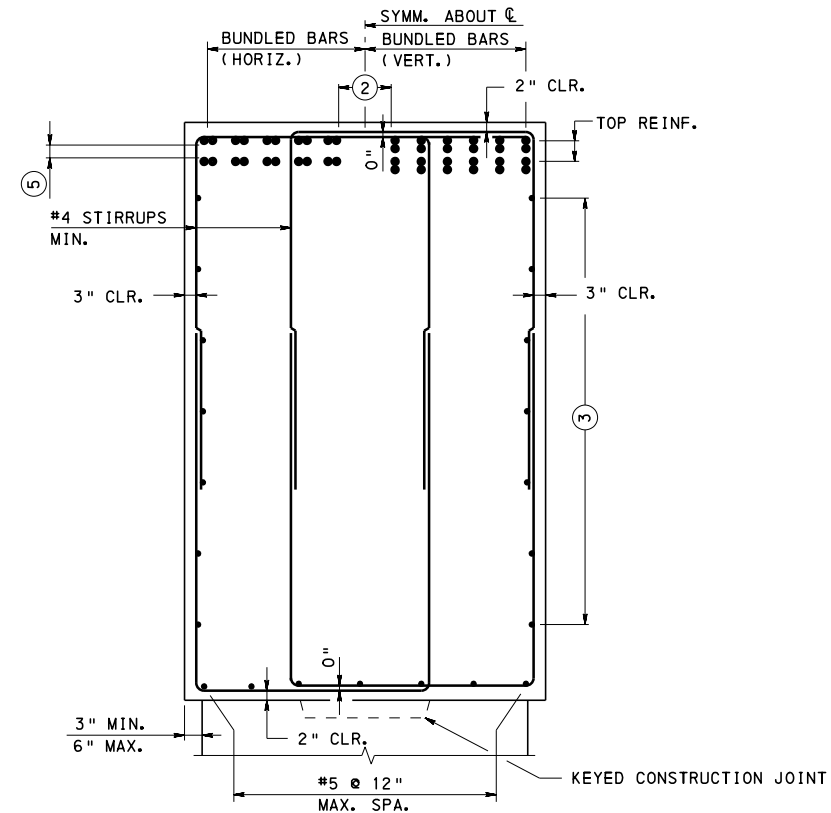
RECOMMENDED NOV. 23, 2022  
*L. L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 8 OF 15  
BD-629M



| RECOMMENDED SINGLE COLUMN CONFIGURATION |       |                                    |
|-----------------------------------------|-------|------------------------------------|
| GRADE SEPARATION                        | RIVER | RAILROAD WITHIN 25 FT. OF CL TRACK |
| X                                       | X     | X                                  |



SECTION A-A

▲ - DENOTES RECOMMENDED VALUE

NOTES:

- ① STIRRUPS TO BE SPACED AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT, EXCEPT LOCALIZED REGIONS (HIGH SHEAR STRESS ZONES) WHERE A SMALLER SPACING WILL NOT INTERFERE WITH VIBRATION OR CONCRETE PLACEMENT. MAX. SPACING IS 12".
- ② PROVIDE AT LEAST ONE SPACE AT A MIN. OF 9" CLEAR TO FACILITATE CONCRETE PLACEMENT. FOR CAPS GREATER THAN 5'-0" WIDE PROVIDE TWO 9" CLEAR SPACES. PROVIDE 6" MIN. AT ALL OTHER SPACES. REINF. SPACING WILL NEED TO BE ADJUSTED TO CLEAR DOWELS OR ANCHOR BOLTS INCLUDING SLEEVES.
- ③ PROVIDE #5 @ 12" MIN. OR IF EFFECTIVE DEPTH "d<sub>e</sub>" EXCEEDS 3'-0" PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4..
- ▲ ④ GUIDELINES FOR COLUMN STEPS:

|                           |                   |
|---------------------------|-------------------|
| H < 20 FT.                | : NO STEP         |
| H > 20 FT. AND H < 40 FT. | : 1 STEP          |
| H > 40 FT.                | : 2 OR MORE STEPS |


STEP CONSIDERATIONS:

- MATERIAL SAVING VS. CONSTRUCTION COST
- REDUCE COLUMN STIFFNESS TO MINIMIZE THERMAL AND/OR SEISMIC FORCES
- LOCATION DETERMINED BY ANALYSIS

- ⑤ MULTI-LAYERS
  - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
  - CLEAR SPACING MUST BE 1/2" MINIMUM.
- ⑥ COORDINATE BOTTOM FLEXURAL CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
- ⑦ BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, ROADWAY PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

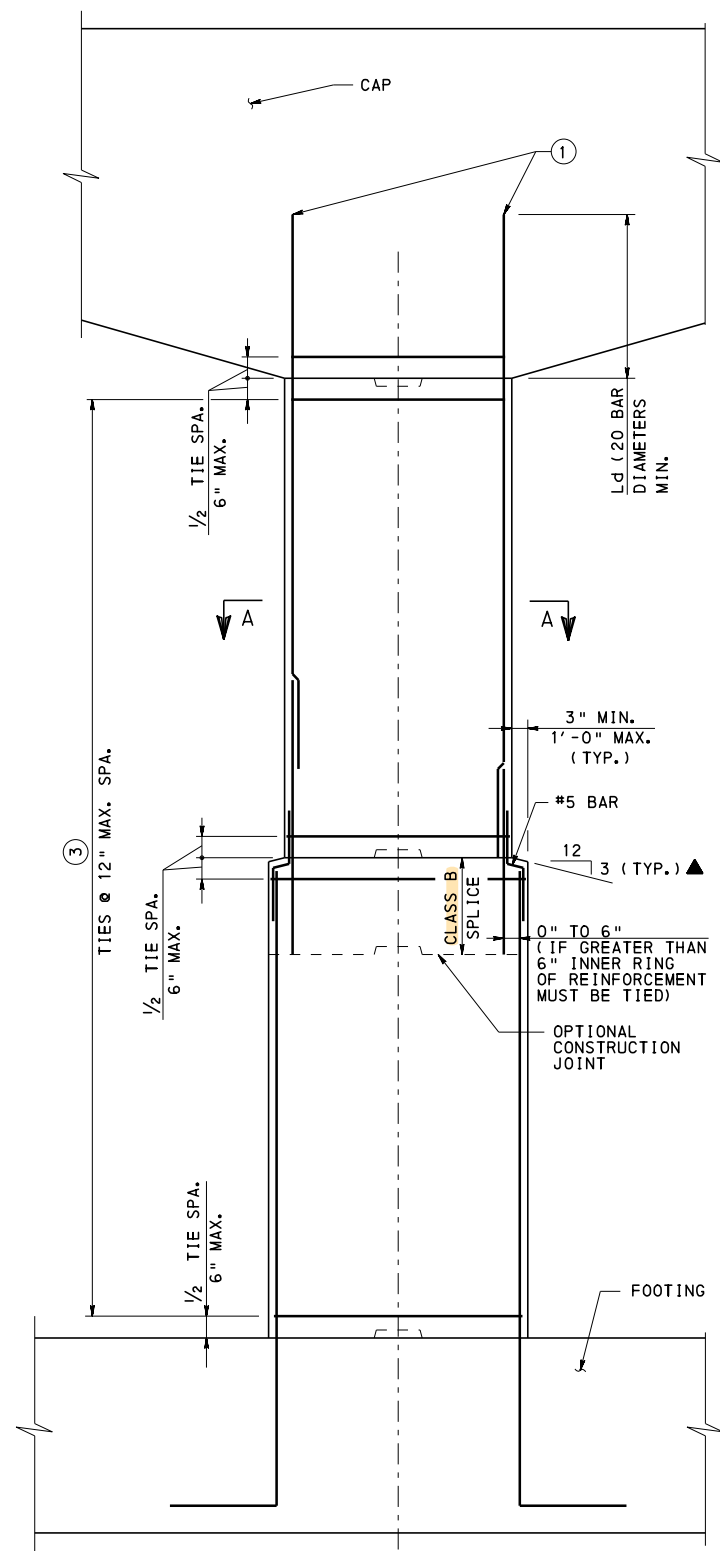
# STANDARD REINFORCED CONCRETE PIERS SINGLE COLUMN DETAILS

RECOMMENDED NOV. 23, 2022  
  
 CHIEF BRIDGE ENGINEER

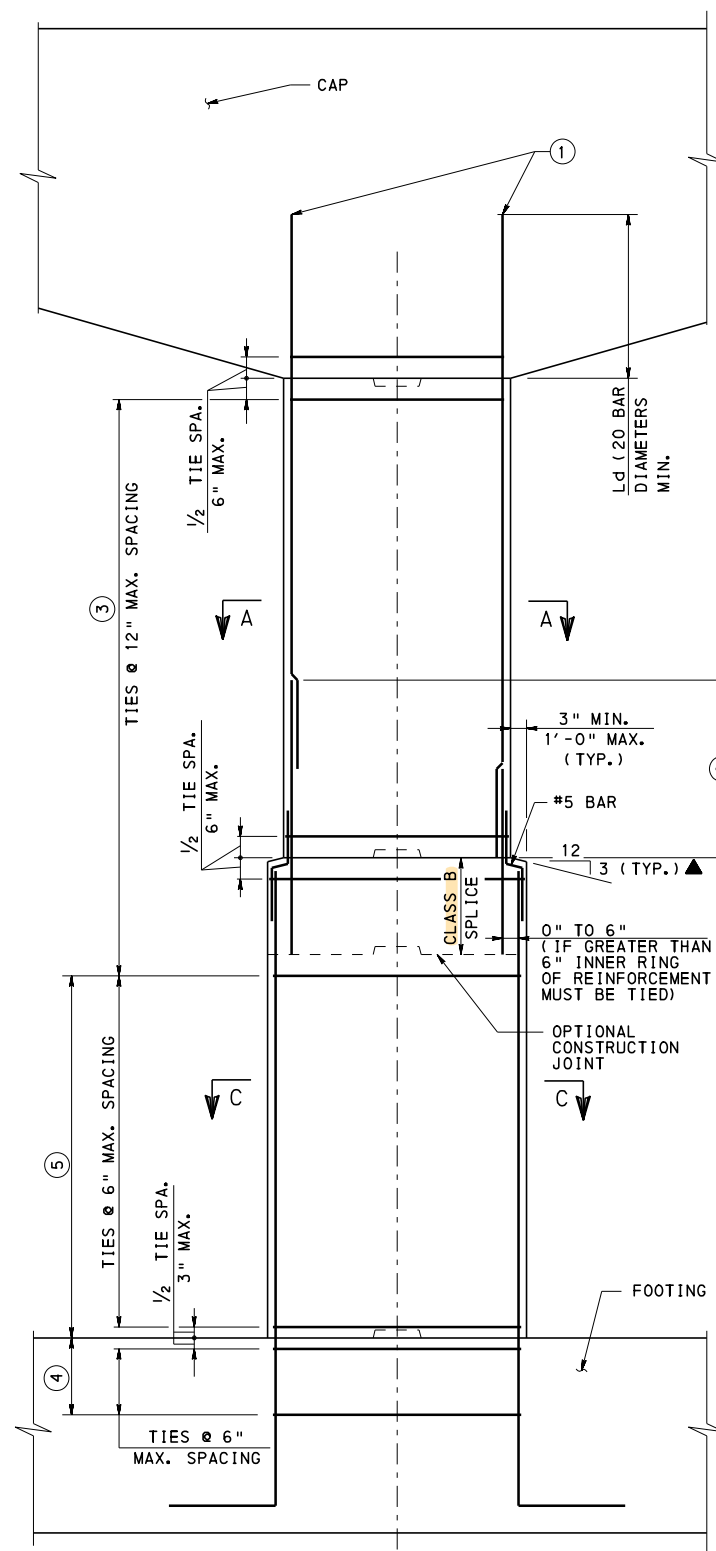
RECOMMENDED NOV. 23, 2022  
*Gravin E. Gray*  
 CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 9 OF 15

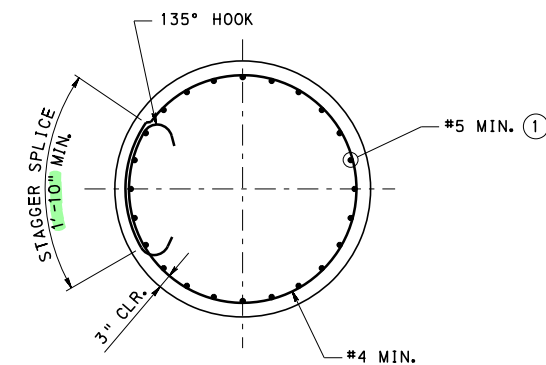
3D-629M



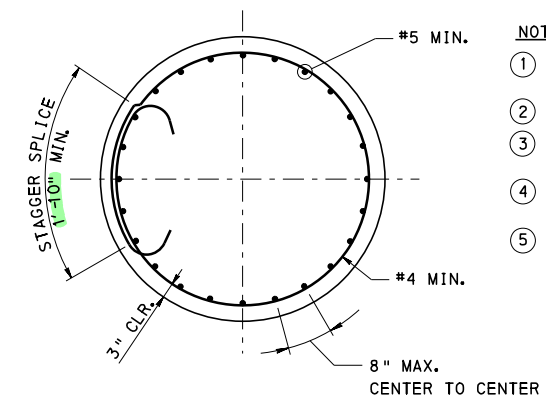
**COLUMN**  
(RESPONSE ACCELERATION  
COEFFICIENT,  $S_{D1}$ ,  
LESS THAN 0.10 )



**COLUMN**  
(SITE CLASS E, F OR RESPONSE  
ACCELERATION COEFFICIENT,  $S_{D1}$ ,  
GREATER THAN OR EQUAL TO 0.10 )



**SECTION A-A**



**SECTION C-C**  
(PLASTIC HINGE ZONE)

▲ - DENOTES RECOMMENDED VALUE

**NOTES:**

- ① COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT TO AVOID INTERFERENCE.
- ② FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
- ③ FOR BUNDLED #10 REINFORCING BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
- ④ COLUMN CONNECTION GREATER OF:  $\frac{1}{2}$  MAX. COL. DIMENSION OR 15"
- ⑤ PLASTIC HINGE ZONE GREATER OF: MAX. COL. DIMENSION,  $\frac{1}{6}$  CLR. HEIGHT OF COLUMN OR 18"

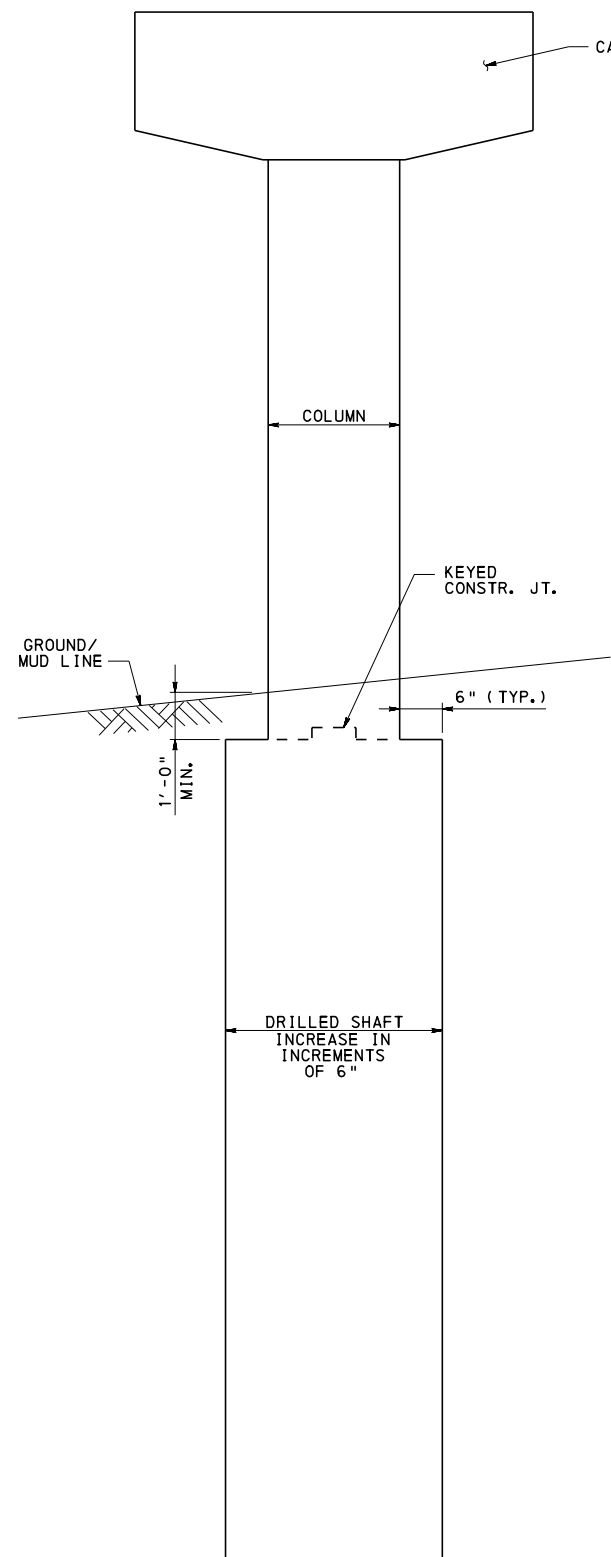
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

**STANDARD**  
**REINFORCED CONCRETE PIERS**  
**SINGLE COLUMN**  
**COLUMN DETAILS AND SECTIONS**

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

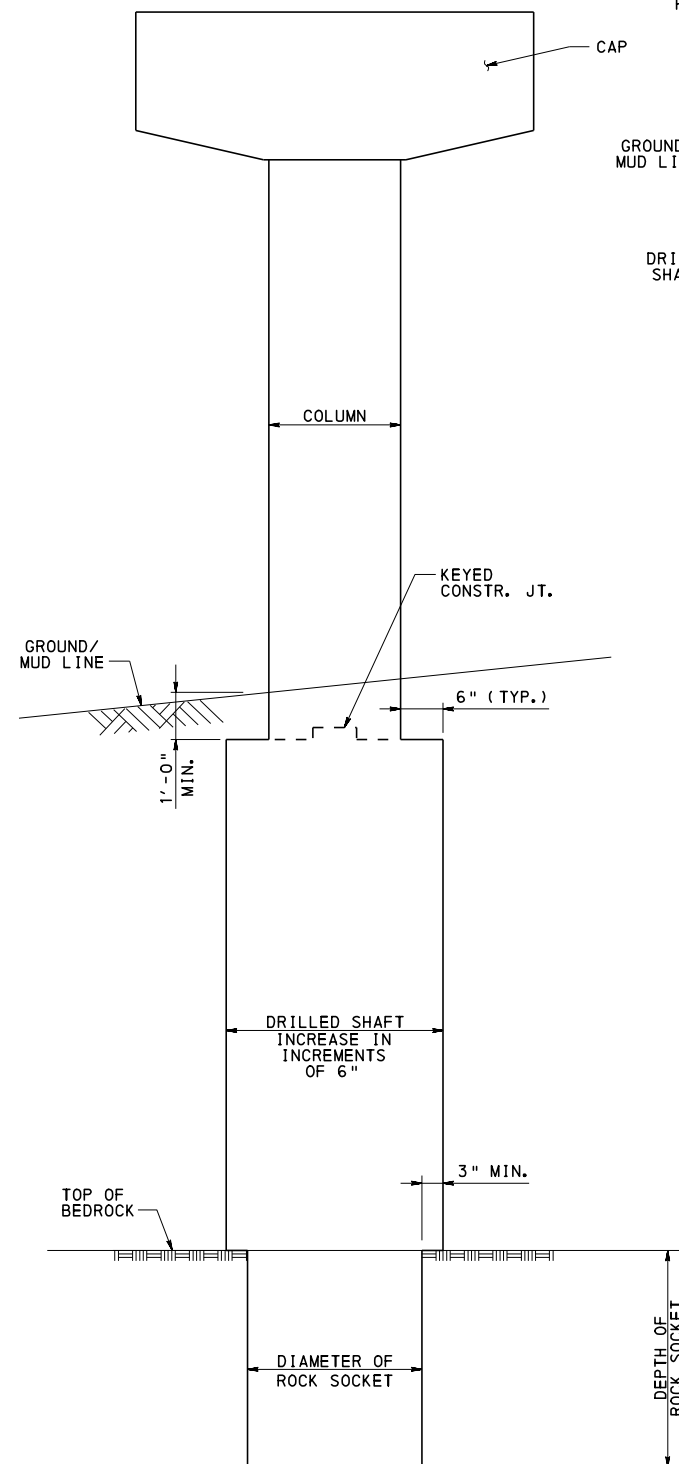
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 10 OF 15  
**BD-629M**

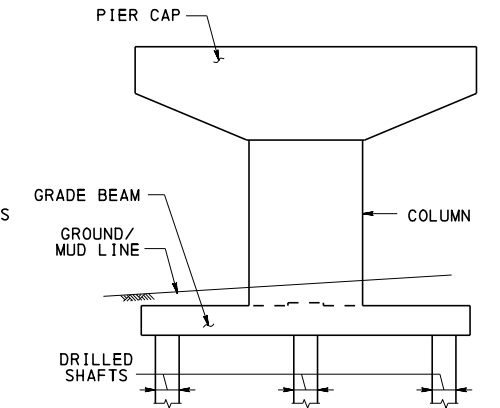
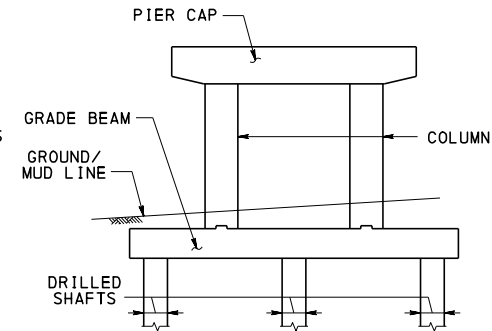
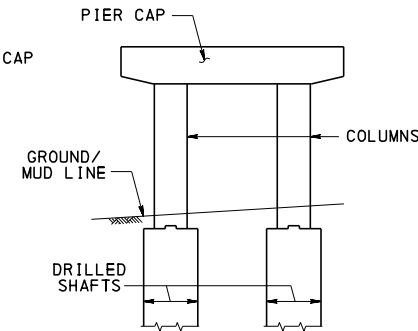


**DRILLED SHAFT**

①



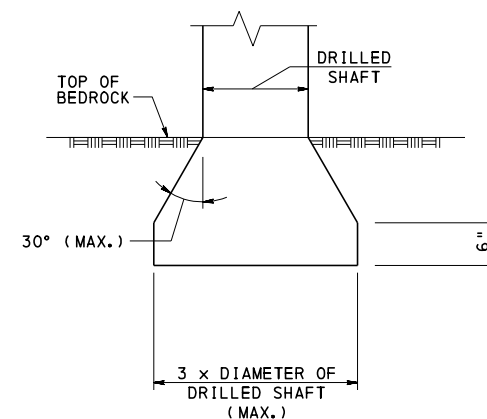
**DRILLED SHAFT  
(WITH ROCK SOCKET)**



**MULTI-DRILLED SHAFT CONFIGURATIONS**  
(DETAILS NOT SHOWN)

**NOTES:**

- ① DRILLED SHAFTS NOT FORMED OR SOCKETED INTO ROCK ARE GENERALLY NOT PERMITTED BY THE DEPT. AND IF USED, MUST BE APPROVED BY THE ACTING CHIEF BRIDGE ENGINEER.
- ② USE OF BELLED TIP REQUIRES THE PRIOR APPROVAL OF THE CHIEF BRIDGE ENGINEER.



**BELLED TIP**

②

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BRIDGE OFFICE**

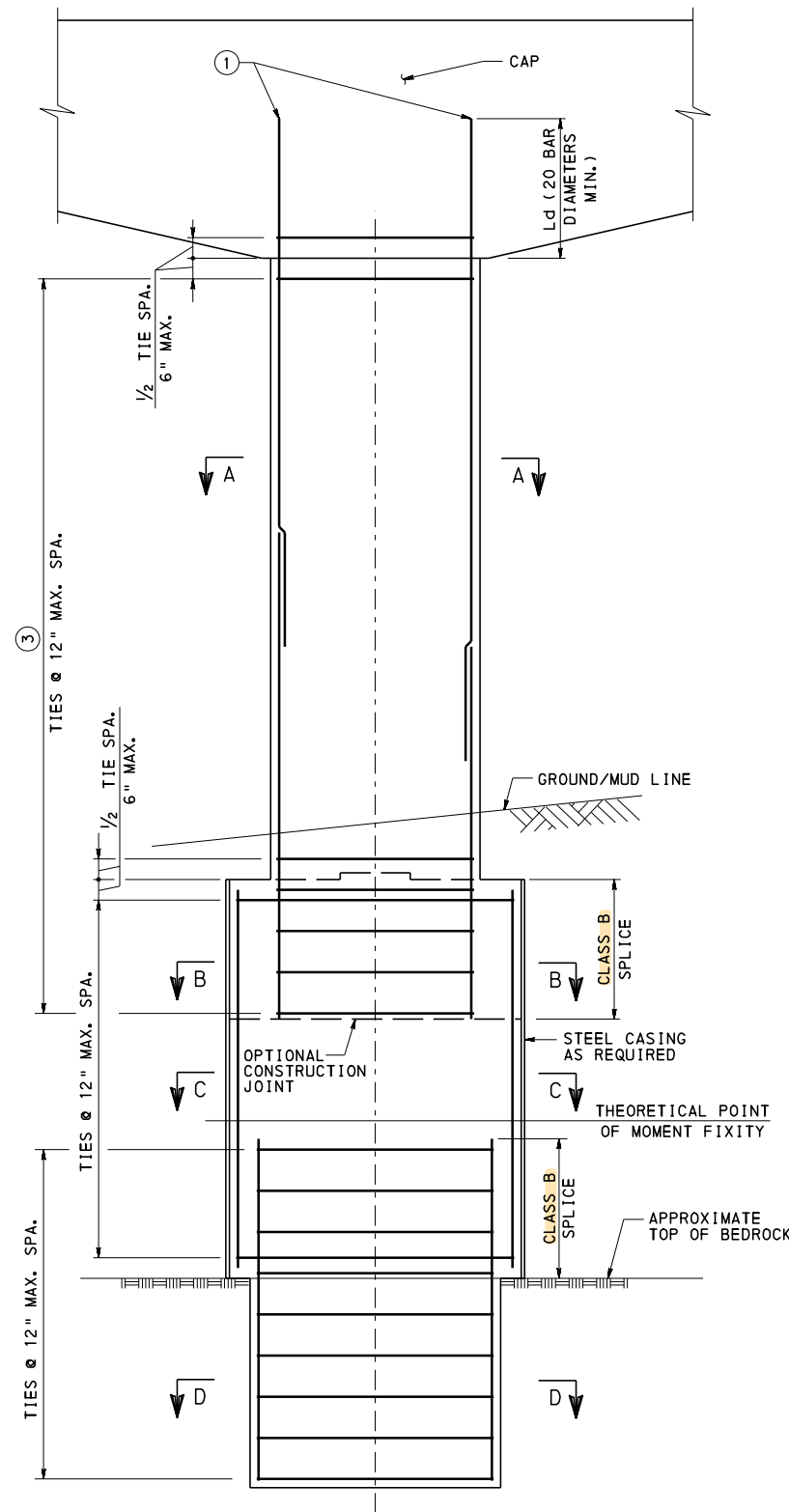
**STANDARD  
REINFORCED CONCRETE PIERS  
SINGLE DRILLED SHAFT  
DETAILS**

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

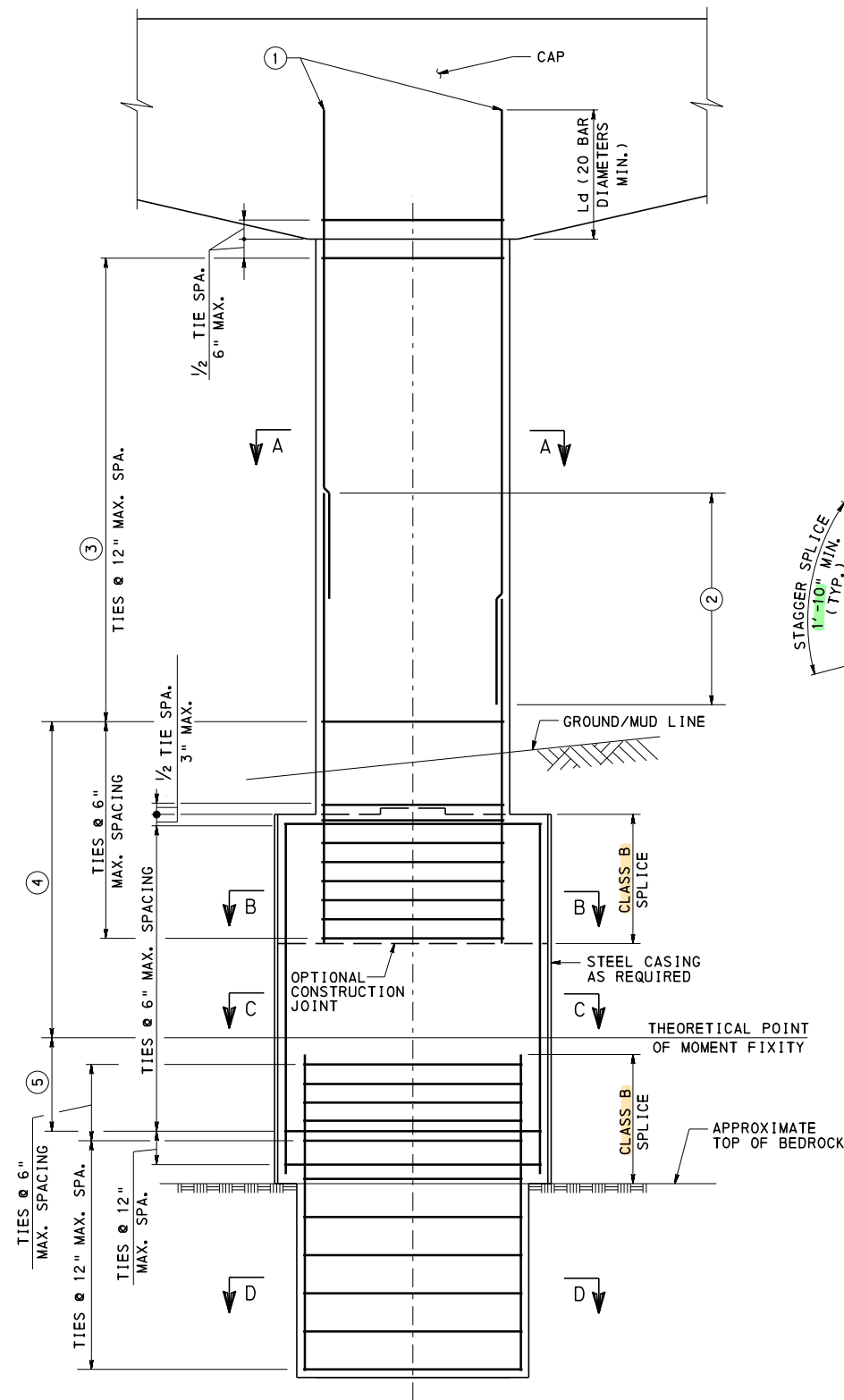
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 11 OF 15  
BD-629M

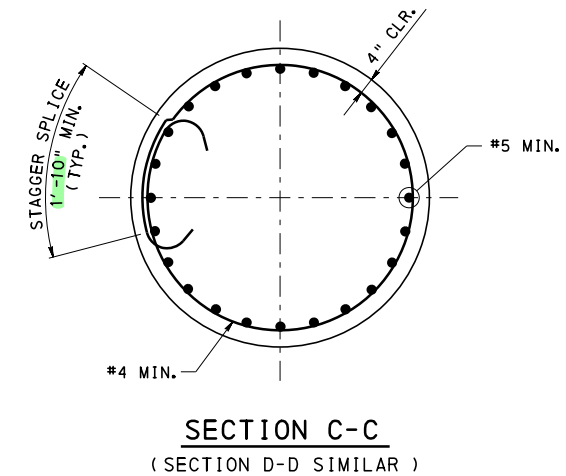
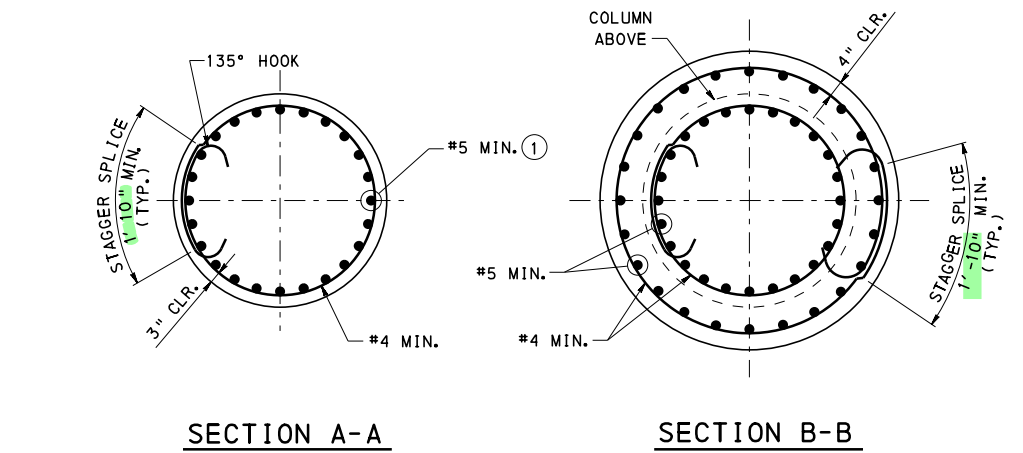




**DRILLED SHAFT**  
(RESPONSE ACCELERATION  
COEFFICIENT,  $S_{D1}$ ,  
LESS THAN 0.10 )



**DRILLED SHAFT**  
(SITE CLASS E, F OR RESPONSE  
ACCELERATION COEFFICIENT,  $S_{D1}$ ,  
GREATER THAN OR EQUAL TO 0.10 )



**NOTES:**

- ① COORDINATE VERTICAL COLUMN REINFORCEMENT WITH BOTTOM CAP REINFORCEMENT.
- ② FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
- ③ FOR BUNDLED #10 REINFORCING BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
- ④ PLASTIC HINGE ZONE  
GROUND/MUD LINE ELEVATION - THEORETICAL POINT OF MOMENT FIXITY ELEVATION + THE GREATER OF MAXIMUM COLUMN DIMENSION OR 1'-6".
- ⑤ PLASTIC HINGE ZONE  
3 X MAXIMUM COLUMN DIMENSION

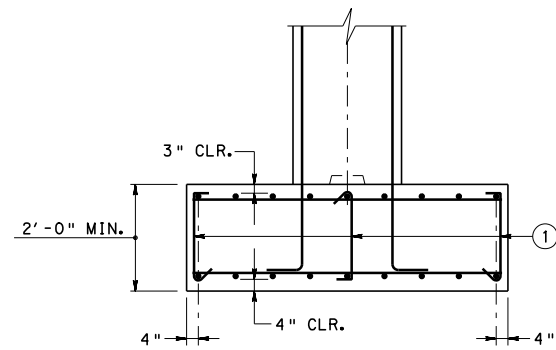
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

**STANDARD**  
**REINFORCED CONCRETE PIERS**  
**SINGLE DRILLED SHAFT**  
**SHAFT/COLUMN DETAILS AND SECTIONS**

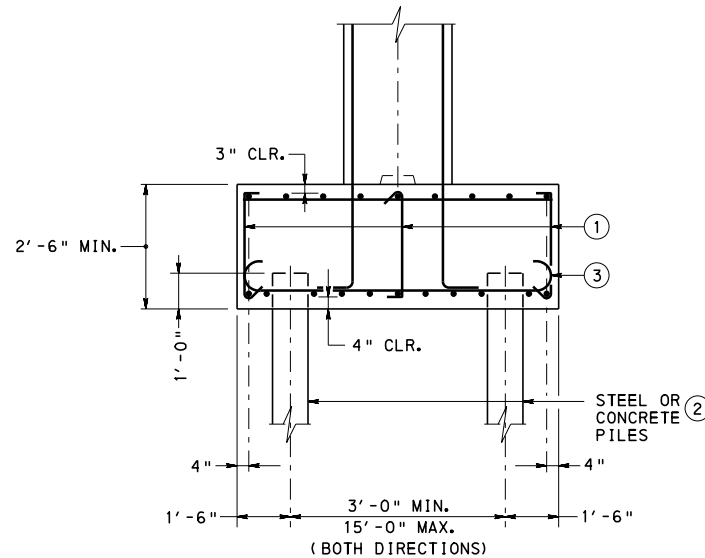
RECOMMENDED NOV. 23, 2022  
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CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*Gray E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

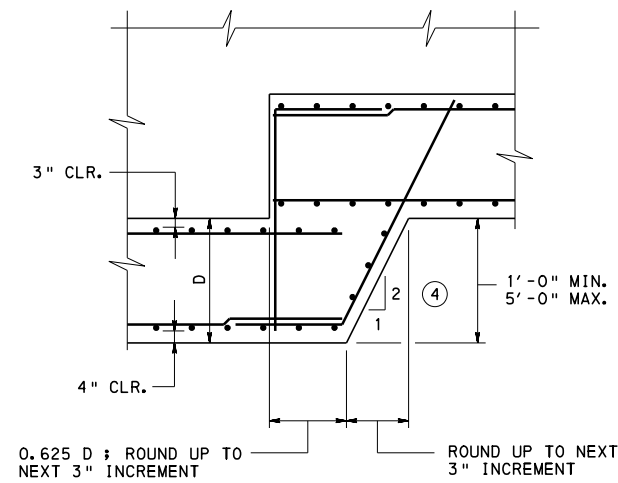
SHEET 12 OF 15  
BD-629M



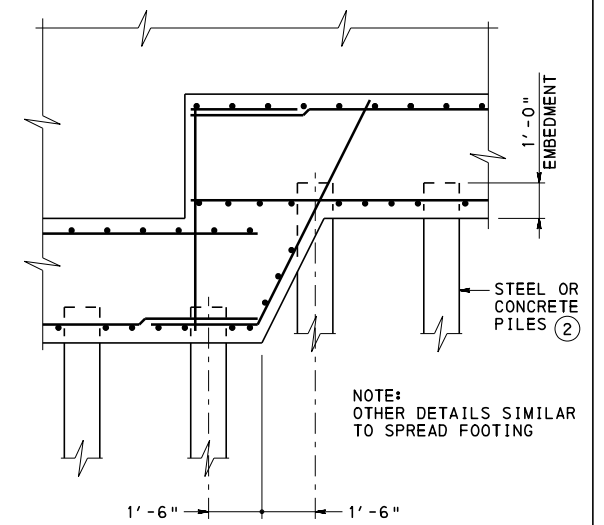
**SINGLE COLUMN  
SPREAD FOOTING**



**SINGLE COLUMN  
PILE FOOTING**

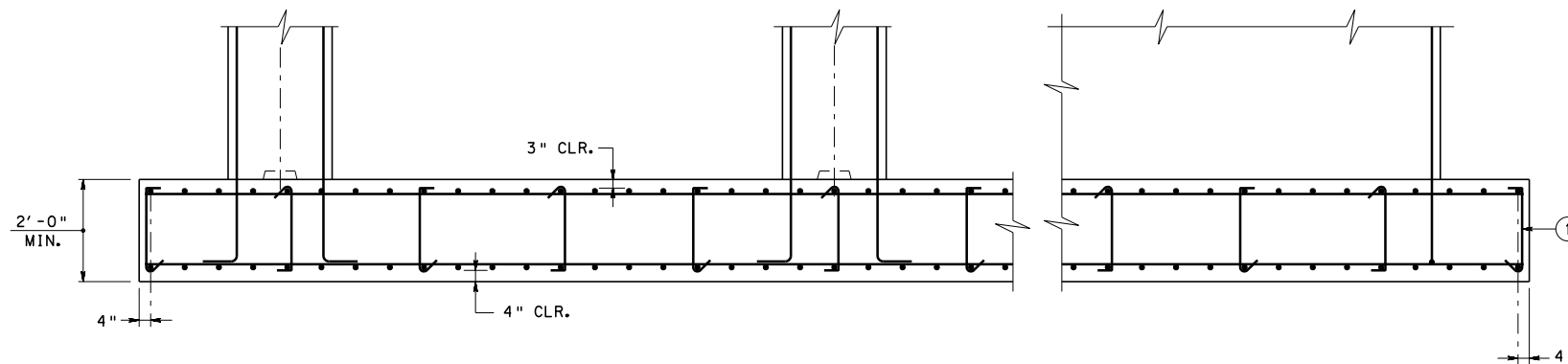


**SPREAD FOOTING**



**PILE FOOTING**

**STEP DETAILS**



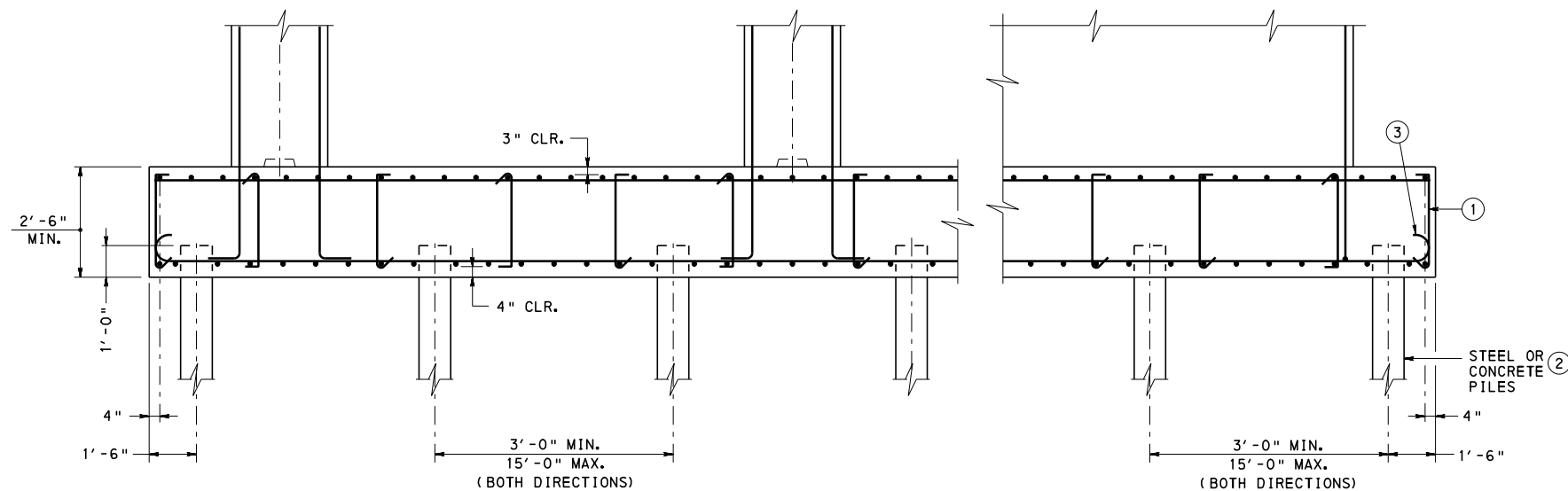
**MULTI-COLUMN BENT**

**CONTINUOUS SPREAD FOOTING**

**HAMMERHEAD & WALL**

**NOTES:**

- ① TIE TOP AND BOTTOM MATS OF REINFORCING STEEL WITH #4 TIE BARS AT A MAXIMUM SPACING OF 4'-0" IN BOTH DIRECTIONS. PROVIDE TIE BARS WITH 90° HOOK AT ONE END AND 135° HOOK AT THE OTHER END. ALTERNATE 90° AND 135° HOOK AT TOP IN ALTERNATING TIES.
- ② FOR PILE ANCHORAGE DETAILS, SEE BD-621M.
- ③ FOR REINFORCEMENT HOOK REQUIREMENTS ON PILE SUPPORTED FOOTINGS, SEE DM-4, SECTION 5.11.1.2.1.
- ④ SLOPE OF FOOTING STEP SHOWN IS FOR FOOTINGS ON ROCK OR PILES. USE 1:1 SLOPE FOR FOOTINGS ON SOIL.



**MULTI-COLUMN BENT**

**CONTINUOUS PILE FOOTING**

**HAMMERHEAD & WALL**

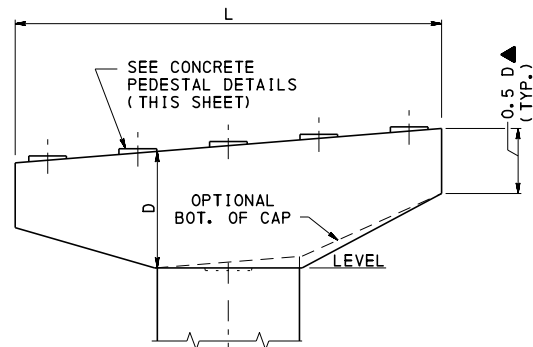
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

**STANDARD  
REINFORCED CONCRETE PIERS  
TYPICAL FOOTING  
DETAILS**

RECOMMENDED NOV. 23, 2022  
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CHIEF BRIDGE ENGINEER

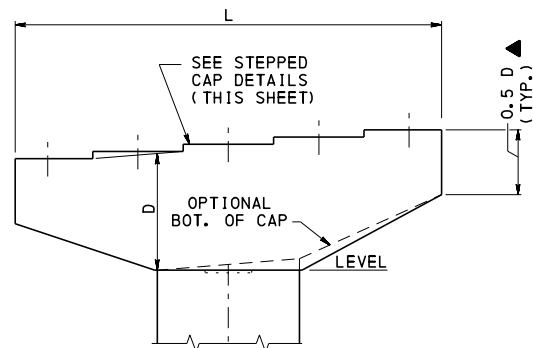
RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 13 OF 15  
**BD-629M**

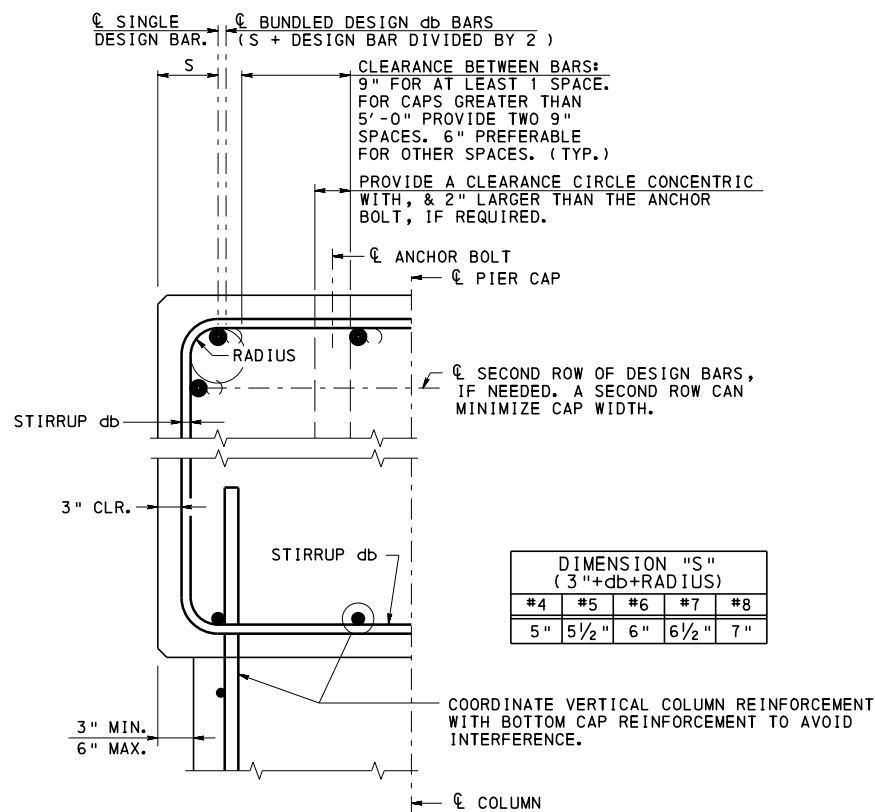


**ELEVATION**  
SLOPED CAP WITH PEDESTALS

▲ - DENOTES RECOMMENDED VALUE

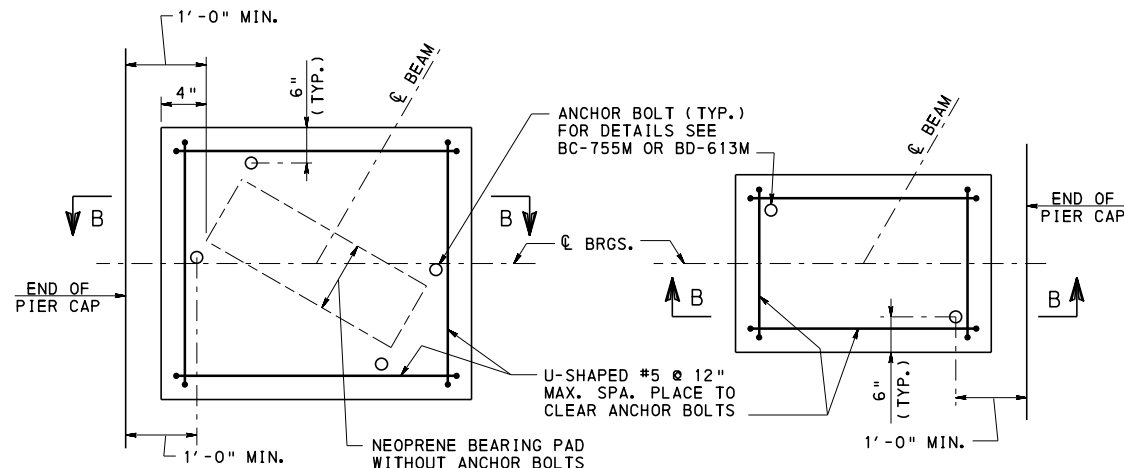


**ELEVATION**  
STEPPED CAP



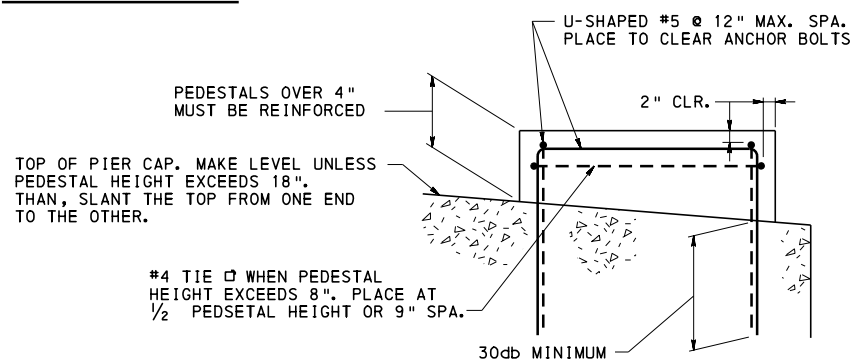
**PIER CAP SECTION**

| DIMENSION "S" (3" + db + RADIUS) |        |    |        |    |
|----------------------------------|--------|----|--------|----|
| #4                               | #5     | #6 | #7     | #8 |
| 5"                               | 5 1/2" | 6" | 6 1/2" | 7" |



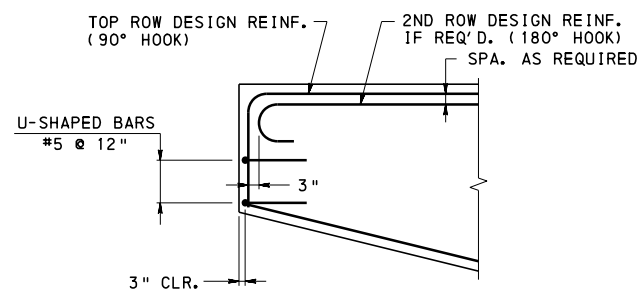
**PLAN - 4 ANCHOR BOLTS OR NEOPRENE PAD**

**PLAN - 2 ANCHOR BOLTS**

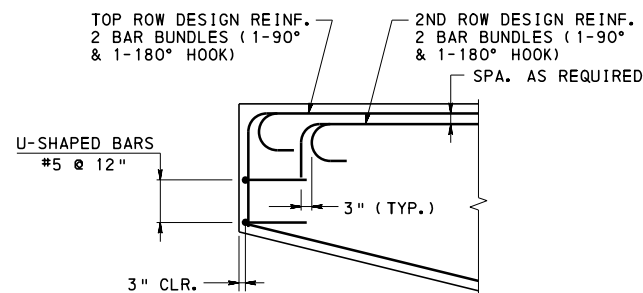


**SECTION B-B**

**CONCRETE PEDESTAL DETAILS**



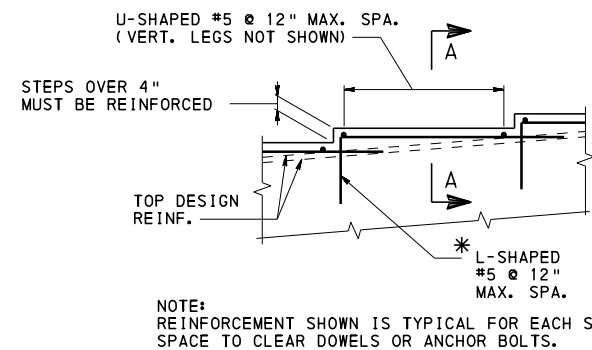
**ELEVATION - SINGLE AND HORIZONTALLY BUNDLED BARS**



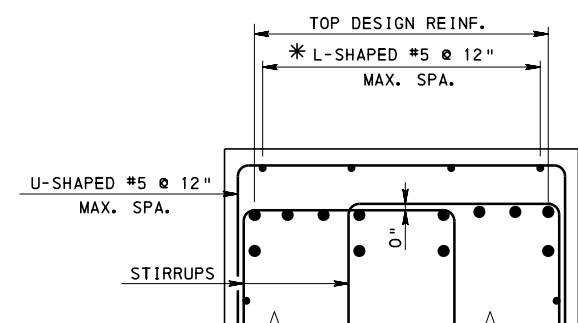
**ELEVATION - VERTICALLY BUNDLED BARS**

**DETAIL A**

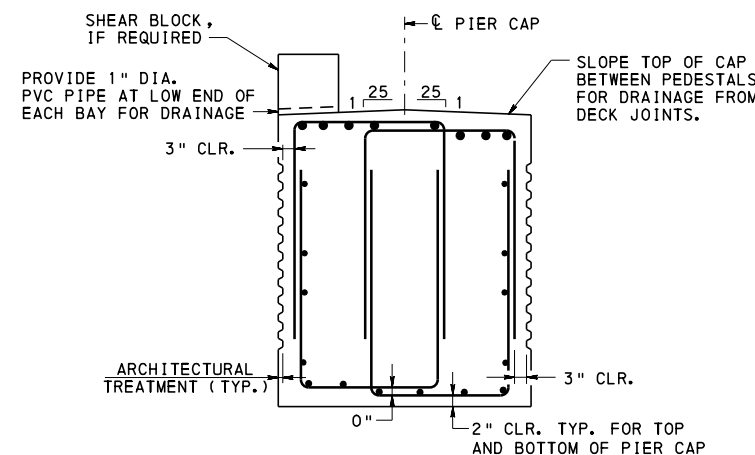
NOTE: STIRRUPS AND SIDE REINF. NOT SHOWN.



**ELEVATION**



**SECTION A-A**  
**STEPPED CAP DETAILS**



**ARCHITECTURAL TREATMENT AND TOP OF CAP AT DECK JOINT**

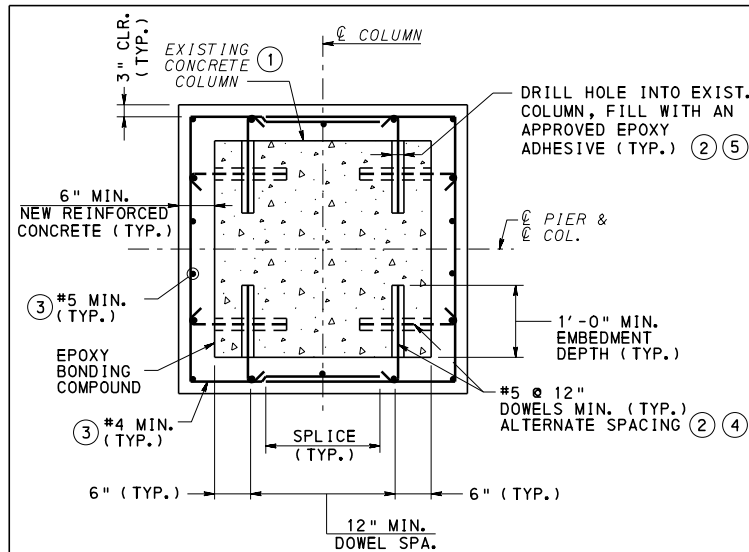
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

**STANDARD**  
**REINFORCED CONCRETE PIERS**  
**TYPICAL CAP**  
**DETAILS**

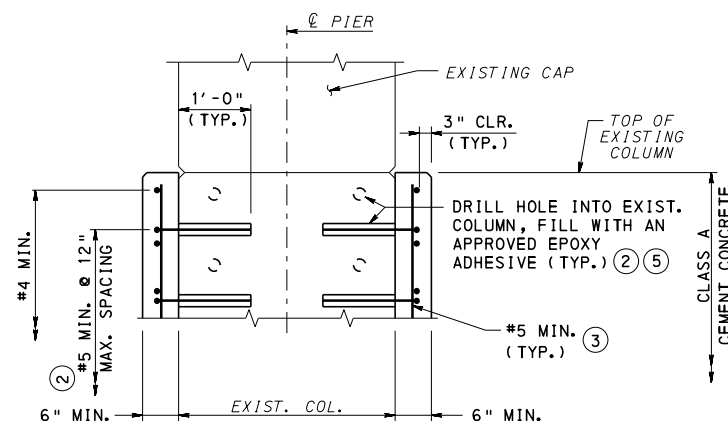
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*Gray E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 14 OF 15  
BD-629M

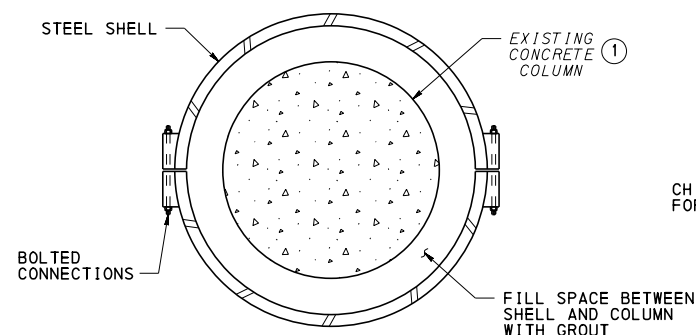


**CROSS SECTION**

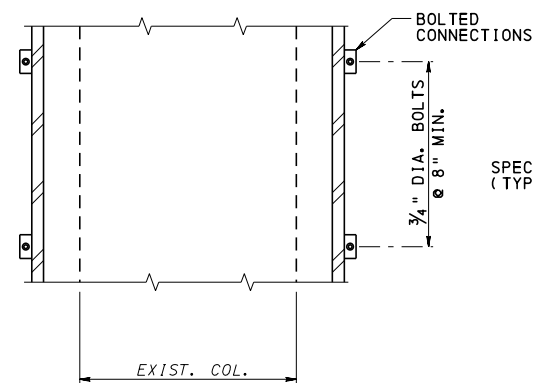


**ELEVATION**

**TYPE 1**

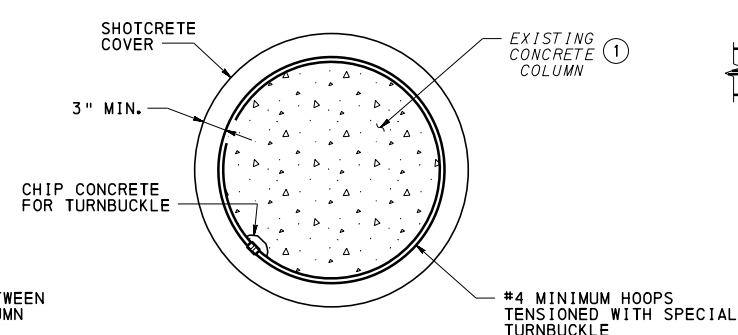


**CROSS SECTION**

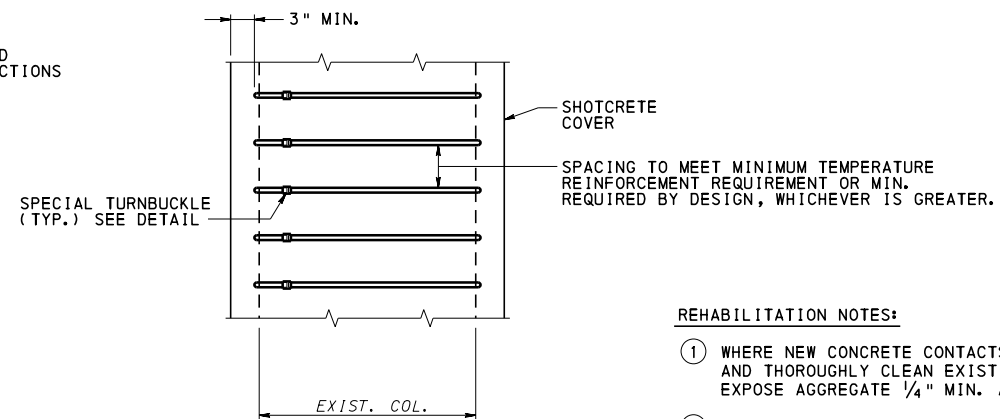


**ELEVATION**

**TYPE 2**



**CROSS SECTION**

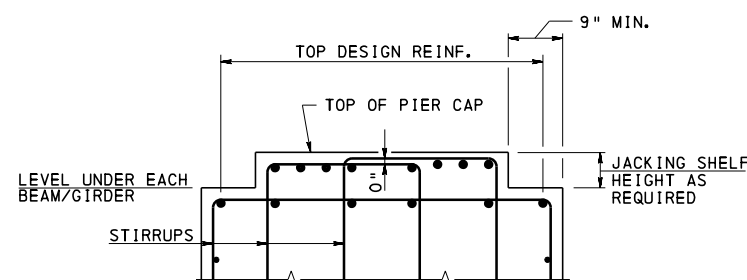


**ELEVATION**

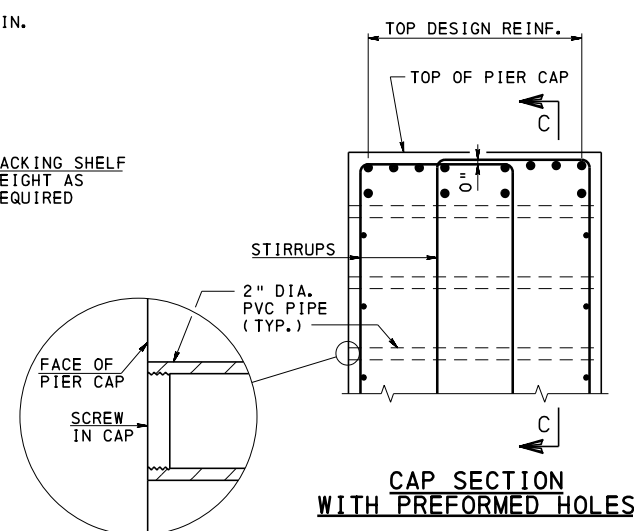
**TYPE 3**

**REHABILITATION NOTES:**

- WHERE NEW CONCRETE CONTACTS EXISTING CONCRETE, SANDBLAST AND THOROUGHLY CLEAN EXISTING CONCRETE SURFACE TO PARTIALLY EXPOSE AGGREGATE 1/4" MIN. AND APPLY EPOXY BONDING COMPOUND.
- THE CONTRACTOR IS RESPONSIBLE FOR LOCATING THE EXISTING BARS PRIOR TO DRILLING DOWEL HOLES. ADJUST SPACING AS REQUIRED.
- CONTRACTOR IS RESPONSIBLE FOR FINAL REINFORCEMENT BAR LENGTHS.
- DOWEL BAR TO ENGAGE NEW VERTICAL COLUMN REINFORCEMENT.
- DRILL HOLES OF PROPER DIAMETER AND DEPTH IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

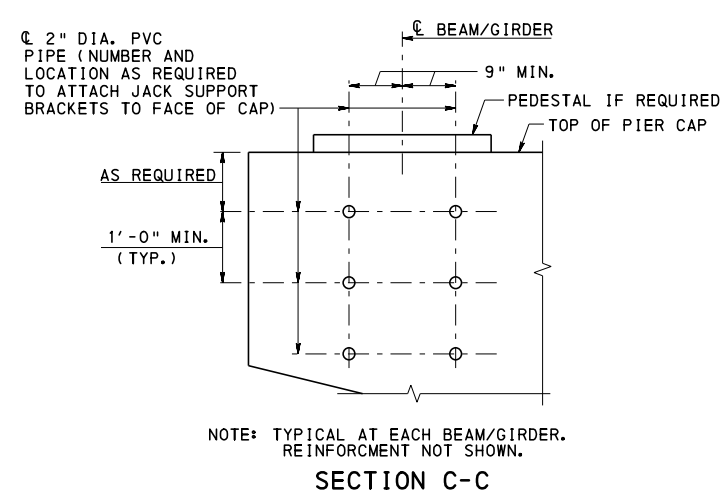


**CAP SECTION WITH JACKING SHELF**



**CAP SECTION WITH PREFORMED HOLES**

**FUTURE SUPERSTRUCTURE JACKING DETAILS**



**SECTION C-C**

**JACKING NOTES:**

- JACKING LOAD TO CONSIST OF SUPERSTRUCTURE DEAD LOAD ONLY
- SPACE 2" PVC PIPE TO CLEAR ANCHOR BOLTS AND PIER CAP REINFORCEMENT.

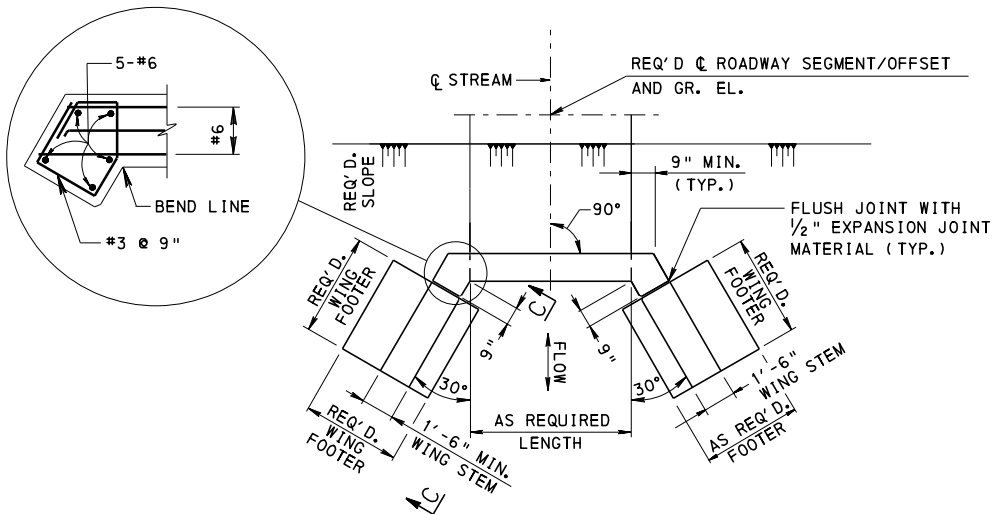
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
 BRIDGE OFFICE

**STANDARD**  
**REINFORCED CONCRETE PIERS**  
**REHABILITATION AND JACKING**  
**DETAILS**

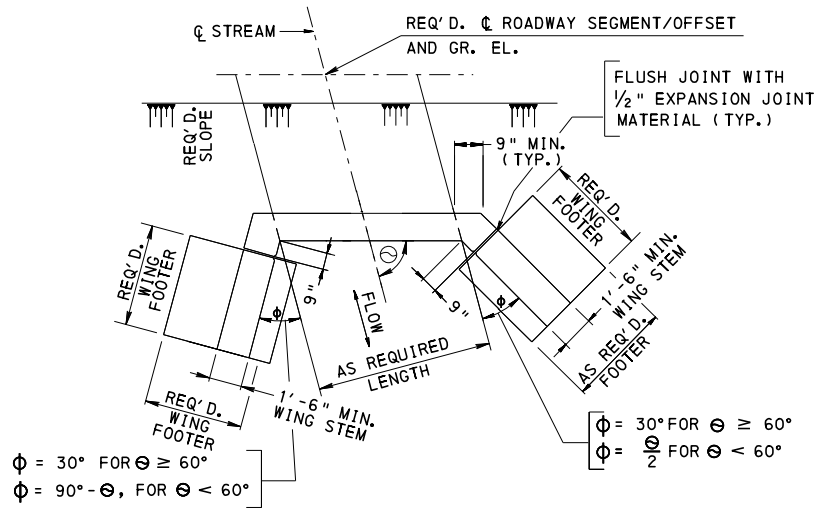
RECOMMENDED NOV. 23, 2022  
 L. L. W. G.  
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
 G. E. Gray  
 CHIEF ENGINEER, HIGHWAY ADMIN.

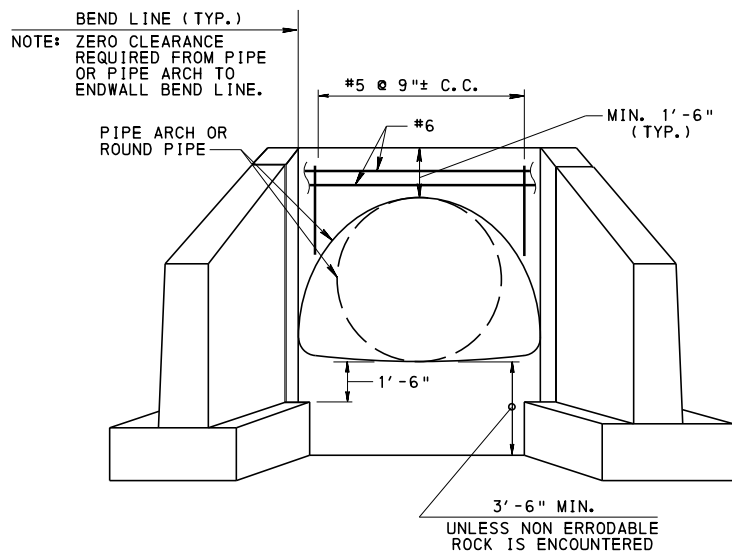
SHEET 15 OF 15  
 BD-629M



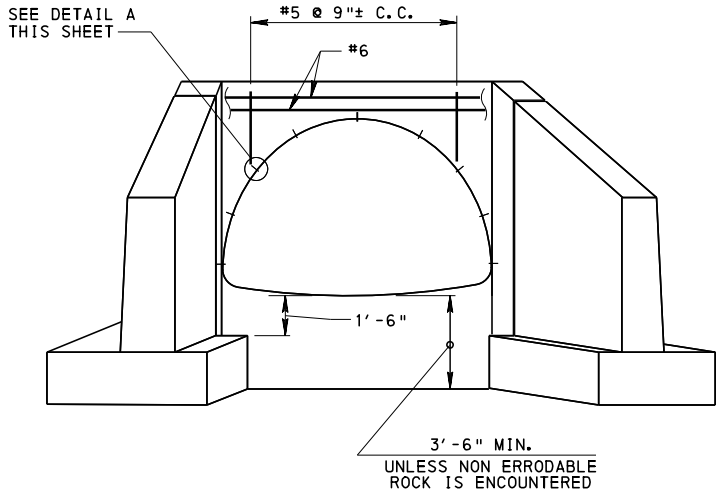
ENDWALL PLAN



ENDWALL PLAN-SKEWED CULVERT  
AND PLATE PIPE ARCH

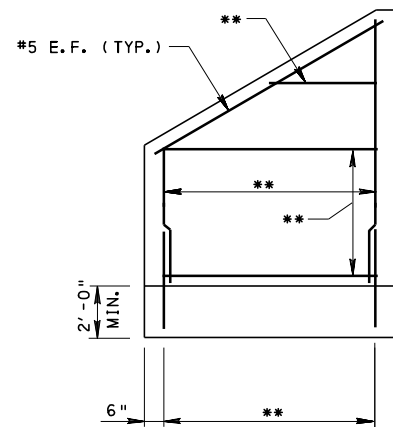


ENDWALL ELEVATION

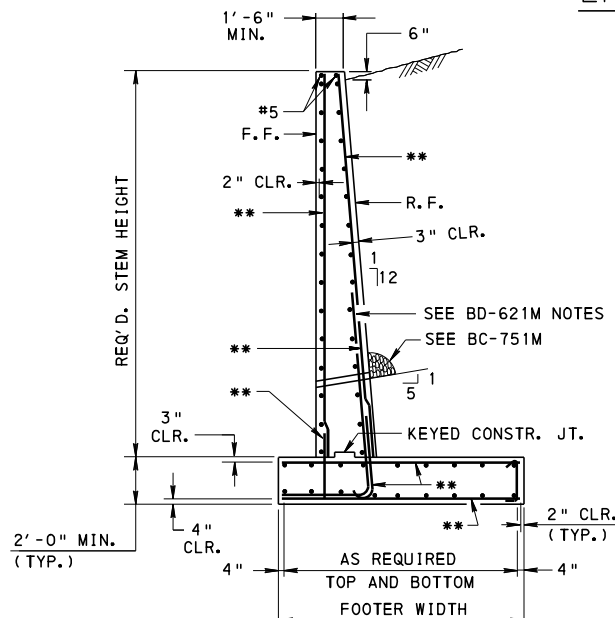


ENDWALL ELEVATION-SKEWED CULVERT  
AND PLATE PIPE ARCH

NOTE: FOR OPTIONAL APRON DETAIL  
SEE BD-632M SHEET 1.

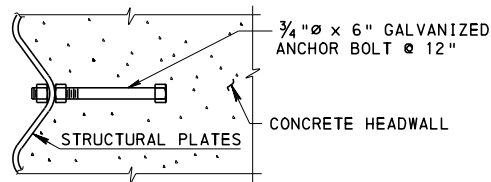


SECTION C-C  
\*\* SEE NOTE 12



TYPICAL WING SECTION

\*\* SEE NOTE 12  
BATTER NOT REQUIRED IF STEM  
HEIGHT IS LESS THAN 12'-0"



DETAIL A  
METAL STRUCTURAL PLATE  
ANCHORAGE

|                    |                                               |
|--------------------|-----------------------------------------------|
| RC-51M             | TYPE 31 STRONG POST GUIDE RAIL                |
| BD-621M            | REINFORCED CONCRETE ABUTMENTS                 |
| BD-625M            | WINGWALL LENGTH                               |
| BD-632M            | R. C. BOX CULVERT                             |
| BC-735M            | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS         |
| BC-751M            | BRIDGE DRAINAGE                               |
| REFERENCE DRAWINGS |                                               |

NOTES:

- ALL REINFORCEMENT AND GALVANIZED ANCHOR BOLT STEEL BAR DETAILS MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706.
- DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATION AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
- PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH OF REINFORCEMENT AND ANCHORS IN ACCORDANCE WITH AASHTO LRFD SPECIFICATIONS: SEE BC-736M.
- INDICATE ALLOWABLE AND MAXIMUM DESIGN FOUNDATION PRESSURE FOR HEADWALL AND WINGWALL, AND COEFFICIENT OF FRICTION FOR WINGWALLS.
- PLACE HEADWALL AND WINGWALL FOOTINGS BELOW THE SCOUR DEPTH OR FROST DEPTH WHICHEVER IS GREATER.
- PROVIDE ROCK PROTECTION AT INLET AND OUTLET ENDS AND BEYOND THE ENDS OF THE WINGS. THIS CRITERIA ALSO APPLIES WHEN A 6" REINFORCED CONCRETE APRON IS USED.
- IF THE LENGTH OF THE WINGWALL IS LESS THAN OR EQUAL TO 10', THE HEADWALL AND THE WINGWALL (NOT THE FOOTING) MAY BE PLACED IN ONE CONTINUOUS OPERATION. IN SUCH CASES THE HORIZONTAL STEEL OF BOTH WALLS MUST BE MADE CONTINUOUS BY ADEQUATE LAPS OR BENDS.
- FOR WEEP HOLE REINFORCEMENT DETAIL SEE BD-621M.
- FOR PA 3-RAIL BRIDGE BARRIER ATTACHMENT & CORRESPONDING HEADWALL REINFORCEMENT DETAILS FOR FILLS 2'-0" OR LESS, SEE BD-632M.
- ALL END WALL AND EMBANKMENT SLOPE DIMENSIONS AND DATA TO BE SUPPLIED ON THE CONSTRUCTION PLAN BY THE DESIGNER.
- PROVIDE WINGWALL REINFORCEMENT EACH FACE AS PER SPECIFIC DESIGN WITH MINIMUM #5 @ 18" EACH FACE.
- USE CLASS A CEMENT CONCRETE IN WING WALL, FOOTING, AND HEADWALLS.
- USE EPOXY COATED REINFORCEMENT FOR APPLICABLE SOIL AND WATER PH CONDITIONS.

DESIGN DATA FOR ENDWALL

- $f'_c = 3000$  P.S.I. FOR CONCRETE (USE CLASS A CEMENT CONCRETE)
- $f_y = 60,000$  P.S.I. FOR REINFORCEMENT BARS
- DENSITY OF BACKFILL MATERIAL = 120 LB/FT<sup>3</sup>
- DENSITY OF CONCRETE = 150 LB/FT<sup>3</sup>
- EQUIVALENT FLUID EARTH PRESSURE = 35 LB/FT<sup>2</sup>/FT OF DEPTH.
- LIVE LOAD SURCHARGE : REFER TO DESIGN MANUAL PART 4.

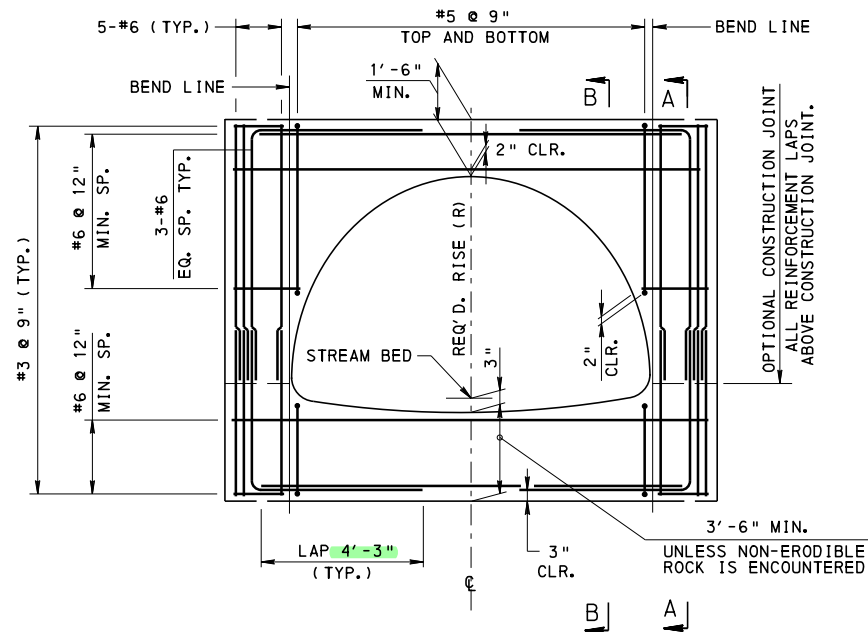
LEGEND

- CLR. : DENOTES CLEAR
- ⊙ : DENOTES SKEW ANGLE
- E.F. : DENOTES EACH FACE
- F.F. : DENOTES FRONT FACE
- R.F. : DENOTES REAR FACE
- GR. EL. : DENOTES GRADE ELEVATION
- REQ'D. : DENOTES REQUIRED AS DESIGNED DETAILS DIMENSIONED ON CONSTRUCTION PLAN

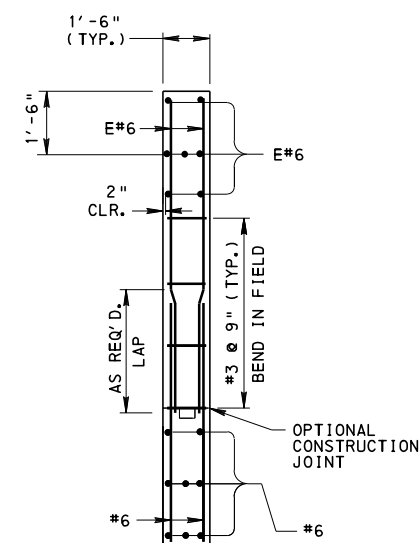
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
END WALL DETAILS  
FOR CULVERTS

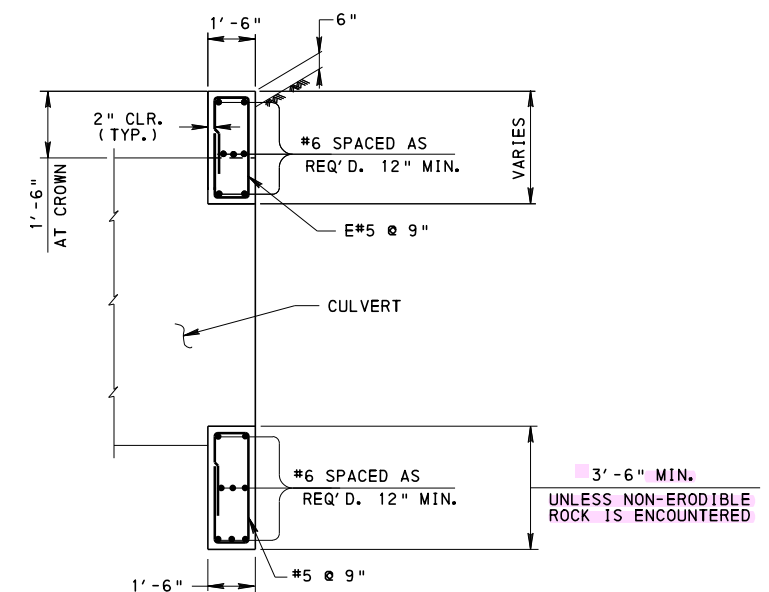
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|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|
| RECOMMENDED FEB. 14, 2023<br><i>L. W. Gray</i><br>CHIEF BRIDGE ENGINEER | RECOMMENDED FEB. 14, 2023<br><i>Gavin E. Gray</i><br>CHIEF ENGINEER, HIGHWAY ADMINISTRATION | SHEET 1 OF 2<br>BD-631M |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|



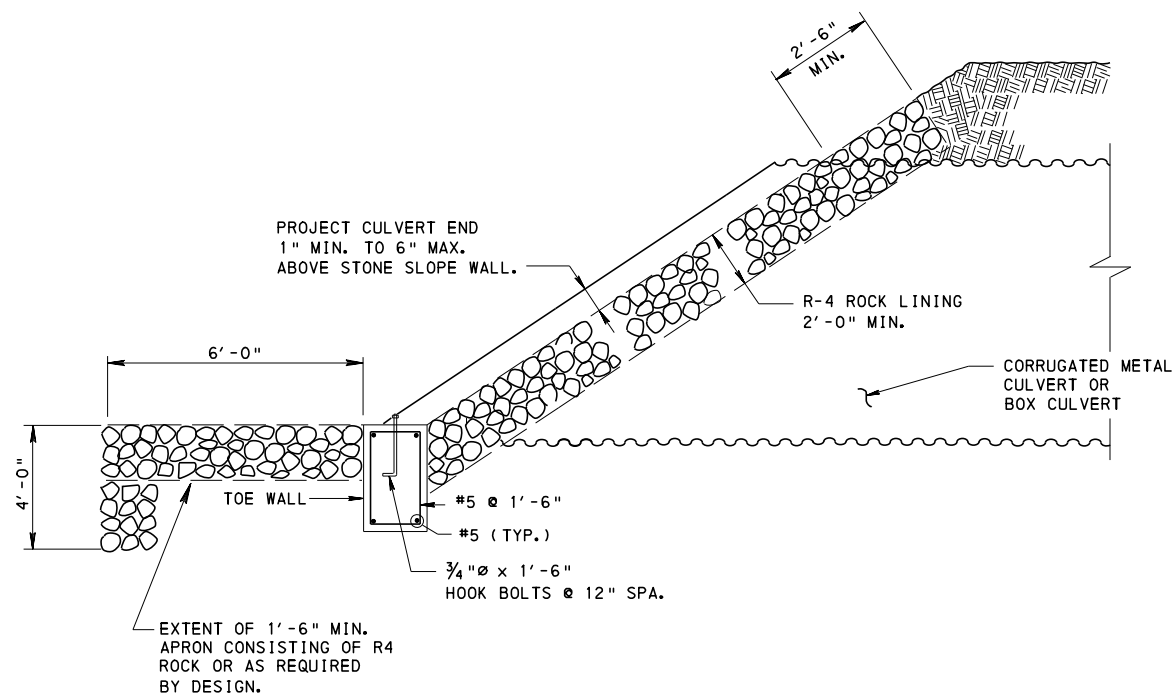
TYPICAL HEADWALL ELEVATION



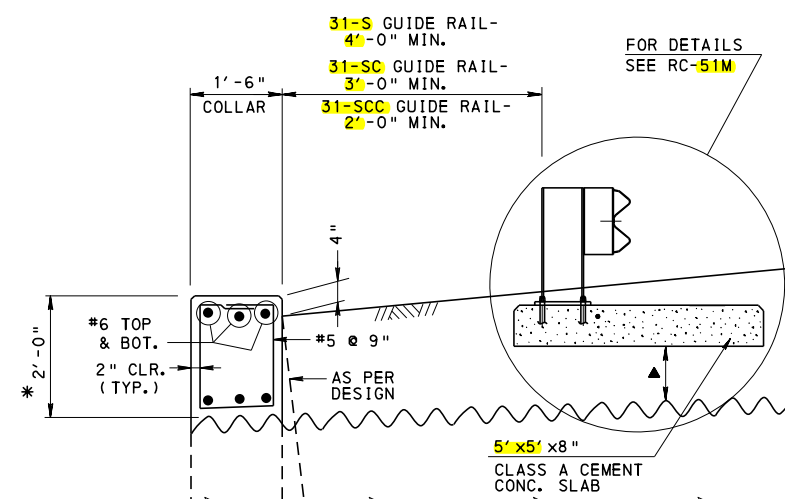
SECTION A-A  
ADJACENT TO CULVERT



SECTION B-B  
THRU CULVERT



ROCK LINING END WALL  
SLOPED END CONDITION



TYPICAL SECTION  
(METAL CULVERTS)

▲ REFER TO DETAIL IN RC-51M FOR "STEEL POSTS OVER UNDERGROUND STRUCTURES" WHEN THIS DIMENSION EXCEEDS 2'-0".

\* WHEN THIS DIMENSION EXCEEDS 2'-0" CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN.

**LEGEND**  
CLR. : DENOTES CLEAR  
EQ. SP. : DENOTES EQUAL SPACING  
REQ'D. : DENOTES REQUIRED AS DESIGNED DETAILS DIMENSIONED ON CONSTRUCTION PLAN

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

**STANDARD  
END WALL DETAILS  
FOR METAL CULVERTS**

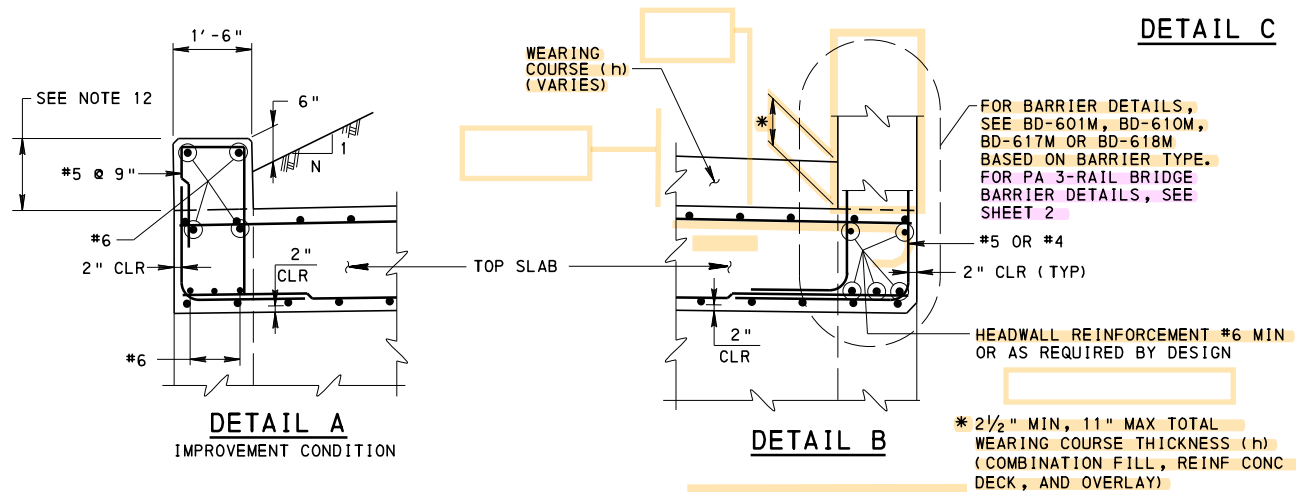
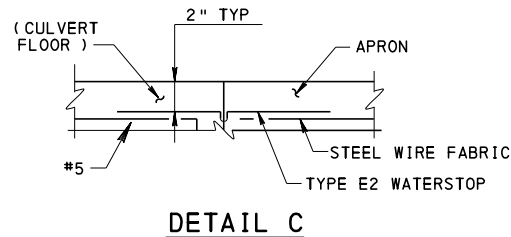
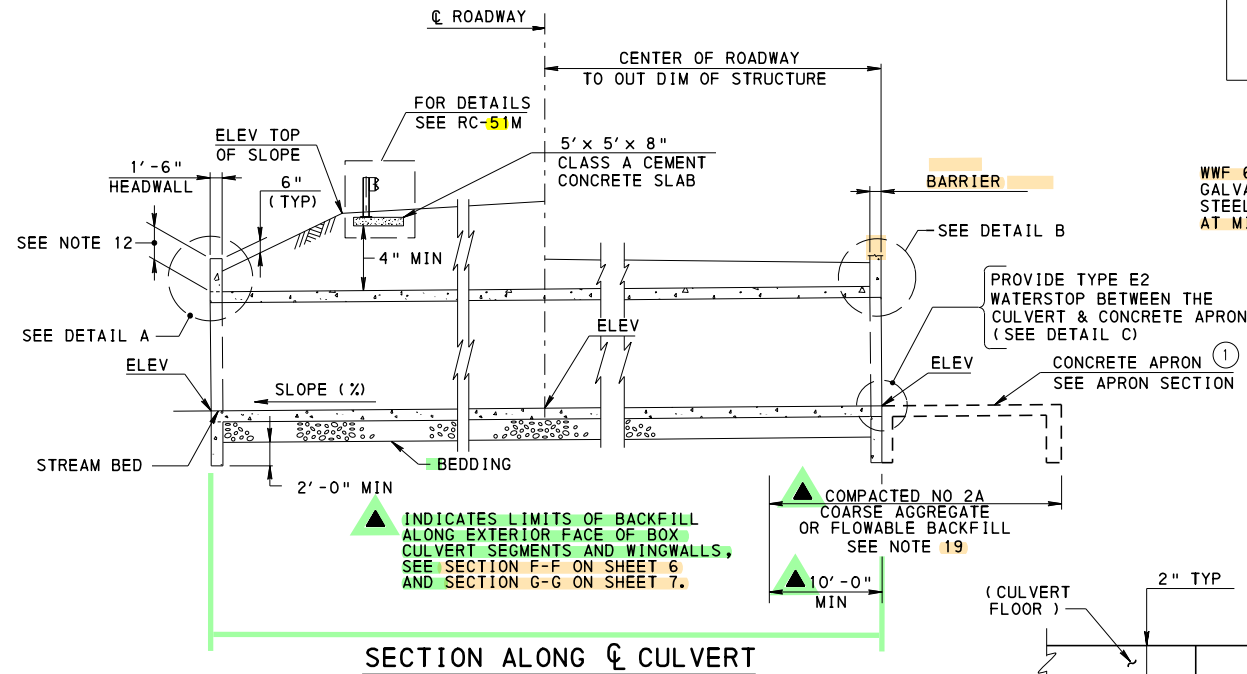
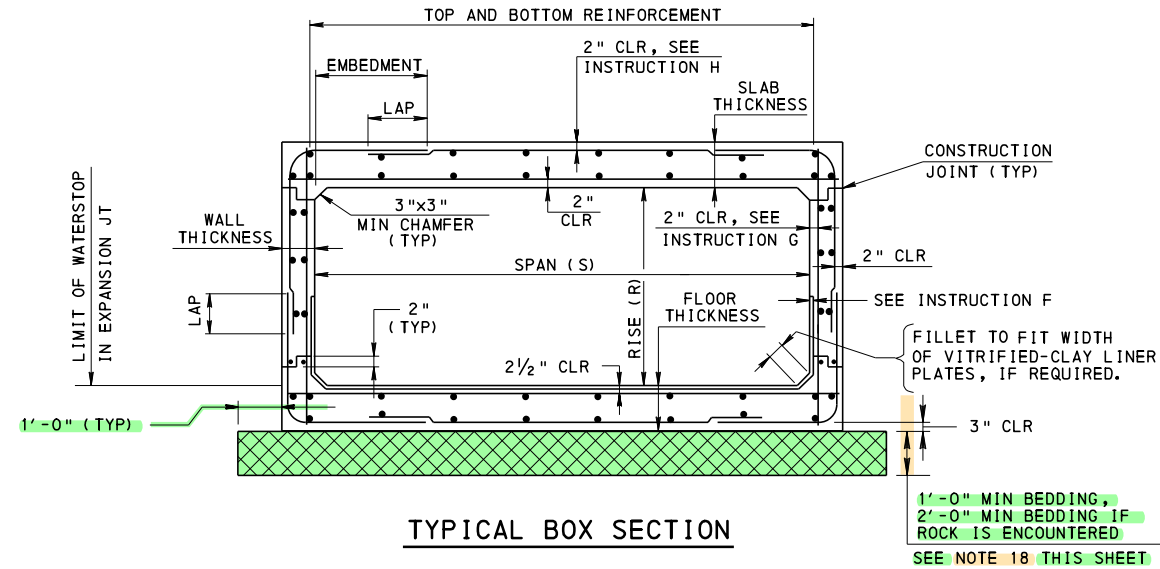
RECOMMENDED FEB. 14, 2023  
*L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023  
*Grain E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 2  
BD-631M



- CHANGE 1
- CHANGE 2
- CHANGE 5
- CHANGE 6
- CHANGE 7

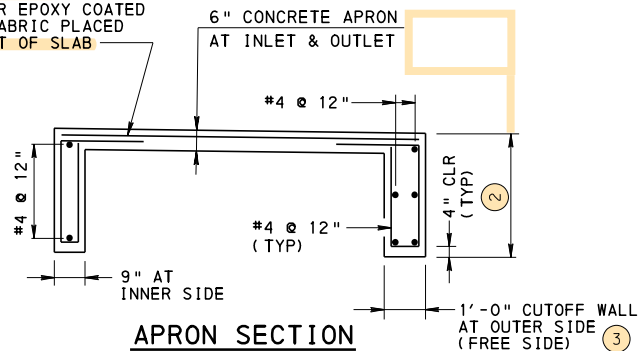


### DESIGN DATA FOR CAST-IN-PLACE BOX CULVERT

- $f'c = 3000$  PSI FOR CLASS A CEMENT CONCRETE
- $f'c = 4000$  PSI FOR TOP SLAB AT GRADE (CLASS AAAP CEMENT CONCRETE)
- $f_y = 60,000$  PSI FOR REINFORCEMENT BARS
- $f_y = 70,000$  PSI FOR PLAIN WELDED WIRE FABRIC
- $f_y = 75,000$  PSI FOR DEFORMED WELDED WIRE FABRIC

### INSTRUCTIONS

- MINIMUM SLAB THICKNESS = 10"
- MINIMUM WALL THICKNESS = 10" FOR RISE  $< 5'-0"$
- MINIMUM WALL THICKNESS = 1'-0" FOR RISE  $> 5'-0"$
- ADD  $1\frac{1}{2}"$  ( $\frac{1}{2}"$  AT THE TOP AND  $1"$  AT BOTTOM) TO THE EFFECTIVE DESIGN THICKNESS OF BOTTOM SLAB OF BOX CULVERTS, FOR THE TOTAL (PROVIDED) THICKNESS.
- FOR BOX CULVERTS AT GRADE, ADD  $\frac{1}{2}"$  INTEGRAL WEARING SURFACE TO THE TOP DECK SLAB THICKNESS.
- IF SPECIFIED, VITRIFIED-CLAY LINER PLATES WITH TYPE B POINTING (INCLUDE COST IN THE PRICE OF CONCRETE TO WHICH ATTACHED.)
- 3" CLEAR IF LINER PLATES ARE USED
- $2\frac{1}{2}"$  CLEAR IF AT GRADE
- PLACE MAIN CIRCUMFERENTIAL REINFORCEMENT NORMAL TO THE CENTERLINE OF THE CULVERT.
- PROVIDE EXPANSION JOINTS AT APPROXIMATELY 90' INTERVALS AND CONSTRUCTION JOINTS AT APPROXIMATELY 30' INTERVALS. PROVIDE EXPANSION JOINTS IN BOTTOM SLAB.
- FOR ADDITIONAL WELDED WIRE FABRIC INFORMATION, SEE SHEET 5.



### ABBREVIATIONS

EF : DENOTES EACH FACE  
FF : DENOTES FRONT FACE  
RF : DENOTES REAR FACE  
ELEV : DENOTES ELEVATION  
CIP : DENOTES CAST-IN-PLACE  
BB : DENOTES BACK BATTER  
RC : DENOTES REINFORCED CONCRETE

| RC-50M             | GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS      |
|--------------------|-----------------------------------------------|
| RC-51M             | TYPE 31 STRONG POST GUIDE RAIL                |
| BD-601M            | CONCRETE DECK SLAB                            |
| BD-609M            | PA 3-RAIL BRIDGE BARRIER                      |
| BD-610M            | PA BRIDGE BARRIER                             |
| BD-617M            | PA TYPE 10M BRIDGE BARRIER                    |
| BD-621M            | REINFORCED CONCRETE ABUTMENTS                 |
| BD-622M            | RC ABUTMENTS WITH BACKWALL                    |
| BD-624M            | RC ABUTMENTS WITHOUT BACKWALL                 |
| BD-625M            | WINGWALL LENGTH                               |
| BD-631M            | END WALL DETAILS                              |
| BC-706M            | PA 3-RAIL BRIDGE BARRIER                      |
| BC-734M            | ANCHOR SYSTEMS                                |
| BC-735M            | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS         |
| BC-751M            | BRIDGE DRAINAGE                               |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS   |
| BC-798M            | MECHANICAL CONNECTION DETAILS                 |
| REFERENCE DRAWINGS |                                               |

### NOTES

- PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A615, A996 OR A706. DO NOT WELD REINFORCEMENT STEEL DO NOT USE RAIL STEEL (A996) WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
- DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
- DEAD LOADS: INCLUDES SURFACE AREA DENSITY OF 30 PSF FOR FUTURE WEARING SURFACE FOR BOXES AT GRADE.
- USE EPOXY COATED REINFORCEMENT BARS IN THE FOLLOWING CONDITIONS:
  - TOP SLAB AND HEADWALL WITHIN 2'-0" OF GRADE.
  - ALL CURBS AND BARRIERS.
  - THROUGHOUT THE CULVERT WHEN VITRIFIED CLAY LINER PLATES ARE USED.
  - IN ALL APRON SLABS.
- PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED.
- FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
- FOR LOW FLOW FISH PASSAGE DESIGN COMMENTARY REFER TO DESIGN MANUAL, PART 2.
- INDICATE FACTORED BEARING RESISTANCE AND MAXIMUM DESIGN FOUNDATION PRESSURE ON THE PLANS.
- PLACE HEADWALLS, APRON WALLS AND WINGWALL FOOTINGS BELOW FROST DEPTH OR 3'-6" WHICHEVER IS GREATER.
- USE 4" DIAMETER FORMED WEEP HOLES AT 15'-0" MAXIMUM CENTERS PLACED AT A MINIMUM 1'-9" ABOVE BOTTOM OF SLAB OR 6" ABOVE NORMAL FLOW LINE, FOR DETAILS SEE BC-751M. FOR WEEP HOLES LOCATED IN THE COMPACTED NO 2A COARSE AGGREGATE AREAS OR FLOWABLE BACKFILL AREAS, PROVIDE PREFORMED DRAIN CONFORMING TO PUBLICATION 408 SECTION 623.2(a), WHICH IS 2'-0" MINIMUM HIGH x 4'-0" WIDE CENTERED HORIZONTALLY ON WEEP HOLE, SEE PREFORMED DRAIN DETAIL ON SHEET 6.
- CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN IF HEIGHT IS GREATER THAN 2'-0".
- USE THIS STANDARD DRAWING IN CONJUNCTION WITH THE APPLICABLE ROADWAY CONSTRUCTION STANDARDS FOR GUIDE RAIL.
- REFER TO DESIGN DRAWINGS FOR SPACING OF POSTS.
- THOROUGHLY COAT ALL SURFACES OF THE BASE PLATES IN CONTACT WITH CONCRETE WITH CAULKING COMPOUNDS PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN THE METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND MEETING THE REQUIREMENTS OF PUBLICATION 408, SECTION 705.
- FOR JOINT DETAILS SEE BC-735M. WHEN EXPANSION JOINTS ARE USED, WATERSTOPS ARE REQUIRED IN THE TOP AND BOTTOM SLABS AND THE WALLS.
- FOR BARRIER TRANSITION DETAILS, SEE SHEET 4.
- INDICATES ADDITIONAL EXCAVATION FOR BEDDING MATERIAL BELOW THE BOTTOM OF RC BOX CULVERT WITH LIMITS AS SHOWN. BACKFILL WITH 2A OR #8 COARSE AGGREGATE. LEVEL BEARING AREA FOR PRECAST BOX SEGMENT WITH MINIMUM THICKNESS OF FINE AGGREGATE.
- PROVIDE COMPACTED NO 2A COARSE AGGREGATE BACKFILL OR TYPE B FLOWABLE BACKFILL AT INLET END OF CULVERTS FOR A MINIMUM LENGTH OF 10'-0" PLUS WINGWALLS. HEIGHT OF COMPACTED NO 2A COARSE AGGREGATE OR FLOWABLE BACKFILL IS A MINIMUM OF 2'-0" ABOVE NORMAL STREAM. ELEVATION EXTENDING TO THE BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER, 3'-6" MINIMUM.
- CLASS A TYPE 4 GEOTEXTILE IS PERMITTED TO BE PLACED BETWEEN THE BEDDING MATERIAL AND EXCAVATION OR TO ENCASE THE BEDDING MATERIAL.
- THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3.

### LEGEND

- USE APRON AT INLET AND OUTLET IF WARRANTED. SEE APRON SECTION THIS SHEET. FOR ALTERNATE DESIGN BY CONTRACTOR, PROVIDE THE APRONS ON THE PLANS.
- EXTEND CUTOFF WALL TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING, WHICHEVER IS DEEPER, 3'-6" MIN FROM TOP OF CULVERT BOTTOM SLAB. SEE NOTE 10.
- AN ALTERNATE CUTOFF WALL WITH GROUTED ROCK IS PERMITTED, SEE DETAILS ON SHEET 7.

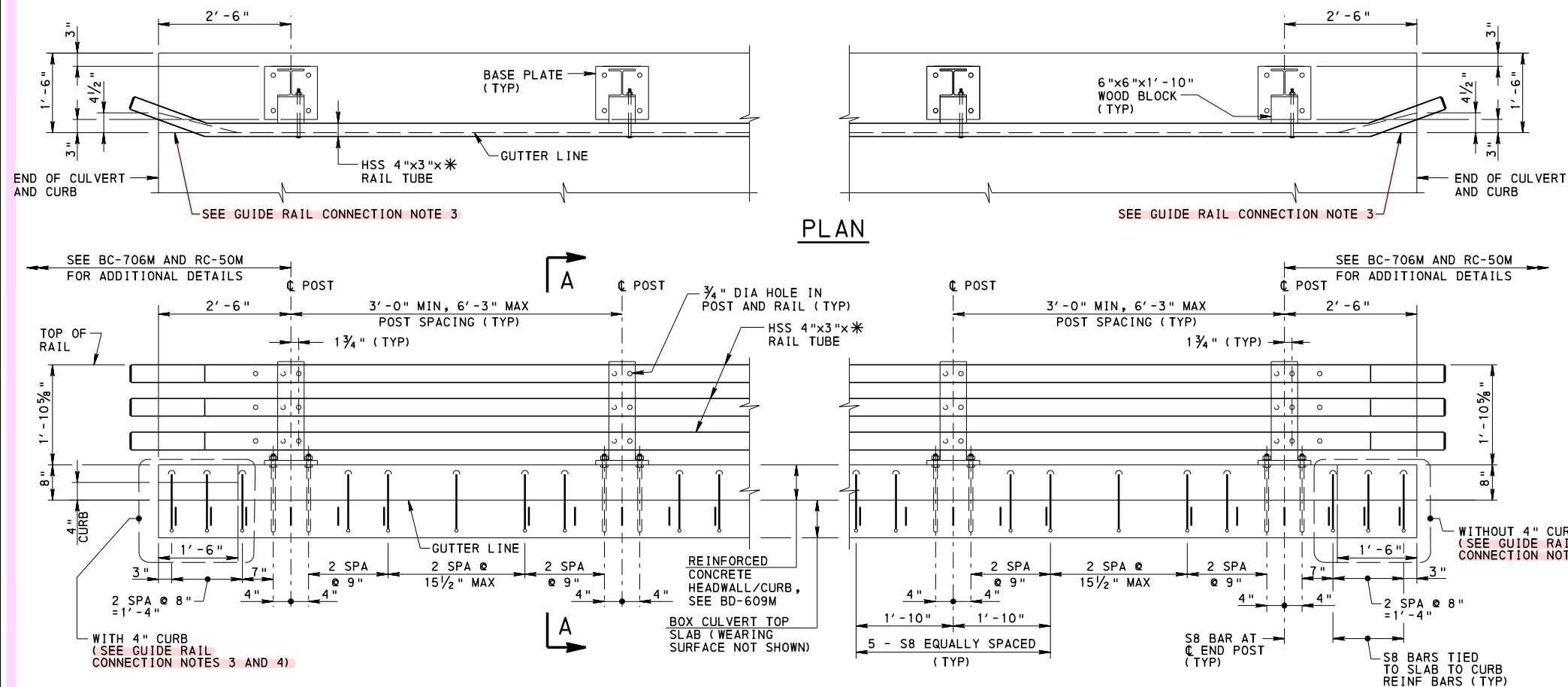
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC BOX CULVERT  
CAST-IN-PLACE

RECOMMENDED OCT. 7, 2024  
Chief Bridge Engineer

RECOMMENDED OCT. 7, 2024  
Chief Engineer, Highway Admin.

SHEET 1 OF 16  
BD-632M

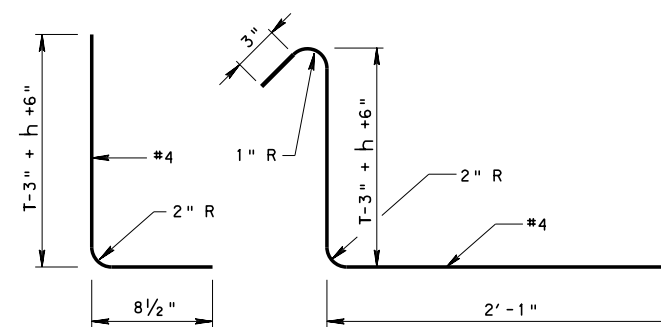


# GUIDE RAIL CONNECTION NOTES:

- ON UNDIVIDED HIGHWAYS WITH TWO-WAY TRAFFIC, PROVIDE END TRANSITIONS THAT CONNECT TO A THRIE-BEAM GUIDE RAIL.
- ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS, PROVIDE APPROACH END TRANSITIONS THAT CONNECT TO A THRIE-BEAM GUIDE RAIL AND PROVIDE TRAILING END TRANSITIONS THAT CONNECT TO A W-BEAM GUIDE RAIL IF WARRANTED BY THE LENGTH OF NEED OF OTHER OBSTRUCTIONS.
- END CHAMFER ON THE CURB IS NOT REQUIRED ON THE TRAILING END OF THE CURB ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL.
- 4" CURB AT THE END OF THE CURB IS NOT REQUIRED ON THE TRAILING END OF THE CURB ON DIVIDED HIGHWAYS AND ONE-WAY ROADWAYS WHEN CONNECTING TO A W-BEAM GUIDE RAIL, UNLESS CURB IS PROVIDED ALONG THE ROADWAY.

## PA 3-RAIL BRIDGE BARRIER ELEVATION ALONG TOP SLAB OF CULVERT

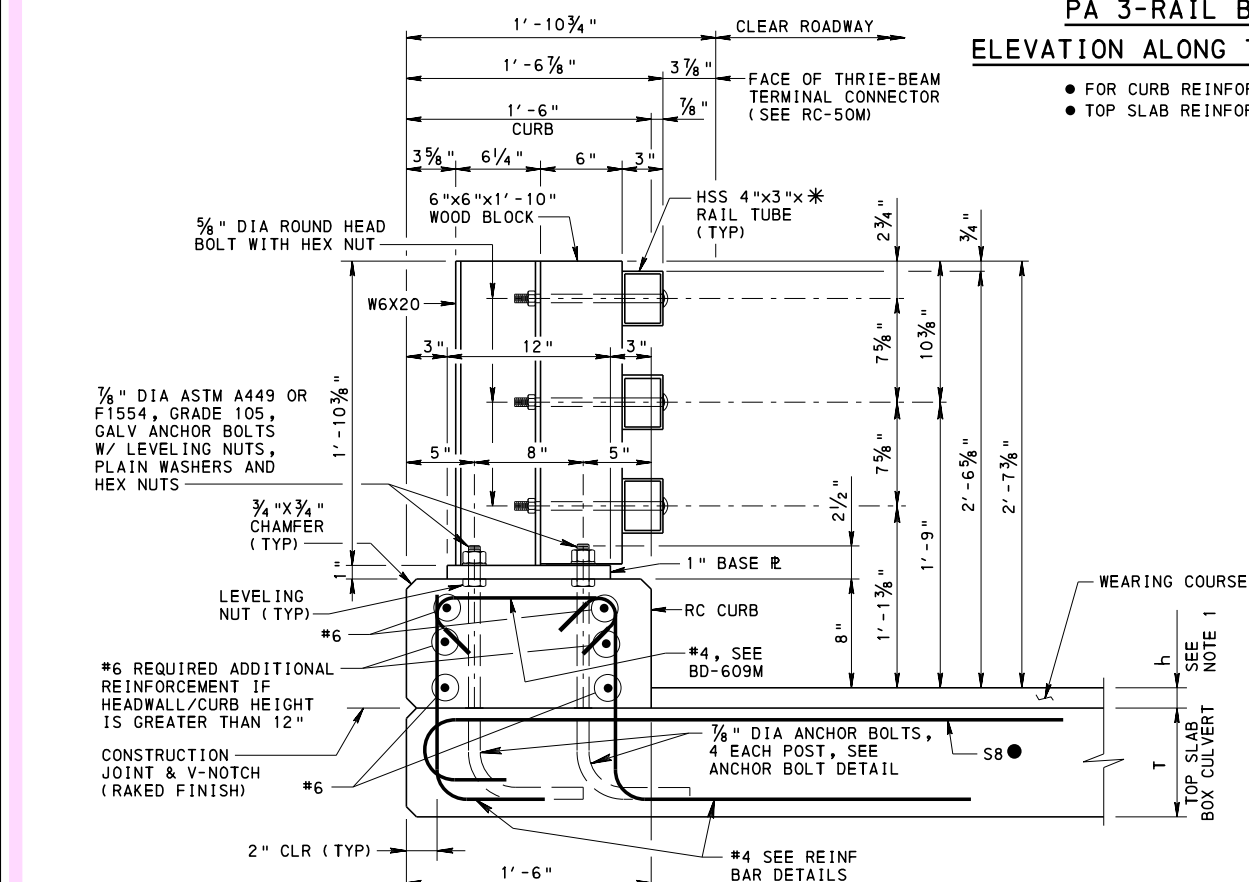
- FOR CURB REINFORCEMENT SEE BD-609M.
- TOP SLAB REINFORCEMENT AS DESIGNED.



## SLAB TO CURB REINFORCEMENT BAR DETAILS

### NOTES:

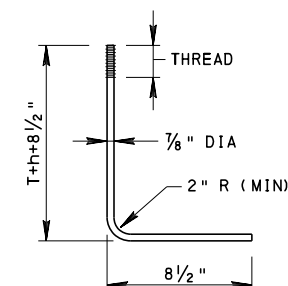
- 2 1/2" MIN, 11" MAX TOTAL WEARING COURSE THICKNESS (h) (COMBINATION FILL AND OVERLAY)



## SECTION A-A

- S8 REINFORCEMENT REQUIRED AT POST LOCATIONS AND ENDS ONLY. SEE SHEET 9 FOR SLAB REINFORCEMENT BAR DETAILS.

\* FOR TUBE THICKNESS, SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.



## ANCHOR BOLT DETAIL

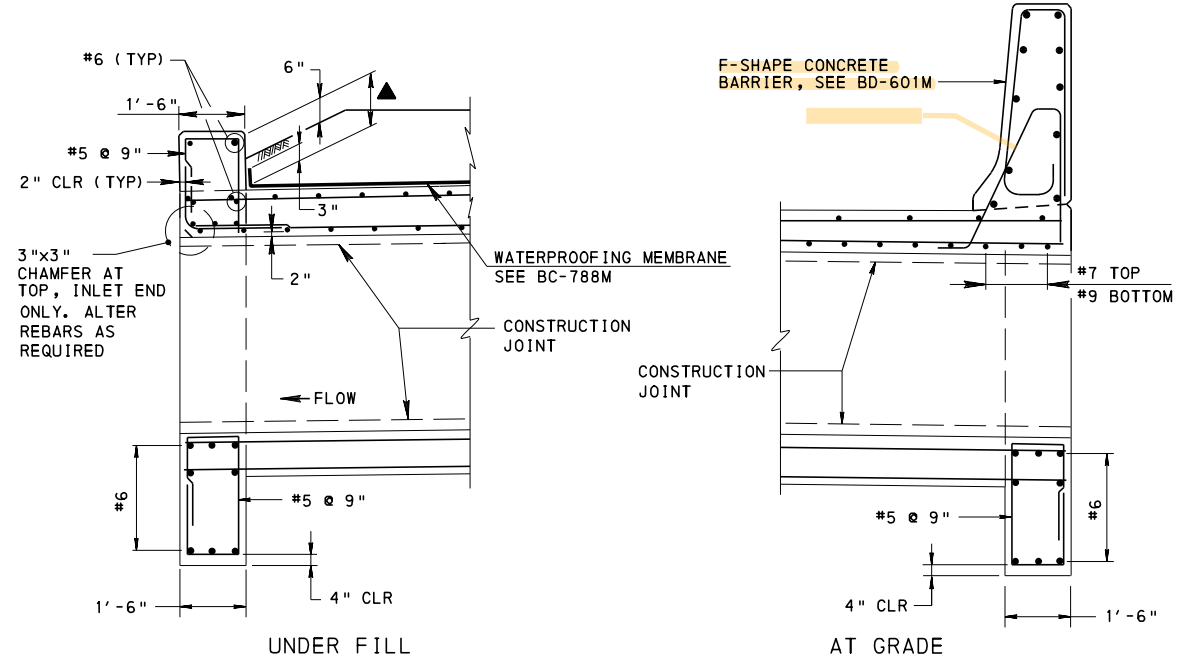
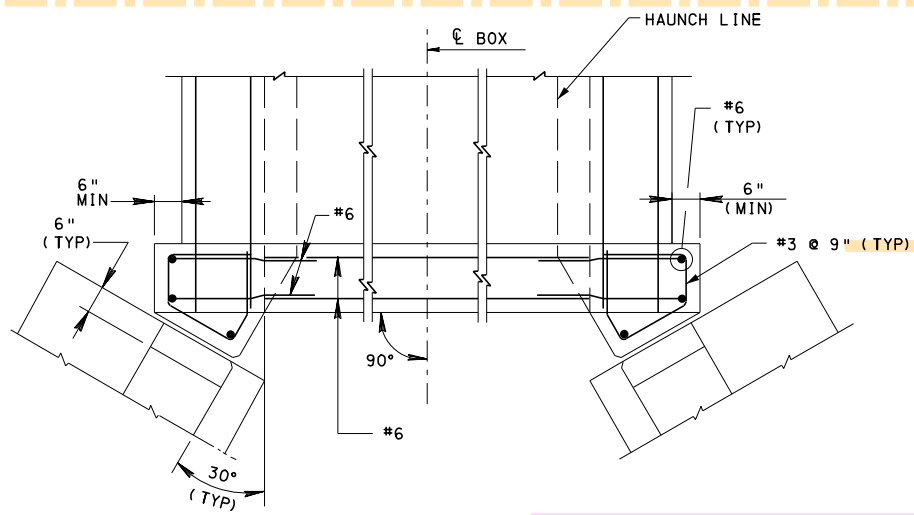
## COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

## STANDARD RC BOX CULVERT CAST-IN-PLACE

RECOMMENDED OCT. 7, 2024  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 16  
BD-632M

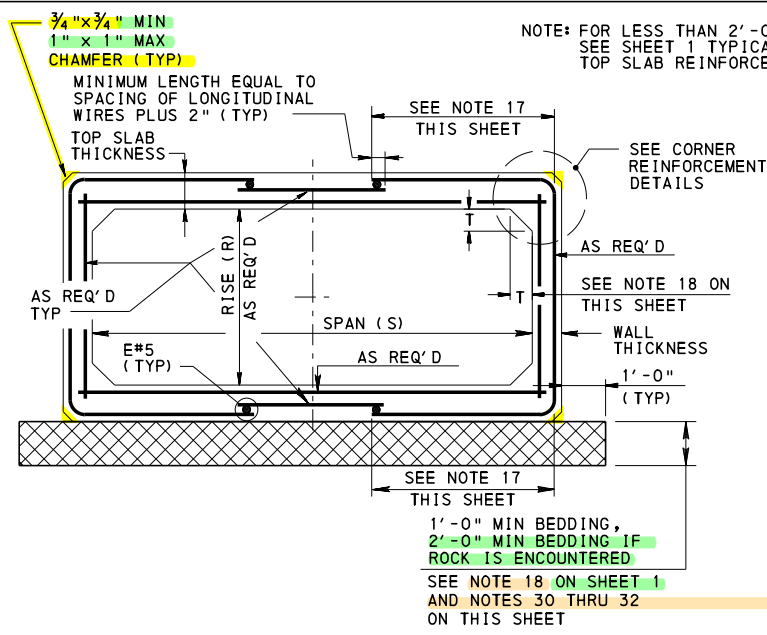


### TYPICAL HEADWALL SECTIONS

- LEGEND:**
- $\ominus$  = SKEW ANGLE  
 $\phi_1 = 30^\circ$  FOR  $\ominus \geq 60^\circ$   
 $\phi_1 = \frac{\ominus}{2}$  FOR  $\ominus < 60^\circ$   
 $\phi_2 = 30^\circ$  FOR  $\ominus \geq 60^\circ$   
 $\phi_2 = 90^\circ - \ominus$  FOR  $\ominus < 60^\circ$   
 ▲ SEE NOTE 12, SHEET 1.

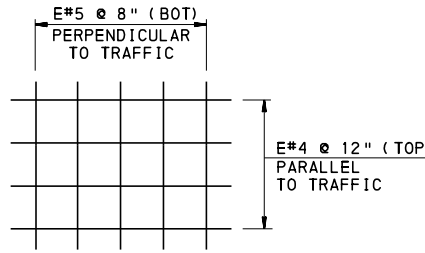




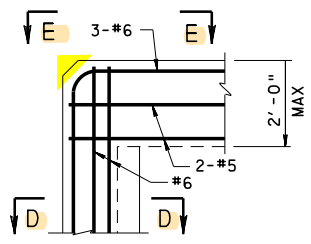


**BOX DETAILS - WELDED WIRE FABRIC**

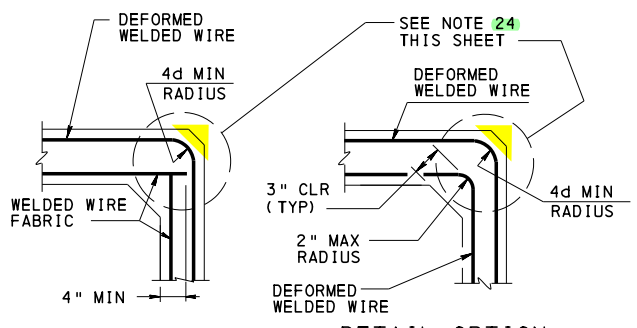
(FOR 2'-0" OR MORE OF COVER)  
SEE BC-798M FOR POST TENSION STRAND DETAILS



**TYPICAL DECK REINFORCEMENT**



**COLLAR CORNER DETAILS**

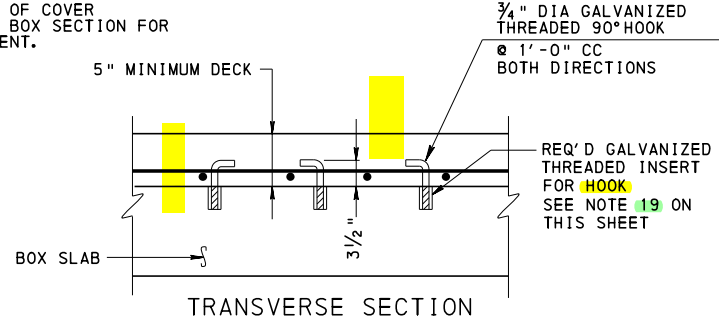


**CORNER REINFORCEMENT DETAILS**

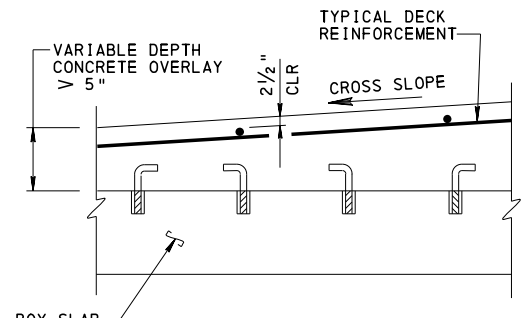
WELDED WIRE FABRIC

**NOTES:**

- FOR LESS THAN 2'-0" OF COVER SEE SHEET 1 TYPICAL BOX SECTION FOR TOP SLAB REINFORCEMENT.
- FOR POST TENSIONING DETAILS, SEE BC-798M.



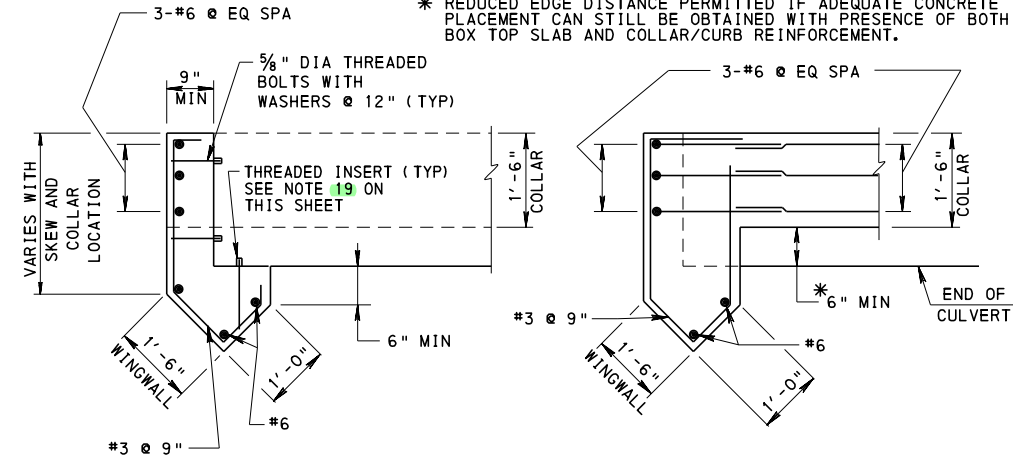
**TRANSVERSE SECTION**



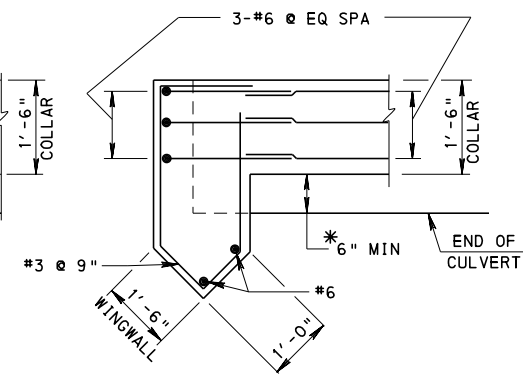
**LONGITUDINAL SECTION**

**DECK CONNECTION DETAILS**

\* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND COLLAR/CURB REINFORCEMENT.



**SECTION D-D**



**SECTION E-E**

**DESIGN DATA:**

- $f'c = 5000$  PSI MINIMUM FOR CONCRETE
- $f'c = 3000$  PSI MINIMUM FOR FISH BAFFLES/WEIRS
- $f'c = 2000$  PSI MINIMUM FOR MUD SLABS
- $f_y = 60,000$  PSI FOR STEEL REINFORCING BARS
- $f_y = 70,000$  PSI FOR PLAIN WELDED WIRE FABRIC (IN FLAT SHEET)
- $f_y = 75,000$  PSI FOR DEFORMED WELDED WIRE FABRIC

**INSTRUCTIONS:**

| SPAN S | POST TENSIONING DUCT LOCATION | MINIMUM SLAB OR WALL THICKNESS |
|--------|-------------------------------|--------------------------------|
| 8'-12' | HAUNCH                        | S/12                           |
| > 12'  | HAUNCH OR WALL                | 13"                            |

- MINIMUM COVER FOR WELDED WIRE FABRIC :
  1. PROVIDE 1 1/2", EXCEPT 2" FOR THE TOP WIRES OF THE TOP SLAB WHERE BOX FILL HEIGHT IS LESS THAN 2'-0".
  2. USE 1/2" MORE COVER FOR THE TOP WIRES OF THE BOTTOM SLAB.
- MINIMUM COVER FOR CONVENTIONAL REINFORCEMENT BARS: PROVIDE 2" FOR THE TOP BARS OF TOP AND BOTTOM SLABS, AND 1 1/2" FOR ALL OTHER BARS, EXCEPT USE 2 1/2" FOR TOP BARS WHEN SLAB IS AT GRADE.
- FOR WELDED WIRE FABRIC, SPACE CIRCUMFERENTIAL WIRES CENTER TO CENTER NOT LESS THAN 2" OR MORE THAN 4", AND SPACE LONGITUDINAL WIRES CENTER TO CENTER NOT MORE THAN 8".

REFER TO SHEET 15 FOR END SECTION SKEW ORIENTATION REQUIREMENTS.

**NOTES**

1. PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A615, A996 OR A706. DO NOT WELD REINFORCEMENT STEEL/DO NOT USE RAIL STEEL (A996) WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. WELDED WIRE FABRIC WILL MEET THE REQUIREMENTS OF ASTM A1064 GRADE 70, AND DEFORMED WELDED WIRE FABRIC WILL MEET THE REQUIREMENTS OF ASTM A1064 GRADE 75.
3. USE EPOXY COATED REINFORCEMENT AND EPOXY OR GALVANIZED WELDED WIRE FABRIC IN THE FOLLOWING CONDITIONS:
  - IN THE CAST IN PLACE DECK AND HEADWALLS IF A DECK IS USED.
  - IN THE TOP SLAB AND HEADWALL WITHIN 2'-0" OF GRADE IF A CAST IN PLACE DECK IS NOT USED.
  - ALL CURBS AND BARRIERS.
  - THROUGHOUT THE CULVERT WHEN VITRIFIED CLAY LINER PLATES ARE USED.
  - IN ALL CAST-IN-PLACE APRON SLABS (SEE SHEET 1)
- IF EPOXY COATED WELDED WIRE FABRIC IS USED IT MUST MEET THE REQUIREMENTS OF ASTM A884, TYPE I, CLASS A.
4. DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATION" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
5. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408.
6. DEAD LOADS: INCLUDE A WEIGHT OF 30 PSF FOR FUTURE WEARING SURFACE FOR BOXES AT GRADE.
7. PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH OF REINFORCEMENT IN ACCORDANCE WITH LRFD SPECIFICATIONS: SEE BC-736M.
8. PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED IN INSTRUCTIONS BELOW.
9. FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
10. FOR LOW FLOW FISH PASSAGE DESIGN REFER TO DESIGN MANUAL, PART 2, AND SEE SHEETS 11, 12 AND 14.
11. INDICATE ALLOWABLE AND MAXIMUM DESIGN FOUNDATION PRESSURE ON PLANS.
12. PLACE HEADWALL AND WINGWALL FOOTINGS BELOW FROST DEPTH OR 3'-6" MINIMUM, WHICH EVER IS GREATER.
13. PROVIDE WATERPROOFING MEMBRANE FOR THE ENTIRE TOP WIDTH AND LENGTH OF THE BOX AND 2'-0" WIDTH ± ALONG THE SIDE JOINTS IN ACCORDANCE WITH PUBLICATION 408, SECTION 680.2(c) OR 680.2(b). FOR ADDITIONAL DETAILS REFER TO BC-788M.
14. USE 4" DIAMETER FORMED WEEPHOLES AT EVERY OTHER SEGMENT PLACED AT A MINIMUM 1'-9" ABOVE THE BOTTOM SLAB OR 6" ABOVE NORMAL FLOW LINE. FOR WEEPHOLE PLACEMENT, THE WEEPHOLE LOCATION MAY BE ADJUSTED BY A MAXIMUM OF 2" IN ANY DIRECTION, OR RELOCATE REINFORCEMENT BY A MAXIMUM OF 1/2". DO NOT CUT REINFORCEMENT BARS. NO ADDITIONAL WEEPHOLE REINFORCEMENT WILL BE REQUIRED. IF WIRE MESH IS USED, MAY CUT THE MESH TO FIT WEEPHOLE CONDUIT BUT REPLACE EQUIVALENT STEEL WITH ADDITIONAL WIRE MESH PLACED ON EACH SIDE OF WIRE MESH MAT.
15. PRECAST BOX CULVERTS AT GRADE (I.e., ≤ 2'-0" OF FILL) REQUIRE AN ADDITIONAL 5" MINIMUM REINFORCED CONCRETE DECK. THIS 5" DECK WILL BE MAINTAINED FOR ENTIRE BOX CULVERT. REFER TO TYPICAL DECK REINFORCEMENT (THIS SHEET) FOR DETAILS. FOR  $ADT \leq 750$  AND  $ADTT \leq 25$ , AN ASPHALT PAVEMENT OVERLAY MAY BE UTILIZED IN LIEU OF A CONCRETE DECK.
16. DESIGN PRECAST REINFORCED CONCRETE BOXES TO HAVE OPENINGS IN 6" INCREMENTS WITH MINIMUM RISE OF 3'-0".
17. REQUIRED DIMENSION FOR BAR LENGTH IS THE TOTAL OF THE THEORETICAL CUT-OFF LENGTH PLUS THE REQUIRED ANCHORAGE.
18. HAUNCH SIZE SHOWN (T) IS BASED ON AASHTO M273. HAUNCH MAY BE MODIFIED IF THE BOX IS CUSTOM DESIGNED TO SATISFY DESIGN, TRANSPORTATION AND CONSTRUCTION REQUIREMENTS, BUT NOT LESS THAN 6" x 6".
19. THREADED INSERTS TO BE INCORPORATED IN PRECAST BOX AND DETAILED BY THE FABRICATOR.
20. CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN IF HEIGHT IS GREATER THAN 2'-0".
21. IF APPROACH ROADWAY UTILIZES CURB, ADJUST DIMENSION TO MATCH CURB HEIGHT.
22. USE EPOXY BONDING COMPOUND WHERE EVER CAST-IN-PLACE CEMENT CONCRETE COMES IN CONTACT WITH PRECAST CEMENT CONCRETE. THE EPOXY BONDING COMPOUND IS TYPE 2, GRADE 2, AS DESCRIBED IN ASTM-C881-90.
23. THE USE OF PRECAST END SECTION IS NOT PRECLUDED BUT WILL BE REVIEWED ON AN INDIVIDUAL BASIS BY THE DISTRICT BRIDGE ENGINEER. HAUNCH SIZE MUST MATCH THAT OF BOX CULVERT SEGMENTS.
24. POST-TENSIONING DUCTS MAY BE PLACED AT EITHER CORNER OR HAUNCH TO SATISFY DESIGN AND CONSTRUCTION REQUIREMENTS. PROVIDE A 3" CONCRETE CLEARANCE. HAUNCH DUCT MUST BE SECURED TO INSIDE FACE REINFORCEMENT, SEE SHEETS 8 AND 10.
25. FOR DECK CONNECTION DETAIL FOR VARIABLE DEPTH CONCRETE DECKS, THE DECK REINFORCEMENT WILL BE INDEPENDENT OF ANCHOR BOLT AND MUST MAINTAIN CLEARANCE AND FOLLOW CROSS SLOPE.
26. SEE NOTE 19 ON SHEET 1 FOR BACKFILL REQUIREMENTS AT INLET END OF CULVERT AND NOTE 11 ON SHEET 1 FOR TREATMENT OF WEEP HOLES IN BACKFILL AREAS AT INLET END OF CULVERT.
27. SPECIFY 4'-0" MINIMUM SEGMENT LENGTH ON THE CONTRACT DRAWINGS.
28. FOR SKEWED SEGMENTS, A SQUARED (NORMAL) CONNECTION IS AN ACCEPTABLE OPTION DURING PHASE CONSTRUCTION.
29. CLASS A, TYPE 4 GEOTEXTILE IS PERMITTED TO BE PLACED BETWEEN THE BEDDING MATERIAL AND EXCAVATION OR TO ENCASE THE BEDDING MATERIAL.
30. A 4" MINIMUM THICKNESS MUD SLAB MAY BE USED FOR PRECAST CULVERT INSTALLATION. BACKFILL BELOW MUD SLAB TO LIMITS OF EXCAVATION SHOWN IN DETAIL ON THIS SHEET. EXCAVATION AND BACKFILL LIMITS ARE MEASURED FROM TOP OF MUD SLAB.
31. USE CLASS C CEMENT CONCRETE FOR MUD SLABS.
32. TROWEL FINISH THE TOP OF MUD SLAB TO PROVIDE A SMOOTH SURFACE.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC BOX CULVERT  
PRECAST

RECOMMENDED OCT. 7, 2024  
  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 5 OF 16  
BD-632M





**\* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND COLLAR/CURB REINFORCEMENT.**

**SCOUR PROTECTION**  
5'-0" MIN

**DEPRESS 1'-0" MIN (TYP)**

**CAST-IN-PLACE WINGWALL**

**TOP OF WING WALL FOOTING**

**CUTOFF WALL AT INLET AND OUTLET**

**ROCK LINING (PUB. 408, SECTION 850) CHOKED WITH STREAMBED MATERIAL AT INLET AND OUTLET, 5'-0" MIN LENGTH FROM END OF CULVERT OR APRON, SIZED AS SPECIFIED IN DESIGN MANUAL, PART 4, CHAPTER 7, TABLE 7.2.5-1**

**1'-6" COLLAR**

**2" CLR**

**#6**

**\* 6" MIN FROM EDGE OF BOX TO COLLAR OR BARRIER CURB**

**#5 @ 9" EACH FACE**

**THREADED INSERTS FOR #5 REINF BAR SEE NOTE 19, SHEET 5**

**3"x3" CHAMFER @ TOP, INLET ONLY, ALTER REBARS AS REQUIRED**

**2 PLY ASPHALT-SATURATED BOND BREAKER**

**FLOW**

**EXISTING STREAMBED ELEV**

**PRECAST CULVERT**

**2" CLR (TYP)**

**#4 @ 12" TYP**

**CUTOFF WALL AT INLET AND OUTLET (USE ONLY IN THE ABSENCE OF AN APRON)**

**4" CLR**

**1'-0"**

**31-S GUIDE RAIL - 4'-0" MIN**

**2'-0" MAX**

**SEE NOTE 12 ON SHEET 1**

**6"**

**FOR DETAILS SEE RC-51M**

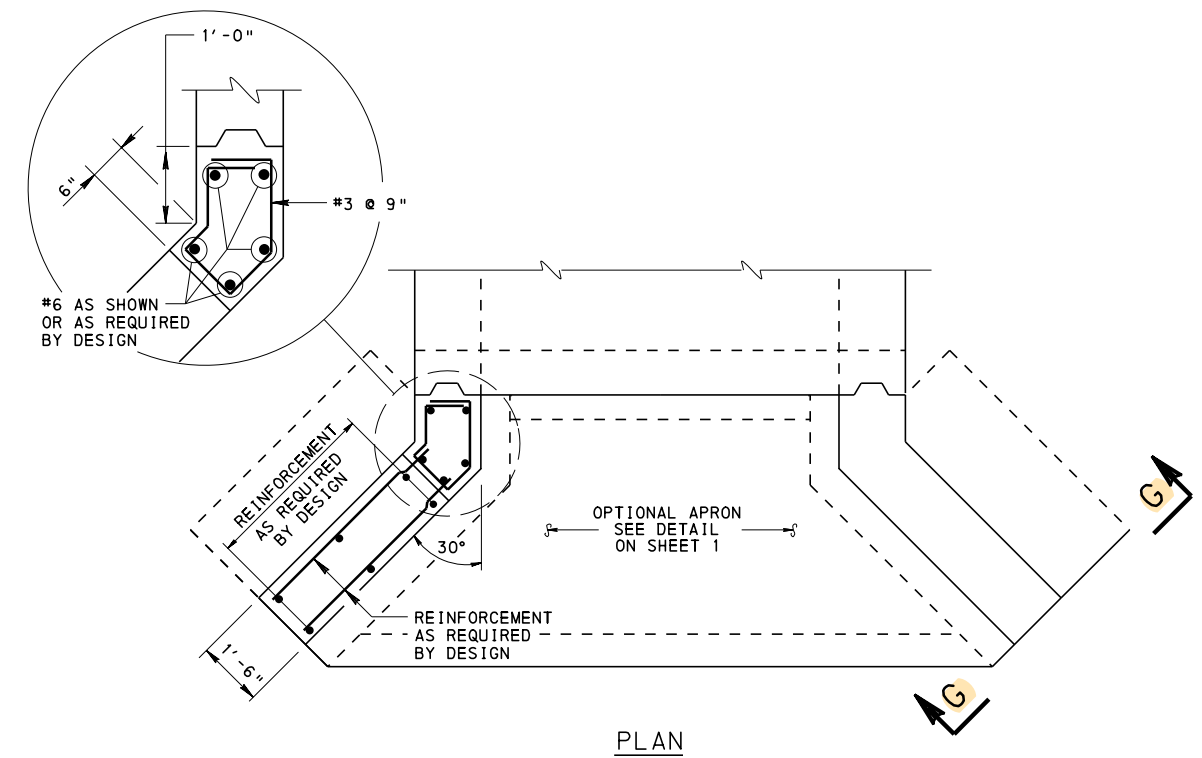
**TOP SLAB**

**RISE**

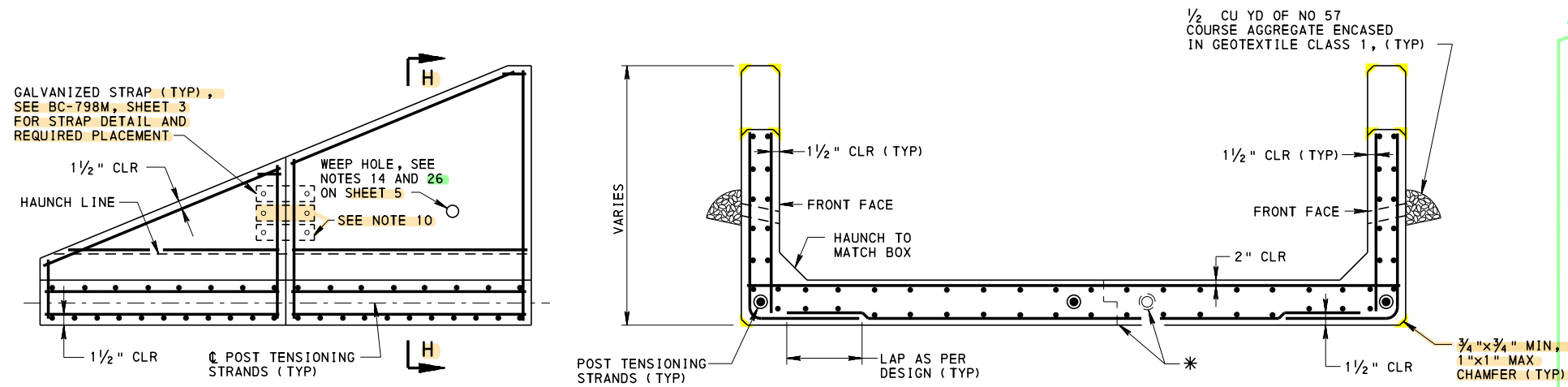
**BOTTOM SLAB**

**BEDDING (SEE NOTE 30, SHEET 5)**

**PROFILE**



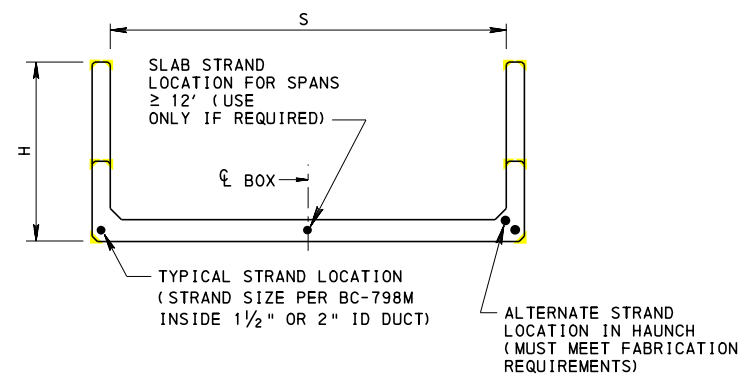
SHEET 7 OF 16  
BD-632M



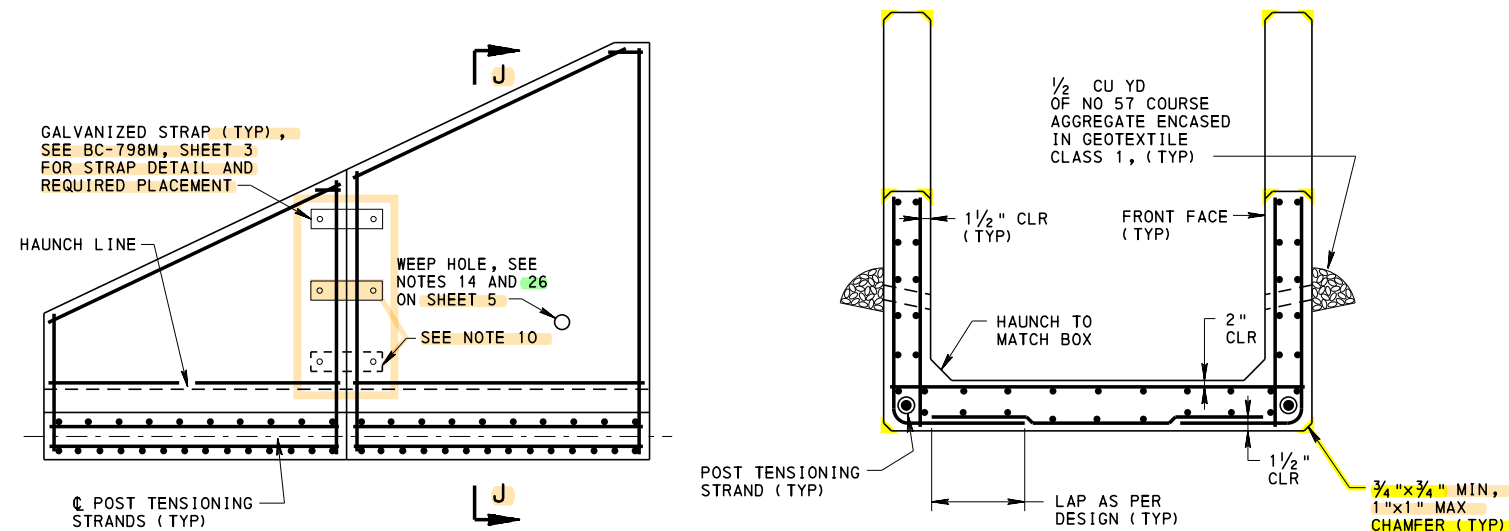
POST-TENSION END SECTION  
SPAN > 12 FEET

SECTION H-H

\* SPECIFY JOINT AND ADDITIONAL END SECTION POST TENSION STRAND  
IF WIDTH IS RESTRICTED DUE TO SHIPPING RESTRAINTS.



TYP BOX END SECTION  
SHOWING STRAND LOCATIONS



POST-TENSION END SECTION  
SPAN ≤ 12 FEET

SECTION J-J

#### GENERAL NOTES:

1. EPOXY COAT REINFORCEMENT AS PER RC BOX CULVERT DESIGN.
2. REBAR SHOWN IS FOR ORIENTATION ONLY, REBAR SIZE AND SPACING AS PER DESIGN.
3. WALL REINFORCEMENT CAN BE ADJUSTED TO ACCOMMODATE WEEPHOLE. DO NOT CUT REINFORCEMENT.
4. CAST-IN-PLACE CONCRETE IS PERMITTED IN ANY PORTION OF THE PRECAST END SECTIONS, ONLY IF HEIGHT OR WIDTH OF END SECTIONS ARE RESTRICTED DUE TO SHIPPING RESTRAINTS.

#### POST-TENSIONING NOTES:

1. EXTEND BOTTOM ROW OF POST-TENSIONING STRANDS THROUGH THE BOTTOM SLAB OF PRECAST CONCRETE INLET AND OUTLET END SECTIONS.
2. BOX SEGMENTS AND END SECTIONS ARE POST-TENSIONED IN STAGES. THE CONTRACTOR IS REQUIRED TO SUBMIT A PLAN FOR POST-TENSIONING SEQUENCE TO THE DEPARTMENT FOR APPROVAL PRIOR TO SETTING ANY SEGMENTS.
3. POST-TENSION BOX SEGMENTS FIRST, THEN PROVIDE:
  - MECHANICAL SPLICERS ON BOTTOM STRANDS TO CONNECT WITH THE INLET/OUTLET END SECTIONS AND POST-TENSION BOTTOM STRANDS THROUGH THE END SECTIONS.
  - STRAPS ON SIDES OF END SECTION AS SHOWN ON BC-798M. IF SLAB THICKNESSES ARE LESS THAN 13", SEE NOTE 10.
4. PROVIDE FULL CONTACT OF THE JOINT SEALING MATERIAL AROUND THE ENTIRE JOINT BETWEEN THE END SECTIONS AND THE BOX SECTIONS.
5. AFTER POST-TENSIONING IS APPROVED, CUT STRANDS TO PROVIDE A MINIMUM OF 2 1/2" CLEAR FROM OUTSIDE FACE OF CONCRETE AND COAT RECESS WITH EPOXY BONDING COMPOUND AND FILL WITH NON-SHRINK GROUT.
6. THE NUMBER OF POST-TENSIONING STRANDS MAY BE INCREASED AND THEIR LOCATIONS MAY BE ADJUSTED BY THE FABRICATOR.
7. PRECAST CONCRETE SEGMENT LENGTH TO BE DETERMINED BY THE FABRICATOR.
8. STAGING, SPACING AND POST-TENSION FORCE TO BE SHOWN ON FABRICATOR'S SHOP DRAWINGS.
9. SEE BC-798M, SHEET 1 FOR ADDITIONAL POST-TENSIONING NOTES.
10. WHEN SLAB THICKNESSES ARE LESS THAN 13", A MINIMUM OF THREE (3) GALVANIZED STRAPS MAY BE INSTALLED ON EACH FACE AS AN ALTERNATIVE TO POST-TENSIONING. IF WINGS ARE FLARED ON SLAB THICKNESSES LESS THAN 13", THIS ALTERNATIVE SHOULD BE USED. SEE BC-798M, SHEET 2 FOR STRAP DETAILS AND PLACEMENT REQUIREMENTS.

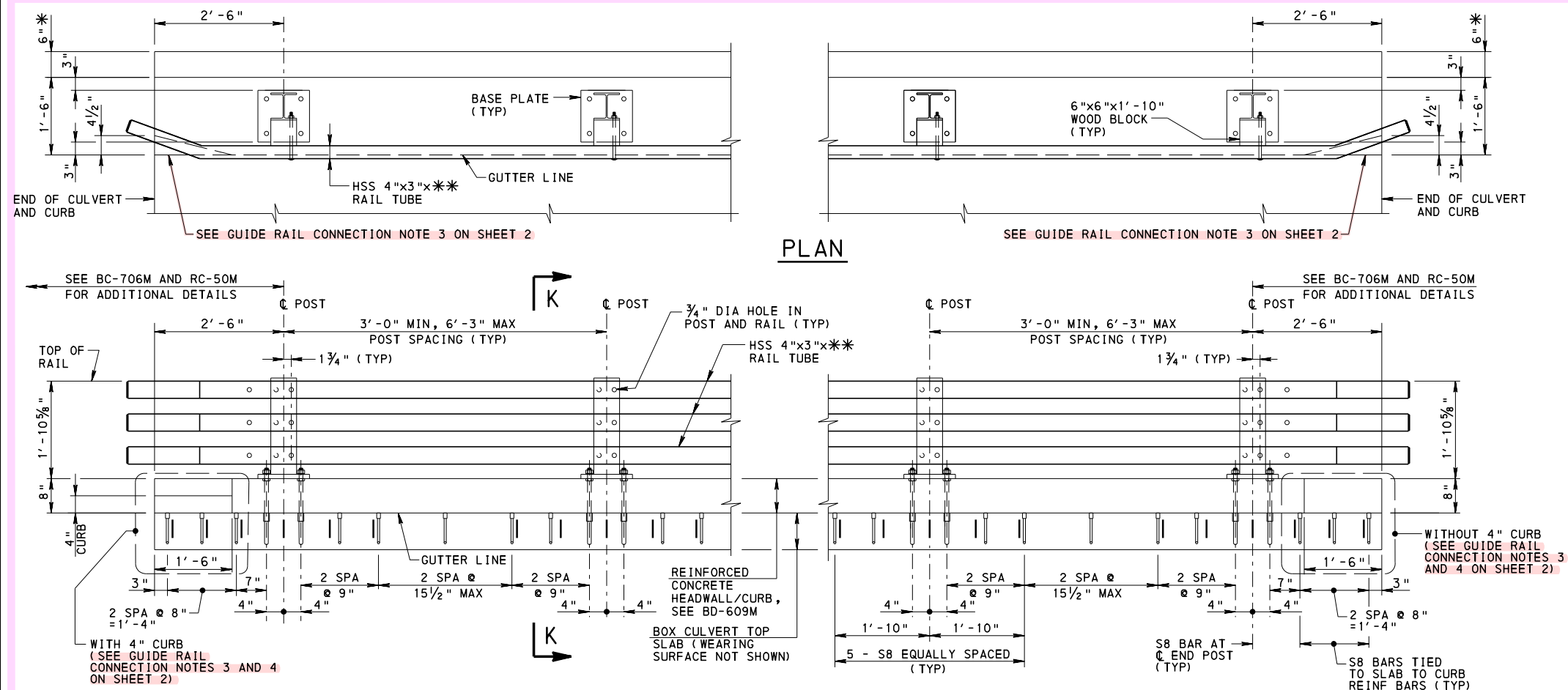
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC BOX CULVERT  
PRECAST  
POST-TENSIONED END SECTIONS

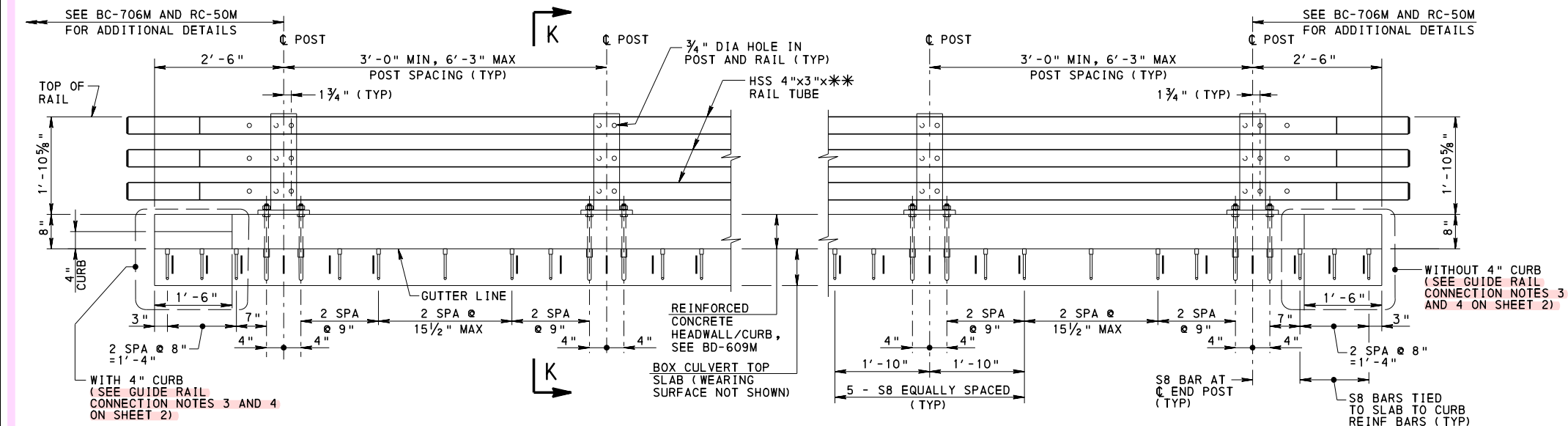
RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

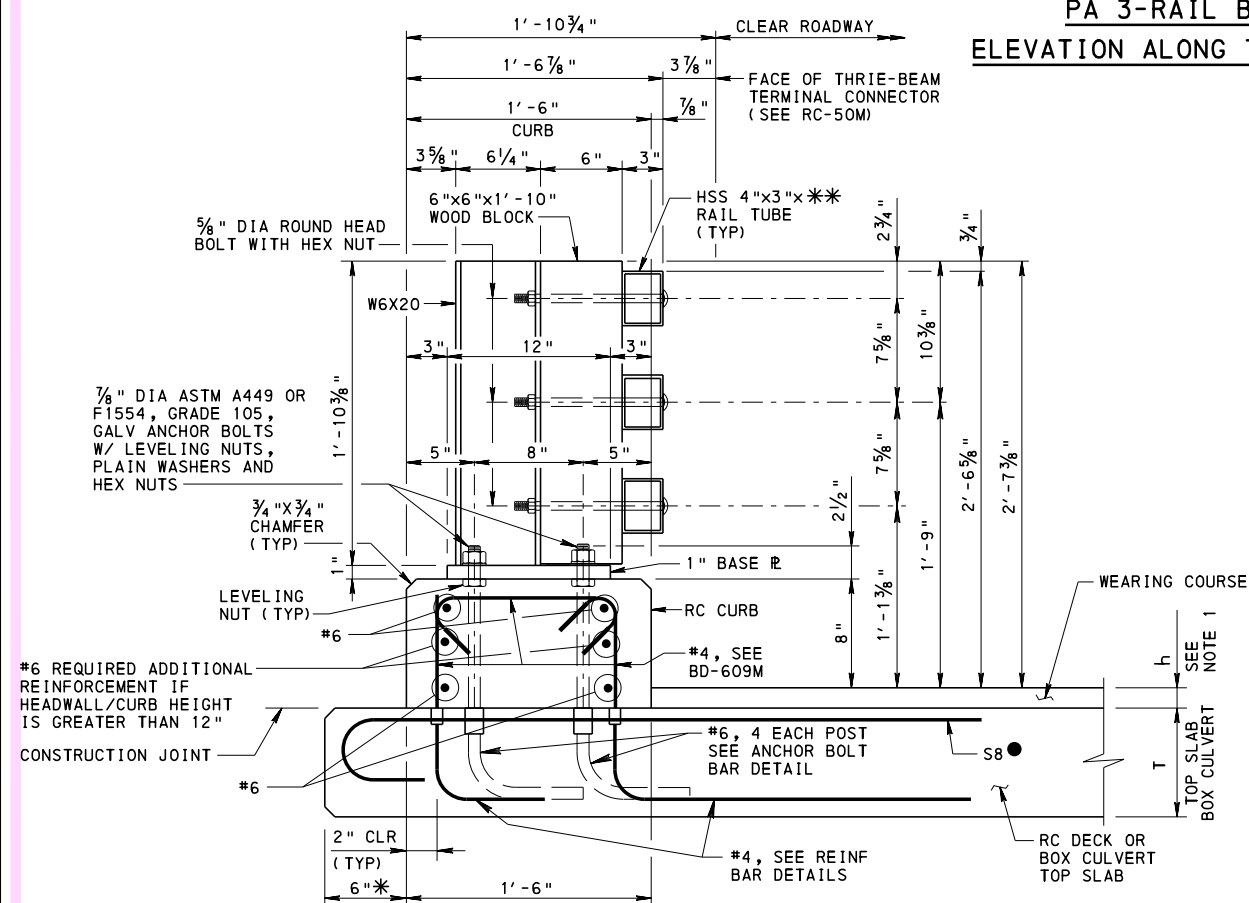
SHEET 8 OF 16  
BD-632M



PLAN



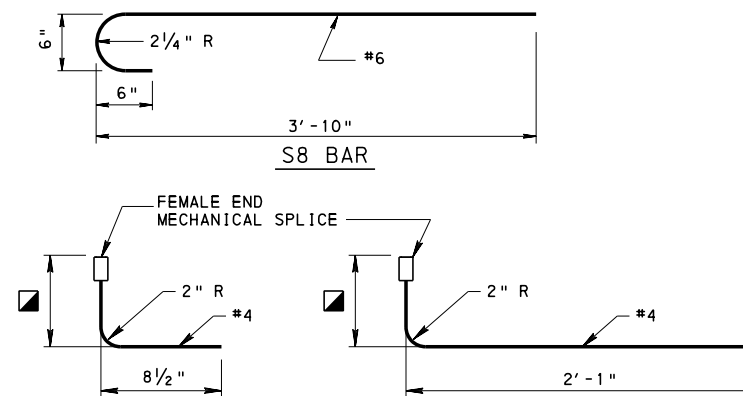
PA 3-RAIL BRIDGE BARRIER  
ELEVATION ALONG TOP SLAB OF CULVERT



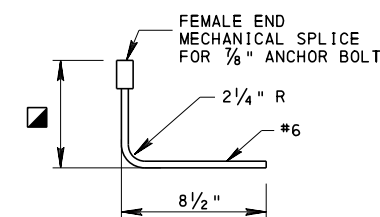
SECTION K-K

NOTE: PRIOR TO CONSTRUCTING HEADWALL/CURB, INSTALL ANCHOR BOLTS IN THE MECHANICAL SPLICES. ENSURE PROPER PLACEMENT AND ALIGNMENT.

● S8 REINFORCEMENT REQUIRED AT POST LOCATIONS AND ENDS ONLY. SEE SLAB REINFORCEMENT BAR DETAILS THIS SHEET.



SLAB TO CURB  
REINFORCEMENT BAR DETAILS  
MECHANICAL SPLICE AS LISTED IN BULLETIN 15



ANCHOR BOLT BAR DETAIL  
MECHANICAL SPLICE AS LISTED IN BULLETIN 15

LEGEND:

- FOR T < 10": T-2"  
FOR T ≥ 10": 8" MIN  
(T=TOP SLAB THICKNESS OF BOX CULVERT)
- \* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND CURB REINFORCEMENT.
- \*\* FOR TUBE THICKNESS SEE TUBE RAIL SPECIFICATIONS TABLE ON BC-706M.

NOTES:

1. 2 1/2" MIN, 11" MAX TOTAL WEARING COURSE THICKNESS (h) (COMBINATION OF FILL OR 5" MIN REINF CONC DECK AND OVERLAY)
2. FOR GUIDE RAIL CONNECTION NOTES, SEE SHEET 2.

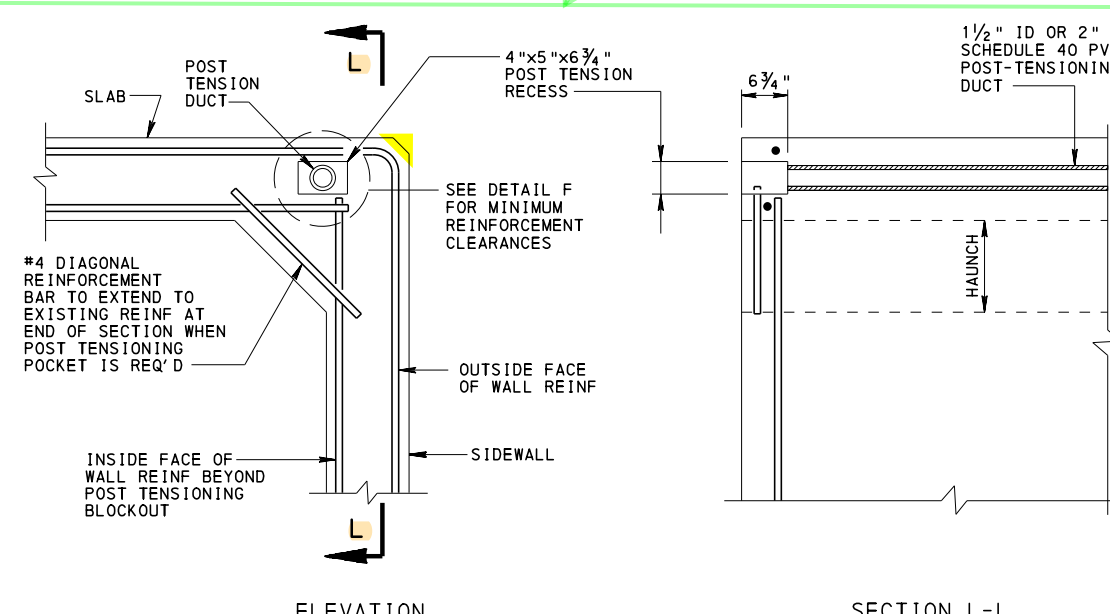
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC BOX CULVERT  
PRECAST

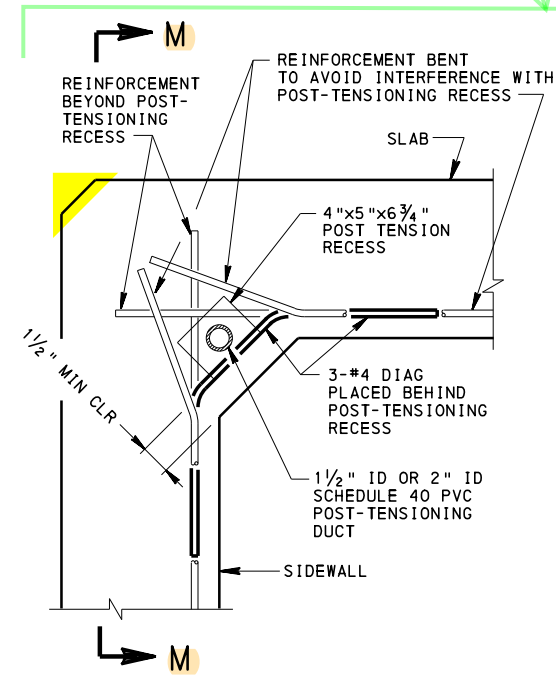
RECOMMENDED OCT. 7, 2024  
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*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

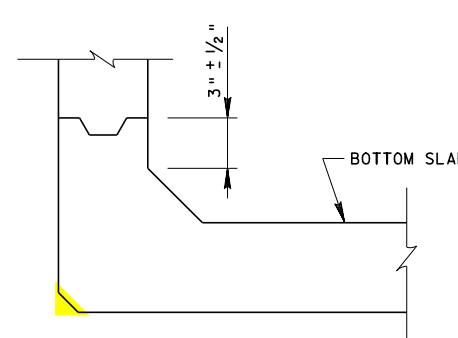
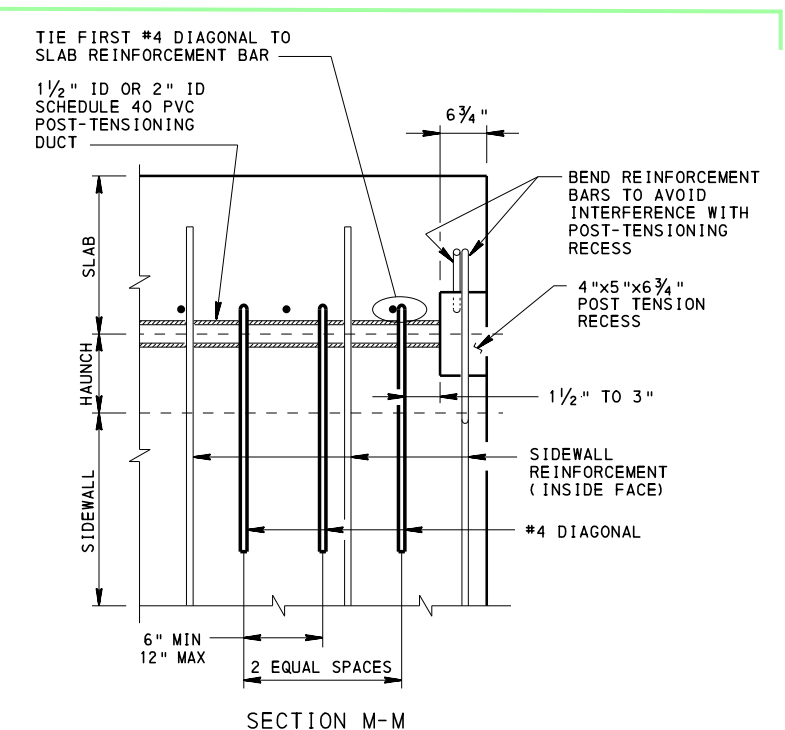
SHEET 9 OF 16  
BD-632M



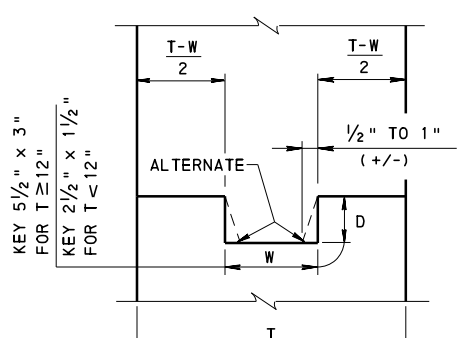
**TYPICAL HAUNCH SECTION DETAIL**



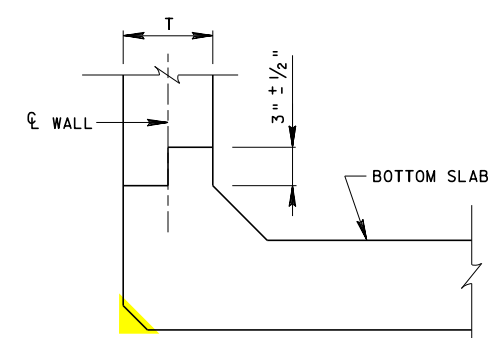
**ALTERNATE HAUNCH SECTION DETAIL**



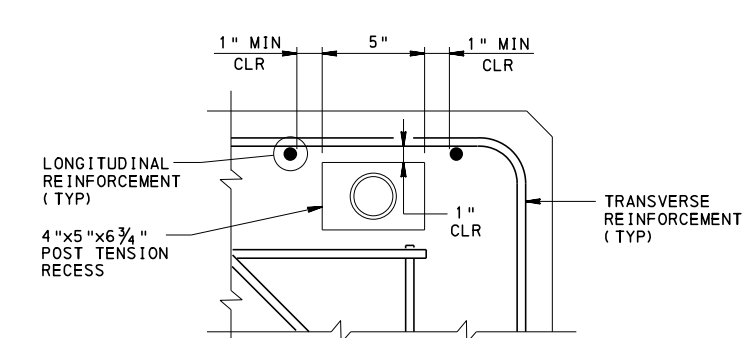
**KEYED CONSTRUCTION JOINT**



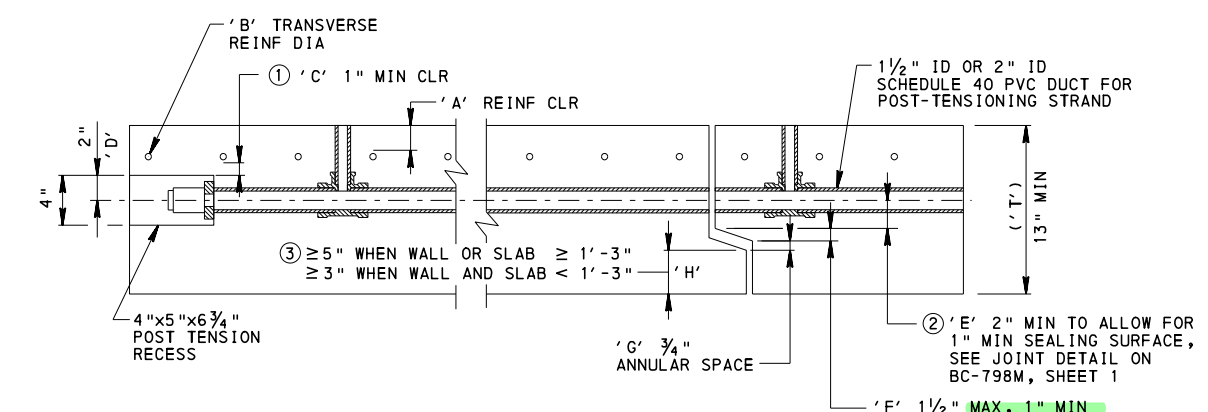
**CONSTRUCTION JOINT DETAIL**



**ALTERNATE SHIPLAP CONSTRUCTION JOINT**



**DETAIL F**



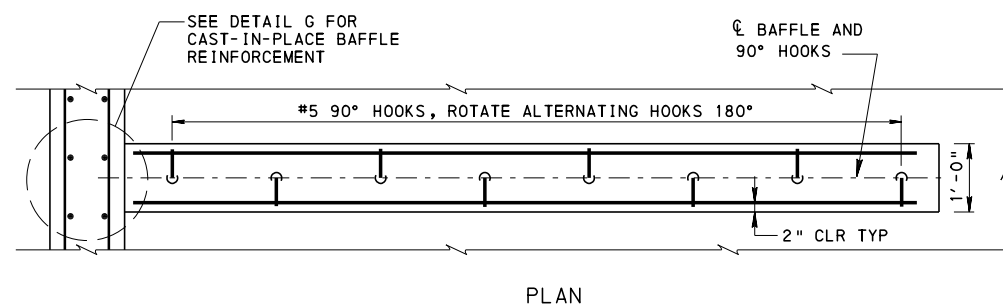
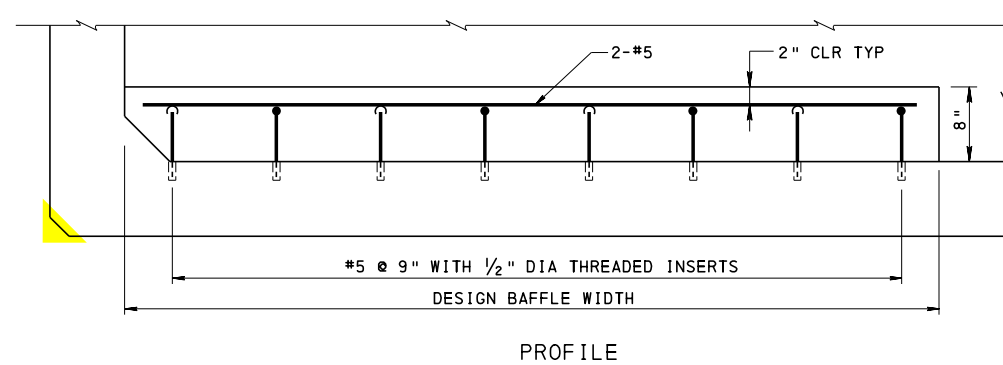
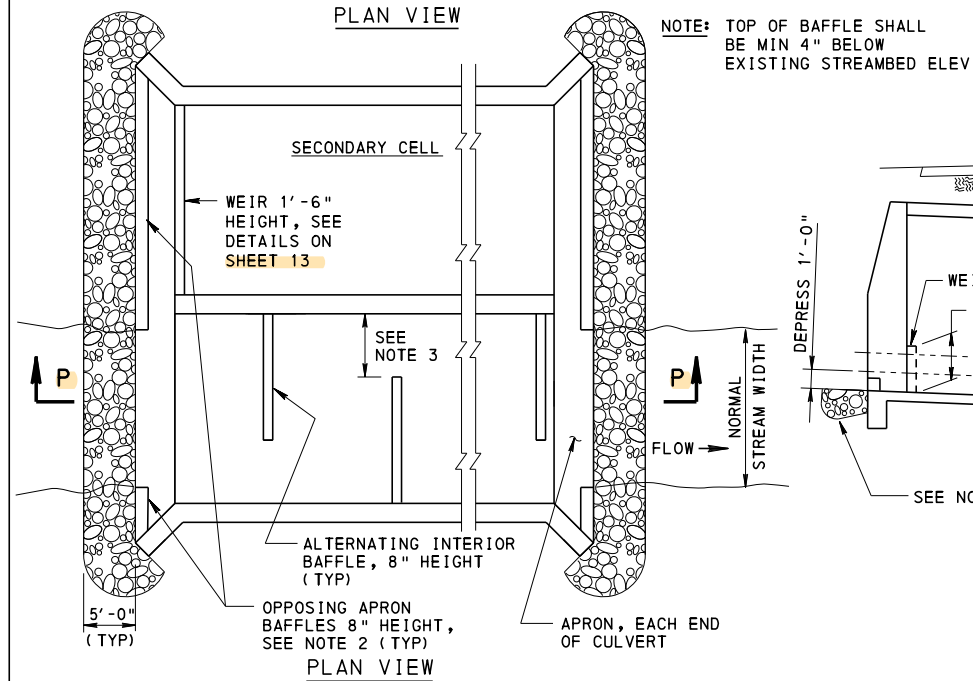
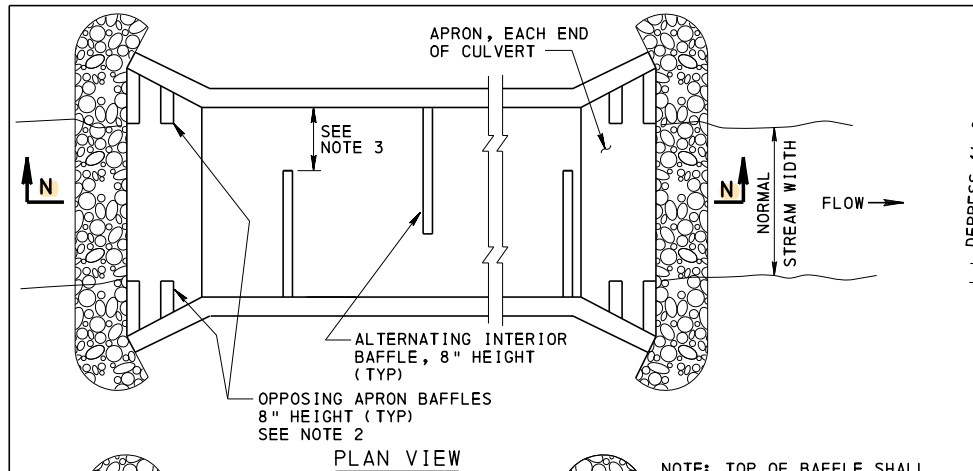
**CONFIGURATION FOR SLAB/WALL WITH POST-TENSIONING**

MIN SLAB/WALL THICKNESS ('T') DETERMINED TO ENSURE THE MIN REQUIREMENTS ①②③ ARE MET.

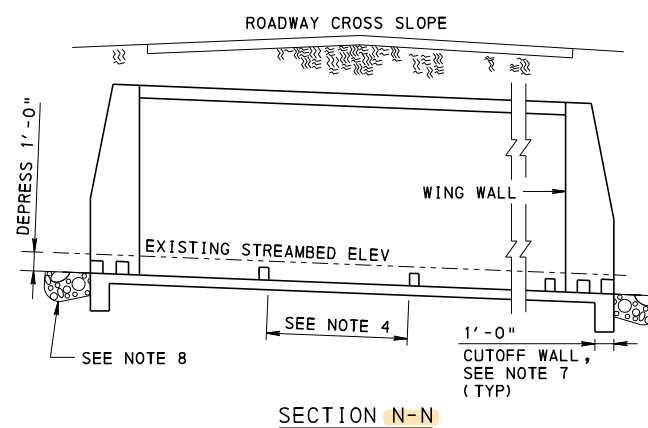
MIN SLAB/WALL THICKNESS:  
 $T = A + B + C + D + E + F + G + H$

NOTE: PLACE POST-TENSIONING DUCTS ONLY IN CORNER HAUNCHES WHEN WALL THICKNESSES ARE < 13".

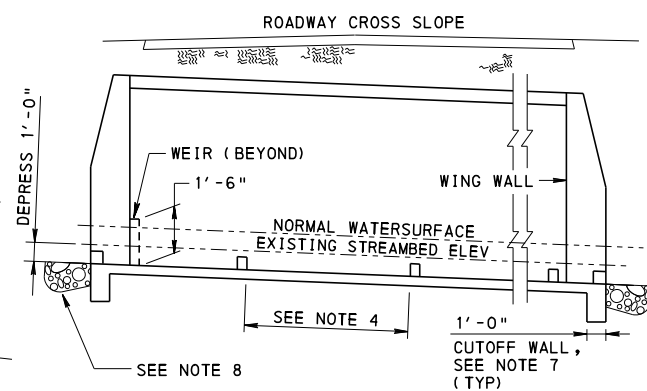
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|------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------|
| <b>COMMONWEALTH OF PENNSYLVANIA</b><br><b>DEPARTMENT OF TRANSPORTATION</b><br>BUREAU OF BRIDGE |                                                                |                           |
| STANDARD<br>RC BOX CULVERT<br>MISCELLANEOUS DETAILS<br>PRECAST                                 |                                                                |                           |
| RECOMMENDED OCT. 7, 2024<br><br>CHIEF BRIDGE ENGINEER                                          | RECOMMENDED OCT. 7, 2024<br><br>CHIEF ENGINEER, HIGHWAY ADMIN. | SHEET 10 OF 16<br>BD-632M |



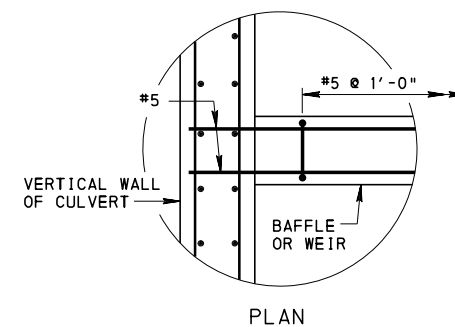
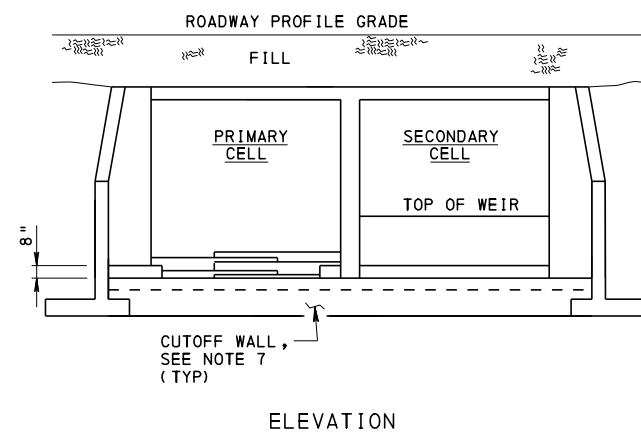
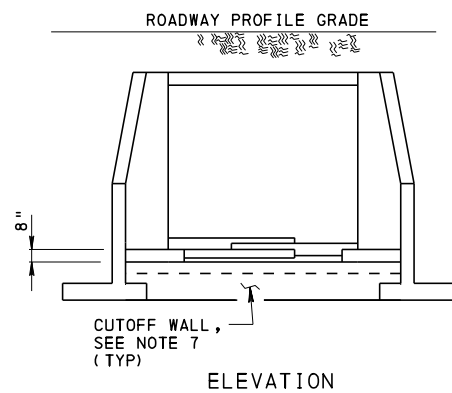
**TYPICAL BAFFLE**  
PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.



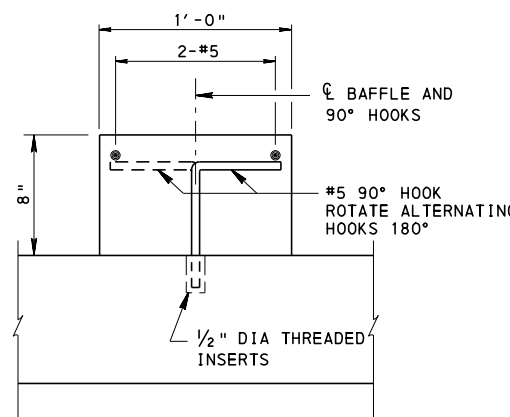
## BOX CULVERTS



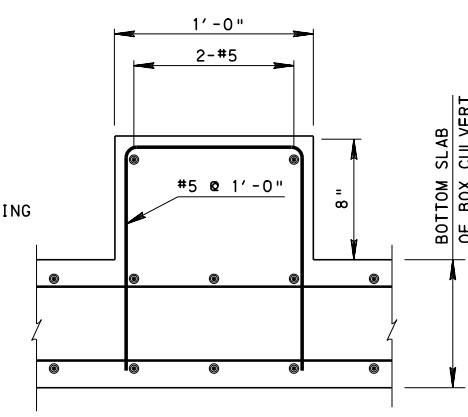
## TWIN CELL BOX CULVERTS



**DETAIL G**  
CAST-IN-PLACE BAFFLE/WEIR REINFORCEMENT



**TYPICAL BAFFLE DETAIL**



**ALTERNATE BAFFLE DETAIL**

## DESIGN NOTES:

- THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE NORMAL CHANNEL WIDTH UPSTREAM AND DOWNSTREAM OF THE STRUCTURE (I.E. EDGE OF WATER TO EDGE OF WATER DURING NORMAL FLOW). AT LEAST THREE (3) MEASUREMENTS SHOULD BE TAKEN UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WHERE THE STREAM EXHIBITS NORMAL, STABLE CONDITIONS. AN AVERAGE OF THOSE SIX (6) MEASUREMENTS SHOULD THEN BE USED FOR THE BAFFLE CONFIGURATIONS.
  - MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL HAS BEEN AFFECTED BY THE STRUCTURE OR SHOW SIGNS OF EROSION. BAFFLE CONFIGURATIONS SHOULD BE BASED ON NORMAL STREAM WIDTH (NOT TOP OF BANK TO TOP OF BANK OR WIDTH OF THE CULVERT).
- THE OPENING IN THE APRON BAFFLES SHOULD BE EQUAL TO AVERAGE NORMAL WIDTH OF THE STREAM. THE APRON BAFFLES SHOULD CONNECT TO THE WINGWALLS AT EACH SIDE OF THE CULVERT. PLACE THE FIRST SET OF BAFFLES AT THE END OF THE APRON. IF THE APRON IS GREATER THAN 8'-0" LONG, A SECOND SET OF OPPOSING BAFFLES ARE REQUIRED TO BE SET AT 1/2 THE DISTANCE FROM THE END BAFFLE TO THE FACE OF THE BOX. FOR LONGER APRONS, BAFFLES NOT TO EXCEED 8'-0" SPACING.
- THE OPENING IN THE INTERIOR BAFFLES SHOULD BE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
- BAFFLES SHOULD BE SPACED AT THE AVERAGE NORMAL STREAM WIDTH OR 8', WHICHEVER IS GREATER. THE FIRST INTERIOR BAFFLE AT THE OUTLET SHOULD BE LOCATED AS CLOSE TO THE DOWNSTREAM END OF CULVERT AS POSSIBLE AND SPACED ACCORDINGLY FROM THAT POINT TO THE INLET.
- IF BAFFLE SPACING NEEDS ADJUSTED DUE TO BOX SEGMENTS, THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.
- THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.
- CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL WING WALL FOOTINGS OR ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN
- ROCK LINING AT THE INLET AND OUTLET SHOULD BE DEPRESSED THE ENTIRE LENGTH AND CHOKED WITH NATURAL STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT SHOULD BE PLACED ON TOP OF THE ROCK LINING AND APRON TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPEMENT OF A NATURAL STREAM BOTTOM IF FEASIBLE.
- THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
- ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 12.
- BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.
- AN ALTERNATE DOUBLE WEIR BAFFLE DESIGN AS PROVIDED BY THE PENNSYLVANIA FISH AND BOAT COMMISSION IS PREFERRED AND MAY BE REQUIRED FOR SLOPES GREATER THAN 2% OR FOR BOXES THAT ARE SIGNIFICANTLY WIDER THAN THE NORMAL CHANNELEV

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF BRIDGE

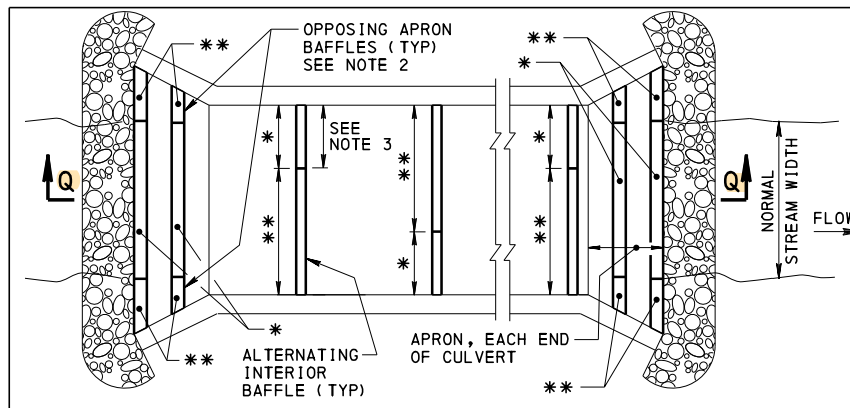
STANDARD  
RC BOX CULVERT  
MISCELLANEOUS DETAILS  
STREAM GRADES  $\leq$  2%

RECOMMENDED OCT. 7, 2024  
*Kevin S. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

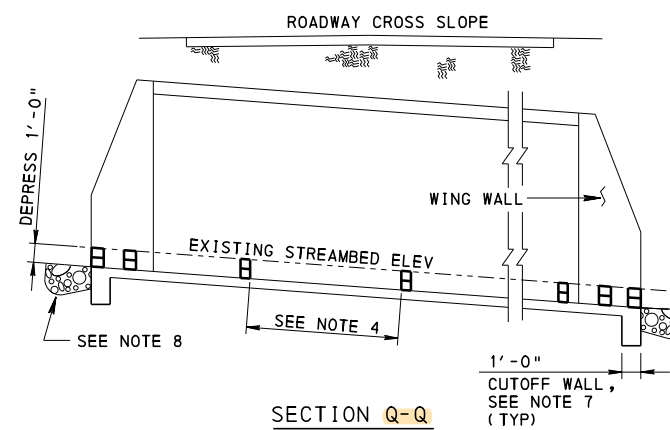
SHEET 11 OF 16  
BD-632M



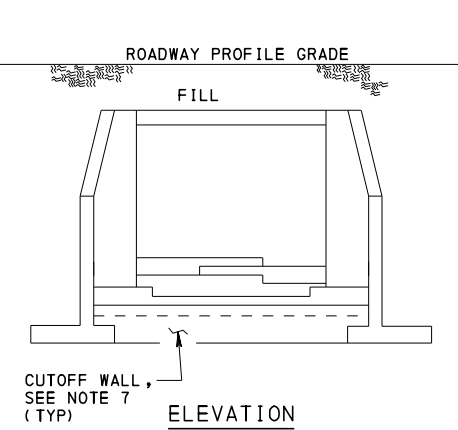


PLAN VIEW

\* = 6" BAFFLE HEIGHT AT OPENING  
 \*\* = 1'-0" BAFFLE HEIGHT

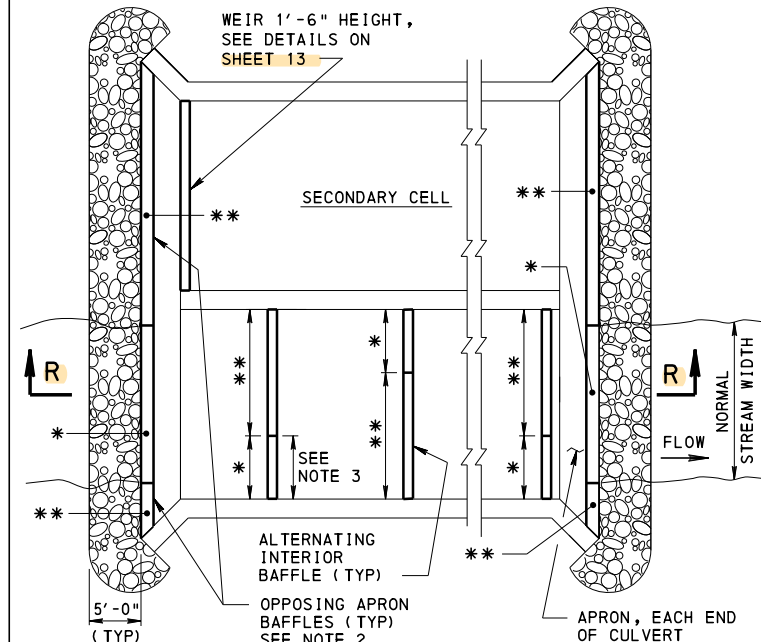


SECTION Q-Q

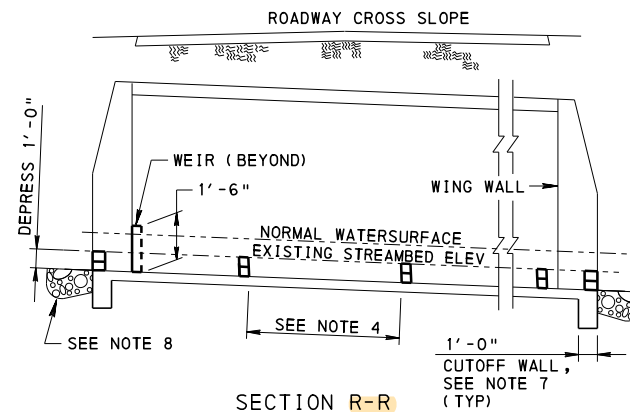


ELEVATION

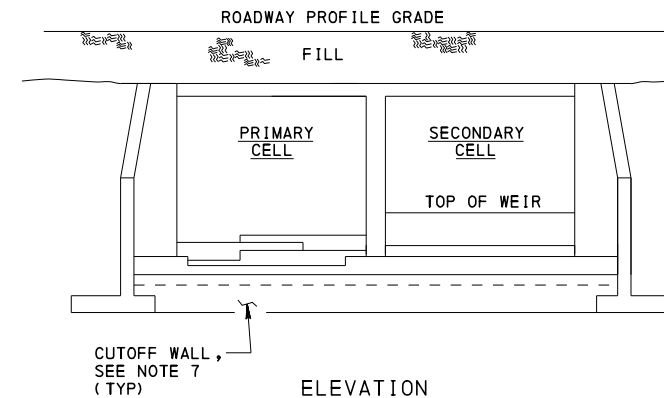
## BOX CULVERTS



PLAN VIEW

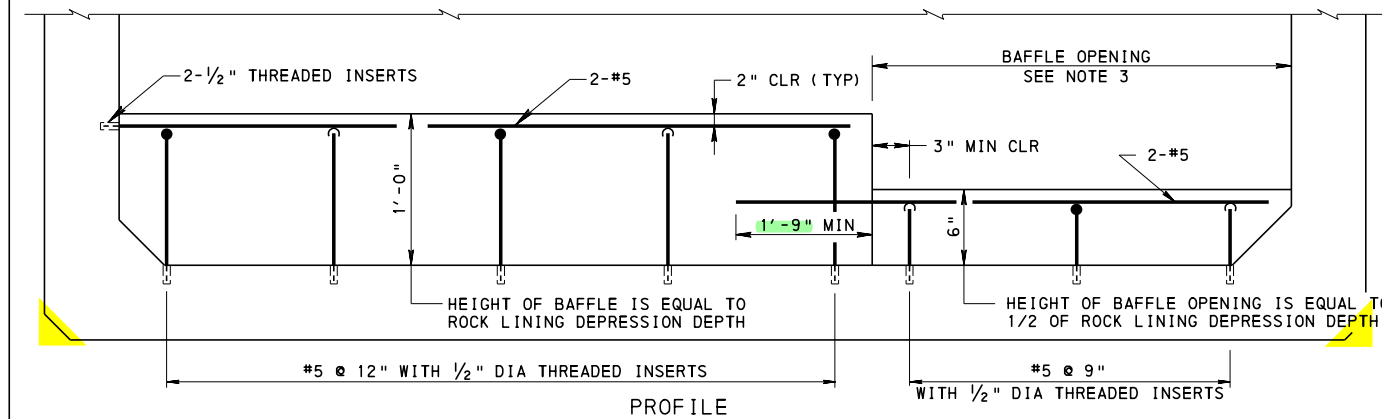


SECTION R-R

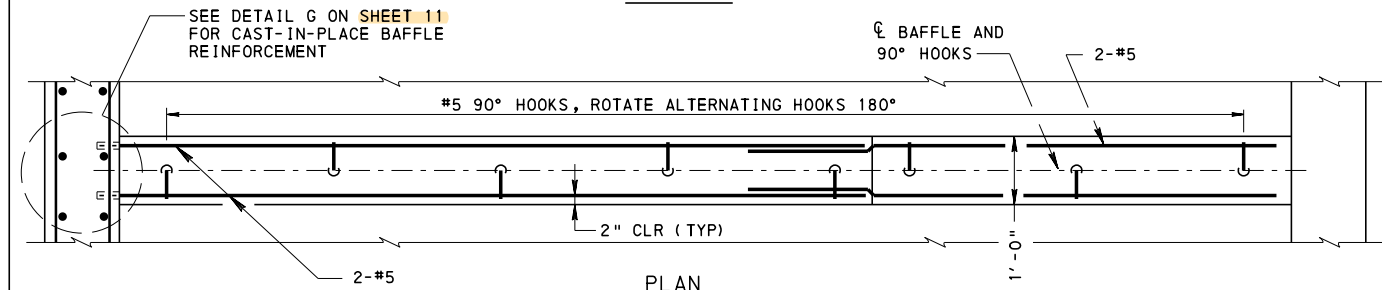


ELEVATION

## TWIN CELL BOX CULVERTS



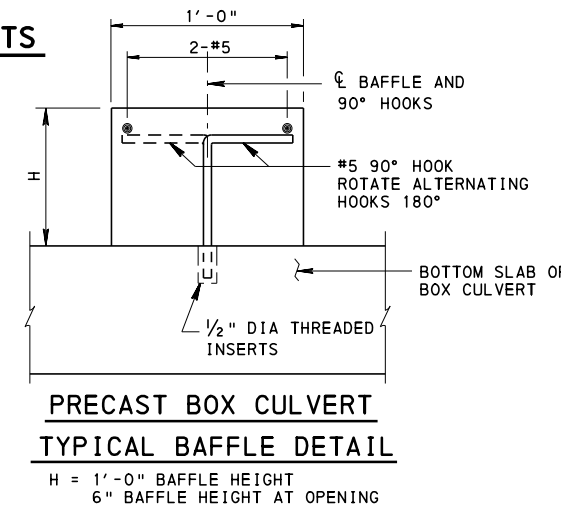
PROFILE



PLAN

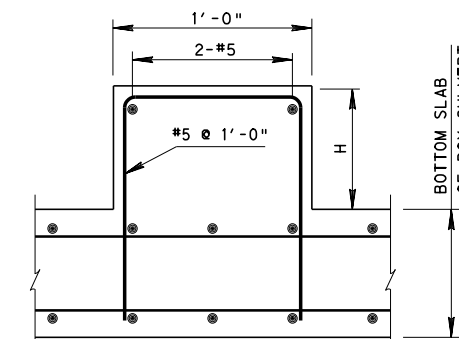
### TYPICAL INTERIOR BAFFLE

PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.



### PRECAST BOX CULVERT TYPICAL BAFFLE DETAIL

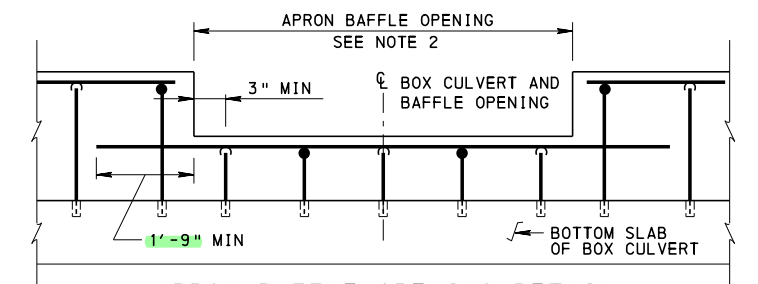
H = 1'-0" BAFFLE HEIGHT  
 6" BAFFLE HEIGHT AT OPENING



### CAST-IN-PLACE BOX CULVERT ALTERNATE BAFFLE DETAIL

### DESIGN NOTES:

- THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE NORMAL CHANNEL WIDTH UPSTREAM AND DOWNSTREAM OF THE STRUCTURE (I.E. EDGE OF WATER TO EDGE OF WATER DURING NORMAL FLOW). AT LEAST THREE (3) MEASUREMENTS SHOULD BE TAKEN UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WHERE THE STREAM EXHIBITS NORMAL, STABLE CONDITIONS. AN AVERAGE OF THOSE SIX (6) MEASUREMENTS SHOULD THEN BE USED FOR THE BAFFLE CONFIGURATIONS.
  - MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL HAS BEEN AFFECTED BY THE STRUCTURE OR SHOW SIGNS OF EROSION. BAFFLE CONFIGURATIONS SHOULD BE BASED ON NORMAL STREAM WIDTH (NOT TOP OF BANK TO TOP OF BANK OR WIDTH OF THE CULVERT).
- THE OPENING IN THE APRON BAFFLES SHOULD BE EQUAL TO AVERAGE NORMAL WIDTH OF THE STREAM. THE APRON BAFFLES SHOULD CONNECT TO THE WINGWALLS AT EACH SIDE OF THE CULVERT. PLACE THE FIRST SET OF BAFFLES AT THE END OF THE APRON. IF THE APRON IS GREATER THAN 8'-0" LONG, A SECOND SET OF OPPOSING BAFFLES ARE REQUIRED TO BE SET AT 1/2 THE DISTANCE FROM THE END BAFFLE TO THE FACE OF THE BOX. FOR LONGER APRONS, BAFFLES NOT TO EXCEED 8'-0" SPACING.
- THE OPENING IN THE INTERIOR BAFFLES SHOULD BE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
- BAFFLES SHOULD BE SPACED AT THE AVERAGE NORMAL STREAM WIDTH OR 8', WHICHEVER IS GREATER. THE FIRST INTERIOR BAFFLE AT THE OUTLET SHOULD BE LOCATED AS CLOSE TO THE DOWNSTREAM END OF CULVERT AS POSSIBLE AND SPACED ACCORDINGLY FROM THAT POINT TO THE INLET.
- IF BAFFLE SPACING NEEDS ADJUSTED DUE TO BOX SEGMENTS, THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.
- THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.
- CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL WING WALL FOOTINGS OR ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN
- ROCK LINING AT THE INLET AND OUTLET SHOULD BE DEPRESSED THE ENTIRE LENGTH AND CHOKED WITH NATURAL STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT SHOULD BE PLACED ON TOP OF THE ROCK LINING AND APRON TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPEMENT OF A NATURAL STREAM BOTTOM IF FEASIBLE.
- THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
- ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 12.
- BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.
- SEE NOTE 12 ON SHEET 11 FOR ALTERNATE BAFFLE DESIGN.



### APRON BAFFLE OPENING DETAIL

APRON BAFFLE TYPICAL TO INTERIOR BAFFLE EXCEPT WHERE NOTED OTHERWISE.

## COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

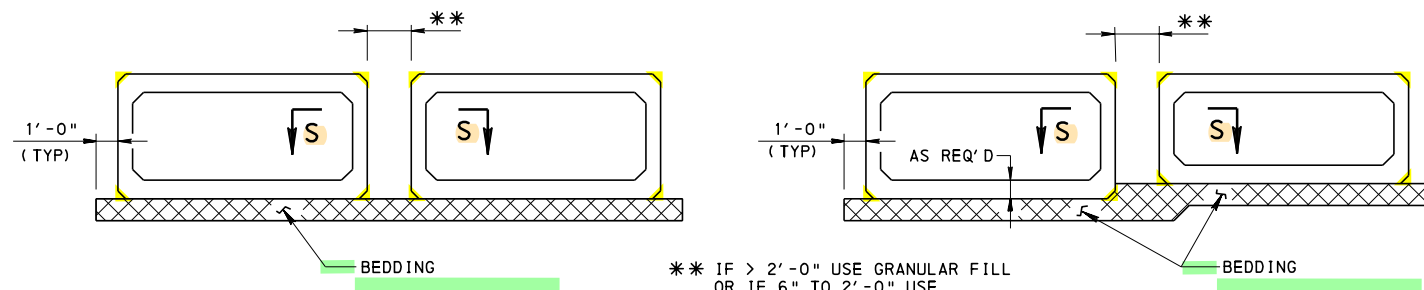
### STANDARD RC BOX CULVERT MISCELLANEOUS DETAILS STREAM GRADES > 2%

RECOMMENDED OCT. 7, 2024  
 [Signature]  
 CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
 [Signature]  
 CHIEF ENGINEER, HIGHWAY ADMIN.

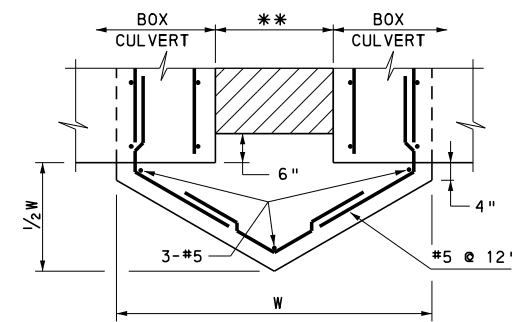
SHEET 12 OF 16  
 BD-632M



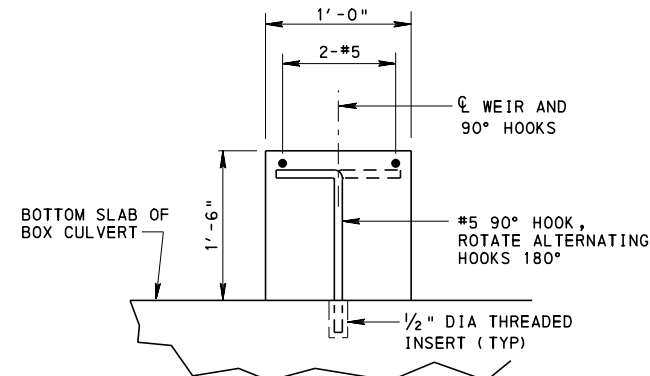


**TYP PRECAST SECTION (NORMAL)**  
SYMMETRICAL

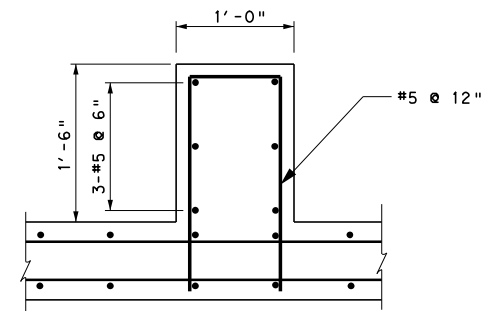
**TYP PRECAST SECTION (NORMAL)**  
UNSYMMETRICAL - OPTION TO WEIR



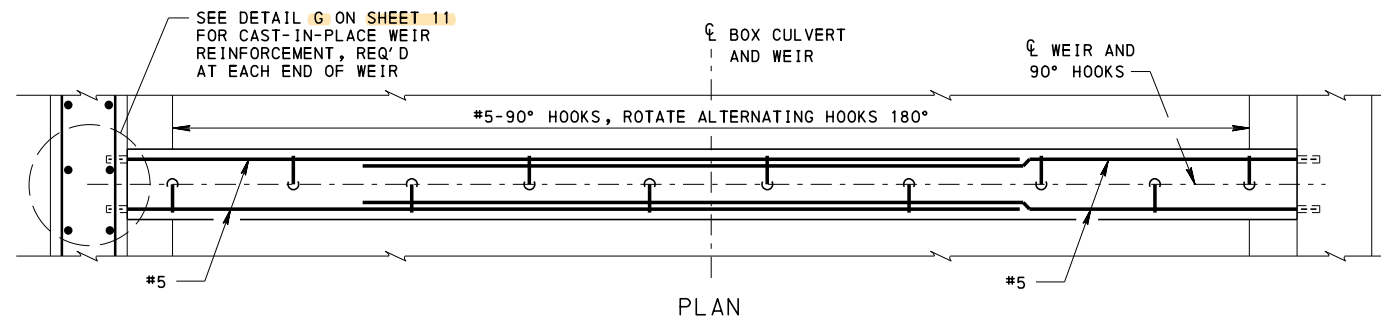
**SECTION S-S**  
CONCRETE PLUG



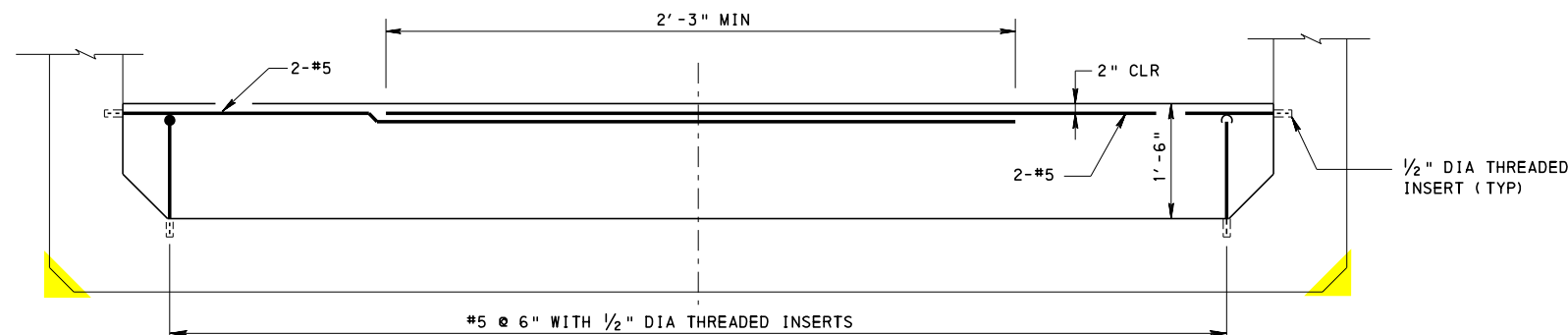
**PRECAST BOX CULVERT**  
**TYPICAL WEIR DETAIL**  
ALL STREAM GRADES



**CAST-IN-PLACE BOX CULVERT**  
**ALTERNATE WEIR DETAIL**  
ALL STREAM GRADES



**PLAN**



**PROFILE**  
**WEIR DETAIL**

PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT  
SIMILAR EXCEPT AS NOTED ON THIS STANDARD.

DESIGN NOTE:  
THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES  
WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA  
FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING  
PRELIMINARY DESIGN.

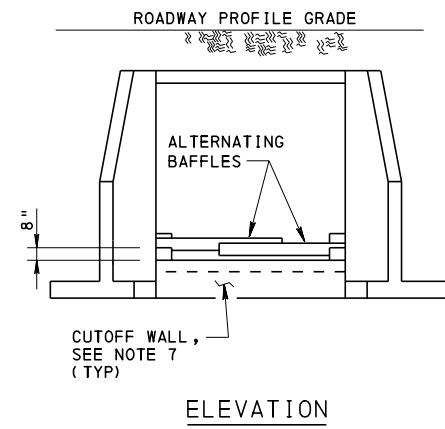
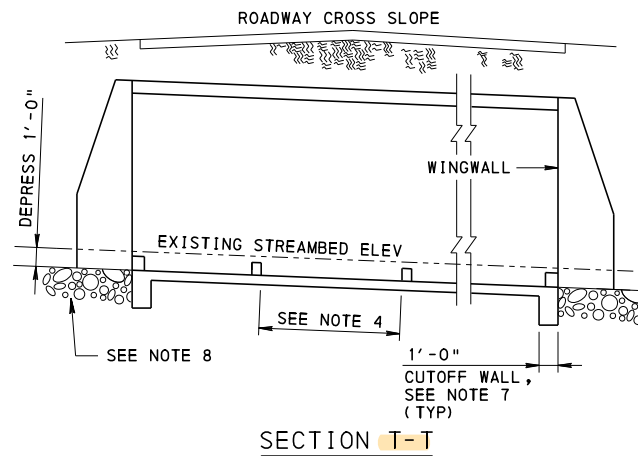
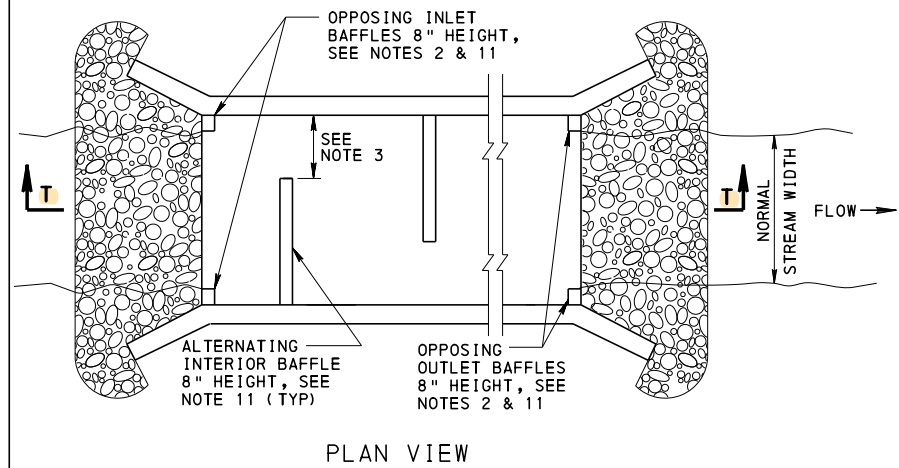
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF BRIDGE

**STANDARD**  
**RC BOX CULVERT**  
**MISCELLANEOUS TWIN CELL DETAILS**

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

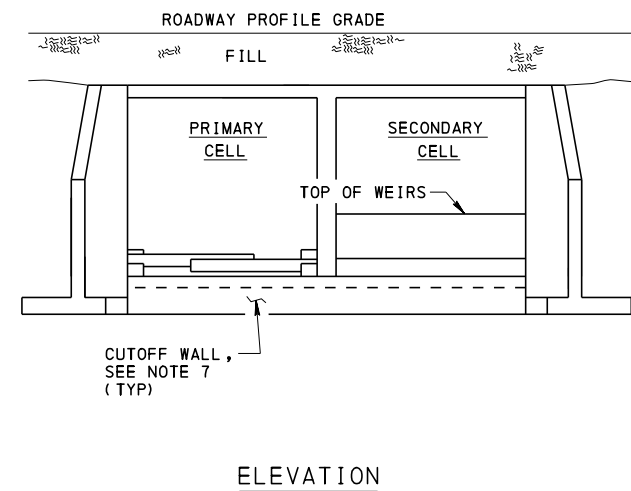
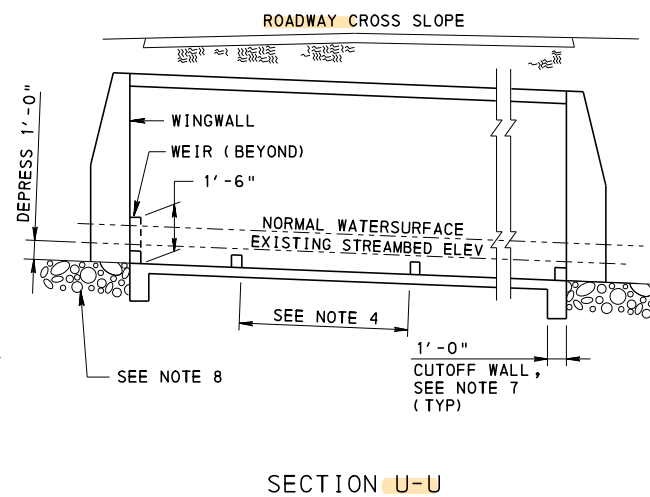
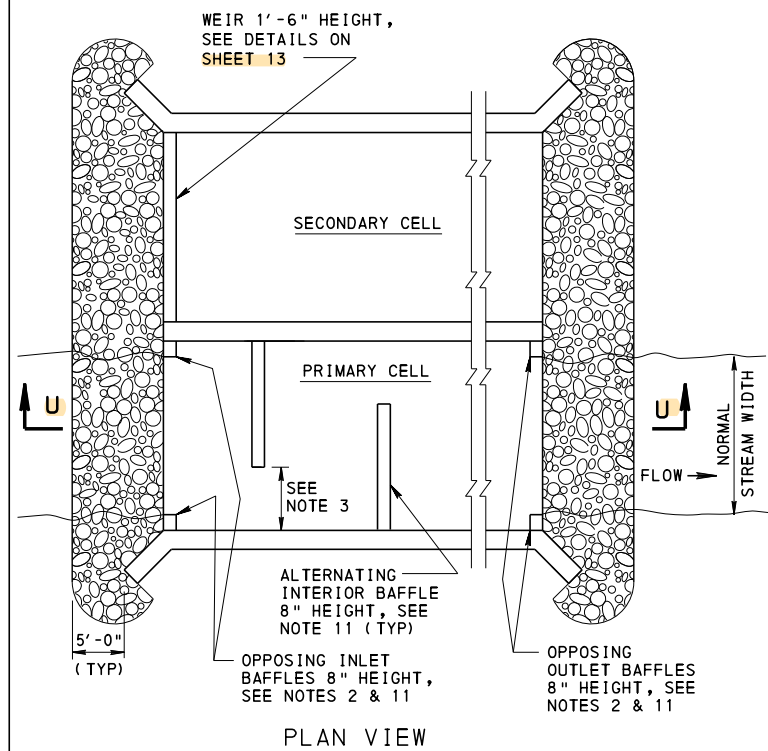
RECOMMENDED OCT. 7, 2024  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 13 OF 16  
BD-632M

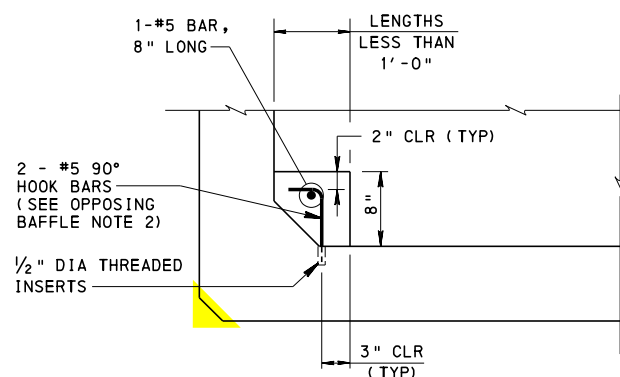


## BOX CULVERTS

NOTE: TOP OF BAFFLE SHALL BE MIN 4" BELOW EXISTING STREAMBED ELEV



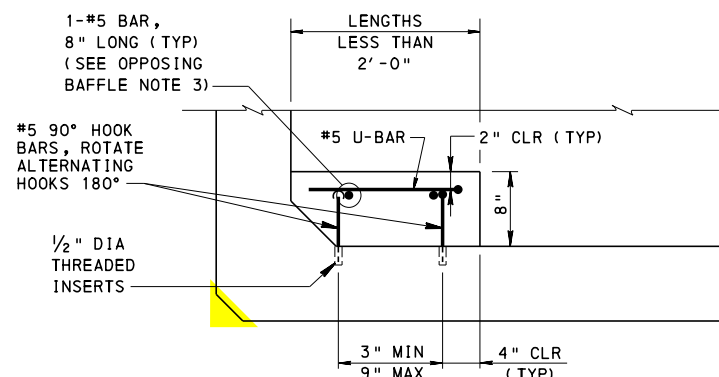
## TWIN CELL BOX CULVERTS



OPPOSING BAFFLES LESS THAN 1'-0"

### OPPOSING BAFFLE NOTES:

1. PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON SHEET 11.
2. FOR OPPOSING BAFFLES LESS THAN 1'-0", CAST ADJACENT INSERTS 7" ON CENTER FOR THE 2 - #5 90° HOOK BARS.
3. FOR OPPOSING BAFFLES LESS THAN 2'-0", REPLACE 2-#5 BARS WITH A #5 U-BAR SUPPORTED BY 8" LONG #5 BARS TIED TO ALTERNATING #5 90° HOOK BARS.



OPPOSING BAFFLES LESS THAN 2'-0"

### DESIGN NOTES:

1. THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE NORMAL CHANNEL WIDTH UPSTREAM AND DOWNSTREAM OF THE STRUCTURE (I.E. EDGE OF WATER TO EDGE OF WATER DURING NORMAL FLOW). AT LEAST THREE (3) MEASUREMENTS SHOULD BE TAKEN UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WHERE THE STREAM EXHIBITS NORMAL, STABLE CONDITIONS. AN AVERAGE OF THOSE SIX (6) MEASUREMENTS SHOULD THEN BE USED FOR THE BAFFLE CONFIGURATIONS.
  - MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL HAS BEEN AFFECTED BY THE STRUCTURE OR SHOWS SIGNS OF EROSION. BAFFLE CONFIGURATIONS SHOULD BE BASED ON NORMAL STREAM WIDTH (NOT TOP OF BANK TO TOP OF BANK OR WIDTH OF THE CULVERT).
2. OPPOSING BAFFLES SHOULD BE PLACED AT THE INLET AND THE OUTLET ENDS OF THE CULVERT. THE BAFFLE OPENING SHOULD BE A DISTANCE EQUAL TO THE AVERAGE NORMAL WIDTH OF THE STREAM.
3. THE OPENING IN THE INTERIOR BAFFLES SHOULD BE A DISTANCE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
4. INTERIOR BAFFLES SHOULD BE SPACED AT A DISTANCE EQUAL TO THE AVERAGE NORMAL STREAM WIDTH OR 8', WHICHEVER IS GREATER AND BE SPACED EVENLY BETWEEN THE INLET AND OUTLET BAFFLES.
5. IF BAFFLE SPACING NEEDS ADJUSTED DUE TO BOX SEGMENTS, THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.
6. THERE MAY BE UNUSUAL CIRCUMSTANCES IN WHICH THE STANDARD LAYOUT FOR BAFFLES WILL NOT ADEQUATELY ACCOMMODATE FISH PASSAGE. IN THESE CASES, THE PENNSYLVANIA FISH AND BOAT COMMISSION MUST PROVIDE SPECIFIC DESIGN GUIDANCE DURING PRELIMINARY DESIGN.
7. CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL WING WALL FOOTINGS OR ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN
8. ROCK LINING AT THE INLET AND OUTLET SHOULD BE DEPRESSED THE ENTIRE LENGTH AND CHOKED WITH NATURAL STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT SHOULD BE PLACED ON TOP OF THE ROCK LINING TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPEMENT OF A NATURAL STREAM BOTTOM IF FEASIBLE.
9. THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
10. ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 13.
11. FOR TYPICAL BAFFLE PLAN, PROFILE AND REINFORCEMENT DETAILS, SEE SHEET 11.
12. AN ALTERNATE DOUBLE WEIR BAFFLE DESIGN AS PROVIDED BY THE PENNSYLVANIA FISH AND BOAT COMMISSION IS PREFERRED AND MAY BE REQUIRED FOR SLOPES GREATER THAN 2% OR FOR BOXES THAT ARE SIGNIFICANTLY WIDER THAN THE NORMAL CHANNEL ELEV

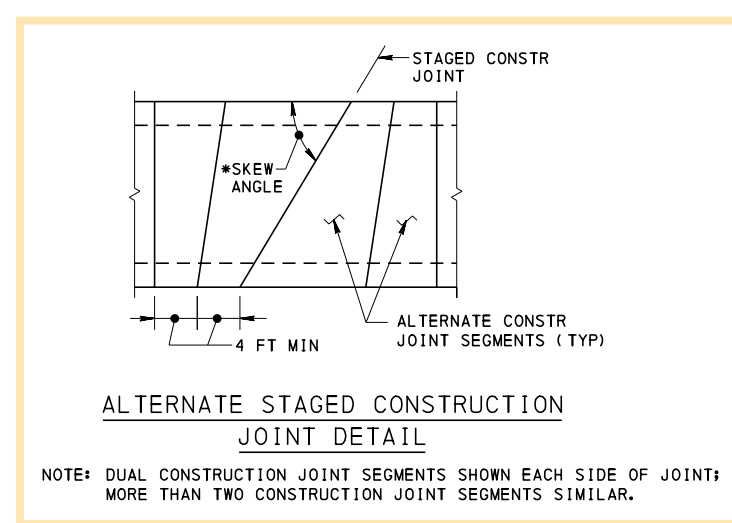
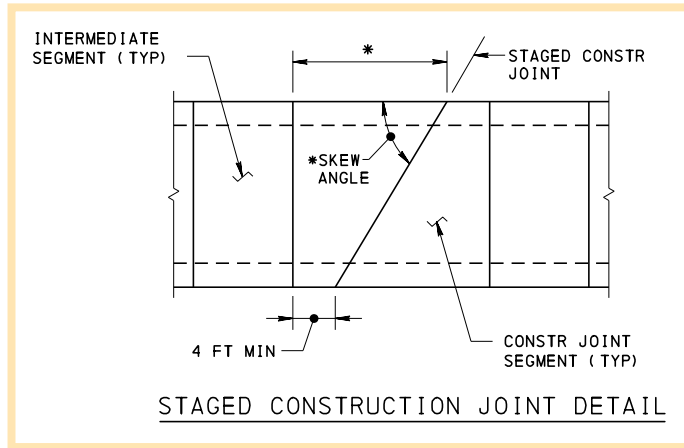
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
RC BOX CULVERT WITHOUT APRONS  
MISCELLANEOUS DETAILS  
STREAM GRADES  $\leq$  2%

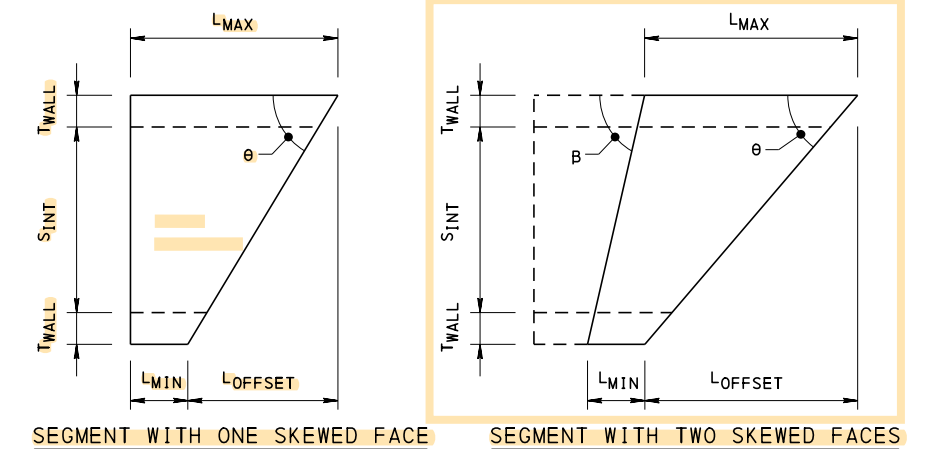
RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 14 OF 16  
BD-632M



## FABRICATION LIMITATIONS



$S_{INT}$  = INTERIOR CLEAR SPAN  
 $T_{WALL}$  = WALL THICKNESS  
 $W$  = OUT-TO-OUT WIDTH OF CULVERT =  $S_{INT} + 2(T_{WALL})$   
 $L_{MAX}$  = MAXIMUM EXTERIOR LENGTH OF SEGMENT =  $H_{MOLD} - 4IN$   
 $L_{MIN}$  = MINIMUM ALLOWED EXTERIOR LENGTH OF SEGMENT, SEE DETAILS ON THIS SHEET  
 $L_{OFFSET}$  = OFFSET BETWEEN LONG AND SHORT SIDES  
 $= L_{MAX} - L_{MIN}$  FOR SEGMENT WITH ONE SQUARE FACE  
 $= L_{MAX} + (W/TAN \beta) - L_{MIN}$  FOR SEGMENT WITH TWO SKEWED FACES  
 $H_{MOLD}$  = HEIGHT OF STEEL FORMING SYSTEM (TYPICALLY 8 FT OR 10 FT)  
 $\theta_{MIN}$  = MINIMUM SKEW ANGLE =  $90 \text{ DEG} - ATAN(L_{OFFSET}/W)$   
 $\beta$  = SECONDARY SKEW ANGLE (IF BOTH FACES ARE SKEWED)

## EXAMPLE CALCULATION - MINIMUM SKEW ANGLE

CALCULATE THE MINIMUM SKEW ANGLE THAT CAN BE FABRICATED WITH AN 8 FT MOLD FOR AN END SEGMENT WITH SQUARED JOINT,  $S_{INT} = 10 \text{ FT}$ , AND  $T_{WALL} = 12IN$

$W = S_{INT} + 2(T_{WALL}) = 10FT + 2(1FT) = 12FT$

$L_{MAX} = H_{MOLD} - 4IN = 8FT - 4IN = 7.67FT$

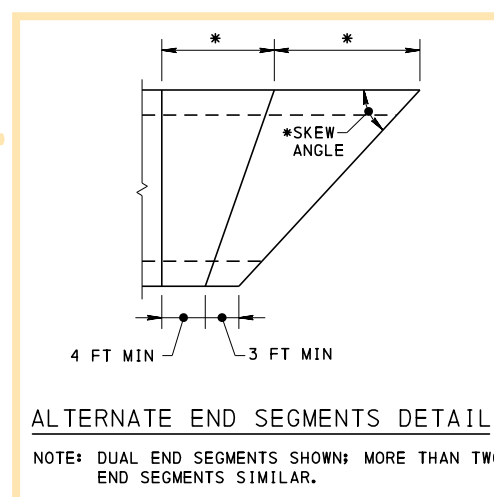
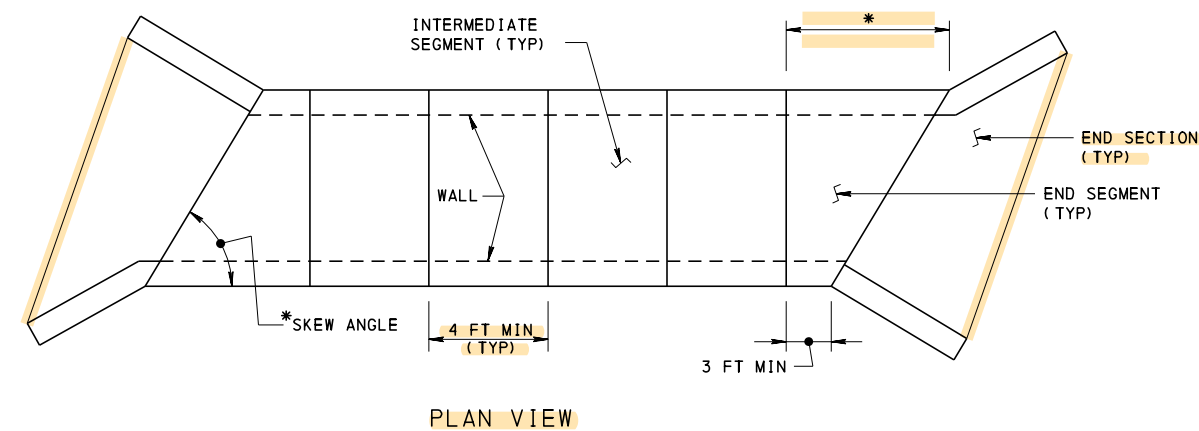
$L_{MIN} = 3FT \text{ (END SEGMENT)}$

$L_{OFFSET} = L_{MAX} - L_{MIN} = 7.667 \text{ FT} - 3FT = 4.667FT$

$\theta_{MIN} = 90 \text{ DEG} - ATAN(L_{OFFSET}/W) = 90 \text{ DEG} - ATAN(4.667 \text{ FT}/12FT) = 68.75 \text{ DEG}$

## DESIGN NOTES

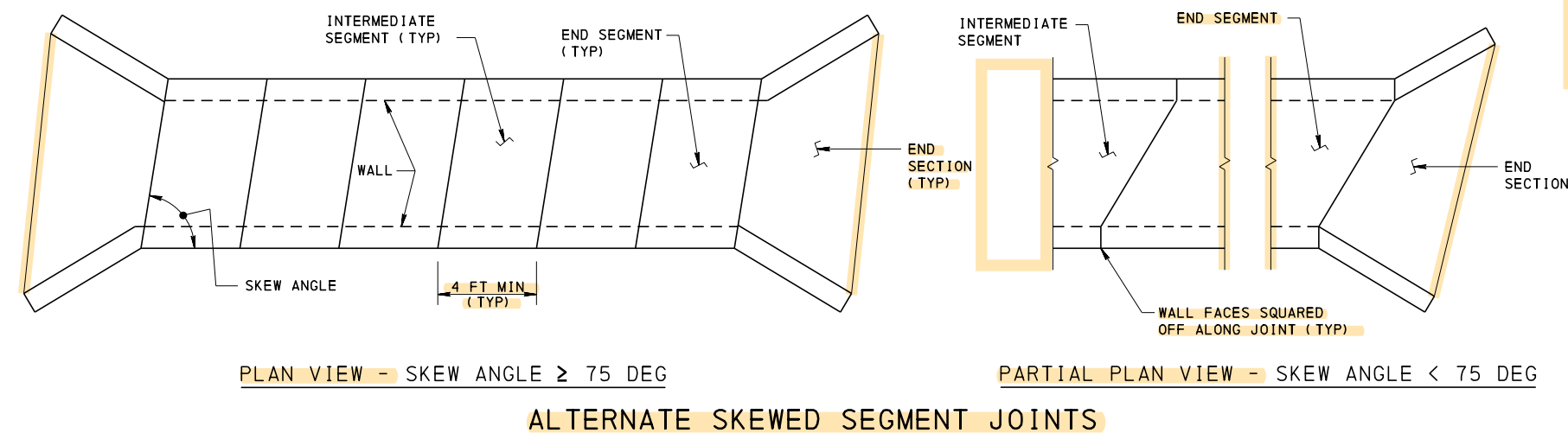
- SQUARED SEGMENT JOINTS ARE PREFERRED DUE TO POST-TENSIONING EFFECTS. AT A MINIMUM, WALL FACES MUST BE SQUARED AT SEGMENT JOINTS FOR CULVERT SKEWS ANGLES LESS THAN 75 DEGREES.
- THE MINIMUM SKEW ANGLE OF A CULVERT IS THE GREATER OF 35 DEGREES AND THE FABRICATION LIMIT AS ILLUSTRATED IN THE FABRICATION LIMITATIONS ON THIS SHEET.
- THE MINIMUM SEGMENT LENGTH IS 4 FT EXCEPT AS NOTED.
- WHEN USING THE STANDARD SQUARED JOINTS, TWO OR MORE SEGMENTS ARE PERMITTED TO BE USED TO TRANSITION FROM THE SQUARED JOINTS TO THE SKEWED ENDS AND CONSTRUCTION JOINTS.



NOTE: AT THE SHOP DRAWING STAGE, THE FABRICATOR MAY SUBMIT ANY OPTION ON THIS STANDARD. IF THE OPTION SUBMITTED MEETS THE DESIGN, THE OPTION SHOULD BE ACCEPTED.

## STANDARD SQUARED SEGMENT JOINTS

\* SEE NOTE 2 AND FABRICATION LIMITATIONS THIS SHEET



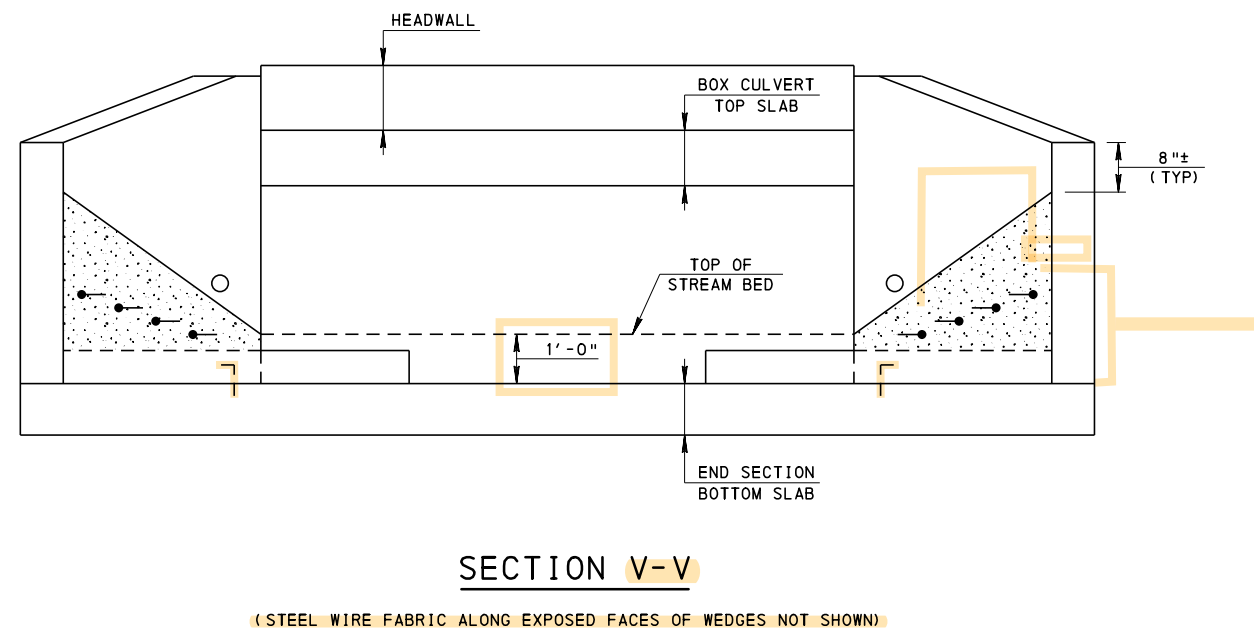
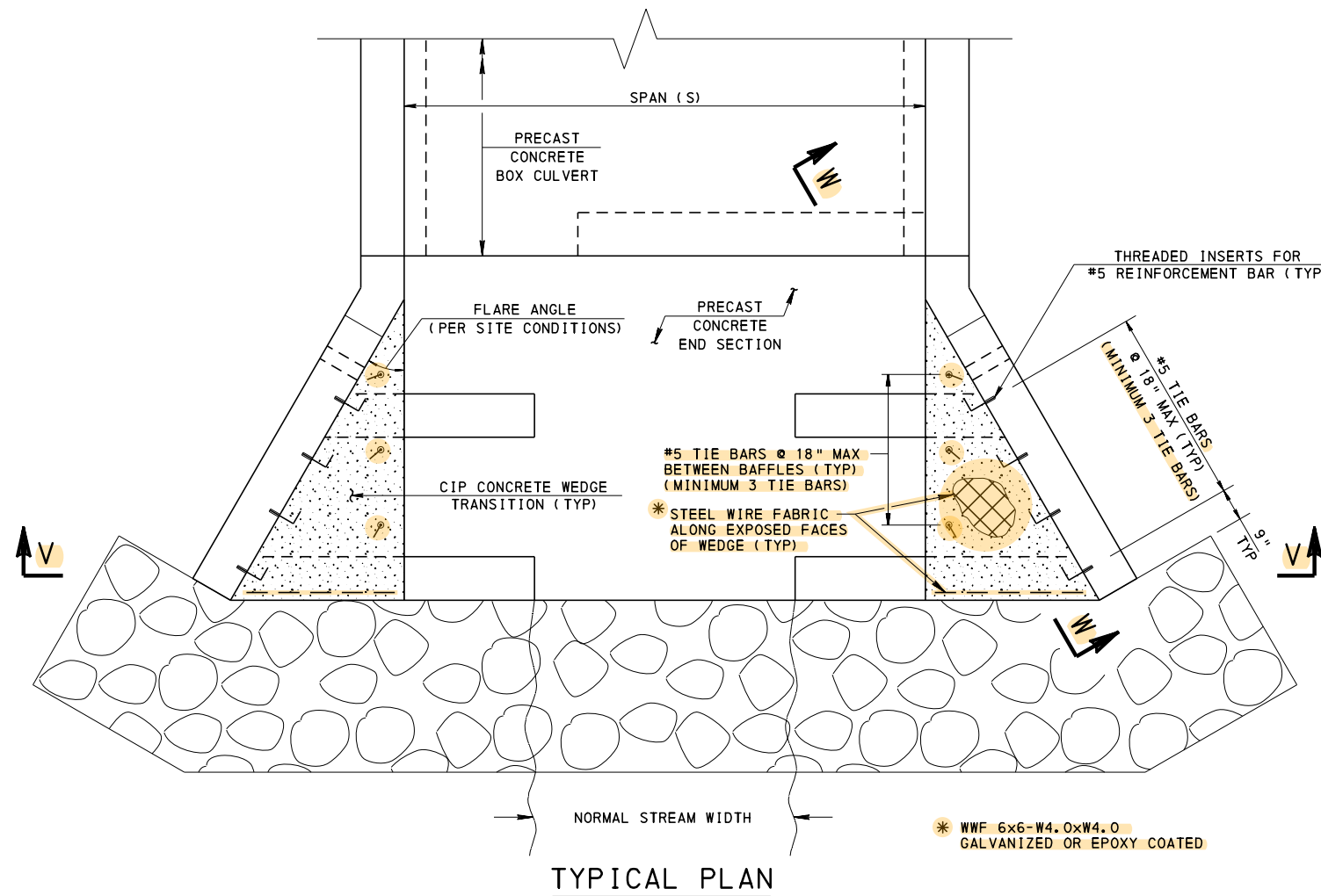
COMMONWEALTH OF PENNSYLVANIA  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF BRIDGE

STANDARD  
 RC BOX CULVERT  
 PRECAST CONCRETE  
 SEGMENT JOINT DETAILS

RECOMMENDED OCT. 7, 2024  
 Chief Bridge Engineer

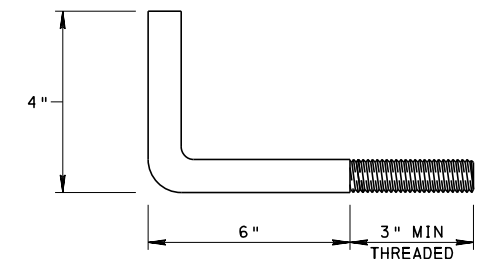
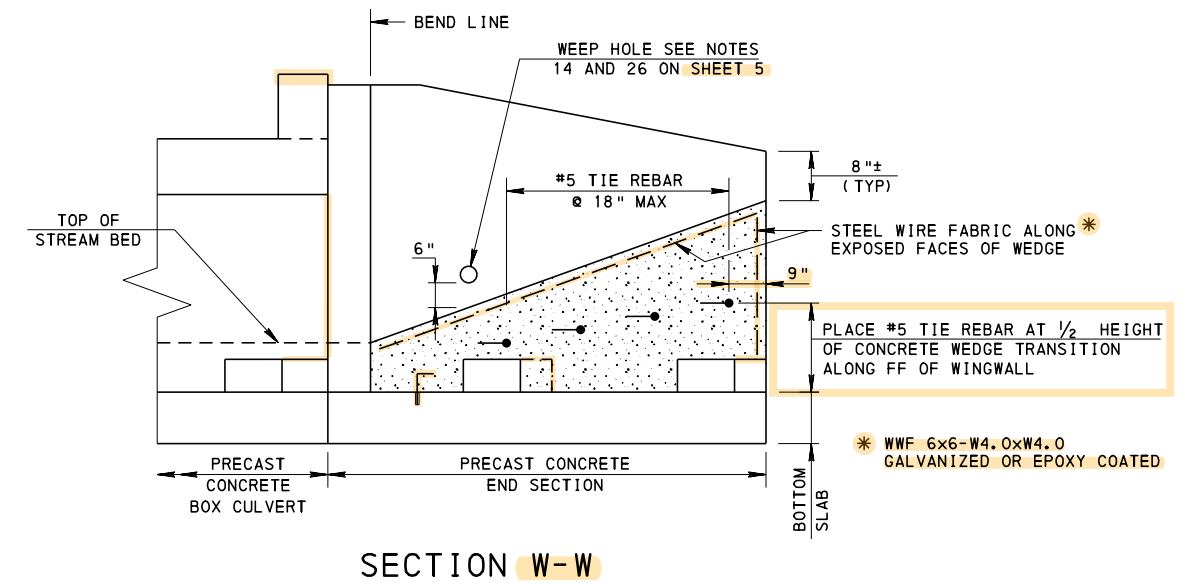
RECOMMENDED OCT. 7, 2024  
 Chief Engineer, Highway Admin.

SHEET 15 OF 16  
 BD-632M



#### DESIGN NOTES:

1. THE LAYOUT OF THE CONCRETE SLOPE TRANSITIONS SHOULD BE BASED ON THE REQUIRED GRADING AROUND THE WING WALLS.
2. CONSTRUCT CONCRETE SLOPE TRANSITIONS USING CLASS A CEMENT CONCRETE.
3. USE THIS DETAIL IN COORDINATION WITH THE DEPARTMENT OF ENVIRONMENTAL PROTECTION AND THE PENNSYLVANIA FISH AND BOAT COMMISSION DURING PRE-APP MEETING.



**#5 TIE BAR DETAIL**

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

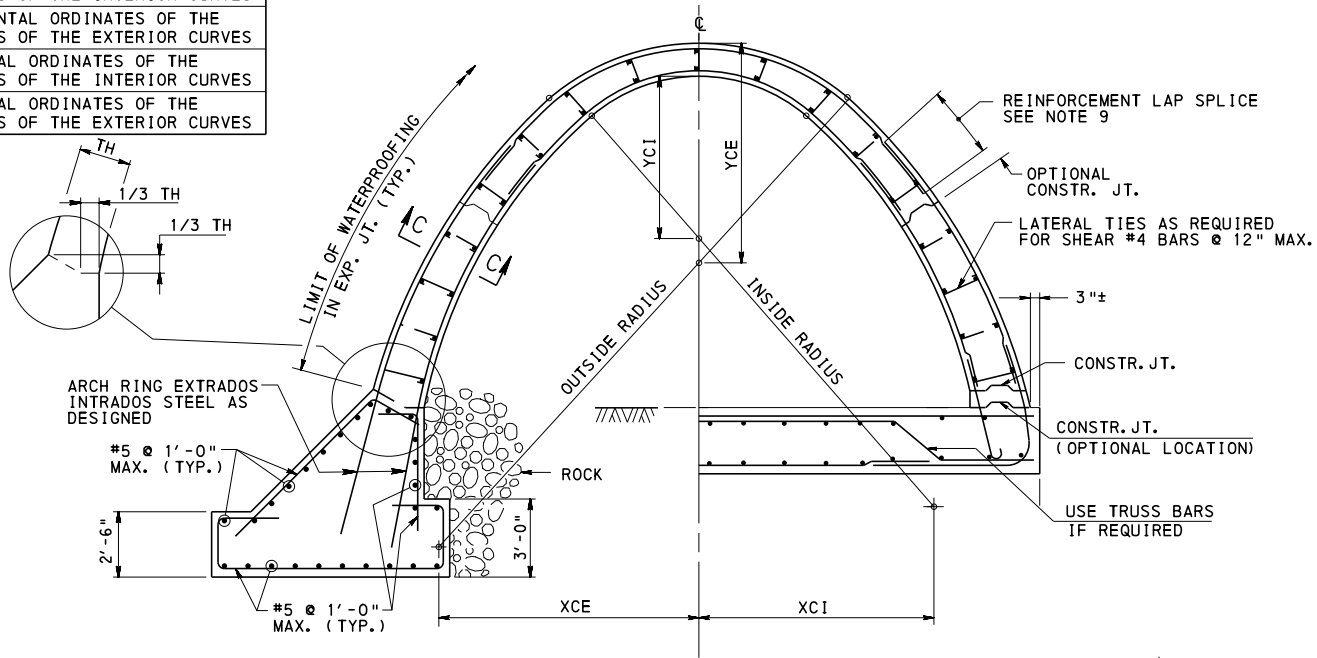
STANDARD  
PRECAST BOX CULVERT WITH APRONS  
CIP CONCRETE WEDGE  
TRANSITION

RECOMMENDED OCT. 7, 2024  
*Kevin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT. 7, 2024  
*Glenn E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 16 OF 16  
BD-632M

| MARK | DESCRIPTION                                                |
|------|------------------------------------------------------------|
| XCI  | HORIZONTAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES |
| XCE  | HORIZONTAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES |
| YCI  | VERTICAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES   |
| YCE  | VERTICAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES   |

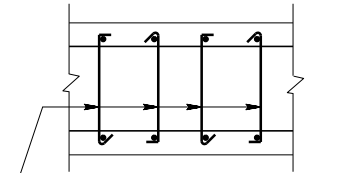


**FIXED ARCH**

**TIED ARCH**  
(LOW FLOW TREATMENT NOT SHOWN)

**TYPICAL ARCH SECTION**

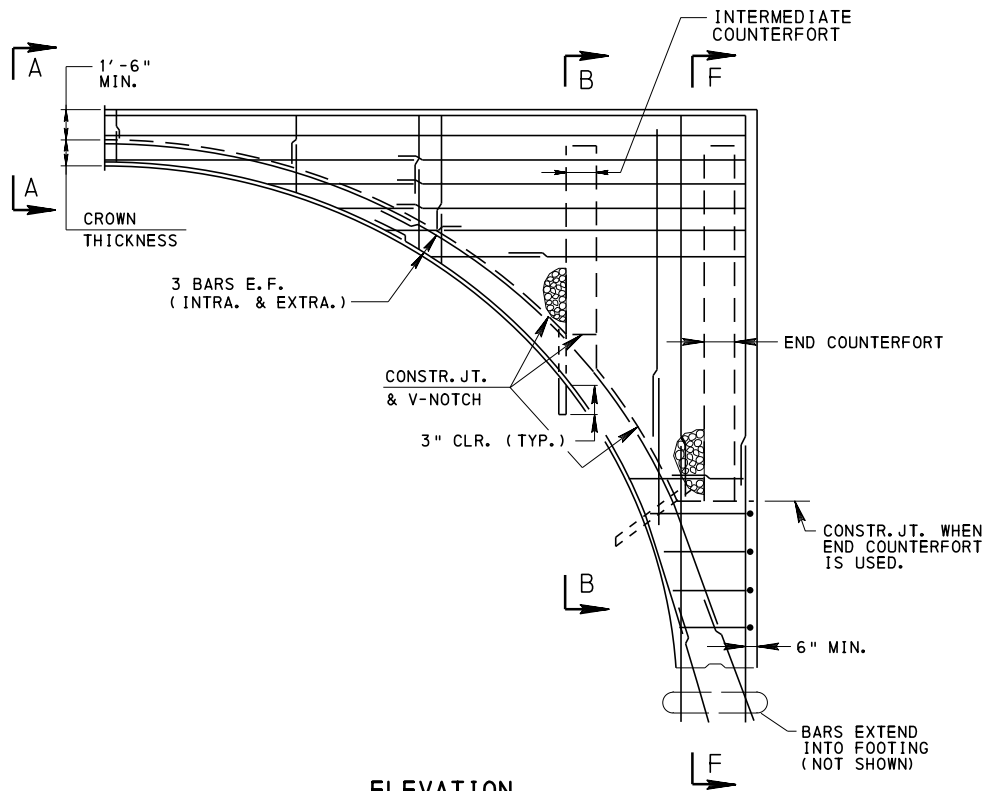
(WEEPHOLES NOT SHOWN, SEE ARCH WEEPHOLE DETAIL)



#4 BAR TIES,  
ALTERNATE INTERSECTIONS  
OF LONGITUDINAL & TRANSVERSE  
BARS AND STAGGER (TYP.)

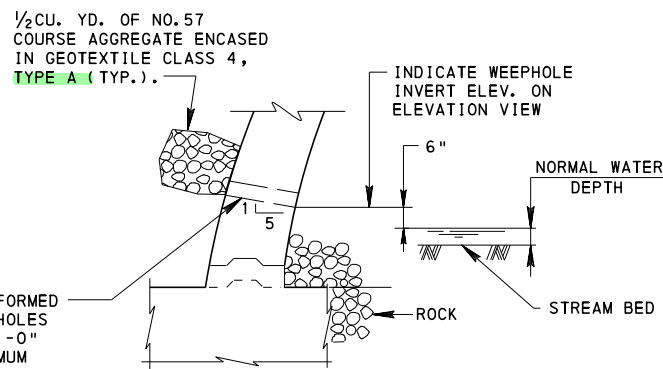
**SECTION C-C**

(TIE DETAIL)



**ELEVATION**

**ARCH RING AND SPANDREL WALL DETAIL**



**ARCH WEEPHOLE DETAIL**

|                    |                                       |
|--------------------|---------------------------------------|
| BD-621M            | REINFORCED CONCRETE ABUTMENTS         |
| BD-631M            | END WALL DETAILS                      |
| BD-632M            | R.C. BOX CULVERT                      |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS |
| REFERENCE DRAWINGS |                                       |

**GENERAL NOTES**

- DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATIONS" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
- PROVIDE MATERIALS AND **WORK QUALITY** IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
- PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED.
- FOR LOW FLOW FISH PASSAGE DESIGN, REFER TO BD-632M.
- INDICATE FACTORED FOUNDATION RESISTANCE AND MAXIMUM DESIGN FOUNDATION PRESSURE.
- PLACE HEADWALL AND WINGWALL FOOTINGS BELOW SCOUR DEPTH OR FROST DEPTH WHICHEVER IS GREATER.
- SEE SHEET 2 FOR SECTION DETAILS.
- MINIMUM FILL OVER CONCRETE ARCHES IS 12" OR SPAN LENGTH/8, WHICH EVER IS GREATER.
- STAGGER ALL LAPS WITH A MINIMUM OF 1'-0" MEASURED ALONG THE CIRCUMFERENCE OF THE ARCH.
- FOOTING DESIGN TO CONFORM TO AASHTO LRFD "BRIDGE DESIGN SPECIFICATIONS" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
- COUNTERFORT DESIGN REQUIRED FOR SPANDREL WALL OVER 8'-0".

**INSTRUCTIONS**

- SPANS  $\leq 15'-0"$  DESIGN WITH SEMI-CIRCULAR OR SEGMENTAL INTRADOS. SPANS  $> 15'-0"$  DESIGN WITH MULTI-CENTERED INTRADOS.
- MINIMUM THICKNESS OF ARCH RING - 10" FOR SPANS  $\leq 20'-0"$ . 1'-0" FOR SPANS  $> 20'-0"$ .
- MINIMUM THICKNESS OF SKEWBACK  $\geq 1.5$  TIMES THE CROWN THICKNESS.
- PLACE MAIN CIRCUMFERENTIAL REINFORCEMENT NORMAL TO THE CENTERLINE OF THE CULVERT.

**DESIGN DATA**

- CONCRETE  $f'c = 3000$  P.S.I. (CLASS A CEMENT CONCRETE)
- REINFORCEMENT BARS  $f_y = 60,000$  P.S.I.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

**STANDARD**

**R.C. ARCH CULVERT**

**DETAILS**

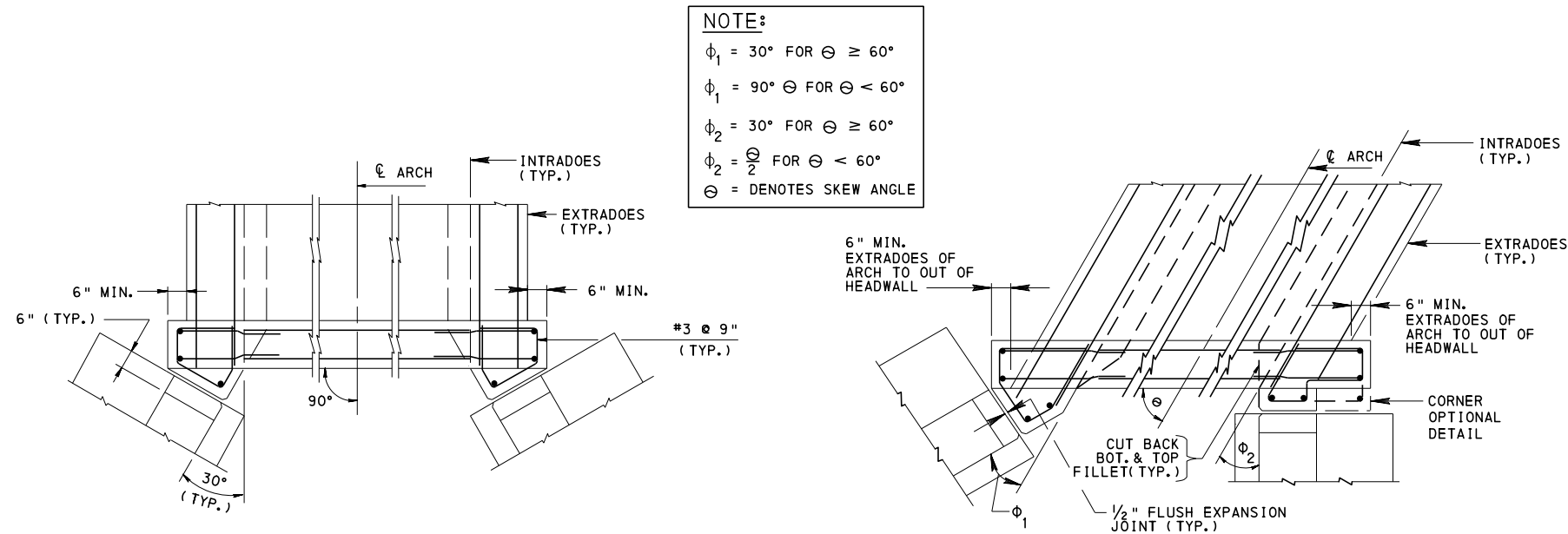
RECOMMENDED AUG. 30, 2019  
*John J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 2

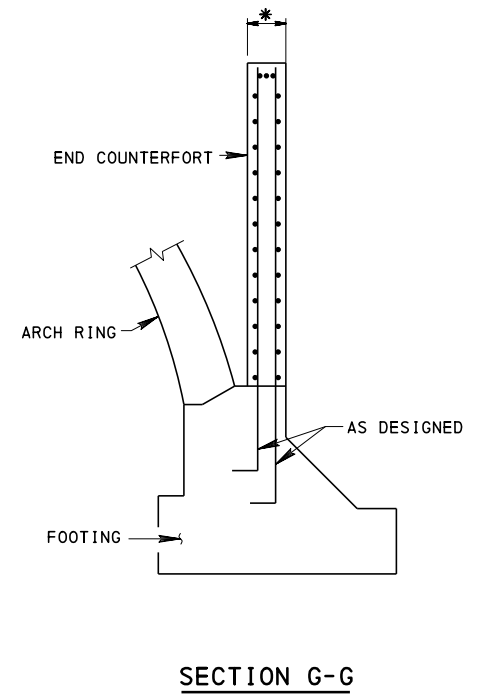
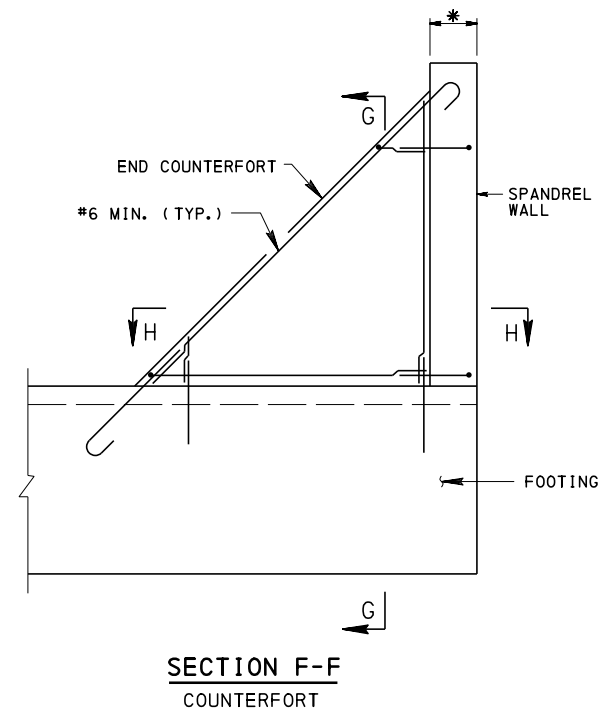
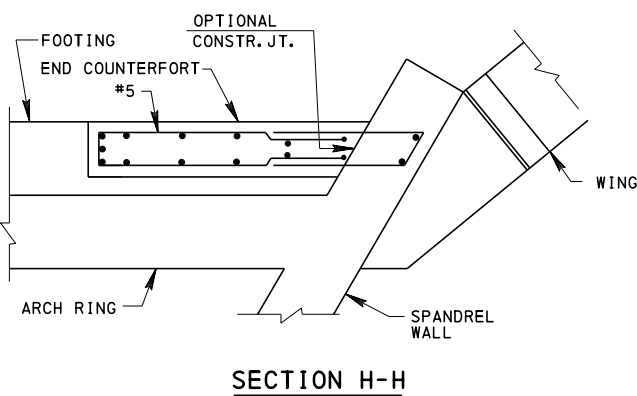
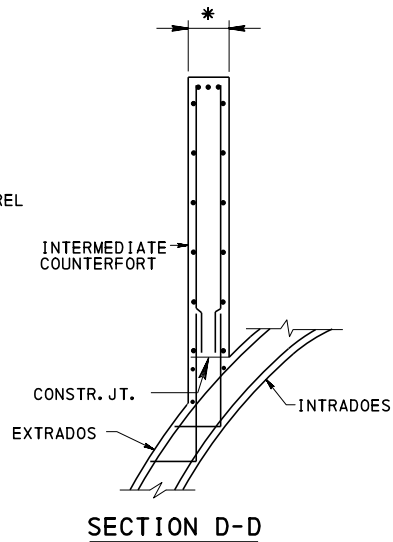
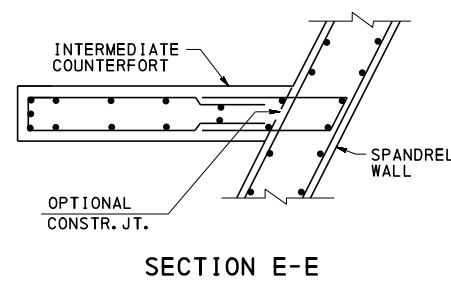
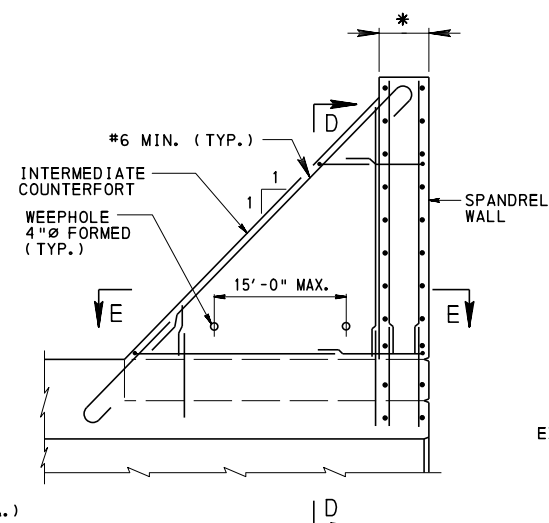
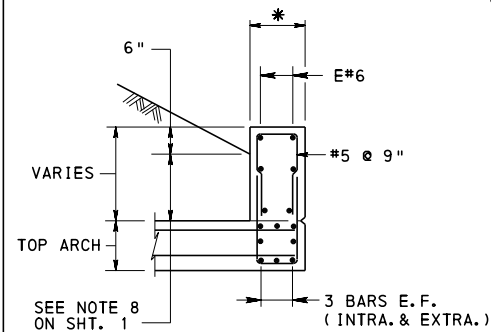
**BD-633M**

**CHANGE 2**



## TYPICAL CULVERT HEADWALL DETAILS - FIXED AND TIED ARCH

(APRON NOT SHOWN)  
 PROVIDE CONCRETE APRON AT INLET AND OUTLET.

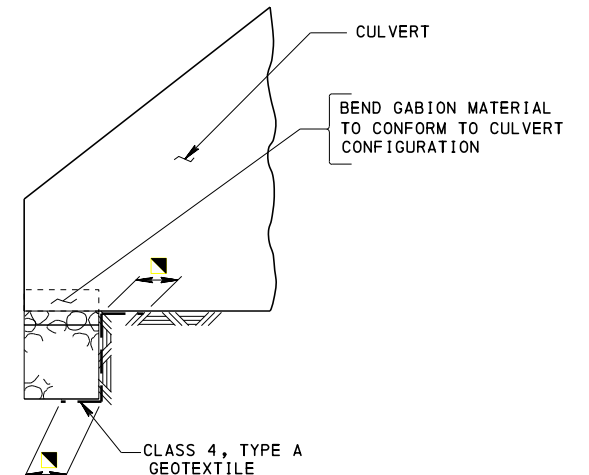
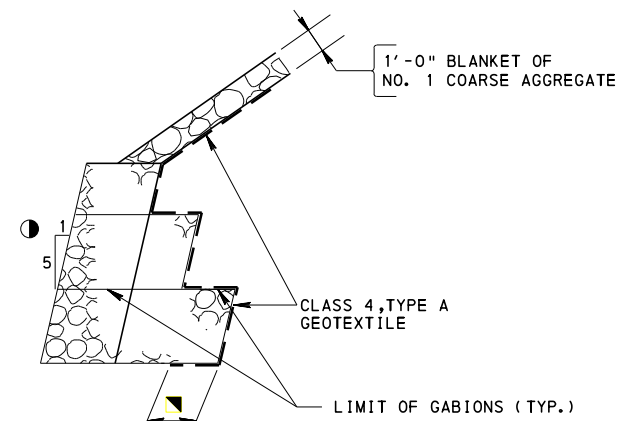
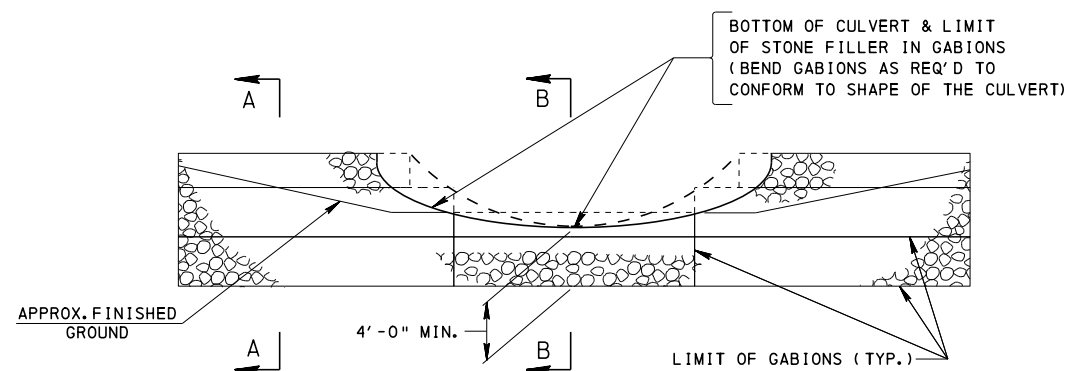
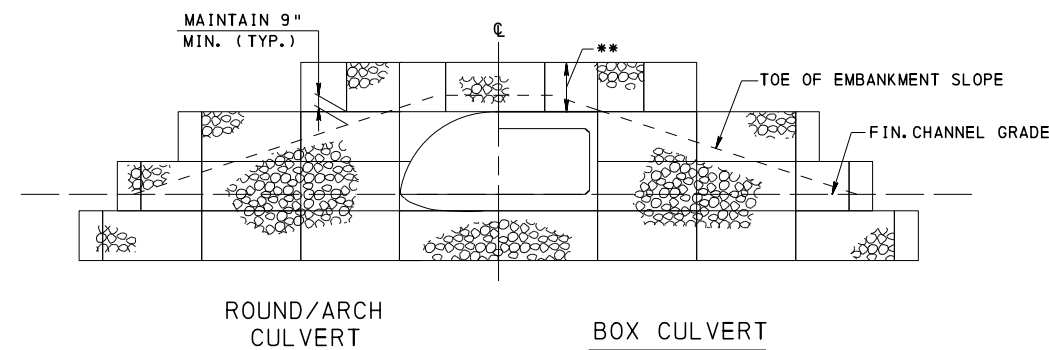
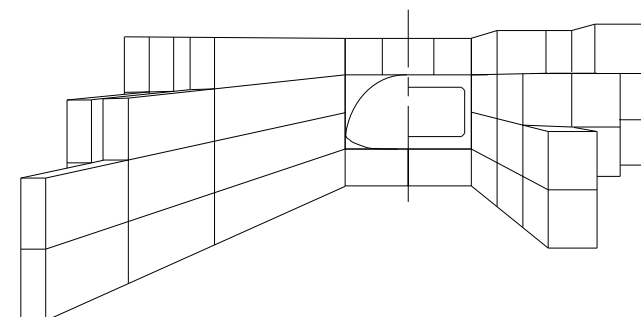
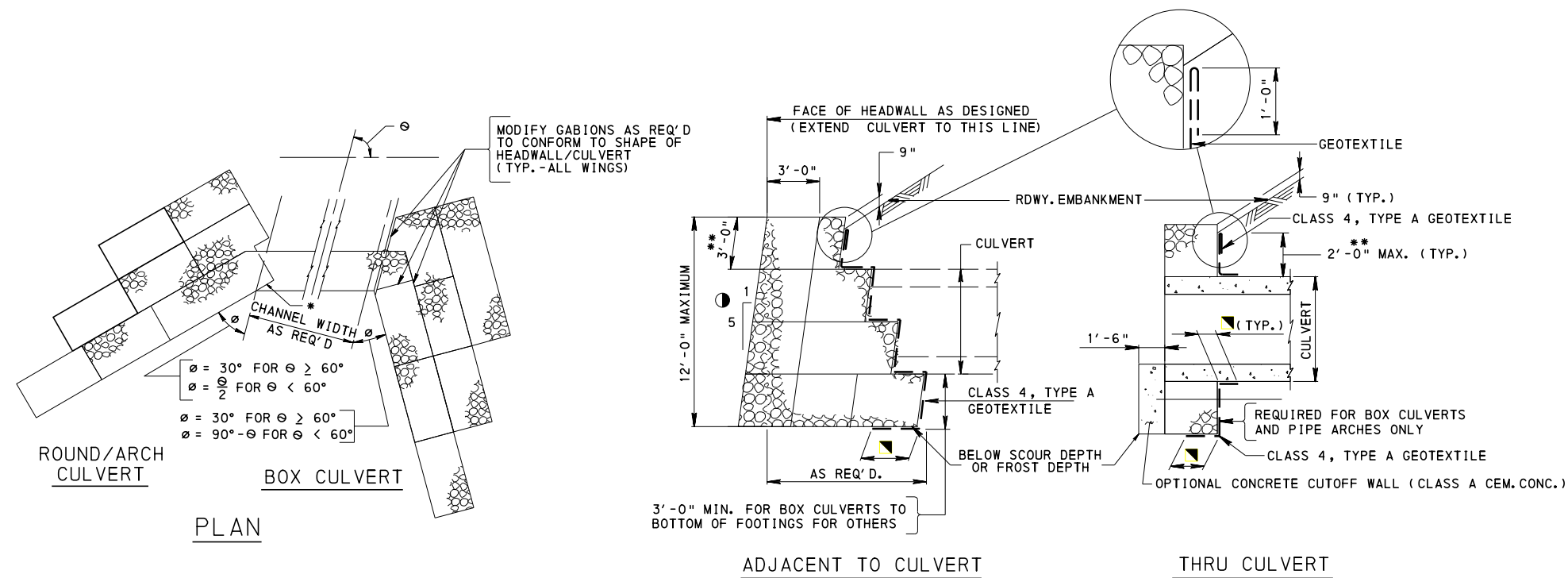


## TYPICAL SPANDREL WALL DETAILS

(SHOWING REINFORCEMENT BARS LAYOUT.)  
 \* 1' - 6" MINIMUM OR AS REQ'D.

| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BUREAU OF PROJECT DELIVERY |                                                                                             |                         |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|
| STANDARD                                                                                   |                                                                                             |                         |
| R. C. ARCH CULVERT                                                                         |                                                                                             |                         |
| DETAILS                                                                                    |                                                                                             |                         |
| RECOMMENDED AUG. 30, 2019<br><i>John J. Rizzo</i><br>ACTING CHIEF BRIDGE ENGINEER          | RECOMMENDED AUG. 30, 2019<br><i>Michael V. Bilek</i><br>ACT. DIR., BUR. OF PROJECT DELIVERY | SHEET 2 OF 2<br>BD-633M |





## GENERAL NOTES

- DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATION" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
- PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
- SUBMIT DESIGN COMPUTATIONS & DETAIL DRAWINGS SHOWING PROPOSED GABION LAYOUT IF GABION ENDWALLS ARE PERMITTED FOR USE IN LIEU OF THE REINFORCED CONCRETE ENDWALL SHOWN ON THE CONSTRUCTION DRAWINGS. GABION DRAWINGS MUST BE IN ACCORDANCE WITH THE CONCEPTUAL SKETCHES SHOWN ON THIS SHEET AND MUST BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
- WHERE STABILITY ANALYSIS INDICATES THAT SLIDING IS A PROBLEM, PLACE A 1'-0" THICK BASE OF NO. 1 COARSE AGGREGATE UNDER THE GABION WALL.
- USE GABION END WALLS FOR METAL CULVERTS AND PRECAST CONCRETE CULVERTS.
- USE OF GABION WALLS IS PERMITTED UP TO 8'-0" MAXIMUM HEIGHT (OUT-TO-OUT) IN RURAL AREAS ONLY.
- FOR ROCK PROTECTION DETAILS, SEE BD-631M.
- FOR GABION SIZES, SEE BC-782M.

## LEGEND:

- \* FOR ROUND/ARCH APPLICATION, PLACE INTERMEDIATE LAYERS OF GABIONS TO CONFORM TO OUTSIDE FACE OF THE CULVERT CONFIGURATION.
- \*\* CHECK THE GABION STABILITY (OVERTURNING AND SLIDING) FOR THE GABION OVER THE CULVERTS FOR ALL APPLICABLE FORCES DUE TO L.L. SURCHARGE AND FILL SLOPE BEING RETAINED BY IT.
- 1'-8" MIN. LENGTH OF GEOTEXTILE
- A STEPPED FRONT FACE IS AN ACCEPTABLE ALTERNATE TO THE SMOOTH INCLINED FRONT FACE SHOWN. WITH EACH 3'-0" VERTICLE LIFT TO BE PLACED WITH A 7" HORIZONTAL SETBACK.

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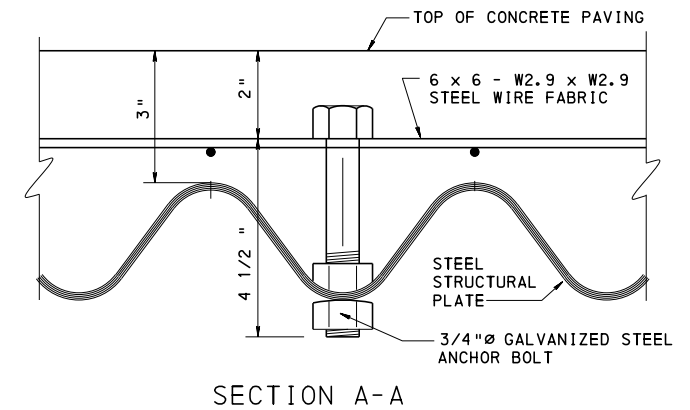
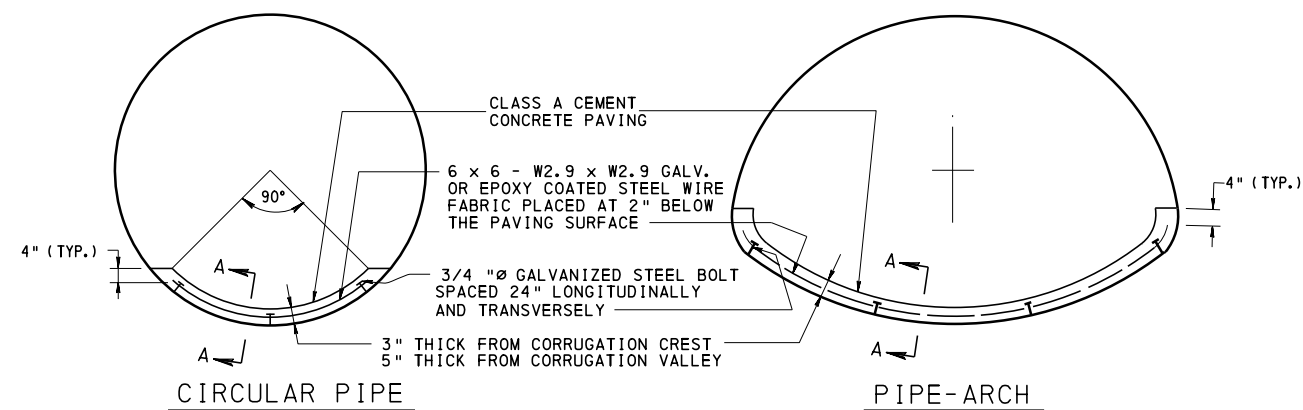
## STANDARD GABION END WALLS DETAILS

|                    |                                    |
|--------------------|------------------------------------|
| BD-631M            | END WALL DETAIL FOR METAL CULVERTS |
| BC-782M            | GABION SLOPE WALL DETAILS          |
| REFERENCE DRAWINGS |                                    |

RECOMMENDED APR. 29, 2016  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
Brenda S. Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 1  
BD-634M



## CONCRETE PAVED INVERT DETAILS

### PLATE THICKNESS

| PLATE THICKNESS |          | PLATE<br>GAGE NO.<br>* |
|-----------------|----------|------------------------|
| GALVANIZED      | UNCOATED |                        |
| 0.280           | 0.2758   | 1                      |
| 0.249           | 0.2451   | 3                      |
| 0.218           | 0.2145   | 5                      |
| 0.188           | 0.1838   | 7                      |
| 0.170           | 0.1644   | 8                      |
| 0.140           | 0.1345   | 10                     |
| 0.111           | 0.1046   | 12                     |

\* APPLIES TO ENGLISH UNITS ONLY

### NOTES:

- PAVE INVERTS OF THE STEEL PIPES AND PIPE ARCHES WITH CLASS A CEMENT CONCRETE WITH MAXIMUM COARSE AGGREGATE SIZE OF 3/4". COVER 25% OF THE PERIPHERY OF PIPES AND APPROXIMATELY 40% OF THE PERIPHERY OF PIPE ARCHES, INCLUDING THE CORNER PLATES, TO A CONCRETE THICKNESS OF 3" ABOVE THE CREST OF CORRUGATIONS.
- PLACE CONCRETE PAVING AFTER COMPLETION OF FILL OVER THE PIPES AND PIPE ARCHES.
- BEFORE THE PLACEMENT OF CONCRETE, THOROUGHLY CLEAN AND DRY THE STEEL CULVERT SURFACE TO BE PAVED AND REMOVE ALL FOREIGN MATERIAL AND CORROSIVE LOOSE SCALE.
- REINFORCE CONCRETE PAVING WITH GALVANIZED OR EPOXY COATED STEEL WIRE FABRIC AND PLACE IT 2" BELOW THE CONCRETE FACE WITH 4" CLEARANCE FROM THE EDGES OF CONCRETE PAVING. FASTEN STEEL WIRE FABRIC TO 3/4"Ø GALVANIZED BOLTS WHICH ARE BOLTED TO THE STEEL CULVERT INVERT AND SPACED 24" ON CENTER LONGITUDINALLY AND TRANSVERSELY.
- USE STEEL WIRE FABRIC OF #6 GAGE WIRE AT 6" CENTERS LONGITUDINALLY AND TRANSVERSELY. MINIMUM LAP LENGTH IS 8". FOLD STEEL WIRE FABRIC UNDER UPSTREAM AND DOWNSTREAM LIPS OF THE CULVERT AT LEAST 12".
- FINISH CONCRETE PAVING TO A SMOOTH SURFACE. AFTER INITIAL SET, COVER CONCRETE SURFACE WITH A HEAVY SPRAY OR MOP COAT OF EMULSIFIED ASPHALT CLASS E-1. CURE CONCRETE FOR A MINIMUM OF 48 HOURS BEFORE WATER IS PERMITTED TO FLOW ON THE PAVED INVERT.

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## STANDARD DESIGN DETAILS FOR METAL CULVERTS

RECOMMENDED APR. 29, 2016  
*Thomas P. Maciore*  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
*Brian S. Thompson*  
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SHEET 1 OF 4  
BD-635M

STEEL STRUCTURAL PLATE PIPE THICKNESS REQUIREMENTS  
WITH MINIMUM★ PREDICTED METAL LOSS CONDITION  
(BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

| DIAMETER<br><br>FT. ( IN. ) | TOP PLATE THICKNESS 0.111 IN.  |                                |                         |                            |                         | TOP PLATE THICKNESS 0.140 IN.  |                                |                         |                            |                         | TOP PLATE THICKNESS 0.170 IN.  |                                |                         |                            |                         | TOP PLATE THICKNESS 0.188 IN.  |                                |                         |                            |                         | TOP PLATE THICKNESS 0.218 IN.  |                                |                         |                            |                         | TOP PLATE THICKNESS 0.249 IN.  |                                |                         |                            |                         | TOP PLATE THICKNESS 0.280 IN. |                         |       |   |       |
|-----------------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|-------------------------------|-------------------------|-------|---|-------|
|                             | MAX. FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         | MAX. FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         | MAX. FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         | MAX. FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         | MAX. FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         | MAX. FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         |                               |                         |       |   |       |
|                             |                                | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                                | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                                | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                                | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                                | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                                | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                               |                         |       |   |       |
|                             |                                | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |                                | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |                                | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |                                | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |                                | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |                                | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT    | WITH<br>PAVED<br>INVERT |       |   |       |
| 5 ( 60 )                    | 42                             | 0.168                          | 0.111                   | 0.249                      | 0.188                   | 60                             | 0.170                          | 0.140                   | 0.280                      | 0.218                   | 79                             | 0.188                          | 0.170                   | 0.280                      | 0.218                   | 88                             | 0.188                          | 0.188                   | 0.280                      | 0.218                   | 103                            | 0.218                          | 0.218                   | —                          | 0.249                   | 118                            | 0.249                          | 0.249                   | —                          | 0.249                   | 133                           | 0.280                   | 0.280 | — | 0.280 |
| 6 ( 72 )                    | 35                             |                                |                         |                            |                         | 50                             |                                |                         |                            |                         | 66                             |                                |                         |                            |                         | 73                             |                                |                         |                            |                         | 86                             |                                |                         |                            |                         | 98                             |                                |                         |                            |                         | 111                           |                         |       |   |       |
| 7 ( 84 )                    | 30                             |                                |                         |                            |                         | 43                             |                                |                         |                            |                         | 56                             |                                |                         |                            |                         | 63                             |                                |                         |                            |                         | 74                             |                                |                         |                            |                         | 84                             |                                |                         |                            |                         | 95                            |                         |       |   |       |
| 8 ( 96 )                    | 26                             |                                |                         |                            |                         | 38                             |                                |                         |                            |                         | 49                             |                                |                         |                            |                         | 55                             |                                |                         |                            |                         | 64                             |                                |                         |                            |                         | 73                             |                                |                         |                            |                         | 83                            |                         |       |   |       |
| 9 (108)                     | 23                             |                                |                         |                            |                         | 33                             |                                |                         |                            |                         | 44                             |                                |                         |                            |                         | 49                             |                                |                         |                            |                         | 57                             |                                |                         |                            |                         | 65                             |                                |                         |                            |                         | 74                            |                         |       |   |       |
| 10 (120)                    | 21                             |                                |                         |                            |                         | 30                             |                                |                         |                            |                         | 39                             |                                |                         |                            |                         | 44                             |                                |                         |                            |                         | 51                             |                                |                         |                            |                         | 59                             |                                |                         |                            |                         | 66                            |                         |       |   |       |
| 11 (132)                    | 19                             |                                |                         |                            |                         | 27                             |                                |                         |                            |                         | 36                             |                                |                         |                            |                         | 40                             |                                |                         |                            |                         | 47                             |                                |                         |                            |                         | 53                             |                                |                         |                            |                         | 60                            |                         |       |   |       |
| 12 (144)                    | 17                             |                                |                         |                            |                         | 25                             |                                |                         |                            |                         | 33                             |                                |                         |                            |                         | 36                             |                                |                         |                            |                         | 43                             |                                |                         |                            |                         | 49                             |                                |                         |                            |                         | 55                            |                         |       |   |       |
| 13 (156)                    | 16                             |                                |                         |                            |                         | 23                             |                                |                         |                            |                         | 30                             |                                |                         |                            |                         | 34                             |                                |                         |                            |                         | 39                             |                                |                         |                            |                         | 45                             |                                |                         |                            |                         | 51                            |                         |       |   |       |
| 14 (168)                    | 15                             |                                |                         |                            |                         | 21                             |                                |                         |                            |                         | 28                             |                                |                         |                            |                         | 31                             |                                |                         |                            |                         | 37                             |                                |                         |                            |                         | 42                             |                                |                         |                            |                         | 47                            |                         |       |   |       |
| 15 (180)                    | 14                             | ↓                              | ↓                       | ↓                          | ↓                       | 20                             |                                |                         |                            |                         | 26                             |                                |                         |                            |                         | 29                             |                                |                         |                            |                         | 34                             |                                |                         |                            |                         | 39                             |                                |                         |                            |                         | 44                            |                         |       |   |       |
| 16 (192)                    | —                              | —                              | —                       | —                          | —                       | 19                             | ↓                              | ↓                       | ↓                          | ↓                       | 24                             |                                |                         |                            |                         | 27                             |                                |                         |                            |                         | 32                             |                                |                         |                            |                         | 36                             |                                |                         |                            |                         | 41                            |                         |       |   |       |
| 17 (204)                    | —                              | —                              | —                       | —                          | —                       | 17                             | ↓                              | ↓                       | ↓                          | ↓                       | 23                             |                                |                         |                            |                         | 26                             |                                |                         |                            |                         | 30                             |                                |                         |                            |                         | 34                             |                                |                         |                            |                         | 39                            |                         |       |   |       |
| 18 (216)                    | —                              | —                              | —                       | —                          | —                       | —                              | —                              | —                       | —                          | —                       | 22                             |                                |                         |                            |                         | 24                             |                                |                         |                            |                         | 28                             |                                |                         |                            |                         | 32                             |                                |                         |                            |                         | 37                            |                         |       |   |       |
| 19 (228)                    | —                              | —                              | —                       | —                          | —                       | —                              | —                              | —                       | —                          | —                       | 20                             | ↓                              | ↓                       | ↓                          | ↓                       | 23                             |                                |                         |                            |                         | 27                             |                                |                         |                            |                         | 31                             |                                |                         |                            |                         | 35                            |                         |       |   |       |
| 20 (240)                    | —                              | —                              | —                       | —                          | —                       | —                              | —                              | —                       | —                          | —                       | —                              | —                              | —                       | —                          | —                       | 22                             | ↓                              | ↓                       | ↓                          | ↓                       | 25                             | ↓                              | ↓                       | ↓                          | ↓                       | 29                             | ↓                              | ↓                       | ↓                          | ↓                       | 33                            | ↓                       | ↓     | ↓ | ↓     |

- ★ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.
- NOTES:

1. THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.

2. THE "INVERT PLATE THICKNESS" IS COMPUTED IN ACCORDANCE WITH THE SERVICE LOAD DESIGN PROCEDURES AS PER AASHTO SPECIFICATIONS, BUT WITH A MINIMUM SAFETY FACTOR OF 1.3 AT THE END OF A DESIGN LIFE BASED ON THE METAL LOSS OF 2 MILS PER YEAR.

3. THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.

4. INVERT PLATES ARE THE PLATES AT THE LOWER 90° OF THE PIPE CIRCUMFERENCE. THE PLATES LOCATED BETWEEN THE INVERT PLATES AND THE HORIZONTAL DIAMETER LINE OF THE PIPE MAY BE ONE GAGE LIGHTER THAN THE INVERT PLATES, BUT NO LIGHTER THAN THE UPPER TOP PLATES. (SEE SKETCH)

5. ALL STEEL PLATES ARE 6"x 2" CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M167 AND MUST BE GALVANIZED.

6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 12" AND IS MEASURED FROM TOP OF RIGID PAVEMENT OR BOTTOM OF FLEXIBLE PAVEMENT. FOR MINIMUM FILL AND COVER REQUIREMENTS (AND DIAGRAMS DEFINITION OF COVER) SEE RC-30. FOR PIPE UNDER PAVEMENT STRUCTURE PLACE PIPE AT THE GREATER DEPTH OF FILL AND COVER. WHEN FILL HEIGHT IS LESS THAN 3 FT., A SPECIAL DESIGN CONSIDERING THE MOST CRITICAL LOAD WILL BE NEEDED. A SPECIAL APPROVAL FROM THE CHIEF BRIDGE ENGINEER WILL BE REQUIRED IF THE PIPE-ARCH IS TO BE DESIGNED FOR SUCH PERMANENT CONDITION.

7. THESE DESIGN VALUES ARE BASED UPON ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN RC STANDARDS AND PUBLICATION 408 ARE USED.

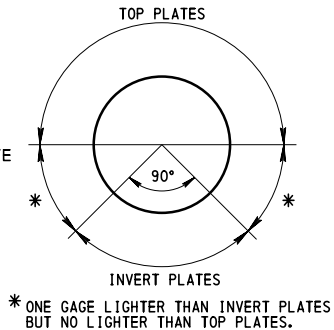
8. PIPES ARE DESIGNED FOR THE FILL HEIGHT INDICATED IN THIS TABLE. IF LIVE LOAD NEEDS TO BE PERMITTED DURING CONSTRUCTION FOR FILL HEIGHT LESS THAN 8 FT. OR THE SPAN LENGTH, WHICHEVER IS GREATER, THE DESIGN OF THE TOP PLATE MUST BE CHECKED FOR WORST LIVE LOAD PLUS DEAD LOAD CONDITION.

9. FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 1.

10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

GENERAL NOTE:

FOR SHEETS 2 THROUGH 4, ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS (FEET AND INCHES).



|                    |  |                                    |  |
|--------------------|--|------------------------------------|--|
| BD-631M            |  | ENDWALL DETAILS FOR METAL CULVERTS |  |
| BD-634M            |  | GABION ENDWALL DETAILS             |  |
| REFERENCE DRAWINGS |  |                                    |  |

|                                                                                            |                                                                                   |                         |  |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------|--|
| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BUREAU OF PROJECT DELIVERY |                                                                                   |                         |  |
| STANDARD<br>DESIGN TABLES<br>FOR METAL CULVERTS                                            |                                                                                   |                         |  |
| RECOMMENDED APR.29, 2016<br>Thomas P. Maciore<br>CHIEF BRIDGE ENGINEER                     | RECOMMENDED APR.29, 2016<br>Brenda Thompson<br>DIRECTOR, BUR. OF PROJECT DELIVERY | SHEET 2 OF 4<br>BD-635M |  |

STEEL STRUCTURAL PLATE PIPE-ARCH THICKNESS REQUIREMENTS  
WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION ( 18" CORNER RADIUS)

( BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

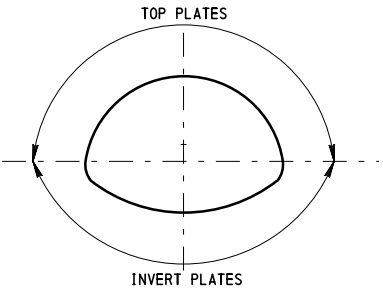
| SIZE                  |                       | MINIMUM<br>REQUIRED<br>TOP<br>PLATE<br>THICKNESS<br>( IN. ) | CORNER BEARING PRESSURE           |                                |                            |                          |                            |                                   |                                |                         |                            |                         |                                   |                                |                            |                          |                            |                                   | SIZE                       |                         | MINIMUM<br>REQUIRED<br>TOP<br>PLATE<br>THICKNESS<br>( IN. ) | CORNER BEARING PRESSURE        |                            |                          |                            |                                   |                                |                         |                            |                         |    |       |       |       |       |  |  |
|-----------------------|-----------------------|-------------------------------------------------------------|-----------------------------------|--------------------------------|----------------------------|--------------------------|----------------------------|-----------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|-----------------------------------|--------------------------------|----------------------------|--------------------------|----------------------------|-----------------------------------|----------------------------|-------------------------|-------------------------------------------------------------|--------------------------------|----------------------------|--------------------------|----------------------------|-----------------------------------|--------------------------------|-------------------------|----------------------------|-------------------------|----|-------|-------|-------|-------|--|--|
|                       |                       |                                                             | 2TSF                              |                                |                            |                          | 3TSF                       |                                   |                                |                         | 4TSF                       |                         |                                   |                                | 2TSF                       |                          |                            |                                   |                            |                         |                                                             | 3TSF                           |                            |                          |                            | 4TSF                              |                                |                         |                            |                         |    |       |       |       |       |  |  |
|                       |                       |                                                             | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                            |                          |                            | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                            |                          |                            | MAX.<br>FILL<br>HEIGHT<br>( FT. ) |                            |                         |                                                             | INVERT PLATE THICKNESS ( IN. ) |                            |                          |                            | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                         |                            |                         |    |       |       |       |       |  |  |
|                       |                       |                                                             |                                   | 50-YEARS<br>DESIGN LIFE        |                            | 100-YEARS<br>DESIGN LIFE |                            |                                   | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |                                   | 50-YEARS<br>DESIGN LIFE        |                            | 100-YEARS<br>DESIGN LIFE |                            |                                   |                            |                         |                                                             | 50-YEARS<br>DESIGN LIFE        |                            | 100-YEARS<br>DESIGN LIFE |                            |                                   | 50-YEARS<br>DESIGN LIFE        |                         | 100-YEARS<br>DESIGN LIFE   |                         |    |       |       |       |       |  |  |
| SPAN<br>( FT. - IN. ) | RISE<br>( FT. - IN. ) |                                                             | WITHOUT<br>PAVED<br>INVERT        | WITH<br>PAVED<br>INVERT        | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT  | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT           | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT        | WITH<br>PAVED<br>INVERT        | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT  | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT           | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT                                  | WITH<br>PAVED<br>INVERT        | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT  | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT           | WITHOUT<br>PAVED<br>INVERT     | WITH<br>PAVED<br>INVERT | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |    |       |       |       |       |  |  |
| 6-1                   | 4-7                   | 0.111                                                       | 14                                | 0.140                          | 0.111                      | 0.249                    | 0.170                      | 21                                | 0.140                          | 0.111                   | 0.249                      | 0.170                   | 28                                | 0.170                          | 0.111                      | 0.249                    | 0.188                      | 11-7                              | 7-5                        | 0.111                   | 5                                                           | 0.140                          | 0.111                      | 0.249                    | 0.170                      | 10                                | 0.140                          | 0.111                   | 0.249                      | 0.170                   | 14 | 0.170 | 0.111 | 0.249 | 0.188 |  |  |
| 6-4                   | 4-9                   |                                                             | 13                                |                                |                            |                          |                            | 20                                |                                |                         |                            |                         | 27                                |                                |                            |                          |                            | 11-10                             | 7-7                        |                         | 4                                                           | ↓                              | ↓                          | ↓                        | ↓                          | 10                                |                                |                         |                            |                         | 14 |       |       |       |       |  |  |
| 6-9                   | 4-11                  |                                                             | 12                                |                                |                            |                          |                            | 19                                |                                |                         |                            |                         | 25                                |                                |                            |                          |                            | 12-4                              | 7-9                        |                         | —                                                           | —                              | —                          | —                        | 9                          |                                   |                                |                         |                            | 13                      |    |       |       |       |       |  |  |
| 7-0                   | 5-1                   |                                                             | 12                                |                                |                            |                          |                            | 18                                |                                |                         |                            |                         | 24                                |                                |                            |                          |                            | 12-6                              | 7-11                       |                         | —                                                           | —                              | —                          | —                        | 9                          |                                   |                                |                         |                            | 13                      |    |       |       |       |       |  |  |
| 7-3                   | 5-3                   |                                                             | 11                                |                                |                            |                          |                            | 17                                |                                |                         |                            |                         | 23                                |                                |                            |                          |                            | 12-8                              | 8-1                        |                         | —                                                           | —                              | —                          | —                        | 9                          |                                   |                                |                         |                            | 13                      |    |       |       |       |       |  |  |
| 7-8                   | 5-5                   |                                                             | 11                                |                                |                            |                          |                            | 16                                |                                |                         |                            |                         | 22                                |                                |                            |                          |                            | 12-10                             | 8-4                        |                         | —                                                           | —                              | —                          | —                        | 9                          |                                   |                                |                         |                            | 13                      |    |       |       |       |       |  |  |
| 7-11                  | 5-7                   |                                                             | 10                                |                                |                            |                          |                            | 16                                |                                |                         |                            |                         | 21                                |                                |                            |                          |                            | 13-5                              | 8-5                        |                         | —                                                           | —                              | —                          | —                        | 8                          |                                   |                                |                         |                            | 12                      |    |       |       |       |       |  |  |
| 8-2                   | 5-9                   |                                                             | 10                                |                                |                            |                          |                            | 15                                |                                |                         |                            |                         | 20                                |                                |                            |                          |                            | 13-11                             | 8-7                        |                         | —                                                           | —                              | —                          | —                        | 8                          |                                   |                                |                         |                            | 11                      |    |       |       |       |       |  |  |
| 8-7                   | 5-11                  |                                                             | 9                                 |                                |                            |                          |                            | 14                                |                                |                         |                            |                         | 19                                |                                |                            |                          |                            | 14-1                              | 8-9                        |                         | —                                                           | —                              | —                          | —                        | 7                          |                                   |                                |                         |                            | 11                      |    |       |       |       |       |  |  |
| 8-10                  | 6-1                   |                                                             | 9                                 |                                |                            |                          |                            | 14                                |                                |                         |                            |                         | 19                                |                                |                            |                          |                            | 14-3                              | 8-11                       |                         | —                                                           | —                              | —                          | —                        | 7                          |                                   |                                |                         |                            | 11                      |    |       |       |       |       |  |  |
| 9-4                   | 6-3                   |                                                             | 7                                 |                                |                            |                          |                            | 13                                |                                |                         |                            |                         | 18                                |                                |                            |                          |                            | 14-10                             | 9-1                        |                         | —                                                           | —                              | —                          | —                        | 7                          |                                   |                                |                         |                            | 10                      |    |       |       |       |       |  |  |
| 9-6                   | 6-5                   |                                                             | 7                                 |                                |                            |                          |                            | 13                                |                                |                         |                            |                         | 18                                |                                |                            |                          |                            | 15-4                              | 9-3                        |                         | —                                                           | —                              | —                          | —                        | 6                          |                                   |                                |                         |                            | 10                      |    |       |       |       |       |  |  |
| 9-9                   | 6-7                   |                                                             | 7                                 |                                |                            |                          |                            | 13                                |                                |                         |                            |                         | 17                                |                                |                            |                          |                            | 15-6                              | 9-5                        |                         | —                                                           | —                              | —                          | —                        | 6                          |                                   |                                |                         |                            | 10                      |    |       |       |       |       |  |  |
| 10-3                  | 6-9                   |                                                             | 6                                 |                                |                            |                          |                            | 12                                |                                |                         |                            |                         | 16                                |                                |                            |                          |                            | 15-8                              | 9-7                        |                         | —                                                           | —                              | —                          | —                        | 6                          |                                   |                                |                         |                            | 10                      |    |       |       |       |       |  |  |
| 10-8                  | 6-11                  |                                                             | 6                                 |                                |                            |                          |                            | 12                                |                                |                         |                            |                         | 16                                |                                |                            |                          |                            | 15-10                             | 9-10                       |                         | —                                                           | —                              | —                          | —                        | 6                          |                                   |                                |                         |                            | 9                       |    |       |       |       |       |  |  |
| 10-11                 | 7-1                   |                                                             | 6                                 |                                |                            |                          |                            | 11                                |                                |                         |                            |                         | 15                                |                                |                            |                          |                            | 16-5                              | 9-11                       |                         | —                                                           | —                              | —                          | —                        | 6                          |                                   |                                |                         |                            | 9                       |    |       |       |       |       |  |  |
| 11-5                  | 7-3                   | ↓                                                           | 5                                 | ↓                              | ↓                          | ↓                        | ↓                          | 10                                | ↓                              | ↓                       | ↓                          | ↓                       | 15                                | ↓                              | ↓                          | ↓                        | ↓                          | 16-7                              | 10-1                       | ↓                       | —                                                           | —                              | —                          | —                        | 5                          | ↓                                 | ↓                              | ↓                       | ↓                          | 9                       | ↓  | ↓     | ↓     | ↓     |       |  |  |

☆ REFER TO DM4 , FIGURE 12.6.9.5P-2 FOR  
CORROSIVE ENVIRONMENTS.

NOTES:

1. THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
2. THE "INVERT PLATE THICKNESS" IS COMPUTED IN ACCORDANCE WITH THE SERVICE LOAD DESIGN PROCEDURES AS PER AASHTO SPECIFICATIONS, BUT WITH A MINIMUM SAFETY FACTOR OF 1.3 AT THE END OF A DESIGN LIFE BASED ON THE METAL LOSS OF 2 MILS PER YEAR.
3. THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.
4. INVERT PLATES INCLUDE THE CORNER PLATES OF THE PIPE-ARCHES.
5. ALL STEEL PLATES ARE 6"x 2" CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M167 AND MUST BE GALVANIZED.
6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 12" AND IS MEASURED FROM TOP OF RIGID PAVEMENT OR BOTTOM OF FLEXIBLE PAVEMENT. FOR MINIMUM FILL AND COVER REQUIREMENTS (AND DIAGRAMS DEFINITION OF COVER) SEE RC-30. FOR PIPE UNDER PAVEMENT STRUCTURE PLACE PIPE AT THE GREATER DEPTH OF FILL AND COVER. WHEN FILL HEIGHT IS LESS THAN 3 FT. A SPECIAL DESIGN CONSIDERING THE MOST CRITICAL LOAD WILL BE NEEDED. A SPECIAL APPROVAL FROM THE CHIEF BRIDGE ENGINEER WILL BE REQUIRED IF THE PIPE-ARCH IS TO BE DESIGNED FOR SUCH PERMANENT CONDITION.

7. THESE DESIGN VALUES ARE BASED UPON ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN RC STANDARDS AND PUBLICATION 408 ARE USED.
8. PIPE-ARCHES ARE DESIGNED FOR THE FILL HEIGHT INDICATED IN THIS TABLE. IF LIVE LOAD NEEDS TO BE PERMITTED DURING CONSTRUCTION FOR FILL HEIGHT LESS THAN 8 FT. OR THE SPAN LENGTH, WHICHEVER IS GREATER, THE DESIGN OF THE TOP PLATE MUST BE CHECKED FOR WORST LIVE LOAD PLUS DEAD LOAD CONDITION.
9. FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 1.
10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.



COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
DESIGN TABLES  
FOR METAL CULVERTS

RECOMMENDED APR.29, 2016  
*Thomas P. Maciore*  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR.29, 2016  
*Brian S. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 3 OF 4  
BD-635M

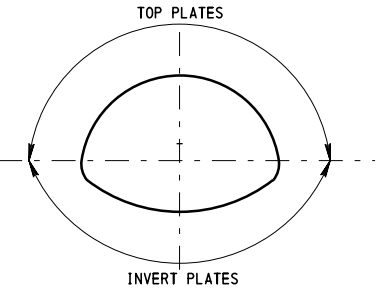
STEEL STRUCTURAL PLATE PIPE-ARCH THICKNESS REQUIREMENTS

WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION (31" CORNER RADIUS)

(BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

| SIZE                    |                       | MINIMUM<br>REQUIRED<br>TOP<br>PLATE<br>THICKNESS<br>( IN. ) |  | CORNER BEARING PRESSURE           |                                |                            |                          |       |                                   |                                |                            |                          |       |                                   |                                |                            |                         |       |
|-------------------------|-----------------------|-------------------------------------------------------------|--|-----------------------------------|--------------------------------|----------------------------|--------------------------|-------|-----------------------------------|--------------------------------|----------------------------|--------------------------|-------|-----------------------------------|--------------------------------|----------------------------|-------------------------|-------|
|                         |                       |                                                             |  | 2TSF                              |                                |                            |                          | 3TSF  |                                   |                                |                            | 4TSF                     |       |                                   |                                |                            |                         |       |
|                         |                       |                                                             |  |                                   |                                |                            |                          |       |                                   |                                |                            |                          |       |                                   |                                |                            |                         |       |
|                         |                       |                                                             |  | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                            |                          |       | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                            |                          |       | MAX.<br>FILL<br>HEIGHT<br>( FT. ) | INVERT PLATE THICKNESS ( IN. ) |                            |                         |       |
| 50-YEARS<br>DESIGN LIFE |                       | 100-YEARS<br>DESIGN LIFE                                    |  |                                   | 50-YEARS<br>DESIGN LIFE        |                            | 100-YEARS<br>DESIGN LIFE |       |                                   | 50-YEARS<br>DESIGN LIFE        |                            | 100-YEARS<br>DESIGN LIFE |       |                                   |                                |                            |                         |       |
| SPAN<br>( FT. - IN. )   | RISE<br>( FT. - IN. ) |                                                             |  | WITHOUT<br>PAVED<br>INVERT        | WITH<br>PAVED<br>INVERT        | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT  |       | WITHOUT<br>PAVED<br>INVERT        | WITH<br>PAVED<br>INVERT        | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT  |       | WITHOUT<br>PAVED<br>INVERT        | WITH<br>PAVED<br>INVERT        | WITHOUT<br>PAVED<br>INVERT | WITH<br>PAVED<br>INVERT |       |
| 13-3                    | 9-4                   | 0.111                                                       |  | 10                                | 0.140                          | 0.111                      | 0.249                    | 0.170 | 16                                | 0.170                          | 0.111                      | 0.280                    | 0.188 | 22                                | 0.170                          | 0.111                      | 0.280                   | 0.218 |
| 13-6                    | 9-6                   |                                                             |  | 10                                |                                |                            |                          |       | 16                                |                                |                            |                          |       | 21                                |                                |                            |                         |       |
| 14-0                    | 9-8                   |                                                             |  | 9                                 |                                |                            |                          |       | 15                                |                                |                            |                          |       | 21                                |                                |                            |                         |       |
| 14-2                    | 9-10                  |                                                             |  | 9                                 |                                |                            |                          |       | 15                                |                                |                            |                          |       | 20                                |                                |                            |                         |       |
| 14-5                    | 10-0                  |                                                             |  | 9                                 |                                |                            |                          |       | 15                                |                                |                            |                          |       | 20                                |                                |                            |                         |       |
| 14-11                   | 10-2                  |                                                             |  | 8                                 |                                |                            |                          |       | 14                                |                                |                            |                          |       | 19                                |                                |                            |                         |       |
| 15-4                    | 10-4                  |                                                             |  | 8                                 |                                |                            |                          |       | 13                                |                                |                            |                          |       | 19                                |                                |                            |                         |       |
| 15-7                    | 10-6                  |                                                             |  | 8                                 |                                |                            |                          |       | 13                                |                                |                            |                          |       | 18                                |                                |                            |                         |       |
| 15-10                   | 10-8                  |                                                             |  | 8                                 |                                |                            |                          |       | 13                                |                                |                            |                          |       | 18                                |                                |                            |                         |       |
| 16-3                    | 10-10                 |                                                             |  | 7                                 |                                |                            |                          |       | 13                                |                                |                            |                          |       | 18                                |                                |                            |                         |       |
| 16-6                    | 11-0                  |                                                             |  | 7                                 |                                |                            |                          |       | 12                                |                                |                            |                          |       | 17                                |                                |                            |                         |       |
| 17-0                    | 11-2                  |                                                             |  | 7                                 |                                |                            |                          |       | 12                                |                                |                            |                          |       | 17                                |                                |                            |                         |       |
| 17-2                    | 11-4                  |                                                             |  | 7                                 |                                |                            |                          |       | 12                                |                                |                            |                          |       | 16                                |                                |                            |                         |       |
| 17-5                    | 11-6                  |                                                             |  | 7                                 |                                |                            |                          |       | 12                                |                                |                            |                          |       | 16                                |                                |                            |                         |       |
| 17-11                   | 11-8                  |                                                             |  | 6                                 |                                |                            |                          |       | 11                                |                                |                            |                          |       | 16                                |                                |                            |                         |       |
| 18-1                    | 11-10                 |                                                             |  | 6                                 |                                |                            |                          |       | 11                                |                                |                            |                          |       | 15                                |                                |                            |                         |       |
| 18-7                    | 12-0                  |                                                             |  | 6                                 |                                |                            |                          |       | 11                                |                                |                            |                          |       | 15                                |                                |                            |                         |       |
| 18-9                    | 12-2                  | ↓                                                           |  | 6                                 | ↓                              |                            |                          |       | 11                                | ↓                              |                            |                          |       | 15                                | ↓                              |                            |                         |       |
| 19-3                    | 12-4                  | 0.140                                                       |  | 5                                 | 0.140                          |                            |                          |       | 10                                | 0.140                          |                            |                          |       | 14                                | 0.140                          |                            |                         |       |
| 19-6                    | 12-6                  |                                                             |  | 5                                 |                                |                            |                          |       | 10                                |                                |                            |                          |       | 14                                |                                |                            |                         |       |
| 19-8                    | 12-8                  |                                                             |  | 5                                 |                                |                            |                          |       | 10                                |                                |                            |                          |       | 14                                |                                |                            |                         |       |
| 19-11                   | 12-10                 |                                                             |  | 5                                 |                                |                            |                          |       | 10                                |                                |                            |                          |       | 14                                |                                |                            |                         |       |
| 20-5                    | 13-0                  |                                                             |  | 4                                 |                                |                            |                          |       | 9                                 |                                |                            |                          |       | 13                                |                                |                            |                         |       |
| 20-7                    | 13-2                  | ↓                                                           |  | 4                                 | ↓                              | ↓                          | ↓                        | ↓     | 9                                 | ↓                              | ↓                          | ↓                        | ↓     | 13                                | ↓                              | ↓                          | ↓                       | ↓     |

☆ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.



- NOTES:
- THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
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  - FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 1.
  - PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
DESIGN TABLES  
FOR METAL CULVERTS

RECOMMENDED APR. 29, 2016  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
Brenda Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

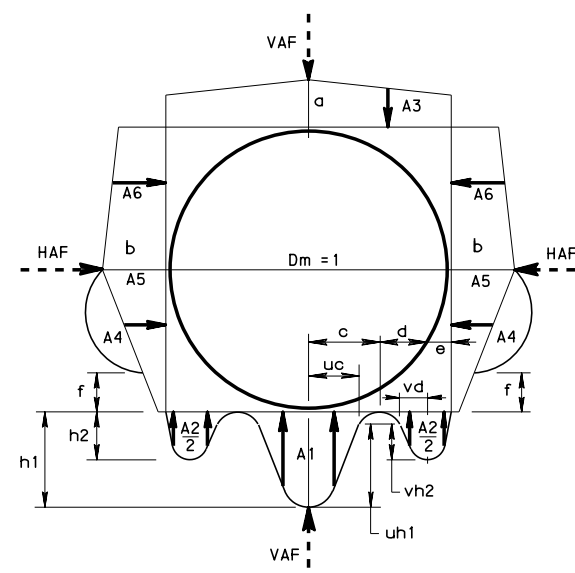
SHEET 4 OF 4  
BD-635M

- \* FOR USAGE OF TYPE A OR TYPE B PIPE, REFER TO D.M.2, TABLE 10.3.5
- \* FOR DIAMETERS GREATER THAN 48", USE TYPE A DESIGN FILL HEIGHT TABLES.
- \* LOCAL AUTHORITIES MAY USE TYPE B OR TYPE A DESIGN FILL HEIGHT TABLES.
- \* SPECIFY SHORING/TRENCH BOX INSTALLATION IF REQUIRED BY SITE CONDITIONS.
- \* USE PENNDOT ACCEPTED SOFTWARE TO PERFORM PIPE DESIGNS FOR REQUIRED FILL HEIGHTS AND CONCRETE STRENGTHS NOT SHOWN IN THE DESIGN TABLES ON SHEET 4 AND SHEETS 6 THRU 10, INDICATED BY DOUBLE ASTERISKS (\*\*).
- \* REFER TO SHEET 3 FOR ADDITIONAL INSTRUCTIONS FOR USAGE OF THIS STANDARD.

|                                               |   |                                                                                                                                                                                                                                            |
|-----------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DIA                                           | = | INSIDE DIAMETER OF THE CONCRETE PIPE.                                                                                                                                                                                                      |
| TYPE A STANDARD<br>INSTALLATION               | = | HEAVY-DUTY CONCRETE PIPE EMBANKMENT INSTALLATION<br>DESIGN (APPROXIMATELY 100-YEAR LIFE).                                                                                                                                                  |
| TYPE A SHORING/<br>TRENCH BOX<br>INSTALLATION | = | HEAVY-DUTY CONCRETE PIPE TRENCH BOX OR SHORING<br>INSTALLATION DESIGN (APPROXIMATELY 100-YEAR LIFE).                                                                                                                                       |
| TYPE B STANDARD<br>INSTALLATION               | = | STANDARD DUTY CONCRETE PIPE EMBANKMENT INSTALLATION<br>DESIGN (APPROXIMATELY 50-YEAR LIFE).                                                                                                                                                |
| TYPE B SHORING/<br>TRENCH BOX<br>INSTALLATION | = | STANDARD DUTY CONCRETE PIPE TRENCH BOX OR SHORING<br>INSTALLATION DESIGN (APPROXIMATELY 50-YEAR LIFE).                                                                                                                                     |
| PROOF TEST LOAD                               | = | THREE EDGE BEARING TEST TO A LOAD EXTRAPOLATED FROM<br>0.007" DESIGN REQUIREMENT TO PRODUCE A 0.01" CRACK.                                                                                                                                 |
| PROOF LOAD                                    | = | THE LOAD CARRIED BY A PIPE SUBJECTED TO A THREE EDGE<br>BEARING TEST, EXPRESSED IN POUNDS PER LINEAR FOOT OF<br>INSIDE DIAMETER. THE PROOF LOAD REFLECTS THE FIELD<br>SERVICE LOAD CONDITION FOR BOTH LIVE AND DEAD LOADS.                 |
| PAIDD                                         | = | <u>PENNSYLVANIA</u> <u>INSTALLATION</u> <u>DIRECT</u> <u>DESIGN</u> .                                                                                                                                                                      |
| H                                             | = | DESIGN FILL HEIGHT, FT.                                                                                                                                                                                                                    |
| f <sub>y</sub>                                | = | SPECIFIED YIELD STRENGTH OF REINFORCEMENT ksi                                                                                                                                                                                              |
| f' <sub>c</sub>                               | = | SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE ksi                                                                                                                                                                                             |
| HAF                                           | = | HORIZONTAL ARCHING FACTOR                                                                                                                                                                                                                  |
| VAF                                           | = | VERTICAL ARCHING FACTOR                                                                                                                                                                                                                    |
| D <sub>m</sub>                                | = | 1 FOR UNITY                                                                                                                                                                                                                                |
| A <sub>1</sub> - A <sub>6</sub>               | = | COEFFICIENTS WHICH REPRESENT THE INTEGRATION OF NON-<br>DIMENSIONAL VERTICAL AND HORIZONTAL COMPONENTS OF SOIL<br>PRESSURE UNDER THE INDICATED PORTIONS OF THE COMPONENT<br>PRESSURE DIAGRAMS (AREA UNDER COMPONENT PRESSURE<br>DIAGRAMS). |
| a, b, c, d,<br>e, f, u, v                     | = | NON-DIMENSIONAL COEFFICIENTS DEFINING HORIZONTAL AND<br>VERTICAL DIMENSIONS OF COMPONENT PRESSURE REGIONS.                                                                                                                                 |
| d                                             | = | 0.5-c-e                                                                                                                                                                                                                                    |
| h <sub>1</sub>                                | = | $\frac{(1.5a_1)}{c(1+u)}$                                                                                                                                                                                                                  |
| h <sub>2</sub>                                | = | $(1.5A_2) / [(d) (1+v) + (2e)]$                                                                                                                                                                                                            |
| SPAN RATIO                                    | = | SPAN ELLIPTICAL/EQUIVALENT ROUND = 1.28                                                                                                                                                                                                    |
| RISE RATIO                                    | = | RISE ELLIPTICAL/EQUIVALENT ROUND = 0.63                                                                                                                                                                                                    |
| VAF                                           | = | VAF ROUND                                                                                                                                                                                                                                  |
| HAF                                           | = | (RISE RATIO/SPAN RATIO) (HAF ROUND PIPE)                                                                                                                                                                                                   |
|                                               | = | 0.49 (HAF ROUND PIPE)                                                                                                                                                                                                                      |

CONSULT THE "CONCRETE PIPE TECHNOLOGY HANDBOOK", 1993 (PUBLISHED BY THE AMERICAN CONCRETE PIPE ASSOCIATION), CHAPTER 8, OR APPENDIX H OF THE DESIGN MANUAL PART 4, STRUCTURES, FOR A PROCEDURE FOR EARTH LOAD MODELING.

1. FABRICATE CONCRETE PIPE AS PER PUBLICATION 280 ENTITLED "MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE".
2. SEE RC-30M AND PUBLICATION 408, SECTIONS 601 AND 604 FOR INSTALLATION OF CONCRETE PIPES.
3. DESIGN CONCRETE PIPE IN ACCORDANCE WITH PENNSYLVANIA INSTALLATION DIRECT DESIGN (PAIDD), AND APPENDIX H OF DESIGN MANUAL, PART 4, STRUCTURES.
4. TEST CONCRETE PIPES IN ACCORDANCE WITH PUBLICATION 408 AND PROOF TEST LOAD TABLES [PRESENTED IN THIS STANDARD AND IN PUBLICATION 280]. PROOF TEST LOADS INCLUDE A 1.43 FACTOR OF SAFETY FOR FIELD CRACKING. TESTING TO ULTIMATE IS NOT REQUIRED.
5. REFERENCE RC-30M FOR MINIMUM FILL HEIGHT AND COVER REQUIREMENTS FOR CONCRETE PIPES.
6. THE DESIGN VALUES SHOWN IN THIS STANDARD ARE BASED UPON THE ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN THE RC STANDARDS AND PUBLICATION 408 ARE USED.
7. ELLIPTICAL REINFORCEMENT IS NOT PERMITTED, EXCEPT FOR QUADRANT REINFORCEMENT AND FOR REINFORCEMENT OF ELLIPTICAL PIPE.
8. SMOOTH WELDED WIRE FABRIC IS USED IN THE DESIGN OF THE STEEL AREAS FOR CONCRETE PIPE. USE OF DEFORMED WIRE FABRIC OR DEFORMED WIRE IS PERMITTED.
9. USE DESIGN TABLES GIVEN IN THIS STANDARD TO DETERMINE STEEL AREA. USE PENNDOT ACCEPTED SOFTWARE FOR DESIGNS NOT COVERED BY THESE TABLES.
10. STEEL AREAS ARE SHOWN AS, IN<sup>2</sup>/FT.
11. PROVIDE ADDITIONAL CONCRETE COVER FOR ACIDIC ( $\text{pH} \leq 4$ ) OR ABRASIVE ENVIRONMENTS.
12. ENSURE THAT CONSTRUCTION CONDITIONS (SHALLOW FILLS AND CONSTRUCTION TRAFFIC, IF APPLICABLE) ARE CONSIDERED AT THE TIME THE PIPE IS SPECIFIED.
13. A 2 FT. SPACING IS REQUIRED (A 3 FT. SPACING IS PREFERRED) FOR MULTIPLE PIPES [SEE SKETCH IN APPENDIX H OF DESIGN MANUAL, PART 4, STRUCTURES].
14. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.



## SOIL PRESSURE DISTRIBUTION MODEL

## CHANGE 2

# STANDARD REINFORCED CONCRETE PIPES DESIGN CRITERIA

SHEET 1 OF 10  
BD-636M



TABLE A

| DESIGN DATA                                                                 |                           |                           |                                 |                           |
|-----------------------------------------------------------------------------|---------------------------|---------------------------|---------------------------------|---------------------------|
| ITEMS                                                                       | STANDARD INSTALLATION     |                           | TRENCH BOX/SHORING INSTALLATION |                           |
| INSTALLATION TYPE                                                           | TYPE A                    | TYPE B                    | TYPE A                          | TYPE B                    |
| HAUNCH COMPACTION                                                           | 95% MIN.                  | 95% MIN.                  | 60% MIN.                        | 60% MIN.                  |
| SOIL WEIGHT                                                                 | 140 lbs./ft. <sup>3</sup> | 140 lbs./ft. <sup>3</sup> | 140 lbs./ft. <sup>3</sup>       | 140 lbs./ft. <sup>3</sup> |
| LIVE LOAD                                                                   | HS 25                     | HS 25                     | HS 25                           | HS 25                     |
| f <sub>y</sub>                                                              | 65,000 psi                | 65,000 psi                | 65,000 psi                      | 65,000 psi                |
| f' <sub>c</sub>                                                             | MIN. 4,000 psi            | MIN. 4,000 psi            | MIN. 4,000 psi                  | MIN. 4,000 psi            |
| CONCRETE COVER                                                              | 1" OVER STEEL             | 1" OVER STEEL             | 1" OVER STEEL                   | 1" OVER STEEL             |
| LOAD FACTORS*                                                               | TYPE A                    | TYPE B                    | TYPE A                          | TYPE B                    |
| DEAD LOAD & EARTH LOAD FACTOR (SHEAR & MOMENT)                              | 1.30                      | 1.30                      | 1.30                            | 1.30                      |
| DEAD LOAD FACTOR (THRUST) †<br>REINFORCEMENT DESIGN<br>CONCRETE COMPRESSION | 1.00<br>1.30              | 1.00<br>1.30              | 1.00<br>1.30                    | 1.00<br>1.30              |
| LIVE LOAD FACTOR (SHEAR & MOMENT)                                           | 2.17                      | 2.17                      | 2.17                            | 2.17                      |
| LIVE LOAD FACTOR (THRUST)                                                   | 1.00                      | 1.00                      | 1.00                            | 1.00                      |
| INTERNAL PRESSURE LOAD FACTORS (THRUST)                                     | 1.50                      | 1.50                      | 1.50                            | 1.50                      |
| IMPACT (TO MAX. 8' HEIGHT)                                                  | 40 [1.0-0.125H] ≥ 10%     | 40 [1.0-0.125H] ≥ 10%     | 40 [1.0-0.125H] ≥ 10%           | 40 [1.0-0.125H] ≥ 10%     |
| STRENGTH REDUCTION (Φ FACTORS) †                                            | TYPE A                    | TYPE B                    | TYPE A                          | TYPE B                    |
| FLEXURE                                                                     | 0.90                      | 0.95                      | 0.90                            | 0.95                      |
| RADIAL TENSION                                                              | 0.85                      | 0.90                      | 0.85                            | 0.90                      |
| DIAGONAL TENSION                                                            | 0.85                      | 0.90                      | 0.85                            | 0.90                      |
| CRACK CONTROL FACTOR                                                        | 0.7                       | 0.7                       | 0.7                             | 0.7                       |
| ORIENTATION ANGLE                                                           | ± 10°                     | ± 10°                     | ± 10°                           | ± 10°                     |
| MATERIAL & PROCESS FACTOR*                                                  | TYPE A                    | TYPE B                    | TYPE A                          | TYPE B                    |
| RADIAL TENSION                                                              | 1.0                       | 1.0                       | 1.0                             | 1.0                       |
| DIAGONAL TENSION                                                            | 1.0                       | 1.0                       | 1.0                             | 1.0                       |
| EMBANKMENT ARCHING FACTORS*<br>VAF (VERTICAL)<br>HAF (HORIZONTAL)           | 1.35<br>0.45              | 1.35<br>0.45              | SEE TABLE 'C'                   | SEE TABLE 'C'             |

TABLE B

| ARCHING COEFFICIENTS  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| INSTALLATION TYPE     | VAF  | HAF  | A1   | A2   | A3   | A4   | A5   | A6   | a    | b    | c    | e    | f    | u    | v    |
| EMBANKMENT            | 1.35 | 0.45 | 0.62 | 0.73 | 1.35 | 0.19 | 0.08 | 0.18 | 1.40 | 0.40 | 0.18 | 0.08 | 0.05 | 0.80 | 0.80 |
| TRENCH BOX OR SHORING | *    | *    | 1.45 | 0.00 | 1.45 | 0.00 | 0.11 | 0.19 | 1.45 | 0.30 | 0.25 | 0.00 | --   | 0.90 | --   |

\* SEE TABLE 'C'

TABLE C

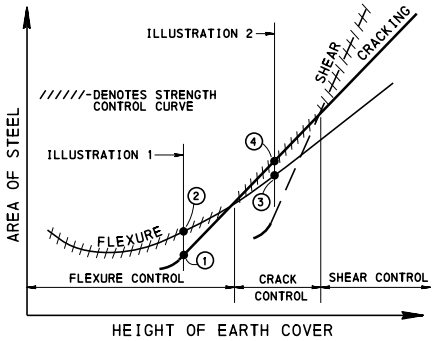
| FACTORS FOR TRENCH BOX OR SHORING INSTALLATION ☆ |                          |      |                           |      |
|--------------------------------------------------|--------------------------|------|---------------------------|------|
| REQUIRED FILL HEIGHT FT.                         | 12" THROUGH 36" DIAMETER |      | 42" THROUGH 120" DIAMETER |      |
|                                                  | VAF                      | HAF  | VAF                       | HAF  |
| 1.5                                              | 1.20                     | 0.29 | 1.20                      | 0.29 |
| 2.0                                              | 1.15                     | 0.29 | 1.20                      | 0.29 |
| 3.0                                              | 1.00                     | 0.25 | 1.20                      | 0.25 |
| 7.0                                              | 0.70                     | 0.18 | 0.90                      | 0.18 |
| 10.0                                             | 0.70                     | 0.16 | 0.90                      | 0.16 |
| 15- 25                                           | 0.70                     | 0.12 | 0.80                      | 0.12 |

☆ BEDDING FACTOR USED TO DETERMINE PROOF TEST LOAD 1.60 FOR EARTH LOADS. LIVE LOAD BEDDING FACTOR AS PER ACPA "DESIGN DATA 40" DECEMBER, 1992.

TABLE D

| FACTORS FOR TRENCH BOX OR SHORING<br>INSTALLATION FOR ELLIPTICAL PIPE |                  |      |                       |            |           |            |                     |            |           |            |
|-----------------------------------------------------------------------|------------------|------|-----------------------|------------|-----------|------------|---------------------|------------|-----------|------------|
| REQUIRED<br>FILL<br>HEIGHT<br>FT.                                     | EQUIVALENT ROUND |      | HORIZONTAL ELLIPTICAL |            |           |            | VERTICAL ELLIPTICAL |            |           |            |
|                                                                       |                  |      | VAF                   |            | HAF       |            | VAF                 |            | HAF       |            |
|                                                                       | VAF              | HAF  | 12"to 36"             | 42"to 120" | 12"to 36" | 42"to 120" | 12"to 36"           | 42"to 120" | 12"to 36" | 42"to 120" |
| 1.5                                                                   | 1.20             | 0.29 | 1.20                  | 1.20       | 0.18      | 0.18       | 1.20                | 1.20       | 0.46      | 0.46       |
| 2.0                                                                   | 1.10             | 0.22 | 1.15                  | 1.20       | 0.18      | 0.18       | 1.15                | 1.20       | 0.46      | 0.46       |
| 3.0                                                                   | 1.10             | 0.22 | 1.00                  | 1.20       | 0.16      | 0.16       | 1.00                | 1.20       | 0.40      | 0.40       |
| 7.0                                                                   | 0.90             | 0.16 | 0.70                  | 0.90       | 0.10      | 0.10       | 0.70                | 0.90       | 0.29      | 0.29       |
| 10.0                                                                  | 0.80             | 0.12 | 0.70                  | 0.90       | 0.10      | 0.10       | 0.70                | 0.90       | 0.25      | 0.25       |
| 15- 25                                                                |                  |      | 0.70                  | 0.90       | 0.08      | 0.08       | 0.70                | 0.90       | 0.19      | 0.19       |

FLEXURE-SHEAR-CRACK CONTROL RELATIONSHIP



EXAMPLE: TYPE B 48" STANDARD INSTALLATION

| 2≤H<3                                                                    | 3≤H<7                        |
|--------------------------------------------------------------------------|------------------------------|
| WALL THICKNESS = 5 3/4"                                                  | 5 3/4"                       |
| AREA OF STEEL:<br>INNER CAGE = 0.15 SQ. IN.<br>OUTER CAGE = 0.09 SQ. IN. | 0.14 SQ. IN.<br>0.07 SQ. IN. |
| PROOF TEST LOAD = 587 LBS.                                               | 823 LBS.                     |

AS SEEN HERE, THE ACTUAL STRENGTH OF THE 3' TO 2' PIPE IS GREATER THAN THE 7' TO 3' PIPE AS REFLECTED BY THE STEEL AREA. THE PROOF LOAD TEST BEING A SERVICE LOAD CONDITION REFLECTS THE ANTICIPATED FIELD LOAD. THE ULTIMATE STRENGTH DESIGN METHOD USED TO DETERMINE STEEL AREAS HAS GREATER DESIGN SAFETY FACTOR FOR LIVE LOADS THAN FOR DEAD LOADS. FOR THIS REASON, THE PROOF LOAD, FOR LOW FILL HEIGHTS, IS NOT A LINEAR RELATIONSHIP WITH THE STEEL AREA.

ILLUSTRATION 1:

1. CRACK CONTROL 2. FLEXURE CONTROL

IN THIS ILLUSTRATION OF THE FLEXURE-SHEAR-CRACK CONTROL RELATIONSHIP, THE PROOF TEST LOAD FOR THIS CASE IS NOT A GOVERNING FACTOR SINCE FLEXURE CONTROLS THE DESIGN.

ILLUSTRATION 2:

3. FLEXURE CONTROL 4. CRACK CONTROL

IN THIS ILLUSTRATION OF THE FLEXURE-SHEAR-CRACK CONTROL RELATIONSHIP, THE PROOF TEST LOAD FOR THIS CASE IS A GOVERNING FACTOR SINCE FLEXURE IS NOT CONTROLLING THE DESIGN.

NOTE: PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES, RELY UPON THE MAXIMUM/MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
REINFORCED CONCRETE PIPES  
DESIGN CRITERIA

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 10

BD-636M

REINFORCED CONCRETE PIPE DESIGN EXAMPLES:

① DESIGN OF A 48" DIAMETER CONCRETE PIPE UNDER 3'-0" OF FILL.

TYPE A (HEAVY-DUTY) SOLUTION:

- \* DESIGNER DETERMINES THAT A 48" DIAMETER PIPE IS REQUIRED AND THAT THE MAXIMUM FILL HEIGHT IS 3'-0". END TREATMENT AND A STANDARD TYPE A INSTALLATION AS PER RC-30M ARE SPECIFIED.
- \* ITEM #0601-7072 IS SPECIFIED. FILL RANGE 10' TO 2'.
- \* FABRICATOR REFERENCES PUBLICATION 280-"MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" FOR A 48" DIAMETER TYPE A STANDARD INSTALLATION PIPE. A 5" WALL THICKNESS AND f'c = 4000 PSI ARE SELECTED FOR 48" DIAMETER. THE AREA OF STEEL REQUIRED FOR A 3'<H<7' MAXIMUM FILL HEIGHT IS 0.19 IN.<sup>2</sup> FOR THE INSIDE CAGE AND 0.12 IN.<sup>2</sup> FOR THE OUTER CAGE.
- \* THE PIPE IS TESTED TO A PROOF TEST LOAD OF 867 LBS./LF AND MARKED PA 48A/S10-2.

② DESIGN OF A 36" DIAMETER CONCRETE PIPE UNDER 9' OF FILL IN A TRENCH BOX INSTALLATION.  
SOLUTION:

- \* DESIGNER DETERMINES THAT A 36" DIAMETER PIPE IS REQUIRED AND MAXIMUM FILL HEIGHT IS 9'-0". END TREATMENT AND A TYPE A TRENCH BOX INSTALLATION AS PER RC-30M ARE SPECIFIED.
- \* ITEM #0601-7537 IS SPECIFIED. FILL RANGE 10' TO 7'.

TYPE B (STANDARD DUTY) SOLUTION:

- \* DESIGNER DETERMINES THAT A 48" DIAMETER CONCRETE PIPE IS REQUIRED AND THAT THE MAXIMUM FILL HEIGHT IS 3'-0", END TREATMENT AND A STANDARD TYPE B INSTALLATION AS PER RC-30M ARE SPECIFIED.
- \* ITEM #0601-7370 IS SPECIFIED. FILL RANGE 10' TO 3'.
- \* FABRICATOR REFERENCES PUBLICATION 280-"MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" FOR A 48" DIAMETER TYPE B STANDARD INSTALLATION PIPE. A 5 3/4" WALL THICKNESS AND f'c = 5000 PSI ARE SELECTED FOR 48" DIAMETER. THE AREA OF STEEL REQUIRED FOR A 3'<H<7' MAXIMUM FILL HEIGHT IS 0.14 IN.<sup>2</sup> FOR THE INSIDE CAGE AND 0.07 IN.<sup>2</sup> FOR THE OUTER CAGE.
- \* THE PIPE IS TESTED TO A PROOF TEST LOAD OF 823 LBS./LF AND MARKED PA 48B/S10-3.
- \* FABRICATOR REFERENCES PUBLICATION 280-"MANUFACTURING SPECIFICATION FOR REINFORCED CONCRETE PIPE" FOR A 36" DIAMETER TYPE A SHORING/TRENCH BOX INSTALLATION PIPE. A DOUBLE CAGE, 4" WALL THICKNESS AND f'c = 4000 PSI ARE SELECTED FOR A 36" DIAMETER. THE AREA OF STEEL REQUIRED FOR A 7'<H<10' MAXIMUM FILL HEIGHT IS 0.16IN.<sup>2</sup> FOR THE INSIDE CAGE AND 0.07 IN.<sup>2</sup> FOR THE OUTER CAGE.
- \* THE PIPE IS TESTED TO A PROOF TEST LOAD OF 1174 LBS./LF AND MARKED PA 36A/SH10-7.

RESPONSIBILITIES FOR DESIGN, FABRICATION AND  
INSTALLATION OF CONCRETE PIPES

DESIGNER:

1. DETERMINES DIAMETER OF PIPE REQUIRED BY HYDRAULICS.
2. DETERMINES MAXIMUM HEIGHT OF FILL.
  - FOR LONG PIPE RUNS, THE LENGTH MAY BE DIVIDED INTO SEGMENTS (DEPENDING UPON INLET LOCATIONS) WHICH MAY HAVE DIFFERENT MAXIMUM FILL HEIGHTS.
  - CONSIDERS THE EFFECT OF FUTURE WIDENING AND LOADS FOR THE PIPE DESIGN.
3. ENSURES THAT THE SIDE SLOPE IS STABLE AND THAT THE PIPE IS NOT EXPECTED TO PROVIDE SLOPE STABILITY.
4. SPECIFY CONCRETE PIPES AS INDICATED IN PUB. 280, SECTION 17.1.2. FOR PIPES WITH I.D. ≥ 8' PREPARE S-DRAWINGS WHICH INCLUDE 2 CORE BORINGS AND A HEADWALL DESIGN ON THE DRAWING.
5. SPECIFIES END TREATMENTS AS PER RC-30M.
6. SPECIFIES INCREASED WALL THICKNESS, IF WARRANTED FOR ACIDIC OR ABRASIVE CONDITIONS.
7. SPECIFIES TRENCH BOX/SHORING INSTALLATION IF REQUIRED.
8. SPECIFIES PROPER ITEM NUMBER.

CONTRACTOR:

1. SELECTS THE TYPE OF PIPE INSTALLATION, I.E., EMBANKMENT OR TRENCH BOX/SHORING.
2. SUBMITS SPECIAL DESIGNS TO THE MATERIALS & TESTING DIVISION OF PENNDOT.
3. INSTALLS THE PIPE AS PER RC-30M.

FABRICATOR:

1. USES PRE-APPROVED DESIGNS [PAIDD/BD-636M, TABLES ON SHEETS 4 THRU 10 UNLESS A SPECIAL DESIGN IS REQUIRED].
2. ENSURES THAT THE PROPER STRUCTURE DESIGN FOR THE PIPE IS SELECTED, TESTED AND DELIVERED.
3. PROVIDES DESIGN AND DETAILS FOR SPECIAL DESIGN PIPES.
4. CONDUCTS PROOF LOAD TESTS ACCORDING TO PUB.280 TO PROOF TEST LOAD VALUES SPECIFIED IN PUB.280 OR BD-636M.

PENNDOT STRUCTURAL MATERIALS SECTION:

1. WITNESSES PROOF LOAD TESTS, CONDUCTS Q/A AT FABRICATION SHOP, AND APPROVES/REJECTS PIPES AT THE PLANT PRIOR TO LOADING THE PIPES FOR TRANSPORTATION TO THE JOB SITE.
2. APPROVES DESIGNS WHICH MEET THIS STANDARD.
3. PROVIDES SPECIAL DESIGNS TO THE BRIDGE QUALITY ASSURANCE DIVISION FOR APPROVAL.
4. MONITORS CONCRETE STRENGTHS AND OTHER MATERIAL PROPERTIES. ENSURES THAT ONLY APPROVED [SPECIFIED IN PA MATERIALS SPECIFICATION PUB 280] SHEAR REINFORCEMENT IS USED.
5. APPROVES SHOP DETAILS, ETC.
6. COORDINATES EFFORTS TO RESOLVE PIPE FAILURE/PROBLEMS.

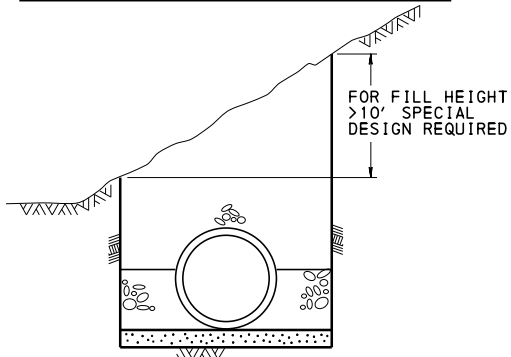
DISTRICT CONSTRUCTION UNIT:

1. INSPECTS PIPE PRIOR TO INSTALLATION.
2. MONITORS INSTALLATION, ENSURING ALL STEPS IN RC-30M AND PUB. 408 ARE FOLLOWED.
3. INSPECTS PIPE AFTER THE SPECIFIED FILL IS PLACED.
4. ACCEPTS PIPES IN ACCORDANCE WITH PUB. 408.

BUREAU OF PROJECT DELIVERY:

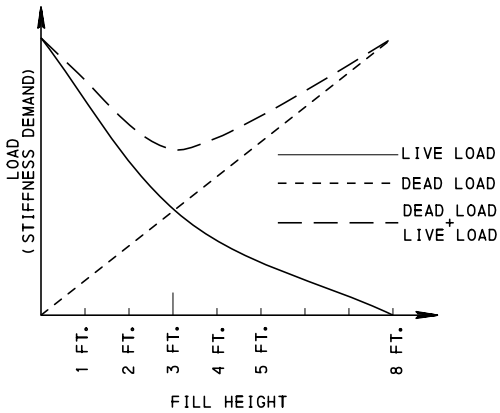
1. MAINTAINS AND UPDATES THIS STANDARD, RC-30M, SPECIAL PROVISIONS, PUB. 408.
2. REVIEWS AND APPROVES SPECIAL DESIGNS SUBMITTED BY THE MATERIALS AND TESTING DIVISION.
3. ASSISTS THE BUREAU OF CONSTRUCTION AND DISTRICTS IN RESOLUTION OF STRUCTURAL PROBLEMS.
4. PAIDD SOFTWARE PACKAGE NO LONGER MAINTAINED BY PENNSYLVANIA PIPE ASSOCIATION.
5. REVIEW/ACCEPT PIPE ANALYSIS SOFTWARE PACKAGES FOR DEPARTMENT USE.

SIDE SLOPE CONDITION



SYMMETRICAL REINFORCEMENT IS REQUIRED FOR INSTALLATIONS WHERE SIDE SLOPE CONDITIONS EXIST. A SPECIAL DESIGN IS REQUIRED WHEN THE FILL HEIGHT VARIES MORE THAN 10' OVER THE TRENCH WIDTH.

CONCRETE PIPE LOADING CURVE



FOR SUBSTITUTION OF PIPES UNDER 3'-0" OF FILL OR LESS USE A LOWER HEIGHT OF FILL. FOR SUBSTITUTION OF PIPES OVER 3'-0" OF FILL OR GREATER, USE A HIGHER HEIGHT OF FILL.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
REINFORCED CONCRETE PIPES  
PAIDD DESIGN  
EXAMPLES/RESPONSIBILITIES

RECOMMENDED AUG. 30, 2019  
[Signature]  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
[Signature]  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 10  
BD-636M

| TYPE A STANDARD INSTALLATION - STEEL AREAS (in. <sup>2</sup> /ft.) |             |            |                            |               |             |             |              |      |      |      |      |              |
|--------------------------------------------------------------------|-------------|------------|----------------------------|---------------|-------------|-------------|--------------|------|------|------|------|--------------|
| Dia.                                                               | Wall Thick. | f' c (psi) | Required Fill/Cover Height |               |             |             |              |      |      |      |      |              |
|                                                                    |             |            | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | 25'  | 30'  | H > 50'      |
| 12"                                                                | 2"          | 4000       | 0.09                       | ←             | ←           | ←           | ←            |      |      |      | →    | 0.14 **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.18 **      |
| 12"                                                                | 2 3/4"      | 4000       | 0.08                       | ←             | ←           | ←           | ←            |      |      |      | →    | 0.09 0.11 ** |
| 15"                                                                | 2 1/4"      | 4000       | 0.12                       | ←             | ←           | ←           | ←            |      | →    | 0.10 | 0.12 | 0.22 **      |
| 15"                                                                | 3"          | 4000       | 0.08                       | ←             | ←           | ←           | ←            |      | →    | 0.08 | 0.09 | 0.12 0.19 ** |
| 18"                                                                | 2 1/2"      | 4000       | 0.14                       | 0.09          | ←           | ←           | ←            |      | →    | 0.11 | 0.13 | 0.16 **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.23 **      |
| 18"                                                                | 3 1/4"      | 4000       | 0.14                       | 0.08          | ←           | ←           | ←            |      | →    | 0.08 | 0.10 | 0.12 0.18 ** |
| 21"                                                                | 2 3/4"      | 4000       | 0.22                       | 0.12          | ←           | ←           | ←            |      | →    | 0.10 | 0.13 | 0.17 0.22 ** |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.26 **      |
| 21"                                                                | 3 1/2"      | 4000       | **                         | 0.10          | ←           | ←           | ←            | 0.08 | 0.10 | 0.13 | 0.16 | 0.27 **      |
|                                                                    |             | 5000       | 0.22                       | *             | *           | *           | *            | *    | *    | *    | *    | **           |
| 24"                                                                | 3"          | 4000       | **                         | 0.15          | ←           | ←           | ←            | 0.12 | 0.16 | 0.20 | 0.28 | **           |
| 24"                                                                | 3 3/4"      | 4000       | **                         | 0.13          | ←           | ←           | ←            | 0.10 | 0.13 | 0.16 | 0.19 | 0.34 **      |
|                                                                    |             | 5000       | 0.22                       | *             | *           | *           | *            | *    | *    | *    | *    | **           |
| 27"                                                                | 3 1/4"      | 4000       | **                         | 0.17          | 0.12        | 0.10        | 0.10         | 0.14 | 0.19 | 0.24 | **   | **           |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | *    | *    | 0.28 | **           |
|                                                                    |             | 6000       | 0.27                       | *             | *           | *           | *            | *    | *    | *    | *    | **           |
| 27"                                                                | 4"          | 4000       | **                         | 0.15          | 0.10        | 0.09        | 0.09         | 0.12 | 0.15 | 0.19 | 0.23 | **           |
|                                                                    |             | 6000       | 0.27                       | *             | *           | *           | *            | *    | *    | *    | *    | **           |
| 30"                                                                | 3 1/2"      | 4000       | **                         | 0.20          | 0.14        | 0.12        | 0.12         | 0.17 | 0.22 | 0.29 | **   | **           |
| 30"                                                                | 4 1/4"      | 4000       | **                         | 0.17          | 0.12        | 0.10        | 0.10         | 0.14 | 0.18 | 0.23 | 0.29 | **           |
| 33"                                                                | 3 3/4"      | 4000       | **                         | 0.22          | 0.17        | 0.17        | 0.17         | 0.22 | 0.25 | **   | **   | **           |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | 0.31 | 0.42 | **   | **           |
| 33"                                                                | 4 1/2"      | 4000       | **                         | 0.19          | 0.15        | 0.12        | 0.12         | 0.16 | 0.21 | 0.26 | 0.35 | **           |
| 36"                                                                | 4"          | 4000       | **                         | 0.24          | 0.19        | 0.14        | 0.16         | 0.22 | 0.29 | **   | **   | **           |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | 0.35 | **   | **   | **           |
|                                                                    |             | 6000       | **                         | *             | *           | *           | *            | *    | **   | 0.45 | **   | **           |
| 36"                                                                | 4 3/4"      | 4000       | **                         | 0.20          | 0.17        | 0.13        | 0.14         | 0.19 | 0.24 | 0.30 | **   | **           |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | 0.35 | **   | **   | **           |

| TYPE A STANDARD INSTALLATION - STEEL AREAS (in. <sup>2</sup> /ft.) |             |            |                            |               |             |             |              |      |      |      |      |              |
|--------------------------------------------------------------------|-------------|------------|----------------------------|---------------|-------------|-------------|--------------|------|------|------|------|--------------|
| Dia.                                                               | Wall Thick. | f' c (psi) | Required Fill/Cover Height |               |             |             |              |      |      |      |      |              |
|                                                                    |             |            | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | 25'  | 30'  | H > 40'      |
| 36"                                                                | 4"          | 4000       | 0.19                       | 0.18          | 0.14        | 0.11        | 0.12         | 0.16 | 0.21 | 0.28 | 0.39 | **           |
|                                                                    |             |            | 0.13                       | 0.12          | 0.09        | 0.07        | 0.07         | 0.08 | 0.11 | 0.14 | 0.17 | **           |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.52 **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.22 **      |
| 36"                                                                | 4 3/4"      | 4000       | 0.16                       | 0.15          | 0.12        | 0.10        | 0.10         | 0.13 | 0.17 | 0.21 | 0.25 | 0.50 **      |
|                                                                    |             |            | 0.10                       | 0.09          | 0.07        | 0.07        | 0.07         | 0.07 | 0.08 | 0.10 | 0.12 | 0.17 **      |
| 42"                                                                | 4 1/2"      | 4000       | 0.20                       | 0.19          | 0.17        | 0.17        | 0.17         | 0.20 | 0.25 | 0.36 | 0.49 | **           |
|                                                                    |             |            | 0.13                       | 0.12          | 0.10        | 0.07        | 0.07         | 0.10 | 0.13 | 0.17 | 0.21 | **           |
| 42"                                                                | 5 1/4"      | 4000       | 0.16                       | 0.16          | 0.14        | 0.14        | 0.14         | 0.16 | 0.21 | 0.25 | 0.37 | **           |
|                                                                    |             |            | 0.10                       | 0.10          | 0.08        | 0.07        | 0.07         | 0.08 | 0.10 | 0.12 | 0.15 | **           |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.53 **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.20 **      |
| 48"                                                                | 5"          | 4000       | 0.18                       | 0.20          | ←           | ←           | ←            | 0.19 | →    | 0.23 | 0.31 | 0.45 0.62 ** |
|                                                                    |             |            | 0.11                       | 0.13          | ←           | ←           | ←            | 0.12 | →    | 0.16 | 0.20 | 0.24 **      |
| 48"                                                                | 5 3/4"      | 4000       | 0.18                       | 0.17          | ←           | ←           | ←            | 0.16 | →    | 0.20 | 0.25 | 0.32 0.52 ** |
|                                                                    |             |            | 0.11                       | 0.10          | ←           | ←           | ←            | 0.10 | →    | 0.07 | 0.12 | 0.15 0.18 ** |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.71 **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.24 **      |
| 54"                                                                | 5 1/2"      | 4000       | 0.21                       | 0.21          | ←           | ←           | ←            | 0.20 | →    | 0.26 | 0.38 | 0.55 **      |
|                                                                    |             |            | 0.14                       | 0.13          | ←           | ←           | ←            | 0.12 | →    | 0.14 | 0.18 | 0.23 **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.64 **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.26 **      |
| 54"                                                                | 6 1/4"      | 4000       | 0.19                       | 0.18          | ←           | ←           | ←            | 0.18 | →    | 0.23 | 0.29 | 0.45 0.68 ** |
|                                                                    |             |            | 0.12                       | 0.11          | ←           | ←           | ←            | 0.10 | →    | 0.11 | 0.14 | 0.18 0.22 ** |


| TYPE A STANDARD INSTALLATION - STEEL AREAS (in. <sup>2</sup> /ft.) |             |            |                            |               |             |             |              |      |      |      |      |         |
|--------------------------------------------------------------------|-------------|------------|----------------------------|---------------|-------------|-------------|--------------|------|------|------|------|---------|
| Dia.                                                               | Wall Thick. | f' c (psi) | Required Fill/Cover Height |               |             |             |              |      |      |      |      |         |
|                                                                    |             |            | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | 25'  | 30'  | H > 30' |
| 60"                                                                | 6"          | 4000       | 0.22                       | 0.22          | 0.22        | 0.22        | 0.22         | 0.30 | 0.45 | 0.69 | **   | **      |
|                                                                    |             |            | 0.14                       | 0.13          | 0.13        | 0.12        | 0.12         | 0.16 | 0.21 | 0.26 | **   | **      |
| 60"                                                                | 6 3/4"      | 4000       | 0.20                       | 0.20          | 0.19        | 0.19        | 0.20         | 0.26 | 0.33 | 0.59 | **   | **      |
|                                                                    |             |            | 0.12                       | 0.11          | 0.11        | 0.10        | 0.10         | 0.13 | 0.17 | 0.21 | **   | **      |
| 66"                                                                | 6 1/2"      | 4000       | 0.24                       | ←             | ←           | ←           | ←            | 0.25 | 0.35 | 0.53 | **   | **      |
|                                                                    |             |            | 0.14                       | ←             | ←           | ←           | ←            | 0.14 | 0.18 | 0.23 | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | 0.66 | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | 0.28 | **      |
| 66"                                                                | 7 1/4"      | 4000       | 0.21                       | ←             | ←           | ←           | ←            | 0.23 | 0.30 | 0.43 | 0.71 | **      |
|                                                                    |             |            | 0.12                       | ←             | ←           | ←           | ←            | 0.11 | 0.15 | 0.19 | 0.24 | **      |
| 72"                                                                | 7"          | 4000       | 0.25                       | 0.25          | 0.24        | 0.26        | 0.29         | 0.40 | 0.65 | **   | **   | **      |
|                                                                    |             |            | 0.15                       | 0.15          | 0.14        | 0.14        | 0.15         | 0.20 | 0.26 | **   | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | 0.76 | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | 0.31 | **      |
| 72"                                                                | 7 3/4"      | 4000       | 0.23                       | 0.23          | 0.22        | 0.24        | 0.26         | 0.34 | 0.53 | 0.86 | **   | **      |
|                                                                    |             |            | 0.13                       | 0.13          | 0.12        | 0.12        | 0.13         | 0.17 | 0.22 | 0.27 | **   | **      |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | 0.72 | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | 0.30 | **      |
| 78"                                                                | 7 1/2"      | 4000       | 0.26                       | 0.26          | 0.26        | 0.29        | 0.32         | 0.47 | 0.78 | **   | **   | **      |
|                                                                    |             |            | 0.15                       | 0.15          | 0.15        | 0.15        | 0.17         | 0.22 | 0.28 | **   | **   | **      |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | 0.80 | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | 0.33 | **      |
| 78"                                                                | 8 1/4"      | 4000       | 0.24                       | 0.24          | 0.24        | 0.27        | 0.29         | 0.38 | 0.66 | **   | **   | **      |
|                                                                    |             |            | 0.14                       | 0.13          | 0.13        | 0.13        | 0.14         | 0.19 | 0.24 | **   | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | 0.76 | **   | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | 0.29 | **   | **      |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | 0.86 | **   | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | 0.34 | **   | **      |

| TYPE A STANDARD INSTALLATION - STEEL AREAS (in. <sup>2</sup> /ft.) |             |            |                            |               |             |             |              |      |      |      |         |  |
|--------------------------------------------------------------------|-------------|------------|----------------------------|---------------|-------------|-------------|--------------|------|------|------|---------|--|
| Dia.                                                               | Wall Thick. | f' c (psi) | Required Fill/Cover Height |               |             |             |              |      |      |      |         |  |
|                                                                    |             |            | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | 25'  | H > 25' |  |
| 84"                                                                | 8"          | 4000       | 0.28                       | 0.28          | 0.29        | 0.32        | 0.35         | 0.54 | 0.91 | **   | **      |  |
|                                                                    |             |            | 0.16                       | 0.16          | 0.16        | 0.16        | 0.18         | 0.24 | 0.31 | **   | **      |  |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | 0.90 | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | 0.36 | **      |  |
| 84"                                                                | 8 3/4"      | 4000       | 0.26                       | 0.26          | 0.27        | 0.30        | 0.33         | 0.43 | 0.79 | **   | **      |  |
|                                                                    |             |            | 0.14                       | 0.14          | 0.14        | 0.15        | 0.16         | 0.21 | 0.27 | **   | **      |  |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | 0.90 | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | 0.32 | **      |  |
| 90"                                                                | 8 1/2"      | 4000       | 0.30                       | 0.30          | 0.32        | 0.36        | 0.39         | 0.64 | **   | **   | **      |  |
|                                                                    |             |            | 0.17                       | 0.17          | 0.17        | 0.19        | 0.20         | 0.27 | **   | **   | **      |  |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | 0.80 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.33 | **   | **      |  |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | 1.00 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.39 | **   | **      |  |
| 90"                                                                | 9 1/4"      | 4000       | 0.28                       | 0.28          | 0.30        | 0.33        | 0.36         | 0.52 | 0.94 | **   | **      |  |
|                                                                    |             |            | 0.15                       | 0.15          | 0.15        | 0.17        | 0.18         | 0.23 | 0.30 | **   | **      |  |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | 0.82 | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.34 | **   | **      |  |
| 96"                                                                | 9"          | 4000       | 0.32                       | 0.32          | 0.35        | 0.39        | 0.43         | 0.74 | **   | **   | **      |  |
|                                                                    |             |            | 0.18                       | 0.17          | 0.18        | 0.20        | 0.22         | 0.29 | **   | **   | **      |  |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | 0.91 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.36 | **   | **      |  |
| 96"                                                                | 9 3/4"      | 4000       | 0.30                       | 0.30          | 0.33        | 0.37        | 0.40         | 0.62 | **   | **   | **      |  |
|                                                                    |             |            | 0.16                       | 0.16          | 0.17        | 0.18        | 0.20         | 0.26 | **   | **   | **      |  |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | 0.79 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.32 | **   | **      |  |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | 0.95 | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.37 | **   | **      |  |
| 102"                                                               | 9 1/2"      | 4000       | 0.34                       | 0.35          | 0.38        | 0.43        | 0.50         | 0.86 | **   | **   | **      |  |
|                                                                    |             |            | 0.18                       | 0.18          | 0.20        | 0.22        | 0.24         | 0.31 | **   | **   | **      |  |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | 1.04 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.38 | **   | **      |  |
| 102"                                                               | 10 1/4"     | 4000       | 0.32                       | 0.33          | 0.36        | 0.40        | 0.44         | 0.75 | **   | **   | **      |  |
|                                                                    |             |            | 0.17                       | 0.17          | 0.18        | 0.20        | 0.22         | 0.28 | **   | **   | **      |  |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | 0.92 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.34 | **   | **      |  |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | 0.75 | **   | **      |  |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | 0.34 | **   | **      |  |

| TYPE A STANDARD INSTALLATION - STEEL AREAS (in <sup>2</sup> /ft.) |             |            |                            |               |             |             |              |      |      |         |    |    |
|-------------------------------------------------------------------|-------------|------------|----------------------------|---------------|-------------|-------------|--------------|------|------|---------|----|----|
|                                                                   |             |            | Required Fill/Cover Height |               |             |             |              |      |      |         |    |    |
| Dia.                                                              | Wall Thick. | f' c (psi) | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | H > 20' |    |    |
| 108"                                                              | 10"         | 4000       | 0.36                       | 0.37          | 0.41        | 0.46        | 0.57         | 1.00 | **   | **      | ** | ** |
|                                                                   |             |            | 0.20                       | 0.19          | 0.21        | 0.24        | 0.26         | 0.34 | **   | **      | ** | ** |
|                                                                   |             | 6000       | *                          | *             | *           | *           | *            | *    | 1.01 | **      | ** | ** |
|                                                                   |             |            | *                          | *             | *           | *           | *            | *    | 0.41 | **      | ** | ** |
| 108"                                                              | 10 3/4"     | 4000       | 0.35                       | 0.35          | 0.39        | 0.44        | 0.48         | 0.89 | **   | **      | ** | ** |
|                                                                   |             |            | 0.18                       | 0.18          | 0.20        | 0.22        | 0.24         | 0.31 | **   | **      | ** | ** |
|                                                                   |             | 5000       | *                          | *             | *           | *           | *            | *    | 1.06 | **      | ** | ** |
|                                                                   |             |            | *                          | *             | *           | *           | *            | *    | 0.37 | **      | ** | ** |
| 114"                                                              | 10 1/2"     | 4000       | 0.39                       | 0.40          | 0.44        | 0.52        | 0.64         | **   | **   | **      | ** | ** |
|                                                                   |             |            | 0.20                       | 0.21          | 0.23        | 0.26        | 0.28         | **   | **   | **      | ** | ** |
|                                                                   |             | 5000       | *                          | *             | *           | *           | *            | 0.86 | **   | **      | ** | ** |
|                                                                   |             |            | *                          | *             | *           | *           | *            | 0.36 | **   | **      | ** | ** |
|                                                                   |             | 6000       | *                          | *             | *           | *           | *            | *    | 1.10 | **      | ** | ** |
|                                                                   |             |            | *                          | *             | *           | *           | *            | 0.44 | **   | **      | ** | ** |
| 114"                                                              | 11 1/4"     | 4000       | 0.37                       | 0.38          | 0.42        | 0.48        | 0.53         | 1.03 | **   | **      | ** | ** |
|                                                                   |             |            | 0.19                       | 0.19          | 0.21        | 0.24        | 0.26         | 0.33 | **   | **      | ** | ** |
|                                                                   |             | 6000       | *                          | *             | *           | *           | *            | *    | 0.94 | **      | ** | ** |
|                                                                   |             |            | *                          | *             | *           | *           | *            | *    | 0.39 | **      | ** | ** |
| 120"                                                              | 11"         | 4000       | 0.41                       | 0.43          | 0.47        | 0.59        | 0.71         | **   | **   | **      | ** | ** |
|                                                                   |             |            | 0.21                       | 0.22          | 0.24        | 0.28        | 0.30         | **   | **   | **      | ** | ** |
|                                                                   |             | 5000       | *                          | *             | *           | *           | *            | 0.97 | **   | **      | ** | ** |
|                                                                   |             |            | *                          | *             | *           | *           | *            | 0.38 | **   | **      | ** | ** |
| 120"                                                              | 11 3/4"     | 4000       | 0.40                       | 0.40          | 0.45        | 0.52        | 0.61         | 1.18 | **   | **      | ** | ** |
|                                                                   |             |            | 0.20                       | 0.20          | 0.23        | 0.26        | 0.28         | 0.36 | **   | **      | ** | ** |

| TYPE A STANDARD INSTALLATION<br>REQUIRED FILL/COVER HEIGHT (FT.) - PROOF TEST LOAD ( lbs./LF/FT.OF DIAMETER) |                 |               |             |             |             |              |               |               |               |               |               |               |               |               |               |               |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                     |                 |                 |               |             |             |             |              |               |               |               |               |               |               |               |               |               |               |                |
|--------------------------------------------------------------------------------------------------------------|-----------------|---------------|-------------|-------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------------------------------------------------------------------------------------|-----------------|-----------------|---------------|-------------|-------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
| DIA.<br>( in. )                                                                                              | 1.0' ≤ H < 1.5' | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 4' | 4' ≤ H < 5' | 5' ≤ H < 10' | 10' ≤ H < 15' | 15' ≤ H < 20' | 20' ≤ H < 25' | 25' ≤ H < 30' | 30' ≤ H < 40' | 40' ≤ H < 50' | 50' ≤ H < 60' | 60' ≤ H < 70' | 70' ≤ H < 80' | 80' ≤ H < 90' | 90' ≤ H < 100' |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                     | DIA.<br>( in. ) | 1.0' ≤ H < 1.5' | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 4' | 4' ≤ H < 5' | 5' ≤ H < 10' | 10' ≤ H < 15' | 15' ≤ H < 20' | 20' ≤ H < 25' | 25' ≤ H < 30' | 30' ≤ H < 40' | 40' ≤ H < 50' | 50' ≤ H < 60' | 60' ≤ H < 70' | 70' ≤ H < 80' | 80' ≤ H < 90' | 90' ≤ H < 100' |
| 12                                                                                                           | 1720            | 1237          | 912         | 752         | 611         | 1277         | 1667          | 2066          | 2470          | 3282          | 4097          | 4913          | 5730          | 6548          | 7366          | 8183          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 60                                                                                  | 601             | 810             | 601           | 663         | 857         | 1222        | 1605         | 1992          | 2383          | 3168          | 3956          | 4745          | 5534          | 6324          | 7114          | 7904          |               |                |
| 15                                                                                                           | 1547            | 1132          | 901         | 713         | 897         | 1244         | 1625          | 2015          | 2408          | 3200          | 3994          | 4790          | 5587          | 6384          | 7181          | 7979          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 66                                                                                  | 555             | 814             | 657           | 688         | 850         | 1219        | 1600         | 1987          | 2377          | 3160          | 3946          | 4733          | 5520          | 6308          | 7096          | 7884          |               |                |
| 18                                                                                                           | 1412            | 1049          | 845         | 698         | 871         | 1222         | 1597          | 1980          | 2367          | 3145          | 3926          | 4709          | 5492          | 6275          | 7059          | 7842          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 72                                                                                  | 490             | 774             | 631           | 667         | 870         | 1245        | 1636         | 2032          | 2431          | 3232          | 4036          | 4841          | 5646          | 6452          | 7258          | 8064          |               |                |
| 21                                                                                                           | 1303            | 980           | 798         | 686         | 858         | 1207         | 1577          | 1955          | 2337          | 3106          | 3877          | 4650          | 5423          | 6197          | 6971          | 7745          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 78                                                                                  | 435             | 736             | 606           | 663         | 867         | 1243        | 1632         | 2028          | 2426          | 3226          | 4029          | 4832          | 5636          | 6441          | 7245          | 8049          |               |                |
| 24                                                                                                           | 1215            | 928           | 766         | 703         | 886         | 1250         | 1635          | 2028          | 2425          | 3223          | 4023          | 4825          | 5628          | 6431          | 7234          | 8037          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 84                                                                                  | 391             | 699             | 582           | 660         | 860         | 1240        | 1630         | 2025          | 2422          | 3221          | 4023          | 4825          | 5628          | 6431          | 7234          | 8037          |               |                |
| 27                                                                                                           | 1386            | 1056          | 732         | 695         | 878         | 1240         | 1623          | 2013          | 2406          | 3199          | 3994          | 4790          | 5586          | 6383          | 7180          | 7978          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 90                                                                                  | 355             | 633             | 590           | 656         | 861         | 1238        | 1627         | 2022          | 2419          | 3217          | 4017          | 4818          | 5620          | 6422          | 7224          | 8026          |               |                |
| 30                                                                                                           | 1303            | 1003          | 701         | 688         | 872         | 1232         | 1613          | 2001          | 2392          | 3179          | 3970          | 4761          | 5553          | 6345          | 7137          | 7930          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 96                                                                                  | 324             | 578             | 556           | 653         | 859         | 1236        | 1625         | 2019          | 2416          | 3213          | 4013          | 4813          | 5614          | 6415          | 7216          | 8017          |               |                |
| 33                                                                                                           | 1230            | 955           | 674         | 663         | 866         | 1226         | 1604          | 1991          | 2380          | 3164          | 3950          | 4738          | 5526          | 6314          | 7102          | 7891          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 102                                                                                 | 339             | 606             | 516           | 650         | 857         | 1234        | 1623         | 2017          | 2413          | 3210          | 4008          | 4808          | 5608          | 6408          | 7208          | 8009          |               |                |
| 36                                                                                                           | 1094            | 915           | 654         | 691         | 881         | 1249         | 1636          | 2030          | 2428          | 3227          | 4030          | 4833          | 5637          | 6441          | 7246          | 8050          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 108                                                                                 | 313             | 559             | 482           | 647         | 855         | 1232        | 1621         | 2015          | 2411          | 3207          | 4005          | 4803          | 5603          | 6402          | 7202          | 8001          |               |                |
| 42                                                                                                           | 972             | 939           | 657         | 682         | 873         | 1240         | 1625          | 2017          | 2412          | 3206          | 4003          | 4802          | 5600          | 6399          | 7199          | 7998          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 114                                                                                 | 291             | 518             | 475           | 645         | 853         | 1231        | 1619         | 2013          | 2409          | 3204          | 4001          | 4799          | 5598          | 6397          | 7196          | 7995          |               |                |
| 48                                                                                                           | 793             | 871           | 618         | 675         | 867         | 1233         | 1617          | 2007          | 2400          | 3191          | 3984          | 4778          | 5573          | 6368          | 7163          | 7959          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 120                                                                                 | 272             | 483             | 448           | 642         | 851         | 1229        | 1618         | 2011          | 2407          | 3202          | 3998          | 4796          | 5594          | 6392          | 7190          | 7989          |               |                |
| 54                                                                                                           | 705             | 863           | 633         | 669         | 861         | 1228         | 1610          | 1999          | 2391          | 3178          | 3968          | 4760          | 5552          | 6344          | 7136          | 7928          |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | NOTE: THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL. |                 |                 |               |             |             |             |              |               |               |               |               |               |               |               |               |               |               |                |

LEGEND

 = FOR INFORMATION ONLY. PROOF LOAD TEST MUST BE PERFORMED TO THE MAXIMUM PROOF TEST LOAD FOR THE RANGE OF ITEM NUMBER.

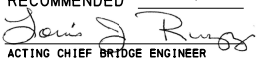
PROOF TEST LOAD TABLE FOR CIRCULAR PIPES - TYPE A STANDARD INSTALLATION

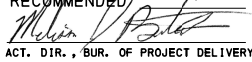
NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

NOTE:  
THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL.  
USE PENNDOT ACCEPTED SOFTWARE TO DETERMINE PROOF LOAD VALUES FOR FILL HEIGHTS GREATER THAN 100' -0".

COMMONWEALTH OF PENNSYLVANIA  
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STANDARD  
REINFORCED CONCRETE PIPES  
PAIDD DESIGN TABLES

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SHEET 5 OF 10  
BD-636M



| TYPE B STANDARD INSTALLATION - STEEL AREAS (in. <sup>2</sup> /ft.) |             |            |                            |               |             |             |              |      |      |      |      |      |      |         |
|--------------------------------------------------------------------|-------------|------------|----------------------------|---------------|-------------|-------------|--------------|------|------|------|------|------|------|---------|
|                                                                    |             |            | Required Fill/Cover Height |               |             |             |              |      |      |      |      |      |      |         |
| Dia.                                                               | Wall Thick. | f' c (psi) | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | 25'  | 30'  | 40'  | 50'  | H ≥ 50' |
| 12"                                                                | 2"          | 4000       | 0.09                       | ←             |             | 0.08        |              |      |      |      | →    | 0.12 | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | *    | 0.16 | **      |
| 12"                                                                | 2 3/4"      | 4000       | 0.08                       | ←             |             | 0.08        |              |      |      |      | →    | 0.08 | *    | **      |
| 15"                                                                | 2 1/4"      | 4000       | 0.11                       | ←             |             | 0.08        |              |      | →    | 0.09 | 0.11 | 0.19 | **   | **      |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | *    | 0.19 | **      |
| 15"                                                                | 3"          | 4000       | 0.08                       | ←             |             | 0.07        |              |      | →    | 0.07 | 0.09 | 0.12 | 0.16 | **      |
| 18"                                                                | 2 1/2"      | 4000       | 0.13                       | ←             |             | 0.08        |              |      | →    | 0.10 | 0.12 | 0.15 | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | *    | 0.21 | **      |
| 18"                                                                | 3 1/4"      | 4000       | 0.12                       | ←             |             | 0.07        |              | →    | 0.08 | 0.10 | 0.11 | 0.16 | **   | **      |
| 21"                                                                | 2 3/4"      | 4000       | 0.17                       | 0.11          | ←           | 0.07        | →            | 0.09 | 0.12 | 0.16 | 0.19 | **   | **   | **      |
| 21"                                                                | 3 1/2"      | 4000       | 0.16                       | 0.07          | ←           | 0.07        | →            | 0.08 | 0.10 | 0.12 | 0.15 | 0.23 | **   | **      |
| 24"                                                                | 3"          | 4000       | 0.22                       | 0.14          | ←           | 0.10        | →            | 0.11 | 0.15 | 0.19 | 0.24 | **   | **   | **      |
| 24"                                                                | 3 3/4"      | 4000       | 0.22                       | 0.12          | ←           | 0.08        | →            | 0.09 | 0.12 | 0.15 | 0.18 | 0.30 | **   | **      |
| 27"                                                                | 3 1/4"      | 4000       | **                         | 0.16          | 0.11        | 0.10        | 0.10         | 0.13 | 0.18 | 0.22 | 0.30 | **   | **   | **      |
|                                                                    |             | 5000       | 0.26                       | *             | *           | *           | *            | *    | *    | *    | *    | *    | **   | **      |
| 27"                                                                | 4"          | 4000       | **                         | 0.14          | 0.10        | 0.08        | 0.08         | 0.11 | 0.14 | 0.18 | 0.22 | **   | **   | **      |
|                                                                    |             | 5000       | 0.25                       | *             | *           | *           | *            | *    | *    | *    | *    | *    | **   | **      |
| 30"                                                                | 3 1/2"      | 4000       | **                         | 0.18          | ←           | 0.13        | →            | 0.16 | 0.21 | 0.26 | **   | **   | **   | **      |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | *    | *    | 0.31 | **   | **   | **      |
| 30"                                                                | 4 1/4"      | 4000       | **                         | 0.16          | ←           | 0.12        | →            | 0.13 | 0.17 | 0.21 | 0.25 | **   | **   | **      |
|                                                                    |             | 6000       | 0.27                       | *             | *           | *           | *            | *    | *    | *    | *    | **   | **   | **      |
| 33"                                                                | 3 3/4"      | 4000       | **                         | 0.21          | ←           | 0.16        | →            | 0.18 | 0.24 | 0.31 | **   | **   | **   | **      |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | *    | *    | 0.39 | **   | **   | **      |
| 33"                                                                | 4 1/2"      | 4000       | **                         | 0.18          | ←           | 0.14        | →            | 0.15 | 0.20 | 0.24 | 0.30 | **   | **   | **      |
| 36"                                                                | 4"          | 4000       | **                         | 0.22          | 0.18        | 0.13        | 0.15         | 0.21 | 0.27 | 0.38 | **   | **   | **   | **      |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | *    | *    | *    | 0.47 | **   | **      |
| 36"                                                                | 4 3/4"      | 4000       | **                         | 0.19          | 0.16        | 0.12        | 0.13         | 0.18 | 0.23 | 0.28 | **   | **   | **   | **      |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | *    | *    | 0.32 | **   | **   | **      |
| 36"                                                                | 4"          | 4000       | **                         | *             | *           | *           | *            | *    | *    | *    | *    | 0.46 | **   | **      |
|                                                                    |             | 5000       | **                         | *             | *           | *           | *            | *    | *    | *    | *    | *    | **   | **      |
| 36"                                                                | 4"          | 4000       | 0.18                       | 0.17          | 0.09        | 0.11        | 0.11         | 0.15 | 0.20 | 0.26 | 0.36 | **   | **   | **      |
|                                                                    |             | 5000       | 0.12                       | 0.11          | 0.07        | 0.07        | 0.07         | 0.08 | 0.10 | 0.13 | 0.16 | **   | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.53 | **   | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.21 | **   | **      |
| 36"                                                                | 4 3/4"      | 4000       | 0.15                       | 0.14          | 0.11        | 0.09        | 0.09         | 0.13 | 0.16 | 0.20 | 0.23 | 0.43 | **   | **      |
|                                                                    |             | 5000       | 0.09                       | 0.09          | 0.07        | 0.07        | 0.07         | 0.07 | 0.07 | 0.09 | 0.11 | 0.15 | **   | **      |
| 42"                                                                | 4 1/2"      | 4000       | 0.19                       | 0.18          | 0.16        | 0.14        | 0.14         | 0.18 | 0.24 | 0.34 | 0.46 | **   | **   | **      |
|                                                                    |             | 5000       | 0.12                       | 0.12          | 0.09        | 0.08        | 0.08         | 0.10 | 0.13 | 0.16 | 0.19 | **   | **   | **      |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.62 | **   | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.25 | **   | **      |
| 42"                                                                | 5 1/4"      | 4000       | 0.16                       | 0.15          | 0.13        | 0.12        | 0.12         | 0.15 | 0.20 | 0.24 | 0.30 | 0.61 | **   | **      |
|                                                                    |             | 5000       | 0.10                       | 0.09          | 0.08        | 0.07        | 0.07         | 0.07 | 0.09 | 0.12 | 0.14 | 0.20 | **   | **      |
| 48"                                                                | 5"          | 4000       | 0.19                       | 0.19          | 0.18        | 0.16        | 0.16         | 0.21 | 0.29 | 0.42 | 0.56 | **   | **   | **      |
|                                                                    |             | 5000       | 0.12                       | 0.12          | 0.11        | 0.09        | 0.09         | 0.11 | 0.15 | 0.19 | 0.23 | **   | **   | **      |
|                                                                    |             | 6000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.74 | **   | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.29 | **   | **      |
| 48"                                                                | 5 3/4"      | 4000       | 0.17                       | 0.16          | 0.15        | 0.14        | 0.14         | 0.18 | 0.23 | 0.28 | 0.44 | **   | **   | **      |
|                                                                    |             | 5000       | 0.10                       | 0.10          | 0.09        | 0.07        | 0.07         | 0.09 | 0.11 | 0.14 | 0.17 | **   | **   | **      |
|                                                                    |             | 5000       | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.62 | **   | **      |
|                                                                    |             |            | *                          | *             | *           | *           | *            | *    | *    | *    | *    | 0.23 | **   | **      |

| TYPE B STANDARD INSTALLATION<br>REQUIRED FILL/COVER HEIGHT FT. / PROOF TEST LOAD ( lbs. /LF/FT. OF DIAMETER) |                |              |             |             |              |               |               |               |               |               |               |               |               |               |               |                |                 |                 |                 |                 |
|--------------------------------------------------------------------------------------------------------------|----------------|--------------|-------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|-----------------|-----------------|-----------------|-----------------|
| DIA.<br>( In. )                                                                                              | 1.0 ≤ H ≤ 1.5' | 1.5 ≤ H ≤ 2' | 2' ≤ H ≤ 3' | 3' ≤ H ≤ 7' | 7' ≤ H ≤ 10' | 10' ≤ H ≤ 15' | 15' ≤ H ≤ 20' | 20' ≤ H ≤ 25' | 25' ≤ H ≤ 30' | 30' ≤ H ≤ 40' | 40' ≤ H ≤ 50' | 50' ≤ H ≤ 60' | 60' ≤ H ≤ 70' | 70' ≤ H ≤ 80' | 80' ≤ H ≤ 90' | 90' ≤ H ≤ 100' | 100' ≤ H ≤ 110' | 110' ≤ H ≤ 120' | 120' ≤ H ≤ 130' | 130' ≤ H ≤ 140' |
| 12                                                                                                           | 1634           | 1175         | 923         | 714         | 866          | 1213          | 1584          | 1963          | 2346          | 3118          | 3892          | 4668          | 5444          | 6220          | 6997          | 7774           |                 |                 |                 |                 |
| 15                                                                                                           | 1470           | 1075         | 856         | 677         | 843          | 1182          | 1544          | 1914          | 2287          | 3040          | 3795          | 4451          | 5308          | 6065          | 6822          | 7580           |                 |                 |                 |                 |
| 18                                                                                                           | 1342           | 996          | 802         | 663         | 827          | 1161          | 1517          | 1881          | 2248          | 2988          | 3730          | 4473          | 5217          | 5961          | 6706          | 7450           |                 |                 |                 |                 |
| 21                                                                                                           | 1238           | 931          | 758         | 652         | 816          | 1147          | 1498          | 1857          | 2220          | 2950          | 3683          | 4418          | 5152          | 5887          | 6622          | 7358           |                 |                 |                 |                 |
| 24                                                                                                           | 1154           | 881          | 728         | 668         | 841          | 1187          | 1553          | 1927          | 2303          | 3061          | 3822          | 4584          | 5347          | 6109          | 6872          | 7635           |                 |                 |                 |                 |
| 27                                                                                                           | 1317           | 1004         | 695         | 660         | 834          | 1178          | 1541          | 1912          | 2286          | 3039          | 3794          | 4550          | 5307          | 6064          | 6821          | 7579           |                 |                 |                 |                 |
| 30                                                                                                           | 1237           | 952          | 666         | 654         | 828          | 1171          | 1532          | 1901          | 2272          | 3020          | 3771          | 4523          | 5275          | 6028          | 6781          | 7534           |                 |                 |                 |                 |
| 33                                                                                                           | 1168           | 907          | 640         | 648         | 823          | 1164          | 1524          | 1891          | 2261          | 3006          | 3753          | 4501          | 5249          | 5998          | 6747          | 7496           |                 |                 |                 |                 |
| 36                                                                                                           | 1039           | 870          | 621         | 656         | 837          | 1186          | 1554          | 1929          | 2306          | 3066          | 3828          | 4591          | 5355          | 6119          | 6883          | 7648           |                 |                 |                 |                 |
| 42                                                                                                           | 924            | 892          | 624         | 648         | 829          | 1178          | 1543          | 1916          | 2291          | 3046          | 3803          | 4562          | 5320          | 6079          | 6839          | 7598           |                 |                 |                 |                 |
| 48                                                                                                           | 754            | 827          | 587         | 641         | 823          | 1171          | 1536          | 1906          | 2280          | 3031          | 3785          | 4539          | 5294          | 6050          | 6805          | 7561           |                 |                 |                 |                 |
| NOTE: THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL.                          |                |              |             |             |              |               |               |               |               |               |               |               |               |               |               |                |                 |                 |                 |                 |

NOTE :

PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

LEGEND



= FOR INFORMATION ONLY. PROOF LOAD TEST MUST BE PERFORMED TO THE MAXIMUM PROOF TEST LOAD FOR THE RANGE OF ITEM NUMBER.

NOTES:

- 1) \* INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
- 2) \*\* INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
- 3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND FOR REINFORCEMENT OF ELLIPTICAL PIPE.
- 4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
- 5) FOR PIPE SIZES GREATER THAN 48" DIAMETER, USE TYPE A STANDARD INSTALLATION DESIGN TABLES.
- 6) H = DESIGN FILL HEIGHT, FT.
- 7) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
- 8) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
- 9) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR CIRCULAR PIPES  
- TYPE B STANDARD INSTALLATION

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
REINFORCED CONCRETE PIPES  
PAIDD DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 10

BD-636M

| TYPE A SHORING/TRENCH BOX - STEEL AREAS (in. <sup>2</sup> /ft.) |             |                            |        |           |         |         |          |
|-----------------------------------------------------------------|-------------|----------------------------|--------|-----------|---------|---------|----------|
|                                                                 |             | Required Fill/Cover Height |        |           |         |         |          |
| Dia.                                                            | Wall Thick. | f' c (psi)                 | H<1.5' | 1.5'≤H<2' | 2'≤H<3' | 3'≤H<7' | 7'≤H<10' |
| 12"                                                             | 2"          | 4000                       | ↑      | ↑         | ↑       |         | 0.08     |
| 12"                                                             | 2¾"         | 4000                       | ↑      | ↑         | ↑       |         | 0.08     |
| 15"                                                             | 2¼"         | 4000                       | ↑      | ↑         | 0.09    |         | 0.08     |
| 15"                                                             | 3"          | 4000                       | ↑      | ↑         | 0.09    |         | 0.08     |
| 18"                                                             | 2½"         | 4000                       | ↑      | ↑         | 0.12    | 0.09    | 0.10     |
| 18"                                                             | 3¼"         | 4000                       | ↑      | ↑         | 0.11    | 0.08    | 0.09     |
| 21"                                                             | 2¾"         | 4000                       | ↑      | ↑         | 0.14    | 0.11    | 0.13     |
| 21"                                                             | 3½"         | 4000                       | ↑      | ↑         | 0.14    | 0.10    | 0.11     |
| 24"                                                             | 3"          | 4000                       | ↑      | ↑         | 0.18    | 0.14    | 0.12     |
| 24"                                                             | 3¾"         | 4000                       | ↑      | ↑         | 0.17    | 0.12    | 0.09     |
| 27"                                                             | 3¼"         | 4000                       | ↑      | ↑         | 0.20    | 0.16    | 0.14     |
| 27"                                                             | 4"          | 4000                       | ↑      | ↑         | 0.17    | 0.14    | 0.12     |
| 30"                                                             | 3½"         | 4000                       | **     | 0.33      | 0.24    | 0.19    | 0.16     |
| 30"                                                             | 4¼"         | 4000                       | **     | 0.26      | 0.20    | 0.16    | 0.20     |
| 33"                                                             | 3¾"         | 4000                       | **     | 0.36      | 0.27    | 0.21    | 0.18     |
| 33"                                                             | 4½"         | 4000                       | **     | 0.30      | 0.23    | 0.18    | 0.21     |
| 36"                                                             | 4"          | 4000                       | **     | 0.36      | 0.31    | 0.22    | 0.21     |
| 36"                                                             | 4¾"         | 4000                       | **     | 0.31      | 0.26    | 0.20    | 0.18     |
| 36"                                                             | 4"          | 4000                       | **     | 0.29      | 0.22    | 0.18    | 0.16     |
|                                                                 |             |                            | **     | 0.16      | 0.12    | 0.09    | 0.09     |
| 36"                                                             | 4¾"         | 4000                       | **     | 0.23      | 0.18    | 0.15    | 0.13     |
|                                                                 |             |                            | **     | 0.12      | 0.09    | 0.07    | 0.07     |
| 42"                                                             | 4½"         | 4000                       | **     | 0.30      | 0.26    | 0.23    | 0.35     |
|                                                                 |             |                            | **     | 0.16      | 0.13    | 0.12    | 0.14     |
| 42"                                                             | 5¼"         | 4000                       | **     | 0.24      | 0.22    | 0.20    | 0.25     |
|                                                                 |             |                            | **     | 0.13      | 0.11    | 0.10    | 0.11     |

NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

| TYPE A SHORING/TRENCH BOX - STEEL AREAS (in. <sup>2</sup> /ft.) |             |                            |        |           |         |         |          |
|-----------------------------------------------------------------|-------------|----------------------------|--------|-----------|---------|---------|----------|
|                                                                 |             | Required Fill/Cover Height |        |           |         |         |          |
| Dia.                                                            | Wall Thick. | f' c (psi)                 | H<1.5' | 1.5'≤H<2' | 2'≤H<3' | 3'≤H<7' | 7'≤H<10' |
| 48"                                                             | 5"          | 4000                       | **     | 0.30      | 0.30    | 0.26    | 0.27     |
|                                                                 |             |                            | **     | 0.16      | 0.16    | 0.13    | 0.13     |
| 48"                                                             | 5¾"         | 4000                       | **     | 0.26      | 0.26    | 0.23    | 0.23     |
|                                                                 |             |                            | **     | 0.14      | 0.14    | 0.11    | 0.11     |
| 54"                                                             | 5½"         | 4000                       | **     | 0.32      | 0.31    | 0.30    | 0.34     |
|                                                                 |             |                            | **     | 0.17      | 0.16    | 0.15    | 0.15     |
| 54"                                                             | 6¼"         | 4000                       | **     | 0.27      | 0.27    | 0.26    | 0.27     |
|                                                                 |             |                            | **     | 0.14      | 0.13    | 0.12    | 0.15     |
| 60"                                                             | 6"          | 4000                       | **     | 0.33      | 0.33    | 0.33    | 0.42     |
|                                                                 |             |                            | **     | 0.18      | 0.17    | 0.17    | 0.20     |
| 60"                                                             | 6¾"         | 4000                       | **     | 0.29      | 0.29    | 0.30    | 0.31     |
|                                                                 |             |                            | **     | 0.15      | 0.14    | 0.15    | 0.18     |
| 66"                                                             | 6½"         | 4000                       | **     | 0.35      | 0.35    | 0.38    | 0.50     |
|                                                                 |             |                            | **     | 0.18      | 0.18    | 0.18    | 0.23     |
| 66"                                                             | 7¼"         | 4000                       | **     | 0.31      | 0.31    | 0.33    | 0.37     |
|                                                                 |             |                            | **     | 0.16      | 0.15    | 0.16    | 0.20     |
| 72"                                                             | 7"          | 4000                       | **     | 0.37      | 0.39    | 0.43    | 0.58     |
|                                                                 |             |                            | **     | 0.19      | 0.19    | 0.18    | 0.21     |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.76     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.26     |
| 72"                                                             | 7¾"         | 4000                       | **     | 0.34      | 0.35    | 0.36    | 0.45     |
|                                                                 |             |                            | **     | 0.17      | 0.16    | 0.17    | 0.19     |
| 78"                                                             | 7½"         | 4000                       | **     | 0.39      | 0.39    | 0.51    | 0.67     |
|                                                                 |             |                            | **     | 0.20      | 0.20    | 0.20    | 0.23     |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.86     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.28     |
| 78"                                                             | 8¼"         | 4000                       | **     | 0.36      | 0.39    | 0.39    | 0.53     |
|                                                                 |             |                            | **     | 0.18      | 0.18    | 0.21    | 0.25     |

DESIGN TABLES AND PROOF TEST LOAD TABLE FOR CIRCULAR PIPES  
- TYPE A SHORING/TRENCH BOX INSTALLATION

| TYPE A SHORING/TRENCH BOX - STEEL AREAS (in. <sup>2</sup> /ft.) |             |                            |        |           |         |         |          |
|-----------------------------------------------------------------|-------------|----------------------------|--------|-----------|---------|---------|----------|
|                                                                 |             | Required Fill/Cover Height |        |           |         |         |          |
| Dia.                                                            | Wall Thick. | f' c (psi)                 | H<1.5' | 1.5'≤H<2' | 2'≤H<3' | 3'≤H<7' | 7'≤H<10' |
| 84"                                                             | 8"          | 4000                       | **     | 0.42      | 0.42    | 0.59    | 0.78     |
|                                                                 |             |                            | **     | 0.21      | 0.21    | 0.22    | 0.26     |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 0.90     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.31     |
| 84"                                                             | 8¾"         | 4000                       | **     | 0.39      | 0.39    | 0.47    | 0.64     |
|                                                                 |             |                            | **     | 0.19      | 0.19    | 0.20    | 0.23     |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.82     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.28     |
| 90"                                                             | 8½"         | 4000                       | **     | 0.45      | 0.45    | 0.68    | 0.92     |
|                                                                 |             |                            | **     | 0.22      | 0.22    | 0.25    | 0.28     |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 1.01     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.33     |
| 90"                                                             | 9¼"         | 4000                       | **     | 0.41      | 0.41    | 0.55    | 0.93     |
|                                                                 |             |                            | **     | 0.20      | 0.20    | 0.23    | 0.28     |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.94     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.30     |
| 96"                                                             | 9"          | 4000                       | **     | 0.50      | 0.48    | 0.76    | **       |
|                                                                 |             |                            | **     | 0.23      | 0.23    | 0.27    | **       |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.88     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.30     |
| 96"                                                             | 9¾"         | 4000                       | **     | 0.44      | 0.44    | 0.64    | 0.93     |
|                                                                 |             |                            | **     | 0.21      | 0.21    | 0.25    | 0.28     |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 0.95     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.33     |
| 102"                                                            | 9½"         | 4000                       | **     | 0.56      | 0.52    | 0.85    | **       |
|                                                                 |             |                            | **     | 0.25      | 0.25    | 0.30    | **       |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.97     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.33     |
| 102"                                                            | 10¼"        | 4000                       | **     | 0.47      | 0.48    | 0.73    | **       |
|                                                                 |             |                            | **     | 0.23      | 0.23    | 0.27    | **       |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.83     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.30     |

| TYPE A SHORING/TRENCH BOX - STEEL AREAS (in. <sup>2</sup> /ft.) |             |                            |        |           |         |         |          |
|-----------------------------------------------------------------|-------------|----------------------------|--------|-----------|---------|---------|----------|
|                                                                 |             | Required Fill/Cover Height |        |           |         |         |          |
| Dia.                                                            | Wall Thick. | f' c (psi)                 | H<1.5' | 1.5'≤H<2' | 2'≤H<3' | 3'≤H<7' | 7'≤H<10' |
| 108"                                                            | 10"         | 4000                       | **     | 0.62      | 0.58    | ***     | **       |
|                                                                 |             |                            | **     | 0.26      | 0.26    | *       | **       |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 1.00     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.35     |
| 108"                                                            | 10¾"        | 4000                       | **     | 0.51      | 0.51    | 0.86    | **       |
|                                                                 |             |                            | **     | 0.24      | 0.24    | 0.30    | **       |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 0.93     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.33     |
| 114"                                                            | 10½"        | 4000                       | **     | 0.68      | 0.65    | ***     | **       |
|                                                                 |             |                            | **     | 0.28      | 0.28    | *       | **       |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 1.11     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.38     |
| 114"                                                            | 11¼"        | 4000                       | **     | 0.58      | 0.55    | 0.73    | **       |
|                                                                 |             |                            | **     | 0.26      | 0.26    | 0.29    | **       |
|                                                                 |             | 5000                       | **     | *         | *       | *       | 1.06     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.35     |
| 120"                                                            | 11"         | 4000                       | **     | 0.75      | **      | ***     | **       |
|                                                                 |             |                            | **     | 0.29      | **      | **      | **       |
|                                                                 |             | 5000                       | **     | *         | 0.72    | *       | **       |
|                                                                 |             |                            | **     | *         | 0.30    | *       | **       |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 1.22     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.40     |
| 120"                                                            | 11¾"        | 4000                       | **     | 0.64      | 0.62    | 0.82    | **       |
|                                                                 |             |                            | **     | 0.28      | 0.28    | 0.31    | **       |
|                                                                 |             | 6000                       | **     | *         | *       | *       | 1.07     |
|                                                                 |             |                            | **     | *         | *       | *       | 0.38     |

| TYPE A SHORING/TRENCH BOX INSTALLATION<br>REQUIRED FILL/COVER HEIGHT (FT.) /<br>PROOF TEST LOAD (lbs/LF/FT. OF DIAMETER) |           |                 |                 |                 |           |           |           |  |
|--------------------------------------------------------------------------------------------------------------------------|-----------|-----------------|-----------------|-----------------|-----------|-----------|-----------|--|
| DIA.<br>(in.)                                                                                                            | 1.5'≤H<2' | 2'≤H<3'         | 3'≤H<7'         | 7'≤H<10'        | 10'≤H<15' | 15'≤H<20' | 20'≤H<25' |  |
| 12                                                                                                                       | 1762      | <del>1496</del> | <del>1196</del> | <del>1295</del> | 1818      | 2376      | 2945      |  |
| 15                                                                                                                       | 1621      | 1393            | <del>1135</del> | <del>1260</del> | 1772      | 2318      | 2872      |  |
| 18                                                                                                                       | 1509      | 1313            | 1087            | 1237            | 1741      | 2276      | 2822      |  |
| 21                                                                                                                       | 1418      | 1247            | 1048            | 1220            | 1719      | 2247      | 2787      |  |
| 24                                                                                                                       | 1341      | 1192            | 1015            | 1207            | 1702      | 2226      | 2761      |  |
| 27                                                                                                                       | 1274      | 1143            | 986             | 1196            | 1888      | 2209      | 2740      |  |
| 30                                                                                                                       | 1216      | 1101            | 961             | 1187            | 1878      | 2195      | 2723      |  |
| 33                                                                                                                       | 1165      | 1063            | 938             | 1180            | 1869      | 2184      | 2710      |  |
| 36                                                                                                                       | 1119      | 1029            | 924             | 1174            | 1861      | 2175      | 2698      |  |
| 42                                                                                                                       | 1092      | 985             | <del>1125</del> | 1467            | 2105      | 2767      | 3439      |  |
| 48                                                                                                                       | 1023      | <del>936</del>  | 1114            | 1457            | 2093      | 2753      | 3422      |  |
| 54                                                                                                                       | 1015      | 895             | 1104            | 1449            | 2084      | 2742      | 3409      |  |
| 60                                                                                                                       | 961       | 858             | 1096            | 1442            | 2077      | 2733      | 3398      |  |
| 66                                                                                                                       | 965       | <del>858</del>  | 1089            | 1436            | 2070      | 2726      | 3389      |  |
| 72                                                                                                                       | 922       | 829             | 1082            | 1431            | 2065      | 2719      | 3382      |  |
| 78                                                                                                                       | 882       | <del>802</del>  | 1076            | 1426            | 2061      | 2714      | 3375      |  |
| 84                                                                                                                       | 847       | <del>778</del>  | 1071            | 1422            | 2057      | 2709      | 3370      |  |
| 90                                                                                                                       | 786       | 786             | 1066            | 1418            | 2053      | 2705      | 3365      |  |
| 96                                                                                                                       | 752       | 752             | 1061            | 1415            | 2050      | 2702      | 3361      |  |
| 102                                                                                                                      | 753       | 712             | 1057            | 1412            | 2047      | 2699      | 3357      |  |
| 108                                                                                                                      | 705       | 678             | 1053            | 1409            | 2044      | 2696      | 3354      |  |
| 114                                                                                                                      | 671       | 671             | 1049            | 1406            | 2042      | 2693      | 3351      |  |
| 120                                                                                                                      | 643       | 643             | 1046            | 1404            | 2040      | 2691      | 3348      |  |
| NOTE: THESE PROOF LOADS INCLUDE A 1.43 SAFETY FACTOR FOR FIELD CRACK CONTROL.                                            |           |                 |                 |                 |           |           |           |  |

NOTES:

- 1) \* INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
- 2) \*\* INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
- 3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCEMENT AND REINFORCEMENT OF ELLIPTICAL PIPE.
- 4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN. THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA IS FOR OUTER CAGE STEEL.
- 5) FOR PIPE DIAMETERS GREATER THAN 48", USE TYPE A SHORING/TRENCH BOX DESIGN TABLES.
- 6) FOR FILL HEIGHTS GREATER THAN INDICATED, USE THE PENNDOT ACCEPTED SOFTWARE.
- 7) H = DESIGN FILL HEIGHT, FT.
- 8) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY WITH DESIGNER APPROVAL.
- 9) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
- 10) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE. WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME. DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.
- 11) \*\*\* INDICATES A SHEAR CONTROL HAS BEEN REACHED, USE PENNDOT ACCEPTED SOFTWARE FOR SPECIAL DESIGN.

| TYPE B SHORING/TRENCH BOX - STEEL AREAS (in. <sup>2</sup> /ft.) |             |                            |        |           |         |         |          |
|-----------------------------------------------------------------|-------------|----------------------------|--------|-----------|---------|---------|----------|
|                                                                 |             | Required Fill/Cover Height |        |           |         |         |          |
| Dia.                                                            | Wall Thick. | f' c (psi)                 | H<1.5' | 1.5'≤H<2' | 2'≤H<3' | 3'≤H<7' | 7'≤H<10' |
| 12"                                                             | 2"          | 4000                       | ↑      | ↑         | ↑       | 0.08    |          |
| 12"                                                             | 2¾"         | 4000                       | ↑      | ↑         | ↑       | 0.07    |          |
| 15"                                                             | 2¼"         | 4000                       | ↑      | ↑         | 0.08    |         |          |
| 15"                                                             | 3"          | 4000                       | ↑      | ↑         | 0.07    |         |          |
| 18"                                                             | 2½"         | 4000                       | ↑      | ↑         | 0.11    | 0.09    | 0.09     |
| 18"                                                             | 3¼"         | 4000                       | ↑      | ↑         | 0.09    | 0.07    | 0.07     |
| 21"                                                             | 2¾"         | 4000                       | ↑      | ↑         | 0.13    | 0.11    | 0.09     |
| 21"                                                             | 3½"         | 4000                       | ↑      | ↑         | 0.11    | 0.09    | 0.09     |
| 24"                                                             | 3"          | 4000                       | ↑      | ↑         | 0.16    | 0.13    | 0.11     |
| 24"                                                             | 3¾"         | 4000                       | ↑      | ↑         | 0.13    | 0.11    | 0.09     |
| 27"                                                             | 3¼"         | 4000                       | ↑      | ↑         | 0.19    | 0.15    | 0.13     |
| 27"                                                             | 4"          | 4000                       | ↑      | ↑         | 0.16    | 0.13    | 0.11     |
| 30"                                                             | 3½"         | 4000                       | **     | 0.29      | 0.22    | 0.17    | 0.15     |
| 30"                                                             | 4¼"         | 4000                       | **     | 0.25      | 0.18    | 0.15    | 0.16     |
| 33"                                                             | 3¾"         | 4000                       | **     | 0.33      | 0.25    | 0.20    | 0.21     |
| 33"                                                             | 4½"         | 4000                       | **     | 0.28      | 0.21    | 0.17    | 0.18     |

| TYPE B SHORING/TRENCH BOX - STEEL AREAS (in. <sup>2</sup> /ft.) |             |                            |        |           |         |         |          |
|-----------------------------------------------------------------|-------------|----------------------------|--------|-----------|---------|---------|----------|
|                                                                 |             | Required Fill/Cover Height |        |           |         |         |          |
| Dia.                                                            | Wall Thick. | f' c (psi)                 | H<1.5' | 1.5'≤H<2' | 2'≤H<3' | 3'≤H<7' | 7'≤H<10' |
| 36"                                                             | 4"          | 4000                       | **     | 0.35      | 0.27    | 0.21    | 0.20     |
| 36"                                                             | 4¾"         | 4000                       | **     | 0.29      | 0.24    | 0.19    | 0.17     |
| 36"                                                             | 4"          | 4000                       | **     | 0.27      | 0.21    | 0.17    | 0.15     |
|                                                                 |             |                            | **     | 0.15      | 0.07    | 0.08    | 0.07     |



| TYPE A STANDARD INSTALLATION<br>HORIZONTAL<br>ELLIPTICAL PIPE H<1.5 ft |                         |                |               |                                           |                         |  |
|------------------------------------------------------------------------|-------------------------|----------------|---------------|-------------------------------------------|-------------------------|--|
| Equi-<br>valent<br>Round                                               | Rise<br>/Span<br>( in.) | Wall<br>Thick. | f' c<br>(psi) | Steel<br>Area<br>( in. <sup>2</sup> /ft.) | PROOF TEST<br>Lbs/ft/ft |  |
| 18 "                                                                   | 14x23                   | 2 3/4 "        | 4000          | **                                        | 1240                    |  |
|                                                                        |                         |                | 5000          | 0.20                                      |                         |  |
| 24 "                                                                   | 19x30                   | 3 1/4 "        | 4000          | **                                        | 1303                    |  |
| 27 "                                                                   | 22x34                   | 3 1/2 "        | 4000          | **                                        | 1190                    |  |
|                                                                        |                         |                | 5000          | **                                        |                         |  |
|                                                                        |                         |                | 6000          | **                                        |                         |  |
| 30 "                                                                   | 24x38                   | 3 3/4 "        | 4000          | 0.22                                      | 1132                    |  |
|                                                                        |                         |                |               | 0.22                                      |                         |  |
| 33 "                                                                   | 27x42                   | 3 3/4 "        | 4000          | 0.25                                      | 972                     |  |
|                                                                        |                         |                |               | 0.25                                      |                         |  |
| 36 "                                                                   | 29x45                   | 4 1/2 "        | 4000          | 0.21                                      | 875                     |  |
|                                                                        |                         |                |               | 0.21                                      |                         |  |
| 42 "                                                                   | 34x53                   | 5 "            | 4000          | 0.23                                      | 726                     |  |
|                                                                        |                         |                |               | 0.23                                      |                         |  |
| 48 "                                                                   | 38x60                   | 5 1/2 "        | 4000          | 0.24                                      | 601                     |  |
|                                                                        |                         |                |               | 0.24                                      |                         |  |
| 54 "                                                                   | 43x68                   | 6 "            | 4000          | 0.26                                      | 531                     |  |
|                                                                        |                         |                |               | 0.26                                      |                         |  |
| 60 "                                                                   | 48x76                   | 6 1/2 "        | 4000          | 0.28                                      | 452                     |  |
|                                                                        |                         |                |               | 0.28                                      |                         |  |
| 66 "                                                                   | 53x83                   | 7 "            | 4000          | 0.30                                      | 398                     |  |
|                                                                        |                         |                |               | 0.30                                      |                         |  |
| 72 "                                                                   | 58x91                   | 7 1/2 "        | 4000          | 0.33                                      | 349                     |  |
|                                                                        |                         |                |               | 0.33                                      |                         |  |
| 78 "                                                                   | 63x98                   | 8 "            | 4000          | 0.36                                      | 358                     |  |
|                                                                        |                         |                |               | 0.36                                      |                         |  |
| 84 "                                                                   | 68x106                  | 8 1/2 "        | 4000          | 0.44                                      | 321                     |  |
|                                                                        |                         |                |               | 0.44                                      |                         |  |
| 90 "                                                                   | 72x113                  | 9 "            | 4000          | 0.50                                      | 294                     |  |
|                                                                        |                         |                |               | 0.50                                      |                         |  |
| 96 "                                                                   | 77x121                  | 9 1/2 "        | 4000          | 0.60                                      | 269                     |  |
|                                                                        |                         |                |               | 0.60                                      |                         |  |
| 102 "                                                                  | 82x128                  | 9 3/4 "        | 4000          | 0.71                                      | 250                     |  |
|                                                                        |                         |                |               | 0.71                                      |                         |  |
| 108 "                                                                  | 87x136                  | 10 "           | 4000          | 0.86                                      | 232                     |  |
|                                                                        |                         |                |               | 0.86                                      |                         |  |
| 114 "                                                                  | 92x143                  | 10 1/2 "       | 4000          | 0.95                                      | 218                     |  |
|                                                                        |                         |                |               | 0.95                                      |                         |  |
| 120 "                                                                  | 97x151                  | 11 "           | 4000          | 1.08                                      | 216                     |  |
|                                                                        |                         |                |               | 1.08                                      |                         |  |

| TYPE B STANDARD INSTALLATION<br>HORIZONTAL<br>ELLIPTICAL PIPE H<1.5 ft. |                         |                |               |                                           |                         |  |
|-------------------------------------------------------------------------|-------------------------|----------------|---------------|-------------------------------------------|-------------------------|--|
| Equi-<br>valent<br>Round                                                | Rise<br>/Span<br>( in.) | Wall<br>Thick. | f' c<br>(psi) | Steel<br>Area<br>( in. <sup>2</sup> /ft.) | PROOF TEST<br>Lbs/ft/ft |  |
| 18 "                                                                    | 14x23                   | 2 3/4 "        | 4000          | 0.20                                      | 1178                    |  |
| 24 "                                                                    | 19x30                   | 3 1/4 "        | 4000          | **                                        | 1237                    |  |
|                                                                         |                         |                | 5000          | **                                        |                         |  |
|                                                                         |                         |                | 6000          | 0.29                                      |                         |  |
| 27 "                                                                    | 22x34                   | 3 1/2 "        | 4000          | **                                        | 1131                    |  |
|                                                                         |                         |                | 5000          | **                                        |                         |  |
|                                                                         |                         |                | 6000          | **                                        |                         |  |
| 30 "                                                                    | 24x38                   | 3 3/4 "        | 4000          | 0.21                                      | 1076                    |  |
|                                                                         |                         |                |               | 0.21                                      |                         |  |
| 33 "                                                                    | 27x42                   | 3 3/4 "        | 4000          | 0.23                                      | 924                     |  |
|                                                                         |                         |                |               | 0.23                                      |                         |  |
| 36 "                                                                    | 29x45                   | 4 1/2 "        | 4000          | 0.20                                      | 832                     |  |
|                                                                         |                         |                |               | 0.20                                      |                         |  |
| 42 "                                                                    | 34x53                   | 5 "            | 4000          | 0.22                                      | 690                     |  |
|                                                                         |                         |                |               | 0.22                                      |                         |  |
| 48 "                                                                    | 38x60                   | 5 1/2 "        | 4000          | 0.23                                      | 571                     |  |
|                                                                         |                         |                |               | 0.23                                      |                         |  |
| 54 "                                                                    | 43x68                   | 6 "            | 4000          | 0.25                                      | 504                     |  |
|                                                                         |                         |                |               | 0.25                                      |                         |  |
| 60 "                                                                    | 48x76                   | 6 1/2 "        | 4000          | 0.27                                      | 429                     |  |
|                                                                         |                         |                |               | 0.27                                      |                         |  |
| 66 "                                                                    | 53x83                   | 7 "            | 4000          | 0.29                                      | 378                     |  |
|                                                                         |                         |                |               | 0.29                                      |                         |  |
| 72 "                                                                    | 58x91                   | 7 1/2 "        | 4000          | 0.32                                      | 332                     |  |
|                                                                         |                         |                |               | 0.32                                      |                         |  |
| 78 "                                                                    | 63x98                   | 8 "            | 4000          | 0.34                                      | 340                     |  |
|                                                                         |                         |                |               | 0.34                                      |                         |  |
| 84 "                                                                    | 68x106                  | 8 1/2 "        | 4000          | 0.42                                      | 305                     |  |
|                                                                         |                         |                |               | 0.42                                      |                         |  |
| 90 "                                                                    | 72x113                  | 9 "            | 4000          | 0.47                                      | 280                     |  |
|                                                                         |                         |                |               | 0.47                                      |                         |  |
| 96 "                                                                    | 77x121                  | 9 1/2 "        | 4000          | 0.56                                      | 255                     |  |
|                                                                         |                         |                |               | 0.56                                      |                         |  |
| 102 "                                                                   | 82x128                  | 9 3/4 "        | 4000          | 0.71                                      | 238                     |  |
|                                                                         |                         |                |               | 0.71                                      |                         |  |
| 108 "                                                                   | 87x136                  | 10 "           | 4000          | 0.82                                      | 220                     |  |
|                                                                         |                         |                |               | 0.82                                      |                         |  |
| 114 "                                                                   | 92x143                  | 10 1/2 "       | 4000          | 0.90                                      | 207                     |  |
|                                                                         |                         |                |               | 0.90                                      |                         |  |
| 120 "                                                                   | 97x151                  | 11 "           | 4000          | 1.02                                      | 206                     |  |
|                                                                         |                         |                |               | 1.02                                      |                         |  |

- NOTES:
- 1) \* INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
  - 2) \*\* INDICATES A SPECIAL DESIGN IS REQUIRED. USE PENNDOT ACCEPTED SOFTWARE.
  - 3) ELLIPTICAL REINFORCING IS NOT ALLOWED, EXCEPT FOR QUADRANT REINFORCE-  
MENT AND REINFORCEMENT OF ELLIPTICAL PIPE.
  - 4) FOR DOUBLE CIRCULAR STEEL REINFORCED PIPE, TWO AREAS ARE SHOWN.  
THE GREATER AREA IS FOR THE INNER CAGE STEEL AND LESSER AREA  
IS FOR OUTER CAGE STEEL.
  - 5) H = DESIGN FILL HEIGHT, FT.
  - 6) SUBSTITUTION OF PIPES UNDER FILLS OF 3'-0" OR LESS IS PERMITTED ONLY  
WITH DESIGNER APPROVAL.
  - 7) FOR DESIGN OF A TYPE A STANDARD ELLIPTICAL PIPE FOLLOW THESE STEPS:  
(a) USE CORRESPONDING VALUES IN PROOF TEST LOAD TABLE TO TEST CONCRETE PIPE.  
SELECT THE LARGER DIMENSION OF SPAN OR RISE FROM ELLIPTICAL PIPE SIZES  
SHOWN IN THE TYPE A SHORING/TRENCH BOX TABLE FOR ELLIPTICAL PIPES.  
I.E. RISE DIMENSION FOR VERTICAL ELLIPTICAL  
SPAN DIMENSION FOR HORIZONTAL ELLIPTICAL  
(b) GO TO TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES.  
(c) USE THE RISE DIMENSION FOR VERTICAL ELLIPTICAL DESIGNS OR THE SPAN  
DIMENSION FOR THE HORIZONTAL ELLIPTICAL DESIGNS AS THE DIAMETER IN  
THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE. IF THE  
SELECTED DIAMETER IS NOT AVAILABLE IN THE TYPE A STANDARD INSTALLATION  
TABLES FOR CIRCULAR PIPE, USE THE NEXT LARGER AVAILABLE DIAMETER IN THE  
TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPE TO DETERMINE THE  
STEEL AREA. J  
(d) FOR THE SELECTED DIAMETER, WALL THICKNESS, DESIGN FILL HEIGHT AND CONCRETE  
STRENGTH, DETERMINE THE AREA OF STEEL REQUIRED FOR THE INNER CAGE OF THE  
PIPE IN THE TYPE A STANDARD INSTALLATION TABLES FOR CIRCULAR PIPES. USE  
THIS AREA FOR EACH, INNER AND OUTER, CAGE FOR THE ELLIPTICAL PIPE DESIGN.
  - 8) USE PENNDOT ACCEPTED SOFTWARE ONLY FOR PIPE DESIGNS NOT PROVIDED BY BD-636M.
  - 9) STEEL AREAS SPECIFIED IN THE FILL HEIGHT / STEEL AREA TABLES ARE TO BE  
ACHIEVED USING ONE LAYER OF REINFORCEMENT FOR EACH CAGE. TWO LAYERS  
MAY BE SUBSTITUTED FOR ONE LAYER PROVIDED THE SUM OF THE STEEL AREAS  
OF THE 2 LAYERS IS EQUAL TO THE AREA OF STEEL FOR THE SINGLE LAYER CAGE.  
WHEN SUBSTITUTING, SPACING OF REINFORCEMENT IS TO REMAIN THE SAME.  
DESIGNING FOR 2 LAYERS OF REINFORCEMENT AND PROVIDING ONE LAYER OF  
REINFORCEMENT OF EQUIVALENT AREA IS NOT PERMITTED.

DESIGN TABLES FOR HORIZONTAL ELLIPTICAL PIPE-STANDARD INSTALLATION- TYPE A / TYPE B

| TYPE A SHORING/TRENCH BOX <b>VERTICAL</b><br>ELLIPTICAL PIPE -STEEL AREAS (in <sup>2</sup> /ft.) |                  |                   |            |                            |               |             |             |             |             |             |             |             |
|--------------------------------------------------------------------------------------------------|------------------|-------------------|------------|----------------------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Equivalent Round (in.)                                                                           | Rise /Span (in.) | Wall Thick. (psi) | f' c (psi) | Required Fill/Cover Height |               |             |             |             |             |             |             |             |
|                                                                                                  |                  |                   |            | H ≤ 1.5'                   | 1.5' ≤ H ≤ 2' | 2' ≤ H ≤ 3' | 3' ≤ H ≤ 4' | 4' ≤ H ≤ 5' | 5' ≤ H ≤ 6' | 6' ≤ H ≤ 7' | 7' ≤ H ≤ 8' | 8' ≤ H ≤ 9' |
| 36"                                                                                              | 45/29            | 4 1/2"            | 4000       | **                         | 0.23          | 0.19        | 0.14        | 0.12        | 0.15        | 0.19        | 0.23        | 0.23        |
|                                                                                                  |                  |                   |            | **                         | 0.12          | 0.10        | 0.07        | 0.07        | 0.07        | 0.08        | 0.09        | 0.09        |
| 42"                                                                                              | 53/34            | 5"                | 4000       | **                         | 0.28          | 0.23        | 0.17        | 0.15        | 0.18        | 0.23        | 0.28        | 0.28        |
|                                                                                                  |                  |                   |            | **                         | 0.14          | 0.12        | 0.09        | 0.08        | 0.07        | 0.09        | 0.12        | 0.12        |
| 48"                                                                                              | 60/38            | 5 1/2"            | 4000       | **                         | 0.20          | 0.18        | 0.15        | 0.15        | 0.20        | 0.25        | 0.31        | 0.31        |
|                                                                                                  |                  |                   |            | **                         | 0.10          | 0.09        | 0.08        | 0.08        | 0.08        | 0.11        | 0.13        | 0.13        |
| 54"                                                                                              | 68/43            | 6"                | 4000       | **                         | 0.21          | 0.19        | 0.18        | 0.18        | 0.23        | 0.29        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.11          | 0.10        | 0.09        | 0.09        | 0.10        | 0.12        | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | *           | 0.30        | 0.30        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.13        | 0.13        |
| 60"                                                                                              | 76/48            | 6 1/2"            | 4000       | **                         | 0.22          | 0.22        | 0.20        | 0.21        | 0.27        | 0.33        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.11          | 0.11        | 0.10        | 0.11        | 0.11        | 0.14        | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | *           | 0.34        | 0.34        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.15        | 0.15        |
| 66"                                                                                              | 83/53            | 7"                | 4000       | **                         | 0.24          | 0.23        | 0.22        | 0.23        | 0.31        | 0.38        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.12          | 0.12        | 0.11        | 0.12        | 0.13        | 0.16        | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | *           | 0.39        | 0.39        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.17        | 0.17        |
| 72"                                                                                              | 91/58            | 7 1/2"            | 4000       | **                         | 0.25          | 0.25        | 0.25        | 0.26        | 0.34        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.13          | 0.13        | 0.13        | 0.13        | 0.15        | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | 0.37        | 0.44        | 0.44        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.16        | 0.19        | 0.19        |
| 78"                                                                                              | 98/63            | 8"                | 4000       | **                         | 0.26          | 0.26        | 0.27        | 0.29        | 0.38        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.13          | 0.13        | 0.14        | 0.15        | 0.16        | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | 0.41        | 0.48        | 0.48        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.18        | 0.21        | 0.21        |
| 84"                                                                                              | 106/68           | 8 1/2"            | 4000       | **                         | 0.28          | 0.28        | 0.29        | 0.33        | 0.42        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.14          | 0.14        | 0.15        | 0.17        | 0.18        | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | 0.45        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.20        | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | *           | 0.53        | 0.53        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.23        | 0.23        |
| 90"                                                                                              | 113/72           | 9"                | 4000       | **                         | 0.29          | 0.29        | 0.30        | 0.35        | 0.45        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.15          | 0.15        | 0.15        | 0.18        | 0.19        | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | 0.48        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.21        | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | *           | 0.56        | 0.56        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.24        | 0.24        |
| 96"                                                                                              | 121/77           | 9 1/2"            | 4000       | **                         | 0.31          | 0.31        | 0.33        | 0.38        | 0.49        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.16          | 0.16        | 0.17        | 0.19        | 0.21        | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | *           | 0.52        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.23        | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | *           | 0.61        | 0.61        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.26        | 0.26        |
| 102"                                                                                             | 128/82           | 9 3/4"            | 4000       | **                         | 0.34          | 0.34        | 0.37        | 0.43        | **          | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.17          | 0.17        | 0.19        | 0.22        | **          | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | 0.48        | 0.58        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | 0.21        | 0.25        | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | *           | 0.73        | 0.73        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.30        | 0.30        |
| 108"                                                                                             | 136/87           | 10"               | 4000       | **                         | 0.36          | 0.36        | 0.41        | 0.49        | *           | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.18          | 0.18        | 0.21        | 0.25        | *           | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | 0.53        | 0.69        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | 0.24        | 0.28        | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | *           | 0.86        | 0.86        |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | *           | 0.33        | 0.33        |
| 114"                                                                                             | 143/92           | 10 1/2"           | 4000       | **                         | 0.39          | 0.39        | 0.44        | 0.55        | **          | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.20          | 0.20        | 0.22        | 0.28        | **          | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | 0.57        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | 0.25        | **          | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | 0.69        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.30        | **          | **          |
| 120"                                                                                             | 151/97           | 11"               | 4000       | **                         | 0.41          | 0.41        | 0.48        | 0.66        | *           | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | 0.21          | 0.21        | 0.24        | 0.33        | *           | **          | **          | **          |
|                                                                                                  |                  |                   | 5000       | **                         | *             | *           | *           | *           | 0.61        | **          | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | 0.27        | **          | **          | **          |
|                                                                                                  |                  |                   | 6000       | **                         | *             | *           | *           | *           | *           | 0.76        | **          | **          |
|                                                                                                  |                  |                   |            | **                         | *             | *           | *           | *           | *           | 0.32        | **          | **          |

NOTE :

PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN (CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

| PROOF TEST<br>LOAD TABLE FOR <b>VERTICAL</b> ELLIPTICAL PIPE<br>TYPE A SHORING TRENCH - BOX INSTALLATION (lbs/LF.FT.of DIAMETER) |                  |               |             |             |             |             |             |             |             |              |               |               |
|----------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|---------------|---------------|
| REQUIRED FILL/COVER HEIGHT (FT.) / PROOF TEST LOADS                                                                              |                  |               |             |             |             |             |             |             |             |              |               |               |
| Equivalent Round (in.)                                                                                                           | Rise /Span (in.) | 1.5' ≤ H ≤ 2' | 2' ≤ H ≤ 3' | 3' ≤ H ≤ 4' | 4' ≤ H ≤ 5' | 5' ≤ H ≤ 6' | 6' ≤ H ≤ 7' | 7' ≤ H ≤ 8' | 8' ≤ H ≤ 9' | 9' ≤ H ≤ 10' | 10' ≤ H ≤ 15' | 15' ≤ H ≤ 20' |
| 36                                                                                                                               | 14x29            | 1007          | 949         | 923         | 1181        | 1677        | 2198        | 2727        |             |              |               |               |
| 42                                                                                                                               | 53x34            | 931           | 889         | 909         | 1168        | 1662        | 2179        | 2705        |             |              |               |               |
| 48                                                                                                                               | 60x38            | 920           | 865         | 1113        | 1465        | 2110        | 2777        | 3453        |             |              |               |               |
| 54                                                                                                                               | 68x43            | 864           | 823         | 1101        | 1454        | 2098        | 2762        | 3435        |             |              |               |               |
| 60                                                                                                                               | 76x48            | 816           | 788         | 1091        | 1446        | 2088        | 2751        | 3421        |             |              |               |               |
| 66                                                                                                                               | 83x53            | 812           | 757         | 1083        | 1438        | 2080        | 2741        | 3409        |             |              |               |               |
| 72                                                                                                                               | 91x58            | 775           | 731         | 1075        | 1432        | 2074        | 2733        | 3400        |             |              |               |               |
| 78                                                                                                                               | 98x63            | 778           | 731         | 1068        | 1426        | 2068        | 2726        | 3392        |             |              |               |               |
| 84                                                                                                                               | 106x68           | 748           | 709         | 1062        | 1422        | 2063        | 2720        | 3385        |             |              |               |               |
| 90                                                                                                                               | 113x72           | 725           | 694         | 1058        | 1418        | 2059        | 2716        | 3380        |             |              |               |               |
| 96                                                                                                                               | 121x77           | 701           | 676         | 1053        | 1414        | 2055        | 2712        | 3374        |             |              |               |               |
| 102                                                                                                                              | 128x82           | 678           | 660         | 1048        | 1410        | 2052        | 2708        | 3370        |             |              |               |               |
| 108                                                                                                                              | 136x87           | 666           | 666         | 1043        | 1407        | 2048        | 2704        | 3365        |             |              |               |               |
| 114                                                                                                                              | 143x92           | 652           | 652         | 1039        | 1404        | 2045        | 2701        | 3361        |             |              |               |               |
| 120                                                                                                                              | 151x97           | 626           | 626         | 1036        | 1401        | 2043        | 2698        | 3358        |             |              |               |               |

| TYPE A SHORING/TRENCH BOX <b>HORIZONTAL</b><br>ELLIPTICAL PIPE -STEEL AREAS (in <sup>2</sup> /ft.) |                  |             |            |                            |               |             |             |             |             |             |             |  |
|----------------------------------------------------------------------------------------------------|------------------|-------------|------------|----------------------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|--|
| Equivalent Round (in.)                                                                             | Rise /Span (in.) | Wall Thick. | f' c (psi) | Required Fill/Cover Height |               |             |             |             |             |             |             |  |
|                                                                                                    |                  |             |            | H ≤ 1.5'                   | 1.5' ≤ H ≤ 2' | 2' ≤ H ≤ 3' | 3' ≤ H ≤ 4' | 4' ≤ H ≤ 5' | 5' ≤ H ≤ 6' | 6' ≤ H ≤ 7' | 7' ≤ H ≤ 8' |  |
| 18"                                                                                                | 14x23            | 2 3/4"      | 4000       | **                         | 0.25          | 0.19        | 0.14        | 0.13        |             |             |             |  |
| 24"                                                                                                | 19x30            | 3 1/4"      | 4000       | **                         | 0.37          | 0.27        | 0.20        | 0.18        |             |             |             |  |
| 27"                                                                                                | 22x34            | 3 1/2"      | 4000       | **                         | 0.39          | 0.33        | 0.25        | 0.22        |             |             |             |  |
| 30"                                                                                                | 24x38            | 3 3/4"      | 4000       | **                         | 0.39          | 0.29        | 0.24        | 0.28        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.39          | 0.29        | 0.24        | 0.28        |             |             |             |  |
| 33"                                                                                                | 27x42            | 3 3/4"      | 4000       | **                         | 0.48          | 0.35        | 0.29        | 0.40        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.48          | 0.35        | 0.29        | 0.40        |             |             |             |  |
| 36"                                                                                                | 29x45            | 4 1/2"      | 4000       | **                         | 0.33          | 0.32        | 0.27        | 0.32        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.33          | 0.32        | 0.27        | 0.32        |             |             |             |  |
| 42"                                                                                                | 34x53            | 5"          | 4000       | **                         | 0.35          | 0.35        | 0.33        | 0.45        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.35          | 0.35        | 0.33        | 0.45        |             |             |             |  |
| 48"                                                                                                | 38x60            | 5 1/2"      | 4000       | **                         | 0.37          | 0.39        | 0.42        | 0.56        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.37          | 0.39        | 0.42        | 0.56        |             |             |             |  |
| 54"                                                                                                | 43x68            | 6"          | 4000       | **                         | 0.43          | 0.45        | 0.54        | 0.71        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.43          | 0.45        | 0.54        | 0.71        |             |             |             |  |
| 60"                                                                                                | 48x76            | 6 1/2"      | 4000       | **                         | 0.50          | 0.54        | 0.66        | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.50          | 0.54        | 0.66        | **          |             |             |             |  |
|                                                                                                    |                  |             | 5000       | **                         | *             | *           | *           | 0.81        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | *           | 0.81        |             |             |             |  |
| 66"                                                                                                | 53x83            | 7"          | 4000       | **                         | 0.57          | 0.60        | 0.77        | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.57          | 0.60        | 0.77        | **          |             |             |             |  |
|                                                                                                    |                  |             | 5000       | **                         | *             | *           | *           | 0.94        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | *           | 0.94        |             |             |             |  |
| 72"                                                                                                | 58x91            | 7 1/2"      | 4000       | **                         | 0.66          | 0.70        | 0.92        | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.66          | 0.70        | 0.92        | **          |             |             |             |  |
|                                                                                                    |                  |             | 6000       | **                         | *             | *           | *           | 1.03        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | *           | 1.03        |             |             |             |  |
| 78"                                                                                                | 63x98            | 8"          | 4000       | **                         | 0.73          | 0.78        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.73          | 0.78        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             | 5000       | **                         | *             | *           | 0.98        | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | 0.98        | **          |             |             |             |  |
|                                                                                                    |                  |             | 6000       | **                         | *             | *           | *           | 1.16        |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | *           | 1.16        |             |             |             |  |
| 84"                                                                                                | 68x106           | 8 1/2"      | 4000       | **                         | 0.84          | 0.89        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.84          | 0.89        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             | 6000       | **                         | *             | *           | 1.07        | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | 1.07        | **          |             |             |             |  |
| 90"                                                                                                | 72x113           | 9"          | 4000       | **                         | 0.92          | 0.99        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 0.92          | 0.99        | **          | **          |             |             |             |  |
| 96"                                                                                                | 77x121           | 9 1/2"      | 4000       | **                         | 1.06          | **          | **          | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 1.06          | **          | **          | **          |             |             |             |  |
|                                                                                                    |                  |             | 5000       | **                         | *             | 1.04        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | 1.04        | **          | **          |             |             |             |  |
|                                                                                                    |                  |             | 7000       | **                         | *             | *           | 1.31        | **          |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | 1.31        | **          |             |             |             |  |
| 102"                                                                                               | 82x128           | 9 3/4"      | 5000       | **                         | 1.13          | 1.21        | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 1.13          | 1.21        | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             | 6000       | **                         | *             | *           | 1.52        | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | *           | 1.52        | ***         |             |             |             |  |
| 108"                                                                                               | 87x136           | 10"         | 5000       | **                         | 1.32          | **          | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 1.32          | **          | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             | 6000       | **                         | *             | 1.33        | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | 1.33        | **          | ***         |             |             |             |  |
| 114"                                                                                               | 92x143           | 10 1/2"     | 5000       | **                         | 1.43          | **          | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | 1.43          | **          | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             | 6000       | **                         | *             | 1.44        | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | *             | 1.44        | **          | ***         |             |             |             |  |
| 120"                                                                                               | 97x151           | 11"         | 4000       | **                         | **            | **          | **          | ***         |             |             |             |  |
|                                                                                                    |                  |             |            | **                         | **            | **          | **          | ***         |             |             |             |  |

| TYPE B SHORING/TRENCH BOX <b>VERTICAL</b><br>ELLIPTICAL PIPE -STEEL AREAS ( in <sup>2</sup> /ft.) |                   |             |             |                            |               |             |             |              |      |      |      |
|---------------------------------------------------------------------------------------------------|-------------------|-------------|-------------|----------------------------|---------------|-------------|-------------|--------------|------|------|------|
| Equivalent Round ( in.)                                                                           | Rise /Span ( in.) | Wall Thick. | f' c ( psi) | Required Fill/Cover Height |               |             |             |              |      |      |      |
|                                                                                                   |                   |             |             | H < 1.5'                   | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 15'  | 20'  | 25'  |
| 36"                                                                                               | 45/29             | 4 1/2"      | 4000        | **                         | 0.22          | 0.18        | 0.13        | 0.11         | 0.16 | 0.20 | 0.25 |
|                                                                                                   |                   |             |             | **                         | 0.13          | 0.11        | 0.08        | 0.07         | —    | —    | —    |
| 42"                                                                                               | 53/34             | 5"          | 4000        | **                         | 0.27          | 0.22        | 0.16        | 0.14         | 0.20 | 0.25 | 0.32 |
|                                                                                                   |                   |             |             | **                         | 0.16          | 0.13        | 0.10        | 0.07         | —    | —    | —    |
| 48"                                                                                               | 60/38             | 5 1/2"      | 4000        | **                         | 0.19          | 0.17        | 0.14        | 0.14         | 0.20 | 0.26 | 0.39 |
|                                                                                                   |                   |             |             | **                         | 0.10          | 0.09        | 0.07        | 0.07         | 0.10 | 0.13 | 0.20 |
| 54"                                                                                               | 68/43             | 6"          | 4000        | **                         | 0.20          | 0.20        | 0.17        | 0.17         | 0.23 | 0.30 | 0.52 |
|                                                                                                   |                   |             |             | **                         | 0.10          | 0.10        | 0.08        | 0.07         | 0.12 | 0.15 | 0.26 |
| 60"                                                                                               | 76/48             | 6 1/2"      | 4000        | **                         | 0.21          | 0.21        | 0.19        | 0.19         | 0.27 | 0.38 | 0.67 |
|                                                                                                   |                   |             |             | **                         | 0.11          | 0.10        | 0.09        | 0.08         | 0.14 | 0.16 | 0.34 |
| 66"                                                                                               | 83/53             | 7"          | 4000        | **                         | 0.22          | 0.22        | 0.21        | 0.22         | 0.30 | 0.49 | **   |
|                                                                                                   |                   |             |             | **                         | 0.11          | 0.11        | 0.10        | 0.10         | 0.15 | 0.25 | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | *    | *    | 0.61 |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | *    | 0.31 |
| 72"                                                                                               | 91/58             | 7 1/2"      | 4000        | **                         | 0.23          | 0.23        | 0.23        | 0.25         | 0.34 | 0.61 | **   |
|                                                                                                   |                   |             |             | **                         | 0.12          | 0.11        | 0.11        | 0.11         | 0.17 | 0.32 | **   |
|                                                                                                   |                   |             | 6000        | **                         | *             | *           | *           | *            | *    | *    | 0.74 |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | *    | 0.37 |
| 78"                                                                                               | 98/63             | 8"          | 4000        | **                         | 0.25          | 0.25        | 0.26        | 0.28         | 0.40 | 0.75 | **   |
|                                                                                                   |                   |             |             | **                         | 0.12          | 0.12        | 0.12        | 0.12         | 0.20 | 0.38 | **   |
|                                                                                                   |                   |             | 6000        | **                         | *             | *           | *           | *            | *    | *    | 0.71 |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | *    | 0.36 |
| 84"                                                                                               | 106/68            | 8 1/2"      | 4000        | **                         | 0.26          | 0.26        | 0.27        | 0.31         | 0.46 | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.13          | 0.13        | 0.13        | 0.14         | 0.23 | **   | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | *    | 0.63 | **   |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | 0.32 | **   |
|                                                                                                   |                   |             | 6000        | **                         | *             | *           | *           | *            | *    | *    | 0.81 |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | *    | 0.42 |
| 90"                                                                                               | 113/72            | 9"          | 4000        | **                         | 0.27          | 0.27        | 0.29        | 0.33         | 0.51 | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.13          | 0.13        | 0.13        | 0.15         | 0.26 | **   | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | *    | 0.71 | *    |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | 0.36 | *    |
| 96"                                                                                               | 121/77            | 9 1/2"      | 4000        | **                         | 0.29          | 0.29        | 0.31        | 0.36         | 0.62 | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.14          | 0.14        | 0.14        | 0.16         | 0.31 | **   | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | *    | 0.83 | *    |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | 0.42 | *    |
| 102"                                                                                              | 128/82            | 9 3/4"      | 4000        | **                         | 0.31          | 0.32        | 0.35        | 0.40         | 0.79 | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.15          | 0.15        | 0.15        | 0.18         | 0.40 | **   | **   |
|                                                                                                   |                   |             | 6000        | **                         | *             | *           | *           | *            | *    | 0.83 | **   |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | *    | 0.42 | **   |
| 108"                                                                                              | 136/87            | 10"         | 4000        | **                         | 0.34          | 0.34        | 0.38        | 0.46         | **   | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.16          | 0.16        | 0.17        | 0.20         | **   | **   | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | 0.72 | *    | **   |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | 0.36 | *    | **   |
| 114"                                                                                              | 143/92            | 10 1/2"     | 4000        | **                         | 0.36          | 0.36        | 0.42        | 0.52         | **   | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.17          | 0.17        | 0.19        | 0.22         | **   | **   | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | 0.80 | *    | **   |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | 0.40 | *    | **   |
| 120"                                                                                              | 151/97            | 11"         | 4000        | **                         | 0.38          | 0.39        | 0.45        | 0.58         | **   | **   | **   |
|                                                                                                   |                   |             |             | **                         | 0.18          | 0.18        | 0.20        | 0.23         | **   | **   | **   |
|                                                                                                   |                   |             | 5000        | **                         | *             | *           | *           | *            | 0.90 | *    | **   |
|                                                                                                   |                   |             |             | **                         | *             | *           | *           | *            | 0.45 | *    | **   |

| PROOF TEST<br>LOAD TABLE FOR <b>VERTICAL</b> ELLIPTICAL PIPE<br>TYPE B SHORING TRENCH - BOX INSTALLATION ( lbs/LF/FT.of DIAMETER) |                   |               |             |             |              |               |               |               |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|-------------|-------------|--------------|---------------|---------------|---------------|--|--|
| REQUIRED FILL/COVER HEIGHT (FT.) / PROOF TEST LOADS                                                                               |                   |               |             |             |              |               |               |               |  |  |
| Equivalent Round ( in.)                                                                                                           | Rise /Span ( in.) | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 10' ≤ H < 15' | 15' ≤ H < 20' | 20' ≤ H < 25' |  |  |
| 36                                                                                                                                | 45x29"            | 957           | 901         | 877         | 1122         | 1594          | 2088          | 2591          |  |  |
| 42                                                                                                                                | 53x34"            | 884           | 845         | 863         | 1110         | 1579          | 2070          | 2569          |  |  |
| 48                                                                                                                                | 60x38"            | 874           | 822         | 1057        | 1391         | 2004          | 2638          | 3280          |  |  |
| 54                                                                                                                                | 68x43"            | 821           | 782         | 1046        | 1382         | 1993          | 2624          | 3263          |  |  |
| 60                                                                                                                                | 76x48"            | 775           | 748         | 1037        | 1373         | 1984          | 2613          | 3250          |  |  |
| 66                                                                                                                                | 83x53"            | 771           | 720         | 1029        | 1366         | 1976          | 2604          | 3239          |  |  |
| 72                                                                                                                                | 91x58"            | 736           | 694         | 1021        | 1360         | 1970          | 2596          | 3230          |  |  |
| 78                                                                                                                                | 98x63"            | 739           | 695         | 1015        | 1355         | 1964          | 2590          | 3222          |  |  |
| 84                                                                                                                                | 106x68"           | 710           | 674         | 1009        | 1350         | 1960          | 2584          | 3215          |  |  |
| 90                                                                                                                                | 113x72"           | 689           | 659         | 1005        | 1347         | 1956          | 2580          | 3211          |  |  |
| 96                                                                                                                                | 121x77"           | 666           | 642         | 1000        | 1343         | 1952          | 2576          | 3206          |  |  |
| 102                                                                                                                               | 128x82"           | 644           | 627         | 995         | 1340         | 1949          | 2572          | 3201          |  |  |
| 108                                                                                                                               | 136x87"           | 633           | 633         | 991         | 1336         | 1946          | 2569          | 3197          |  |  |
| 114                                                                                                                               | 143x92"           | 619           | 619         | 987         | 1333         | 1943          | 2566          | 3193          |  |  |
| 120                                                                                                                               | 151x97"           | 599           | 595         | 984         | 1331         | 1940          | 2563          | 3190          |  |  |

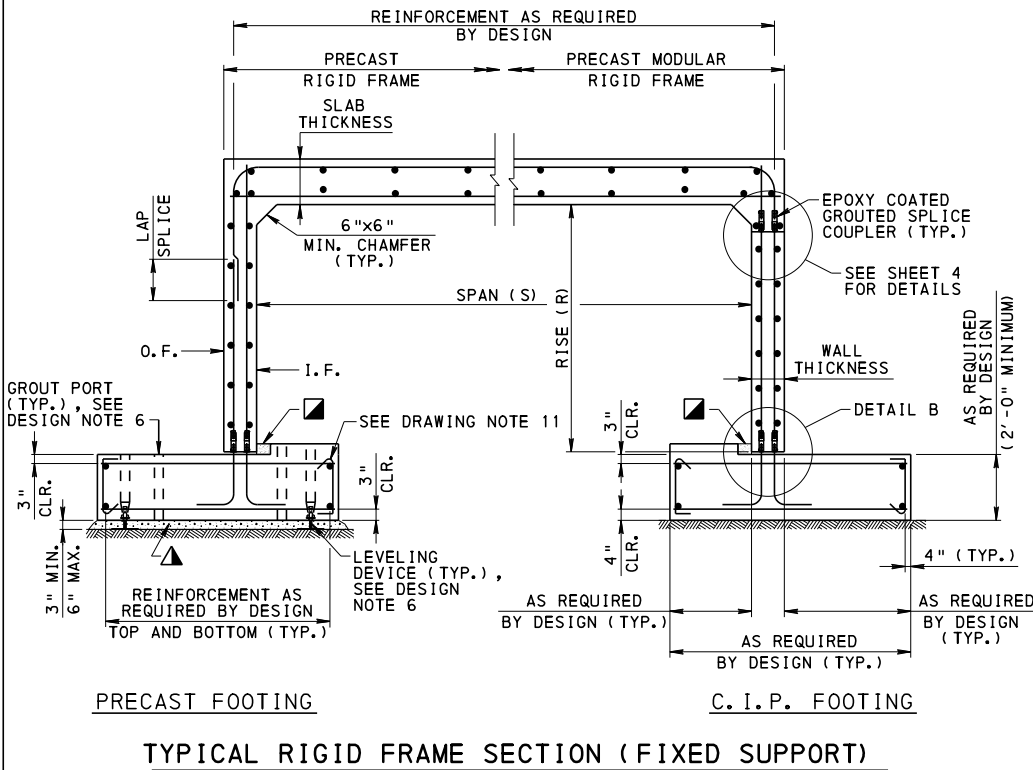
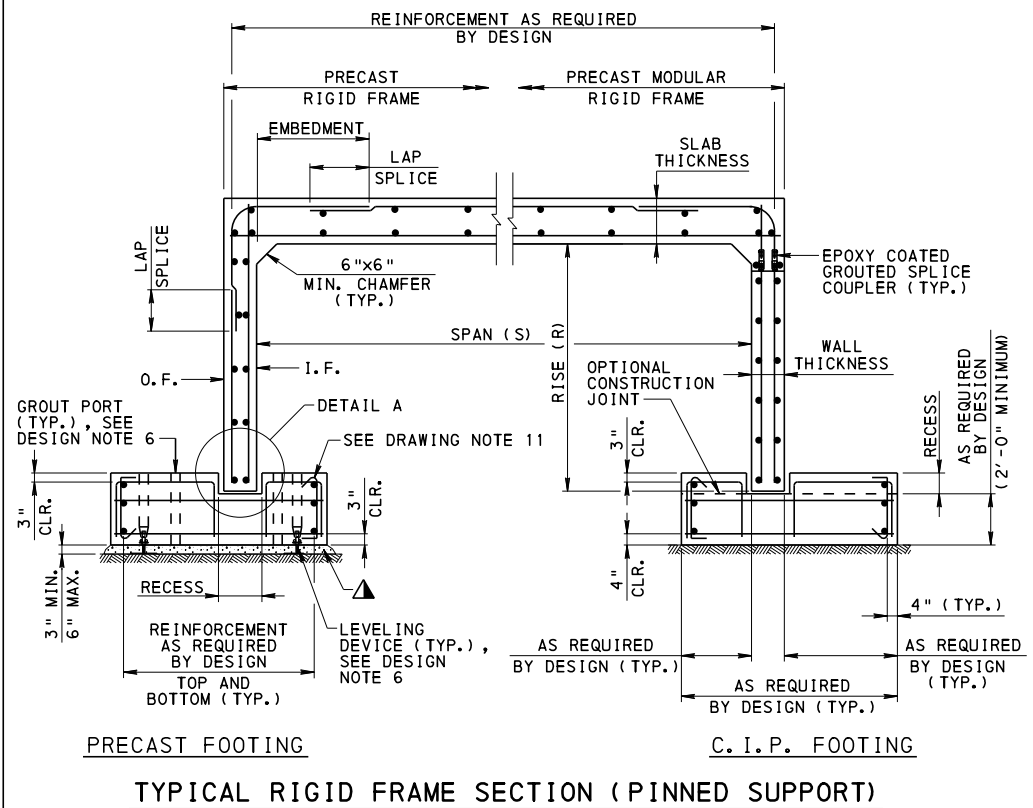
NOTE : PROOF LOADS ARE AN INDICATION OF CRACK CONTROLS AND NOT NECESSARILY STRENGTH CONTROL. ACTUAL STRUCTURAL DESIGN ( CONCRETE STRENGTH, AREA OF STEEL AND WALL THICKNESS) IS BASED UPON FLEXURE, CRACKING, OR SHEAR - WHICHEVER GOVERNS. FOR SUBSTITUTION OF PIPES RELY UPON THE MAXIMUM VS. MINIMUM FILL HEIGHT STAMP. DO NOT USE THE PROOF LOAD FOR SUBSTITUTION PURPOSES. SEE FIGURE "FLEXURE - SHEAR - CRACK CONTROL" AND EXAMPLE ON SHEET 2.

| TYPE B SHORING/TRENCH BOX |                   |             |             |                            | HORIZONTAL                    |             |             |              |  |
|---------------------------|-------------------|-------------|-------------|----------------------------|-------------------------------|-------------|-------------|--------------|--|
| ELLIPTICAL PIPE -STEEL    |                   |             |             |                            | AREAS ( in <sup>2</sup> /ft.) |             |             |              |  |
| Equivalent Round ( in.)   | Rise /Span ( in.) | Wall Thick. | f' c ( psi) | Required Fill/Cover Height |                               |             |             |              |  |
|                           |                   |             |             | H ≤ 1.5'                   | 1.5' ≤ H ≤ 2'                 | 2' ≤ H ≤ 3' | 3' ≤ H ≤ 7' | 7' ≤ H ≤ 10' |  |
| 18"                       | 14x23             | 2¾"         | 4000        | **                         | 0.22                          | 0.18        | 0.13        | 0.12         |  |
| 24"                       | 19x30             | 3¼"         | 4000        | **                         | 0.32                          | 0.25        | 0.19        | 0.17         |  |
| 27"                       | 22x34             | 3½"         | 4000        | **                         | 0.38                          | 0.31        | 0.23        | 0.21         |  |
| 30"                       | 24x38             | 3¾"         | 4000        | **                         | 0.34                          | 0.27        | 0.22        | 0.26         |  |
|                           |                   |             |             | **                         | 0.34                          | 0.27        | 0.22        | 0.26         |  |
| 33"                       | 27x42             | 3¾"         | 4000        | **                         | 0.37                          | 0.33        | 0.27        | 0.38         |  |
|                           |                   |             |             | **                         | 0.37                          | 0.33        | 0.27        | 0.38         |  |
| 36"                       | 29x45             | 4½"         | 4000        | **                         | 0.30                          | 0.30        | 0.25        | 0.30         |  |
|                           |                   |             |             | **                         | 0.30                          | 0.30        | 0.25        | 0.30         |  |
| 42"                       | 34x53             | 5"          | 4000        | **                         | 0.33                          | 0.33        | 0.32        | 0.43         |  |
|                           |                   |             |             | **                         | 0.33                          | 0.33        | 0.32        | 0.43         |  |
| 48"                       | 38x60             | 5½"         | 4000        | **                         | 0.37                          | 0.37        | 0.40        | 0.53         |  |
|                           |                   |             |             | **                         | 0.37                          | 0.37        | 0.40        | 0.53         |  |
| 54"                       | 43x68             | 6"          | 4000        | **                         | 0.43                          | 0.43        | 0.51        | 0.67         |  |
|                           |                   |             |             | **                         | 0.43                          | 0.43        | 0.51        | 0.67         |  |
| 60"                       | 48x76             | 6½"         | 4000        | **                         | 0.51                          | 0.51        | 0.63        | 0.82         |  |
|                           |                   |             |             | **                         | 0.51                          | 0.51        | 0.63        | 0.82         |  |
| 66"                       | 53x83             | 7"          | 4000        | **                         | 0.57                          | 0.57        | 0.73        | 0.89         |  |
|                           |                   |             |             | **                         | 0.57                          | 0.57        | 0.73        | 0.89         |  |
| 72"                       | 58x91             | 7½"         | 4000        | **                         | 0.67                          | 0.67        | 0.87        | 1.03         |  |
|                           |                   |             |             | **                         | 0.67                          | 0.67        | 0.87        | 1.03         |  |
| 78"                       | 63x98             | 8"          | 4000        | **                         | 0.74                          | 0.74        | **          | **           |  |
|                           |                   |             |             | **                         | 0.74                          | 0.74        | **          | **           |  |
|                           |                   |             | 5000        | **                         | *                             | *           | 0.93        | **           |  |
|                           |                   |             |             | **                         | *                             | *           | 0.93        | **           |  |
|                           |                   |             | 6000        | **                         | *                             | *           | *           | 1.10         |  |
|                           |                   |             |             | **                         | *                             | *           | *           | 1.10         |  |
| 84"                       | 68x106            | 8½"         | 4000        | **                         | 0.85                          | 0.85        | **          | **           |  |
|                           |                   |             |             | **                         | 0.85                          | 0.85        | **          | **           |  |
|                           |                   |             | 5000        | **                         | *                             | *           | 1.08        | **           |  |
|                           |                   |             |             | **                         | *                             | *           | 1.08        | **           |  |
| 90"                       | 72x113            | 9"          | 4000        | **                         | 0.94                          | 0.94        | **          | **           |  |
|                           |                   |             |             | **                         | 0.94                          | 0.94        | **          | **           |  |
|                           |                   |             | 6000        | **                         | *                             | *           | 1.14        | **           |  |
|                           |                   |             |             | **                         | *                             | *           | 1.14        | **           |  |
| 96"                       | 77x121            | 9½"         | 4000        | **                         | 1.06                          | 1.06        | **          | **           |  |
|                           |                   |             |             | **                         | 1.06                          | 1.06        | **          | **           |  |
|                           |                   |             | 6000        | **                         | *                             | *           | 1.30        | **           |  |
|                           |                   |             |             | **                         | *                             | *           | 1.30        | **           |  |
| 102"                      | 82x128            | 9¾"         | 5000        | **                         | 1.14                          | 1.14        | **          | **           |  |
|                           |                   |             |             | **                         | 1.14                          | 1.14        | **          | **           |  |
| 108"                      | 87x136            | 10"         | 5000        | **                         | 1.33                          | 1.33        | **          | ***          |  |
|                           |                   |             |             | **                         | 1.33                          | 1.33        | **          | ***          |  |
| 114"                      | 92x143            | 10½"        | 5000        | **                         | 1.44                          | 1.44        | **          | ***          |  |
|                           |                   |             |             | **                         | 1.44                          | 1.44        | **          | ***          |  |
| 120"                      | 97x151            | 11"         | 4000        | **                         | **                            | **          | **          | ***          |  |
|                           |                   |             |             | **                         | **                            | **          | **          | ***          |  |

| PROOF TEST<br>LOAD TABLE FOR <b>HORIZONTAL</b> ELLIPTICAL PIPE<br>TYPE B SHORING TRENCH - BOX INSTALLATION ( lbs/LF/FT.of DIAMETER) |                   |               |             |             |              |               |               |               |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|-------------|-------------|--------------|---------------|---------------|---------------|--|--|
| REQUIRED FILL/COVER HEIGHT (FT.) / PROOF TEST LOADS                                                                                 |                   |               |             |             |              |               |               |               |  |  |
| Equivalent Round ( in.)                                                                                                             | Rise /Span ( in.) | 1.5' ≤ H < 2' | 2' ≤ H < 3' | 3' ≤ H < 7' | 7' ≤ H < 10' | 10' ≤ H < 15' | 15' ≤ H < 20' | 20' ≤ H < 25' |  |  |
| 18                                                                                                                                  | 14x23"            | 1515          | 1296        | 1050        | 1155         | 1624          | 2122          | 2631          |  |  |
| 24                                                                                                                                  | 19x30"            | 1375          | 1198        | 994         | 1134         | 1596          | 2087          | 2588          |  |  |
| 27                                                                                                                                  | 22x34"            | 1310          | 1152        | 968         | 1125         | 1586          | 2073          | 2571          |  |  |



CHANGE 2  
CHANGE 6



**LEGEND**  
C.I.P. : DENOTES CAST-IN-PLACE  
I.F. : DENOTES INSIDE FACE  
O.F. : DENOTES OUTSIDE FACE  
▲ : FLOWABLE BACKFILL, TYPE C  
■ : PROVIDE GAP (3" MIN. WIDTH) TO FACILITATE INSTALLATION OF SPLICE COUPLER GROUT. FILL GAP WITH NON-SHRINK GROUT AFTER POST-TENSIONING.

#### GENERAL NOTES

- USE OF THIS STANDARD REQUIRES PERMISSION FROM THE DISTRICT BRIDGE ENGINEER. THE STANDARD IS INTENDED TO BE UTILIZED BY DESIGNERS OF ACCELERATED BRIDGE CONSTRUCTION PROJECTS AND BY CONTRACTORS FOR VALUE ENGINEERING OR DESIGN-BUILD PROJECTS.
- DESIGN SPECIFICATIONS: AASHTO LRFD "BRIDGE DESIGN SPECIFICATIONS" AND AS SUPPLEMENTED BY THE DESIGN MANUAL, PART 4, STRUCTURES.
- IN PRECAST CONCRETE, PROVIDE 1½" CONCRETE COVER ON REINFORCEMENT BARS AND GROUTED SPLICE COUPLERS, EXCEPT AS NOTED IN THE INSTRUCTIONS BELOW.
- PLACE FOOTINGS IN ACCORDANCE WITH DESIGN MANUAL, PART 4.
- INDICATE MAXIMUM FACTORED DESIGN FOUNDATION PRESSURE AND FACTORED BEARING RESISTANCE ON PLANS.
- PRECAST AND C.I.P. FOOTING TYPES SHOWN ARE INTERCHANGABLE WITHIN THE PRECAST RIGID FRAME TYPES SHOWN.
- FOR PRECAST CONCRETE SUBSTRUCTURE STANDARDS, REFER TO STANDARD DRAWING 12-603-BDTD.
- FOR DETAILS A AND B, SEE SHEET 2.
- FOR PRECAST RIGID FRAMES "AT GRADE" (I.E. ≤ 2'-0" OF FILL OR PAVEMENT) AN ADDITIONAL 5" MINIMUM CAST IN PLACE REINFORCED CONCRETE DECK MAY BE REQUIRED BY THE DISTRICT BRIDGE ENGINEER. FOR DECK CONNECTION DETAILS, SEE SHEET 3.
- FOR DECK CONNECTION DETAIL FOR VARIABLE DEPTH CONCRETE DECKS, THE DECK REINFORCEMENT WILL BE INDEPENDENT OF ANCHOR HOOK AND MUST MAINTAIN CLEARANCE AND FOLLOW CROSS SLOPE.
- DETAILS SHOWN ARE FOR REINFORCING STEEL BARS. IF WELDED WIRE FABRIC REINFORCEMENT IS USED, FOLLOW MATERIAL REQUIREMENTS AND PLACEMENT DETAILS ON BD-632M SHEET 5, AS APPLICABLE.
- FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
- DESIGN PRECAST REINFORCED CONCRETE RIGID FRAMES TO HAVE A MINIMUM VERTICAL CLEARANCE OF 3'-0" FROM THE STREAM BED.
- POST-TENSIONING DUCTS MAY BE PLACED AT EITHER CORNER OR HAUNCH TO SATISFY DESIGN AND CONSTRUCTION REQUIREMENTS. FOR HAUNCH AND POST-TENSIONING DETAILS, SEE SHEET 5 AND BC-798M. ALSO, POST-TENSIONING DUCTS MAY BE PLACED IN THE WALLS OR SLAB AS REQUIRED BY DESIGN.
- SPECIFY 4'-0" MINIMUM SEGMENT LENGTH ON THE CONTRACT DRAWINGS.
- USE THIS STANDARD DRAWING IN CONJUNCTION WITH THE APPLICABLE ROADWAY CONSTRUCTION STANDARDS FOR GUIDE RAIL.
- THE PA 3-RAIL BRIDGE BARRIER IS DESIGNATED AS MASH TL-3 AND MAY BE USED ON STRUCTURES ON NON-NHS ROADWAYS ONLY. WHERE BRIDGE BARRIERS WITH DESIGNATIONS GREATER THAN TL-3 ARE PROVIDED, A SEPARATE DESIGN IS REQUIRED.
- FOR WINGWALL CONNECTION CORNER DETAILS, REFER TO BD-632M.
- FOR BURIED STRUCTURES, A HEADWALL DESIGN IS REQUIRED.
- IF PAVING NOTCH IS REQUIRED, REFER TO BD-632M.
- FOR A PRECAST RIGID FRAME, THE FABRICATOR SHALL CHECK TRANSPORTATION AND ERECTION STRESSES, AND IF NECESSARY, PROVIDE ADDITIONAL STRUCTURAL CAPACITY TO MEET DEMAND OR INDICATE THAT TEMPORARY INTERNAL BRACING IS REQUIRED IN THE CONTRACT DOCUMENTS.
- PEDESTALS MAY BE REQUIRED FOR DEEP FOOTING CONSTRUCTION.

#### DRAWING NOTES

- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
- DEAD LOADS: INCLUDE A SURFACE AREA WEIGHT OF 30 P.S.F. ON THE TOP SLAB FOR FUTURE WEARING SURFACE.
- PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706. DO NOT WELD REINFORCING STEEL BARS UNLESS SPECIFIED. DO NOT USE RAIL STEEL (A 996) REINFORCING BARS WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
- PROVIDE MINIMUM EMBEDMENT AND SPLICE LENGTHS IN ACCORDANCE WITH STANDARD DRAWING BC-736M, UNLESS OTHERWISE INDICATED.
- USE EPOXY COATED REINFORCEMENT BARS IN THE FOLLOWING LOCATIONS:
  - IN THE CAST IN PLACE DECK IF A DECK IS USED.
  - IN THE TOP SLAB IF A CAST IN PLACE DECK IS NOT USED.
  - ALL CURBS AND BARRIERS.
  - WHERE THE BARS ARE SPLICED WITH EPOXY COATED GROUTED SPLICE COUPLERS.
  - ALL J-BARS AND L-BARS PROTRUDING FROM THE FOOTING INTO THE WALL.
- USE EPOXY BONDING COMPOUND WHEREVER CAST-IN-PLACE CEMENT CONCRETE COMES IN CONTACT WITH PRECAST CEMENT CONCRETE. THE EPOXY BONDING COMPOUND IS TYPE 2, GRADE 2, AS DESCRIBED IN ASTM-C881-90
- PROVIDE WATERPROOFING MEMBRANE AS PER PUB.408, SECTION 680.2(d) OR 680.2(b) FOR THE ENTIRE TOP WIDTH AND LENGTH OF THE RIGID FRAME AND 2'-0" MIN. WIDTH ALONG THE SIDE JOINTS. FOR ADDITIONAL WATERPROOFING DETAILS, SEE SHEET 2 AND BC-788M. OMIT ON TOP SLAB WHEN A CAST IN PLACE DECK IS USED.
- USE 4"Ø FORMED WEEPHOLES, AT A MAXIMUM SPACING OF 15'-0", PLACED AT A MINIMUM 6" ABOVE NORMAL FLOW LINE, FOR DETAILS, SEE BC-751M. FOR WEEPHOLE PLACEMENT, THE WEEPHOLE LOCATION MAY BE ADJUSTED BY A MAXIMUM OF 2" IN ANY DIRECTION, OR RELOCATE REINFORCEMENT BY A MAXIMUM OF ½". DO NOT CUT REINFORCEMENT BARS. NO ADDITIONAL WEEPHOLE REINFORCEMENT WILL BE REQUIRED.
- THREADED INSERTS TO BE INCORPORATED IN PRECAST RIGID FRAME AND DETAILED BY THE FABRICATOR.
- FOR BRIDGE RAILING POSTS, THOROUGHLY COAT ALL SURFACES OF THE BASE PLATES IN CONTACT WITH CONCRETE WITH CAULKING COMPOUND PRIOR TO ERECTION. AFTER ERECTION AND ALIGNMENT, SEAL OPENINGS BETWEEN THE METAL SURFACES AND THE CONCRETE WITH CAULKING COMPOUND MEETING THE REQUIREMENTS OF SECTION 705, PUB. 408.
- FOR FOOTINGS, TIE TOP AND BOTTOM MATS OF REINFORCING STEEL WITH #4 TIE BARS AT A MAXIMUM SPACING OF 4'-0" IN BOTH DIRECTIONS. PROVIDE TIE BARS WITH 90° HOOK AT ONE END AND 135° HOOK AT THE OTHER END. ALTERNATE 90° AND 135° HOOKS AT TOP IN ALTERNATE TIES.

#### DESIGN DATA:

- f'c = 5,000 P.S.I. MINIMUM FOR PRECAST CONCRETE
- f'c = 3,000 P.S.I. MINIMUM FOR C.I.P. CONCRETE IN FOOTING (USE CLASS A CEMENT CONCRETE).
- f'c = 4,000 P.S.I. MINIMUM FOR C.I.P. CONCRETE IN REINFORCED CONCRETE DECK (USE CLASS AAAP CEMENT CONCRETE).
- fy = 60,000 P.S.I. FOR STEEL REINFORCING BARS

#### INSTRUCTIONS:

- MINIMUM WALL THICKNESS = 12"
- MINIMUM SLAB THICKNESS = 12"
- MINIMUM COVER FOR TOP REINFORCEMENT IN TOP SLAB OF PRECAST RIGID FRAME = 2" EXCEPT USE 2½" WHEN SLAB IS AT GRADE AND CAST-IN-PLACE DECK IS NOT PROVIDED.

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BUREAU OF BRIDGE

STANDARD  
ACCELERATED BRIDGE CONSTRUCTION  
DETAILS FOR PRECAST RIGID FRAME

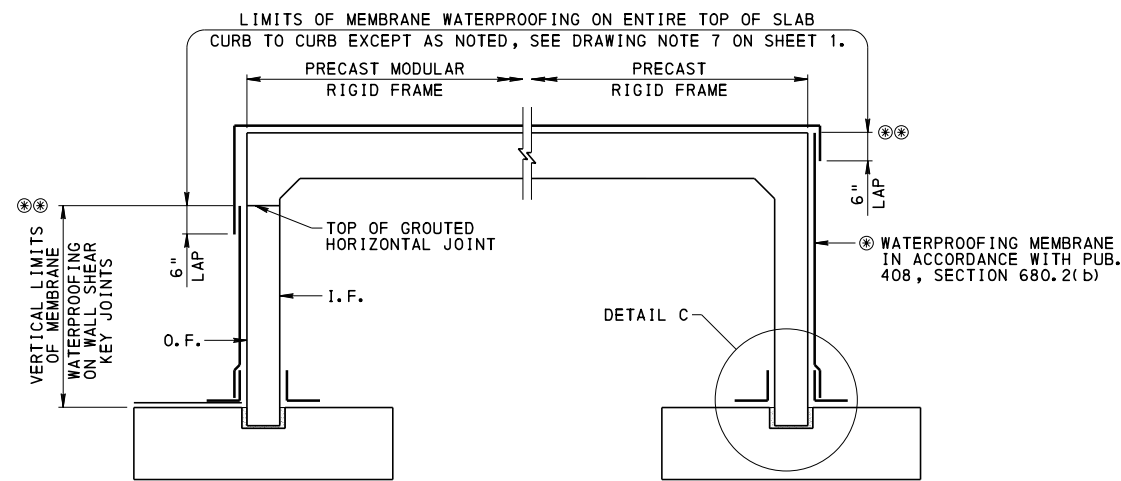
|         |                                             |
|---------|---------------------------------------------|
| RC-11M  | CLASSIFICATION OF EARTHWORK FOR STRUCTURES  |
| RC-12M  | BACKFILL AT STRUCTURES                      |
| RC-50M  | GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS    |
| RC-51M  | TYPE 31 STRONG POST GUIDE RAIL              |
| BD-609M | PA 3-RAIL BRIDGE BARRIER                    |
| BD-628M | BRIDGE APPROACH SLABS                       |
| BD-632M | R.C. BOX CULVERT                            |
| BC-706M | PA 3-RAIL BRIDGE BARRIER                    |
| BC-734M | ANCHOR SYSTEMS                              |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS       |
| BC-751M | BRIDGE DRAINAGE                             |
| BC-788M | TYPICAL WATERPROOFING AND EXPANSION DETAILS |
| BC-798M | MECHANICAL CONNECTION DETAILS               |

REFERENCE DRAWINGS

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*L. D. W. G.*  
CHIEF BRIDGE ENGINEER

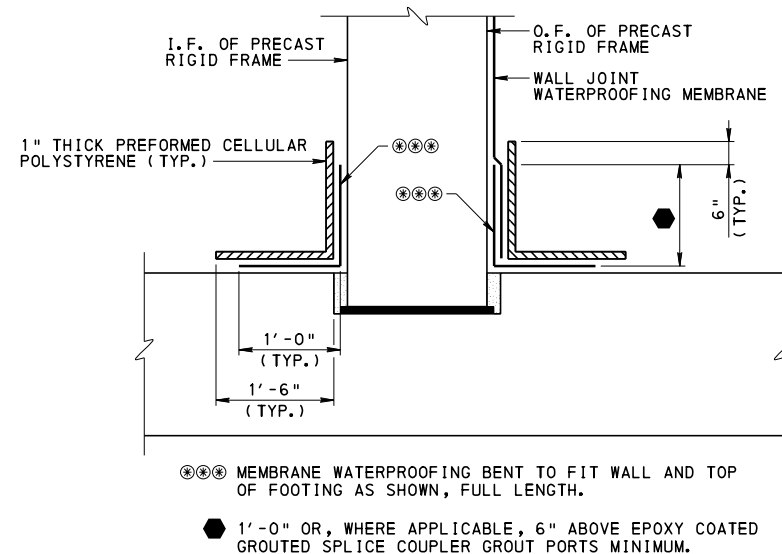
RECOMMENDED FEB. 14, 2023  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 6  
BD-637M

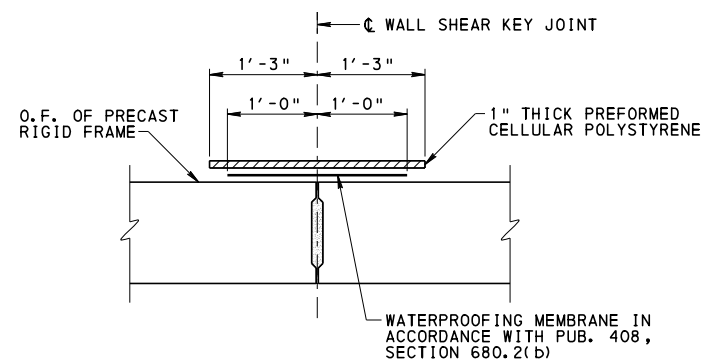


- ⑥ PROVIDE 2'-0" WIDTH MEMBRANE WATERPROOFING AS PER PUB. 408, SECTION 680.3 ALONG OUTSIDE FACE OF ALL WALL JOINTS. PLACE THE MEMBRANE WATERPROOFING ON THE WALLS BEFORE PLACING IT ON TOP OF THE RIGID FRAME.
- ⑥⑥ EXTEND WATERPROOFING MEMBRANE TO TOP OF CAST-IN-PLACE SLAB WHERE APPLICABLE.

TYPICAL RIGID FRAME SECTION



DETAIL C



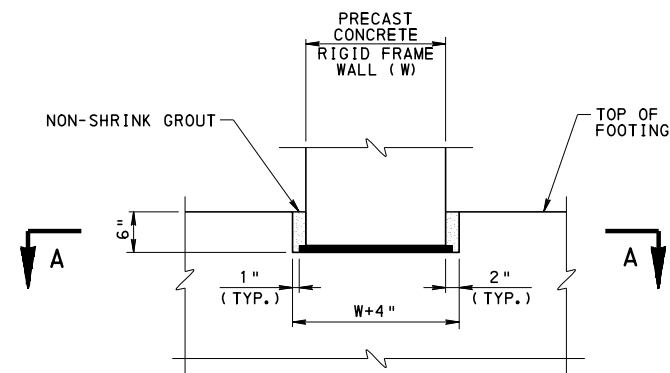
TYPICAL SECTION AT WALL SHEAR KEY JOINT

### WATERPROOFING DETAILS

PINNED SUPPORT SHOWN, FIXED SUPPORT SIMILAR.

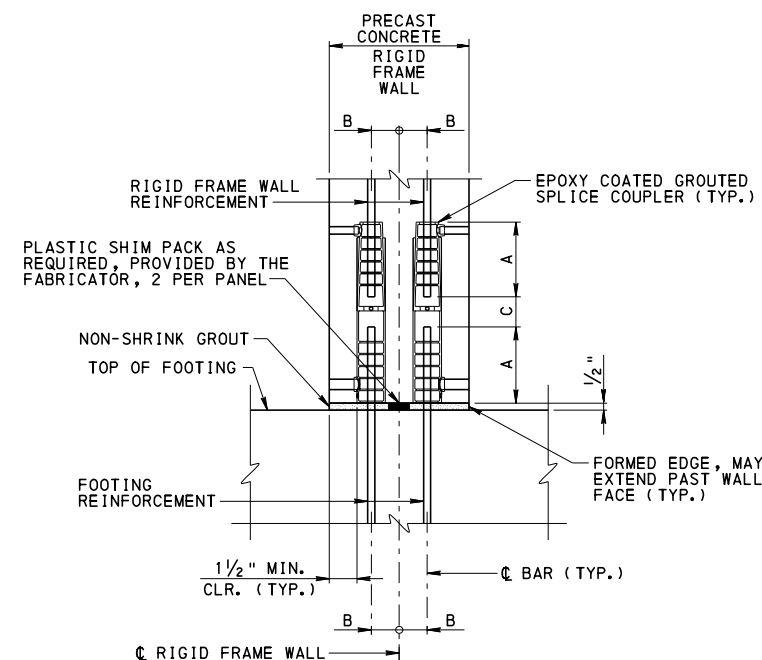
### SUGGESTED CONSTRUCTION SEQUENCE NOTES FOR PRECAST MODULAR RIGID FRAME:

1. INSTALL/CONSTRUCT FOOTINGS.
2. SET AND BRACE WALL PANELS.
3. GROUT TOP SLAB PANELS ONTO WALL PANELS.
4. GROUT SLAB TO WALL CONNECTION SPLICE COUPLERS.
5. (FOR FIXED SUPPORT CONDITION ONLY) GROUT WALL TO FOOTING CONNECTION SPLICE COUPLERS.
6. GROUT KEYED JOINTS BETWEEN PANELS.
7. REMOVE WALL BRACING.
8. POST-TENSION RIGID FRAME.
9. (FOR PINNED SUPPORT CONDITION ONLY) PLACE GROUT IN FOOTING RECESS.
10. (FOR FIXED SUPPORT CONDITION ONLY) PLACE GROUT BETWEEN FOOTING AND I.F. WALLS.
11. INSTALL WATERPROOFING MEMBRANE.
12. BACKFILL.
13. PLACE OVERLAY OR CONSTRUCT C.I.P. CONCRETE DECK.



NOTE : PROVIDE (W+2") x 6" x 1/2" NEOPRENE LEVELING PADS/SHEAR KEY GROUT STOPS. PLACE PADS AT THE ENDS OF EACH SEGMENT, AS REQUIRED. FILL RECESS WITH NON-SHRINK EPOXY GROUT AFTER POST-TENSIONING.

DETAIL A

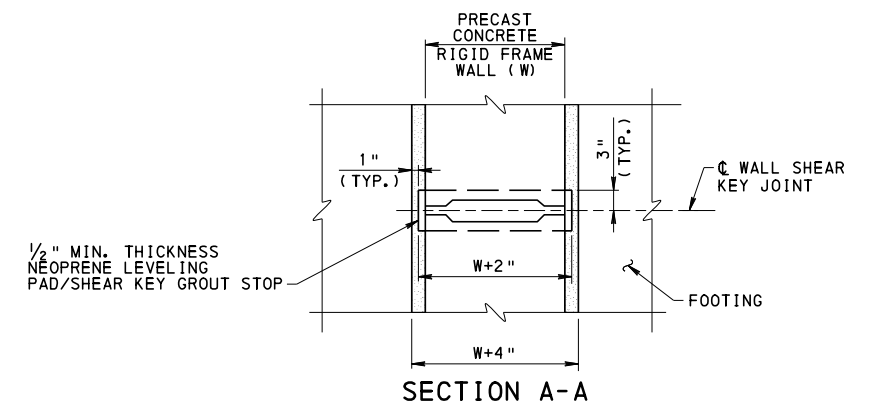


NOTE : NON-SHRINK GROUT IN FRONT OF I.F. WALL NOT SHOWN FOR CLARITY.

DETAIL B

### SUGGESTED CONSTRUCTION SEQUENCE NOTES FOR PRECAST RIGID FRAME:

1. INSTALL/CONSTRUCT FOOTINGS.
2. SET RIGID FRAME SECTIONS IN PLACE.
3. (FOR FIXED SUPPORT CONDITION ONLY) GROUT WALL TO FOOTING CONNECTION SPLICE COUPLERS.
4. GROUT KEYED JOINTS BETWEEN SECTIONS.
5. POST-TENSION RIGID FRAME.
6. (FOR PINNED SUPPORT CONDITION ONLY) PLACE GROUT IN FOOTING RECESS.
7. (FOR FIXED SUPPORT CONDITION ONLY) PLACE GROUT BETWEEN FOOTING AND I.F. WALLS.
8. INSTALL WATERPROOFING MEMBRANE.
9. BACKFILL.
10. PLACE OVERLAY OR CONSTRUCT C.I.P. CONCRETE DECK.



### EPOXY COATED GROUTED SPLICE COUPLER NOTES :

- USE MATCHING TEMPLATES FOR PLACEMENT OF PRECAST MODULAR RIGID FRAME REINFORCEMENT, FOOTING REINFORCEMENT, AND EPOXY COATED GROUTED SPLICE COUPLERS TO ENSURE PROPER FIT-UP.
- CONSULT MANUFACTURER OF EPOXY COATED GROUTED SPLICE COUPLER FOR FINAL DIMENSIONS, TOLERANCES, AND INSTALLATION RECOMMENDATIONS.
- USE A COUPLER FROM A BULLETIN 15 APPROVED MANUFACTURER.
- PLACE NON-SHRINK GROUT SLIGHTLY HIGHER THAN PLASTIC SHIMS TO ENSURE FULL CONTACT BETWEEN CONNECTED SURFACES.

### EPOXY COATED GROUTED SPLICE COUPLER DIMENSION TOLERANCES

| A | EMBEDMENT LENGTH                                                               | CONSULT MANUFACTURER |
|---|--------------------------------------------------------------------------------|----------------------|
| B | LOCATIONS OF REINFORCEMENT AND GROUTED SPLICE COUPLER AS MEASURED FROM CL WALL | ± 1/4"               |
| C | GAP BETWEEN REINFORCEMENT BARS                                                 | CONSULT MANUFACTURER |

### NOTES :

1. FOR LOCATION OF DETAILS A AND B, SEE SHEET 1.

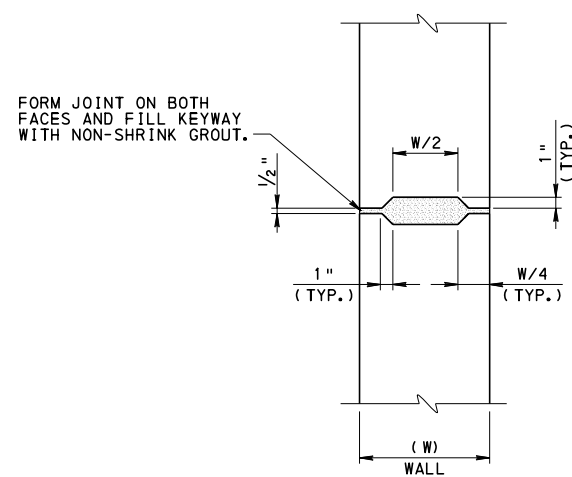
### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

### STANDARD ACCELERATED BRIDGE CONSTRUCTION DETAILS FOR PRECAST RIGID FRAME CONSTRUCTION NOTES, WATERPROOFING & FOOTING CONNECTION DETAILS

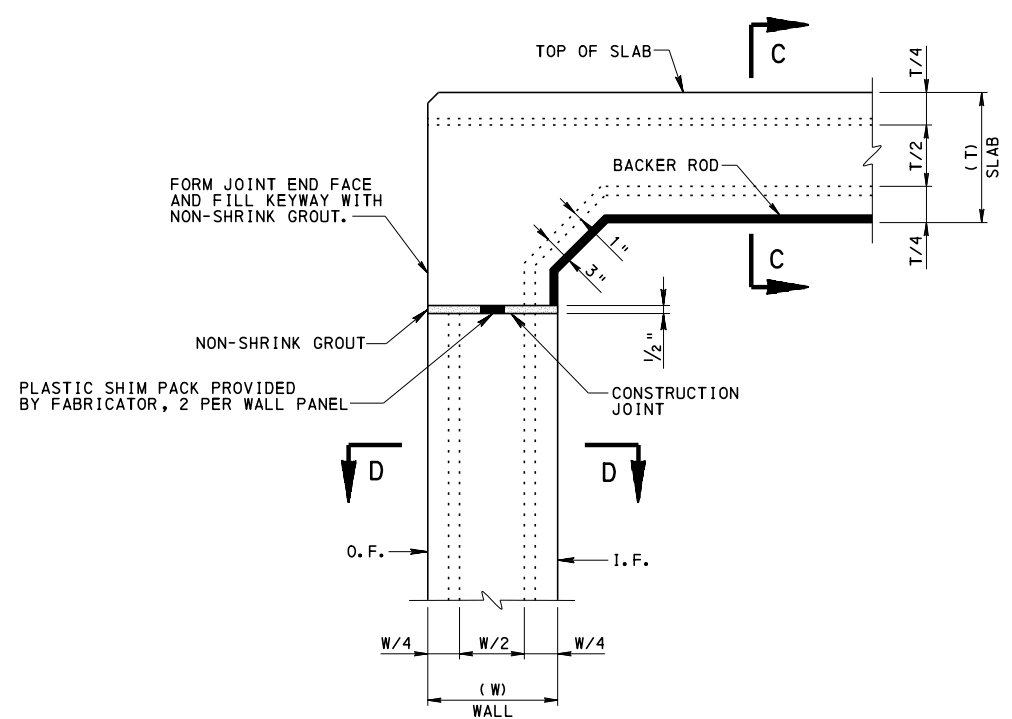
RECOMMENDED FEB. 14, 2023  
L. W. Gray  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMIN.

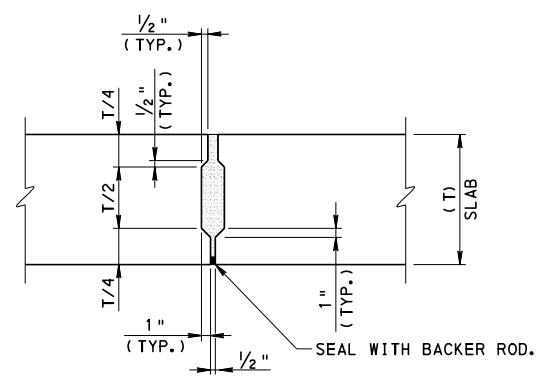
SHEET 2 OF 6  
BD-637M



SECTION D-D



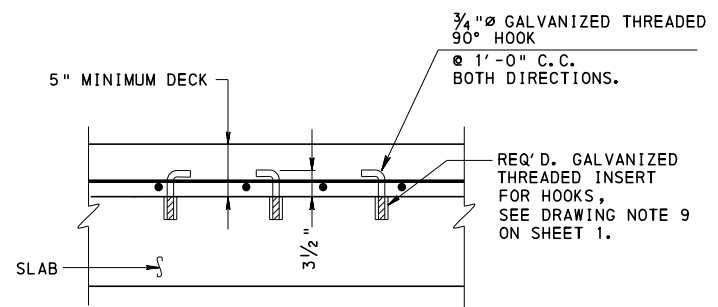
ELEVATION



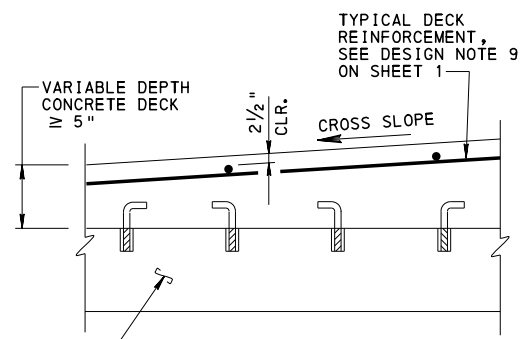
SECTION C-C

NOTE : REINFORCEMENT AND POST-TENSIONING SYSTEM ELEMENTS NOT SHOWN FOR CLARITY.

PRECAST SHEAR KEY DETAILS



TRANSVERSE SECTION



LONGITUDINAL SECTION

NOTE : FOR TYPICAL CAST-IN-PLACE DECK REINFORCEMENT, SEE BD-632M.

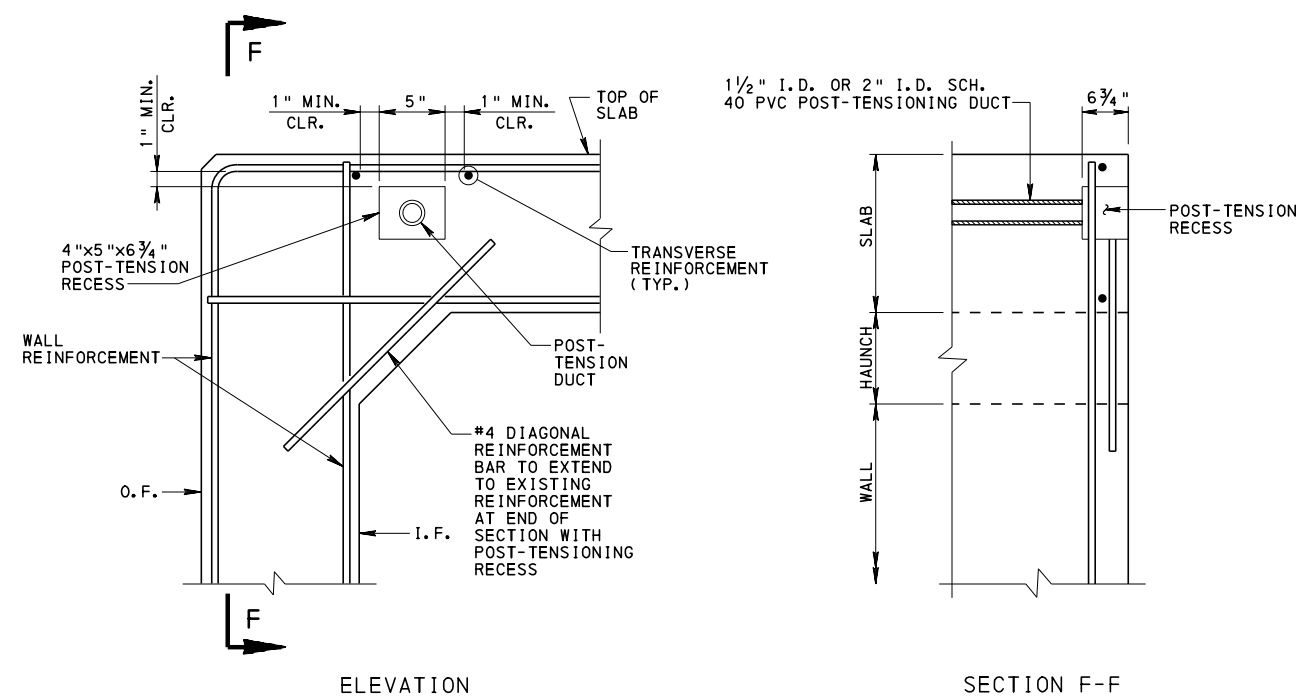
DECK CONNECTION DETAILS

NOTES :

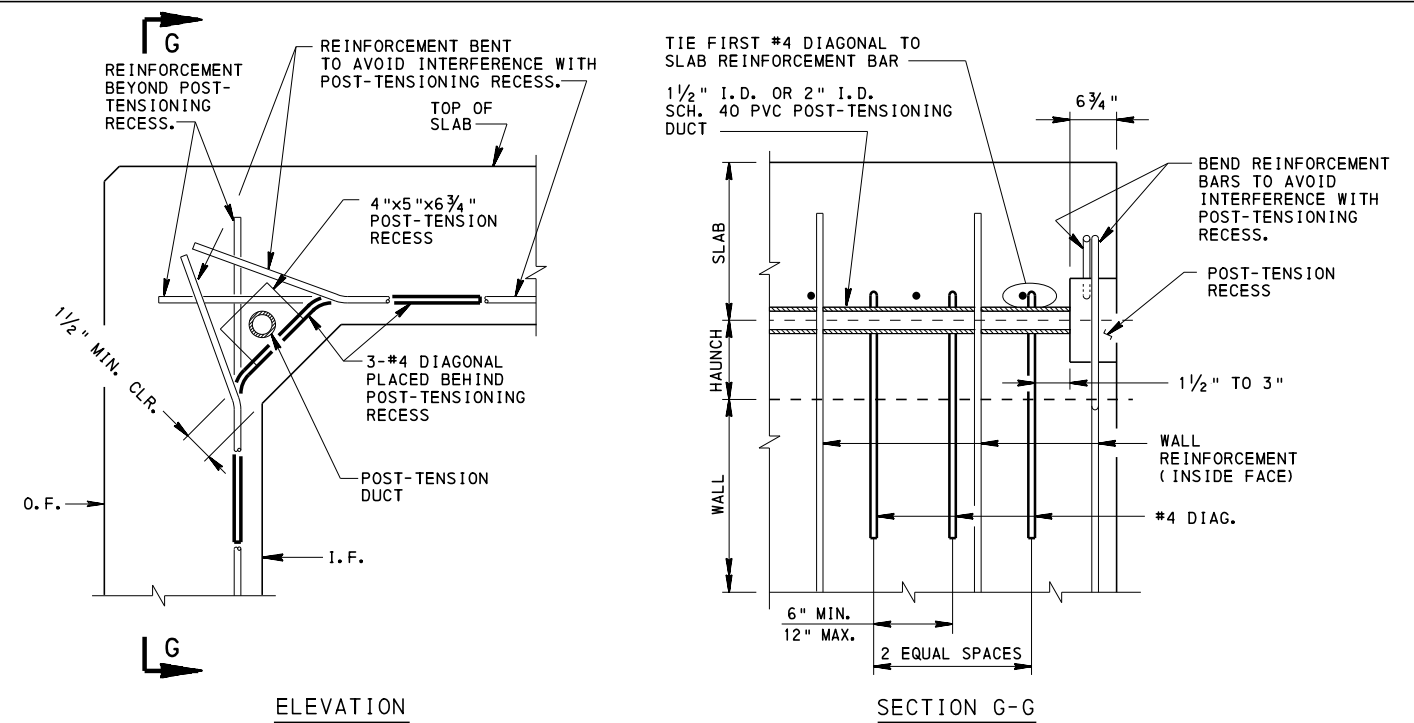
1. THE INSIDE FACES OF ALL SHEAR KEYS AND ASSOCIATED POST-TENSIONING DUCT HAND HOLES SHALL HAVE AN EXPOSED AGGREGATE FINISH.
2. FOR ADDITIONAL DETAILS AND NOTES, SEE BC-798M.
3. PROVIDE FORMWORK FOR GROUTING WHICH IS LIQUID TIGHT.

|                                                                                                                                                                                               |                                                                 |                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------|
| <p align="center"><b>COMMONWEALTH OF PENNSYLVANIA</b><br/> <b>DEPARTMENT OF TRANSPORTATION</b><br/>         BUREAU OF BRIDGE</p>                                                              |                                                                 |                         |
| <p align="center"><b>STANDARD</b><br/> <b>ACCELERATED BRIDGE CONSTRUCTION</b><br/> <b>DETAILS FOR PRECAST RIGID FRAME</b><br/> <b>DECK CONNECTION</b><br/> <b>&amp; SHEAR KEY DETAILS</b></p> |                                                                 |                         |
| RECOMMENDED FEB. 14, 2023<br><br>CHIEF BRIDGE ENGINEER                                                                                                                                        | RECOMMENDED FEB. 14, 2023<br><br>CHIEF ENGINEER, HIGHWAY ADMIN. | SHEET 3 OF 6<br>BD-637M |

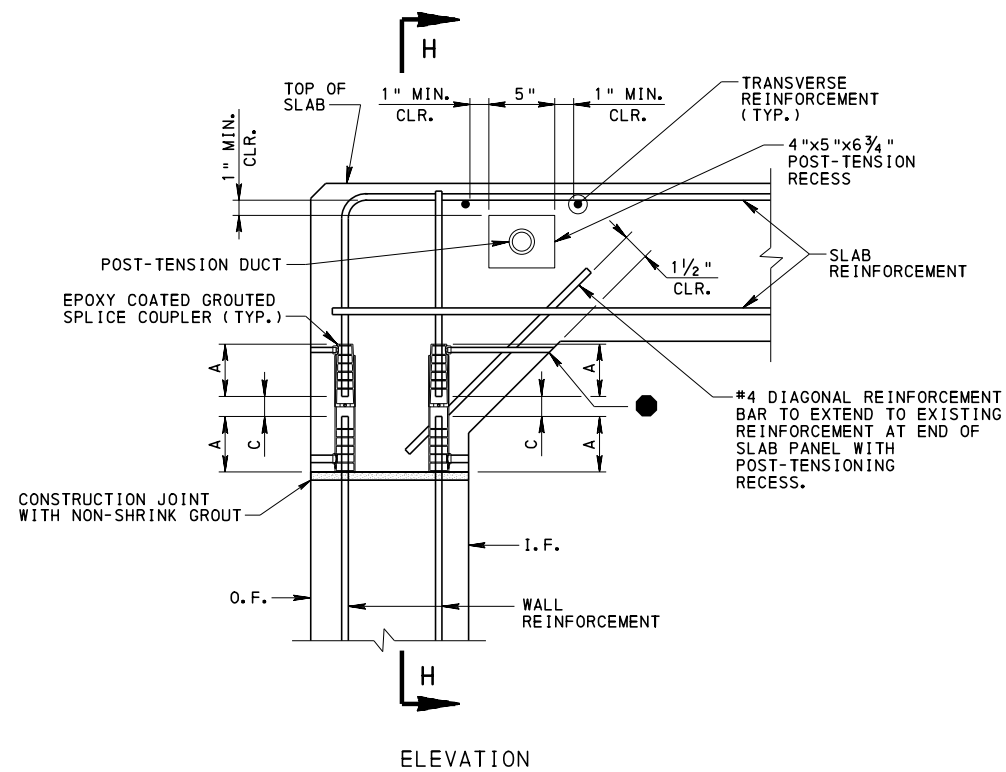




**TYPICAL HAUNCH DETAIL  
ON PRECAST RIGID FRAME**



**ALTERNATE HAUNCH DETAIL  
ON PRECAST RIGID FRAME**



● EPOXY COATED GROUDED SPLICE COUPLER MAY BE RE-ORIENTED WITH GROUT PORTS TO O.F. OF SLAB WHERE REQUIRED TO AVOID INTERFERENCE WITH POST-TENSIONING SYSTEM OR HAUNCH.

NOTE : PLACE NON-SHRINK GROUT SLIGHTLY HIGHER THAN PLASTIC SHIMS TO ENSURE FULL CONTACT BETWEEN CONNECTED SURFACES.

**TYPICAL HAUNCH DETAIL ON PRECAST MODULAR RIGID FRAME**

**NOTES :**

1. FOR EPOXY COATED GROUDED SPLICE COUPLER DETAILS, SEE SHEET 2.
2. FOR POST-TENSIONING DETAILS AND NOTES, SEE SHEET 5.
3. MODULAR RIGID FRAME INSIDE FACE AND OUTSIDE FACE GROUDED SPLICE COUPLERS MAY NOT NECESSARILY BE THE SAME SIZE; THEREFORE, THEIR RESPECTIVE "A" AND "C" DIMENSIONS, AS SHOWN HERE, MAY NOT BE THE SAME.
4. CHAMFER EXPOSED EDGES OF PRECAST CONCRETE 3/4" BY 3/4".

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BUREAU OF BRIDGE**

**STANDARD**

**ACCELERATED BRIDGE CONSTRUCTION  
DETAILS FOR PRECAST RIGID FRAME**

**HAUNCH DETAILS**

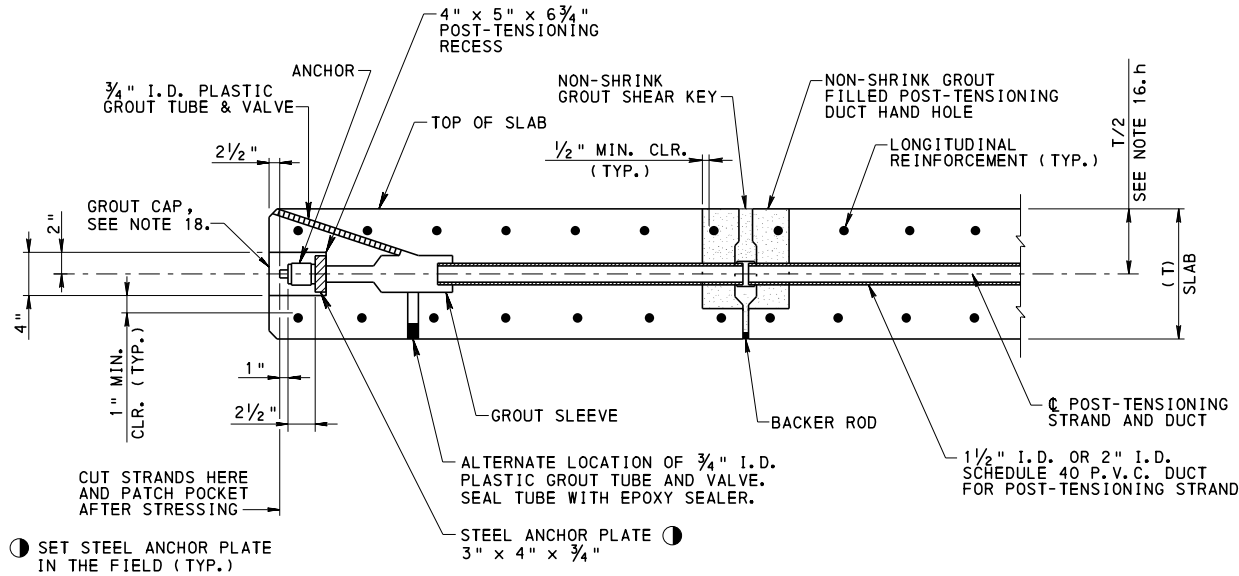
RECOMMENDED FEB. 14, 2023  
*L. W. Gray*  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 14, 2023  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMIN.

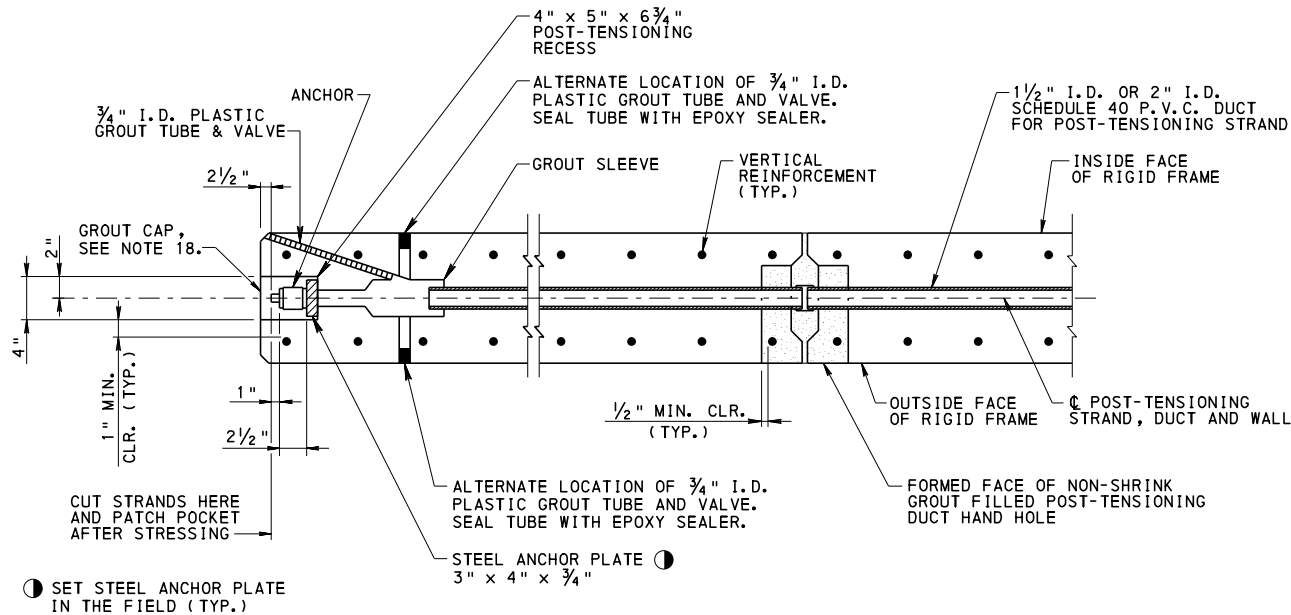
SHEET 4 OF 6  
BD-637M

INSTRUCTIONS FOR POST-TENSIONING

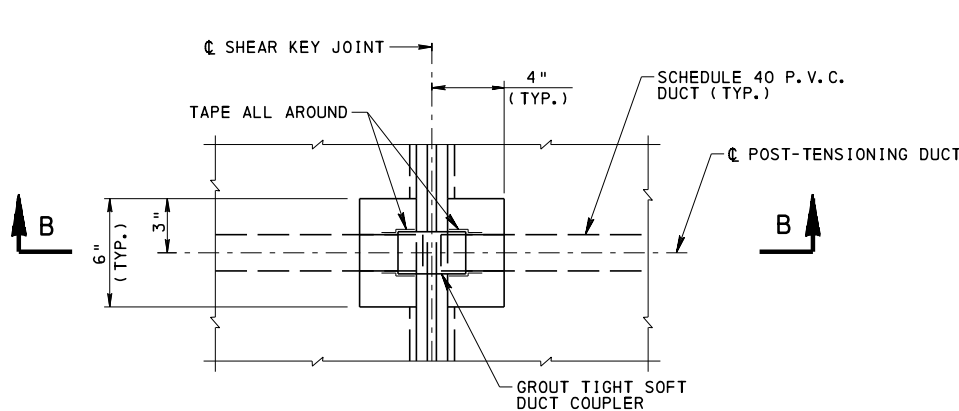
1. PROVIDE POST-TENSIONING OPERATIONS AND MATERIALS IN ACCORDANCE WITH PUB. 408, SECTION 1108. SHOP DRAWINGS ARE REQUIRED.
2. SHOW ALL POST-TENSIONING CONNECTION DETAILS OF PRECAST RIGID FRAME SEGMENTS ON THE SHOP DRAWINGS.
3. THE CONTRACTOR IS RESPONSIBLE FOR THE FINAL POST-TENSIONING DESIGN, LAYOUT, AND SEQUENCE.
4. SUBMIT POST-TENSIONING COMPUTATIONS WITH A PLAN FOR POST-TENSIONING TO THE DEPARTMENT FOR REVIEW AND ACCEPTANCE WITH THE SHOP DRAWINGS IN ACCORDANCE WITH PUB. 408, SECTION 1108. DESIGN MUST BE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA.
5. GROUT DUCT HAND HOLES ALONG WITH THEIR ASSOCIATED SHEAR KEYWAYS.
6. POST-TENSION AFTER THE SHEAR KEY JOINTS ARE FILLED WITH NON-SHRINK GROUT AND CURED A MINIMUM OF 24 HOURS.
7. PROVIDE THE INSIDE OF THE SHEAR KEYWAYS AND HAND HOLES WITH AN EXPOSED AGGREGATE FINISH TO IMPROVE THE BOND WITH THE NON-SHRINK GROUT. BEFORE SHIPPING, SAND OR WATER BLAST THE ENTIRE SHEAR KEYWAY AREA PROVIDING A ROUGH TEXTURE, AND COMPLETELY REMOVE ALL OIL, GREASE, DIRT, OR MATERIAL THAT WOULD PREVENT BONDING. JUST BEFORE ERECTION, CLEAN THE BLASTED SURFACE WITH COMPRESSED AIR, CLEAN STIFF-BRISTLE FIBER BRUSHES, OR VACUUM. BLAST CLEANING IS NOT TO BE USED WHERE THERE IS COATED PROJECTING REINFORCEMENT.
8. PROVIDE A BULLETIN 15 APPROVED, PREMIXED, NON-SHRINK GROUT (NON-METALLIC, NON-STAINING) WITH A 24 HOUR MINIMUM COMPRESSIVE STRENGTH  $\geq 3,750$  P.S.I. AND A 28 DAY MINIMUM COMPRESSIVE STRENGTH  $\geq 10,000$  P.S.I. CURE THE GROUT IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. DO NOT PERMIT CONSTRUCTION ACTIVITY OR OTHER LOADINGS ON THE RIGID FRAME UNTIL POST-TENSIONING OPERATIONS ARE COMPLETE. FOR VEHICULAR LOADING, SECTION 1080.3(d)5 OF PUB. 408 APPLIES.
9. PROVIDE  $\frac{1}{2}$ " DIAMETER POLY STRANDS OR APPROVED EQUAL HAVING A YIELD STRENGTH OF 270 K.S.I.
10. INSTALL STRANDS IN PRECAST SECTIONS. STRESS EACH STRAND IN ACCORDANCE WITH THE APPROVED POST-TENSIONING DESIGN. CHECK RAM AREA AND CALIBRATION CURVES OF EQUIPMENT FURNISHED FOR GAGE PRESSURES.
11. TENSION THE STRANDS IN ACCORDANCE WITH SECTION 1108.03(e) OF PUB. 408 EXCEPT ACCOMPANY JACK GAGES WITH A CURRENT, CERTIFIED CALIBRATION CHART, NOT OLDER THAN 6 MONTHS.
12. TENSION STRAND AT CENTERLINE OF SPAN FIRST AND THEN PROGRESS UP FRAME WALLS TOWARD ENDS OF SPAN. ALTERNATE LEFT AND RIGHT OF CENTERLINE.
13. AFTER STRESSING, GROUT ALL STRAND DUCTS. REFER TO PUB. 408 SECTION 1085.3(c)1 FOR TIME LIMITATIONS ASSOCIATED WITH GROUTING.
14. PLACE GROUT MIX INTO TUBING USING PRESSURE GROUT.
15. BASE THE POST-TENSIONING DESIGN UPON THE FOLLOWING CRITERIA:
  - a. THE TOTAL POST-TENSION FORCE IS THE FORCE REQUIRED TO CREATE A PRESSURE OF 10 P.S.I. OVER THE CROSS SECTION OF THE RIGID FRAME.
  - b. MAXIMUM TOTAL POST-TENSION FORCE SHOULD NOT CREATE A PRESSURE GREATER THAN 100 P.S.I. OVER THE CROSS SECTION OF ANY SEGMENT.
  - c. MINIMUM TOTAL POST-TENSION FORCE IS 100 KIPS.
  - d. MAXIMUM LOAD ON A  $\frac{1}{2}$ " DIAMETER STRAND IS 29 KIPS. USE 0.6" DIAMETER STRAND WITH HIGHER LOAD WHEN PERMITTED.
  - e. PLACE STRANDS SYMMETRICALLY ABOUT THE CENTERLINE OF THE RIGID FRAME.
  - f. USE A MINIMUM OF 5 STRANDS.
  - g. MINIMUM STRAND SPACING IS 2'-0".
  - h. PLACE CORNER STRANDS AT THE LOCATION OF CENTERLINES BETWEEN WALL AND SLAB OR AT A MAXIMUM DISTANCE OF 2'-0" FROM THIS LOCATION.
  - i. LOCATE STRANDS SO AS TO NOT INTERFERE WITH REINFORCEMENT DETAILS.
16. PROVIDE SEALS AT THE DUCT JOINTS TO MAKE JOINTS GROUT TIGHT.
17. ALL POST-TENSIONING MUST BE WITNESSED BY THE ENGINEER.
18. AFTER POST-TENSIONING IS APPROVED, CUT STRANDS TO PROVIDE A MINIMUM OF  $\frac{2}{2}$ " CLEAR FROM OUTSIDE FACE OF CONCRETE AND COAT RECESS WITH EPOXY BONDING COMPOUND. FILL ALL RECESSES WITH AN APPROVED PRODUCT LISTED IN BULLETIN 15 UNDER MISCELLANEOUS POLYMER MODIFIED AND SPECIAL CEMENTS, MORTARS AND CONCRETE TO FORM A SEAL AND CAP.
19. POST-TENSION AND GROUT ALL DUCTS BEFORE BACKFILLING AND PLACING TRAFFIC OVER THE RIGID FRAME.
20. ALL POST-TENSIONING CHUCKS MUST BE OF THE REUSABLE TYPE. OPERATORS MUST EXERCISE PROPER PRECAUTIONS WHEN RE-ALIGNING WEDGES AFTER RELEASE OF TENDONS AND PRIOR TO RETENSIONING AND RE-SEATING.
21. REMOVE A MINIMAL AMOUNT OF POLYSTRAND TO ACCOMMODATE SPLICES AT STAGED CONSTRUCTION JOINT ENDS, IF APPLICABLE.



SLAB POST-TENSIONING CONNECTION DETAILS

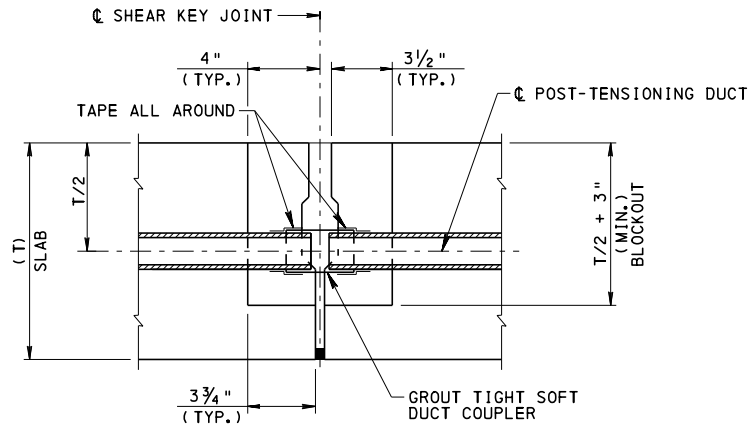


WALL POST-TENSIONING CONNECTION DETAILS



NOTE : HAND HOLE IN SLAB SHOWN, HAND HOLE IN WALL SIMILAR. REINFORCEMENT NOT SHOWN FOR CLARITY.

POST-TENSIONING DUCT HAND HOLE PLAN



NOTE : REINFORCEMENT NOT SHOWN FOR CLARITY.

SECTION B-B

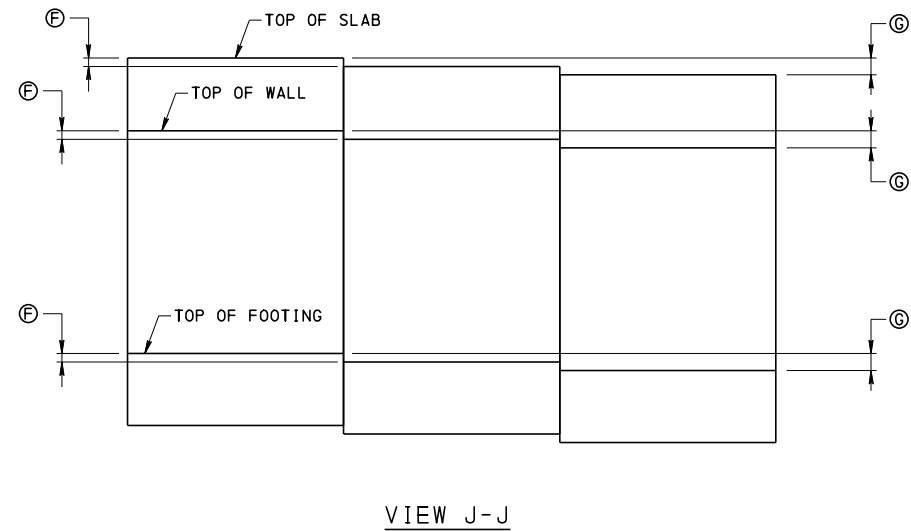
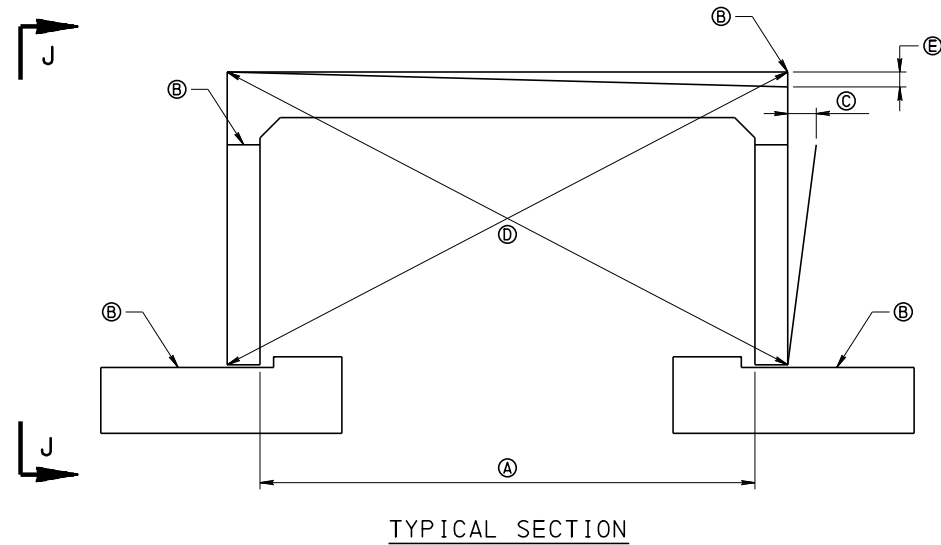
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STANDARD  
ACCELERATED BRIDGE CONSTRUCTION  
DETAILS FOR PRECAST RIGID FRAME  
MECHANICAL CONNECTION DETAILS

RECOMMENDED FEB. 14, 2023  
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SHEET 5 OF 6  
BD-637M



# **RIGID FRAME ERECTION TOLERANCE DETAILS** PRECAST MODULAR RIGID FRAME SHOWN, PRECAST RIGID FRAME SIMILAR.

| RIGID FRAME ERECTION TOLERANCES |                                                                                                  |         |
|---------------------------------|--------------------------------------------------------------------------------------------------|---------|
| A                               | CLEAR SPAN LENGTH BETWEEN WALL SEGMENTS                                                          | ± 1/2 " |
| B                               | MAXIMUM VARIATION FROM CONTRACT DRAWING VALUE IN TOP OF FOOTING, WALL, OR SLAB SEGMENT ELEVATION | ± 0.01' |
| C                               | MAXIMUM VERTICAL VARIATION OVER HEIGHT OF WALL (MODULAR SECTION)                                 | PLUMB * |
| D                               | MAXIMUM SQUARE VARIATION                                                                         | ± 1/2 " |
| E                               | MAXIMUM LEVEL VARIATION ACROSS SPAN OF SLAB SEGMENTS                                             | ± 1/8 " |
| F                               | MAXIMUM TOP OF WALL, SLAB, OR FOOTING ELEVATION BETWEEN ADJACENT SEGMENTS                        | ± 1/4 " |
| G                               | MAXIMUM TOP OF WALL, SLAB, OR FOOTING ELEVATION BETWEEN ANY TWO SEGMENTS                         | ± 1/4 " |

\* FOR NON-MODULAR SECTIONS, "C" DIMENSION SHALL BE ± 1/8 "

## NOTES :

1. FOR EPOXY COATED GROUTED SPLICE COUPLER TOLERANCES, SEE SHEET 2.
2. FOR FABRICATION TOLERANCES, SEE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 145, "INSPECTION OF PRESTRESSED/PRECAST CONCRETE PRODUCTS AND REINFORCED CONCRETE PIPE".

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
 BUREAU OF BRIDGE

STANDARD  
 ACCELERATED BRIDGE CONSTRUCTION  
 DETAILS FOR PRECAST RIGID FRAME  
 ERECTION TOLERANCES

CHANGE 1

CHANGE 8

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-741M, SHEET 2.
- DESIGN TABLES DO NOT INCLUDE CMS LOADINGS. DESIGN COMPUTATIONS ARE REQUIRED TO BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER TO VERIFY STRUCTURAL CAPACITY FOR ALL STRUCTURES INTENDED TO SUPPORT CMS LOADS.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:  

BD-641M: CANTILEVER AND CENTER-MOUNT STRUCTURES, STRUT LENGTHS UP TO 40'
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. ALTERNATE CAISSON FOUNDATIONS ARE PERMITTED WHERE SITE CONDITIONS DO NOT ALLOW FOR THE SPREAD FOOTING. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL AND THE CORRESPONDING INFORMATION SHOWN ON THE CONTRACT DRAWINGS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-741M.
- THE FOLLOWING CRITERIA WERE USED TO DEVELOP THE DESIGN TABLES IN THIS STANDARD. DEVIATION FROM ANY OF THESE ASSUMPTIONS REQUIRE THE DESIGNER TO VERIFY THE DETAILS INCLUDED IN BD-641M AND BC-741M.
  - DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II.
  - STRUCTURES WERE DESIGNED ASSUMING THE SIGN PANELS AND LUMINAIRES BEING MOUNTED ON ONLY ONE SIDE OF THE TRUSS.
  - LUMINAIRE AND SUPPORT ARM WEIGHT OF 400 LBS AND WIND AREA OF 9.92 SF (FOR BOTH TRUCK GUST AND NORMAL WIND LOADS).
  - CATWALKS WERE NOT CONSIDERED FOR THESE STRUCTURES. DESIGNERS MUST CHECK STRUCTURES FOR CATWALKS WHEN REQUIRED BY DISTRICT ENGINEER.
  - HEIGHT ABOVE GROUND FOR NORMAL WIND PRESSURE CALCULATION WAS ASSUMED TO BE 33 FT.
  - TRAFFIC DESIGN SPEED OF 70 MPH WAS USED FOR TRUCK GUST LOAD CALCULATION.
  - SOIL FRICTION COEFFICIENT OF TAN(30°) 0.58 WAS USED FOR SLIDING RESISTANCE.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS AND CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB.408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE DIAMETER OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE AS DETAILED IN BC-741M. IF THESE MINIMUMS ARE NOT PROVIDED, BOLT BEARING MUST BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. ANCHOR BOLTS WERE DESIGNED AND DETAILED IN ACCORDANCE WITH ACI 318-14 AND AISC DESIGN GUIDE 1, 2ND EDITION. A MINIMUM EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS MUST BE PROVIDED.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS WITH THICKNESSES GREATER THAN 1/2" REQUIRE CHARPY V-NOTCH TESTING AND ARE DESIGNATED ON THE PLANS BY (CVN). PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, LOAD PATH REDUNDANT AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
18. ONE TEST BORING SHALL BE PROVIDED AT EACH DRILLED CAISSON FOUNDATION LOCATION.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS

PENNDOT STD. DWGS. (U.N.O.) \*

SIGN PANELS  
LIGHT FIXTURES  
SIGN SUPPORT BEAM  
COLUMNS, STRUTS

TC-8701E OR TC-8701S  
BC-741M, SHT. 6  
BC-741M, SHT. 6  
CALCULATED INTERNALLY WITHIN PROGRAM
- EXTERNAL LOADS

AASHTO LRFD SIGN

BASIC WIND SPEED  
SERVICE WIND SPEED  
MEAN WIND SPEED

STR/EXT 120 MPH (1700 YR MRI)  
SER 76 MPH (10 YR MRI)  
FAT 11.2 MPH
- GROUP LOADS

AASHTO LRFD SIGN 3.4
- STEEL CRITERIA

AASHTO LRFD SIGN

SECTION PROPERTIES FOR TUBULAR SHAPES  
COMBINED FORCE INTERACTIONS  
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)  
ALLOWABLE DEFLECTION  
PERMANENT CAMBER  
STRUCTURAL STEEL DESIGN

APPENDIX B, TABLE B.2.1  
5.12  
SECTION 11  
10.4  
10.5  
SECTION 5
- BOLT CRITERIA

AASHTO LRFD BRIDGES (U.N.O.)

SLIP-CRITICAL BOLT  
BOLT PRYING ACTION  
COMBINED BOLT SHEAR AND TENSION  
ANCHOR BOLT DESIGN

6.13.2.8  
6.13.2.10.4  
6.13.2.11  
SEE NOTE 15
- CONCRETE CRITERIA

AASHTO LRFD BRIDGES & ACI 318-14

BEARING RESISTANCE  
SHEAR RESISTANCE OF FOOTINGS  
SHEAR RESISTANCE OF CONCRETE  
SLENDERNESS OF COLUMNS  
MINIMUM REINF. OF FLEXURAL MEMBERS  
SPACING LIMITS FOR REINFORCEMENT  
MINIMUM CONCRETE COVER  
TORSION  
COLUMN DESIGN (PEDESTALS)

5.6.5  
5.7.1.4  
5.7.1  
5.6.4.3  
DM-4, D5.6.3.3  
DM-4, D5.10.3  
DM-4, D5.10.1  
5.7.2.1  
5.6.4
- SPREAD FOOTINGS ON SOIL

MAXIMUM FACTORED BEARING RESISTANCE  
MINIMUM AREA IN BEARING  
UNIT WEIGHT OF SOIL  
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS  
SLIDING RESISTANCE

3 TONS PER SQUARE FOOT  
75% (STRENGTH) 95% (SERVICE)  
100 POUNDS PER CUBIC FOOT  
DM-4, D10.6.1.4  
DM-4, D10.6.3.4
- DRILLED CAISSONS

DM-4, SECTION 10.8

MAXIMUM DESIGN LATERAL DISPLACEMENT  
ANALYSES

0.5"  
PENNDOT COM624 OR L-PILE
- SEISMIC DESIGN CRITERIA

SEISMIC LOADS WERE NOT CONSIDERED IN THE DEVELOPMENT OF THIS STANDARD. THE DESIGNER MUST CHECK THE ADEQUACY OF THESE STANDARDS WHEN SEISMIC LOADS ARE TO BE CONSIDERED.

\* LEGEND:

- AASHTO LRFD SIGN: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO LRFD BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-14).
- CVN: CHARPY V-NOTCH.
- AISC: AMERICAN INSTITUTE OF STEEL CONSTRUCTION - DESIGN GUIDE 1, BASE PLATE AND ANCHOR ROD DESIGN, 2ND EDITION
- CMS: CHANGEABLE MESSAGE SIGN

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORK:

PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS & PIPE STRUTS: SEE PUBLICATION 408, SECTION 948.2.

ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36 OR 50  
ASTM A709, GRADE 36 OR 50
- ALTERNATE PRESS-BREAK MEMBERS:

ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 3/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBERS FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR STRUTS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS: ASTM F1554, GRADE 55 PER PUBLICATION 408  
SECTION 1105.02(c) 3.

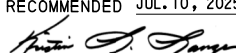
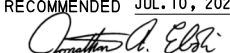
BOLTS: ASTM F3125, GRADE A325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 1ST EDITION, 2015 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH EDITION, 2017; PENNDOT DESIGN MANUAL - PART 4, DECEMBER 2019 EDITION
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE ROLLING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE YEAR AND CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- CHANGEABLE MESSAGE SIGNS (CMS) ARE PROHIBITED ON OVERHEAD CANTILEVER STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS.
- DURING THE REVIEW PROCESS OF THE SHOP DRAWINGS, CALLING FOR "VERIFICATION" OF AN ITEM, SIZE, DIMENSION, WELD, OR ANY DETAIL IS INSUFFICIENT. SUCH DETAILS AND/OR CORRECTIONS SHALL BE NOTED ON THE SHOP DRAWINGS BY THE REVIEWING AUTHORITY. ANY DISCREPANCIES OF QUESTIONS SHALL BE REFERRED TO PENNDOT FOR REVIEW AND RESOLUTION.
- IF CONTRACT DRAWINGS INDICATE A "SCALE" THEN ALL DETAILS, LAYOUTS OF SIGN PANELS/BOXES, SIGN/WALKWAY SUPPORTS, HANDRAILS AND ALL ITEMS RELATED TO THE STRUCTURE SHALL BE DEPICTED PER "SCALE" SHOWN.

|                    |                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------|
| TC-8700C           | SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS                                      |
| TC-8701D           | SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS                                                |
| TC-8701E           | EXTRUDED ALUMINUM CHANNEL SIGN                                                                 |
| TC-8701S           | FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS                                    |
| TC-8715            | SIGN LIGHTING                                                                                  |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                                                          |
| BC-741M            | OVERHEAD SIGN STRUCTURES - CANTILEVER AND CENTERMOUNT SIGN STRUCTURES STRUT LENGTHS UP TO 40FT |
| RC-11M             | CLASSIFICATION OF EARTHWORK FOR STRUCTURES                                                     |
| RC-51M             | TYPE 31 STRONG POST GUIDE RAIL                                                                 |
| RC-53M             | TYPE 2 WEAK POST GUIDE RAIL                                                                    |
| RC-54M             | BARRIER PLACEMENT AT OBSTRUCTIONS                                                              |
| RC-58M             | SINGLE FACE CONCRETE BARRIER                                                                   |
| REFERENCE DRAWINGS |                                                                                                |

| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BUREAU OF BRIDGE                                                           |                                                                                                                                                      |                            |
|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| OVERHEAD SIGN STRUCTURES<br>CANTILEVER AND CENTER-MOUNT STRUCTURES<br>STRUT LENGTHS UP TO 40'                                              |                                                                                                                                                      |                            |
| NOTES AND DESIGN CRITERIA                                                                                                                  |                                                                                                                                                      |                            |
| RECOMMENDED JUL.10, 2025<br><br>CHIEF BRIDGE ENGINEER | RECOMMENDED JUL.10, 2025<br><br>CHIEF EXECUTIVE, HIGHWAY ADMIN. | SHT. 1 OF 7<br><br>BD-641M |



HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION A MINIMUM 6 INCHES 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:

1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
4. THE SIGN AREA CALCULATED FOR MULTIPLE SIGN PANELS AS DESCRIBED BELOW.

- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.

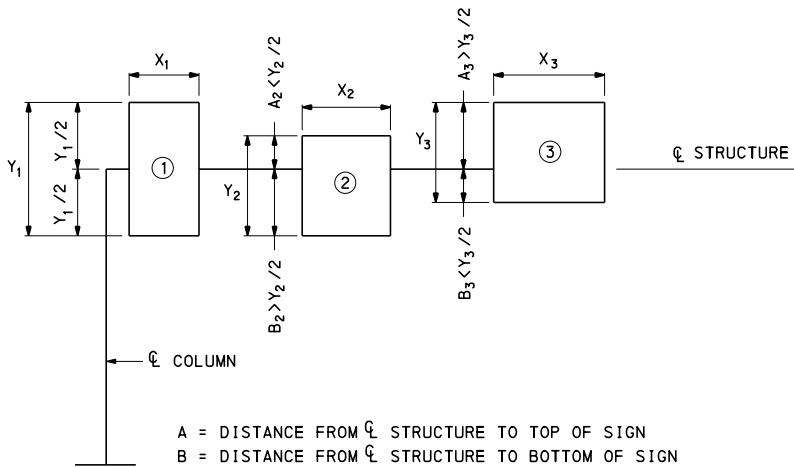
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

THE SIGN AREA FOR ANY SIGN PANEL PLACED OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

EXAMPLE:

AREA OF SIGN NO. 1 = (X<sub>1</sub>) x (Y<sub>1</sub>)  
AREA OF SIGN NO. 2 = (X<sub>2</sub>) x (B<sub>2</sub>) x 2  
AREA OF SIGN NO. 3 = (X<sub>3</sub>) x (A<sub>3</sub>) x 2

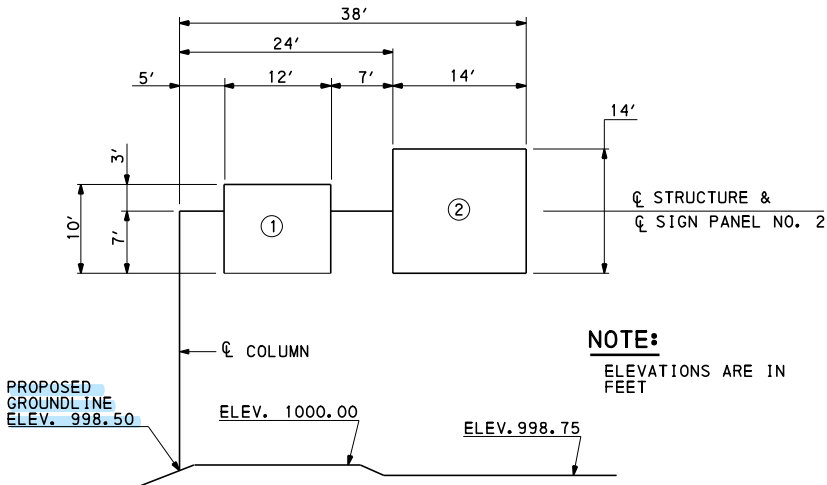


A = DISTANCE FROM CL STRUCTURE TO TOP OF SIGN  
B = DISTANCE FROM CL STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO. 1 = X<sub>1</sub> Y<sub>1</sub>  
DESIGN AREA OF SIGN NO. 2 = (X<sub>2</sub> B<sub>2</sub>) x 2  
DESIGN AREA OF SIGN NO. 3 = (X<sub>3</sub> A<sub>3</sub>) x 2

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN, SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL DESIGN POST HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.
- THE DESIGN SIGN PANEL LENGTH AND "X" DIMENSION SHALL BE THE DIMENSIONS AS DETERMINED IN THE FOLLOWING EXAMPLE ROUNDED UP TO THE NEXT HIGHEST INCREMENTS SHOWN IN THE DESIGN TABLES.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SIGN LOCATION, & POST HEIGHT



NOTE:

ELEVATIONS ARE IN FEET

- HEIGHT OF SIGN PANEL NO. 2 EXCEEDS 12', THEREFORE, USE 2-STRUT STRUCTURE.

$$\Delta \text{ ELEV.} = 1000.00 - 998.75 = 1.25 < 2'-6" \\ \left. \begin{array}{l} Y_1 = 10' \\ Y_2 = 14' \end{array} \right\} Y_1 < Y_2 \quad \left. \begin{array}{l} \Delta \text{ ELEV.} = 1.25 < 2'-6" \\ Y_1 < Y_2 \end{array} \right\} \text{USE CASE B}$$

- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION  
ELEV. 1000.00 + 17'-6" + 1'-2" = 1018.67  
[1'-2" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]

- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2  
ELEV. 1018.67 + 14'/2 = 1025.67

- DESIGN COLUMN HEIGHT (H):  
H = 1025.67 - 998.50 - 0.50 = 26.67' → USE H = 28'-0"  
[0.50' = MINIMUM HEIGHT OF PEDESTAL ABOVE GRADE]

- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:  
A<sub>1</sub> = 12' x 7' x 2 = 168.0 SF  
A<sub>2</sub> = 14' x 14' = 196.0 SF

$$\frac{364.0 \text{ SF}}{364.0 \text{ SF}} \rightarrow \text{USE } 400.0 \text{ SF}$$

- COMPUTE CENTER OF GRAVITY OF SIGN AREA (X):  
X = [168.0 SF x (5' + 12'/2)] + [196.0 SF x (24' + 14'/2)]  
364 SF

$$X = 21.77' \rightarrow \text{USE } X = 24' \text{ WITH A SIGN AREA OF } 400 \text{ SF}$$

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES  
CANTILEVER AND CENTER-MOUNT STRUCTURES  
STRUT LENGTHS UP TO 40'

DESIGN INSTRUCTIONS

RECOMMENDED JUL. 10, 2025

CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025

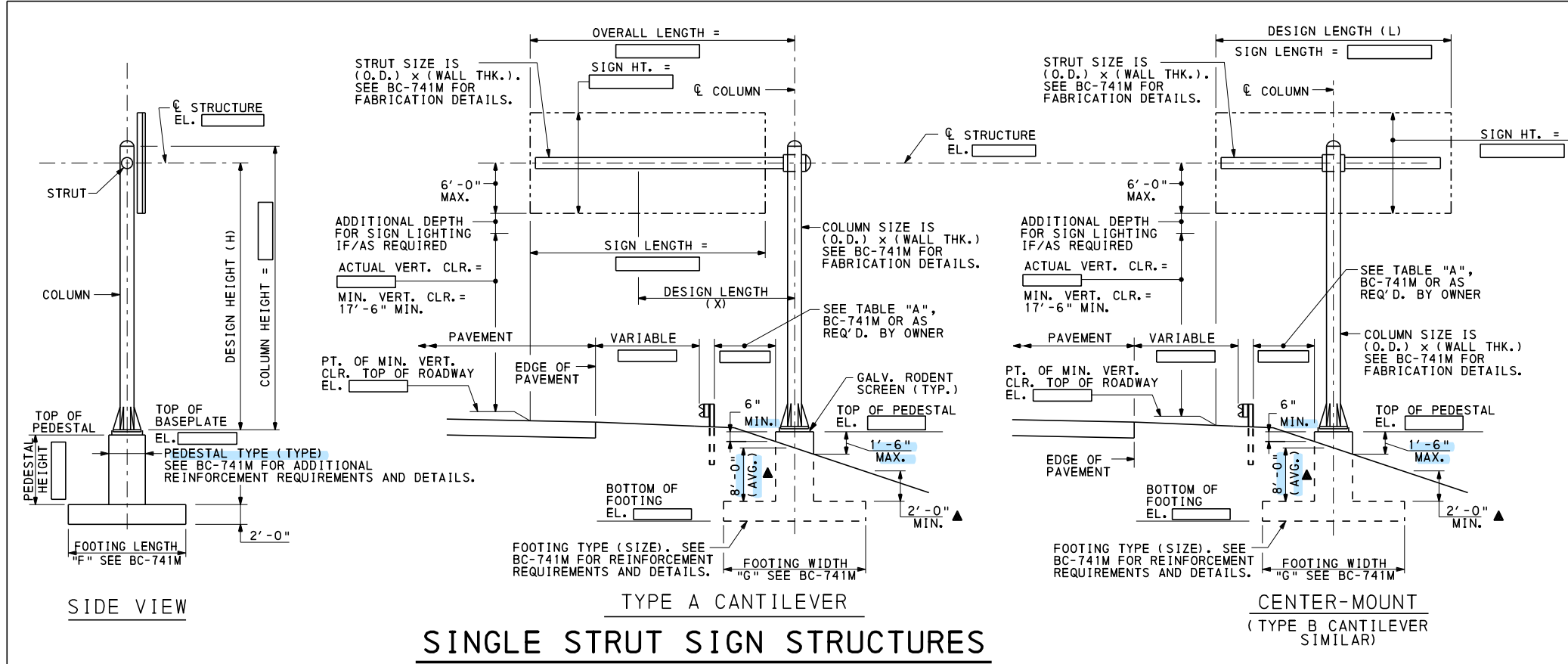
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 2 OF 7

BD-641M

SHT. 3 OF 7  
BD-641M





| TABLE OF ESTIMATED QUANTITIES |                         |      |          |
|-------------------------------|-------------------------|------|----------|
| ITEM NO.                      | ITEM                    | UNIT | QUANTITY |
| *                             | STEEL SIGN STRUCTURE    | LBS  |          |
| 0000-0000                     | STRUCTURE MOUNTED SIGNS | SF   |          |
| 0000-0000                     | CLASS 3 EXCAVATION      | CY   |          |
| 0000-0000                     | CLASS A CEMENT CONCRETE | CY   |          |
| 0000-0000                     | REINFORCEMENT BARS      | LBS  |          |

\* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 0000 - 0000

DESIGN CRITERIA

DESIGN SIGN AREA (A) =

DESIGN LENGTH (X OR L) =

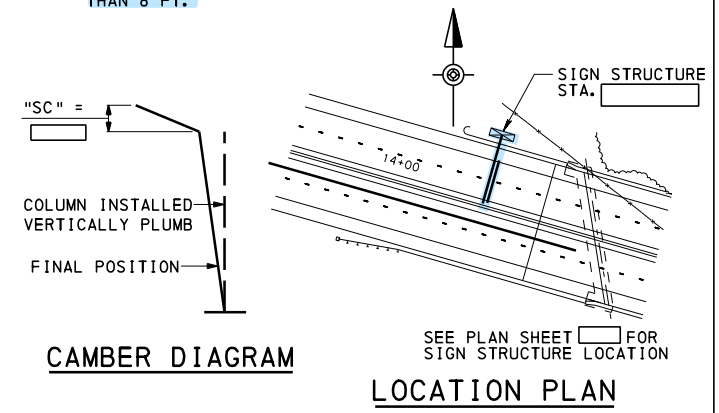
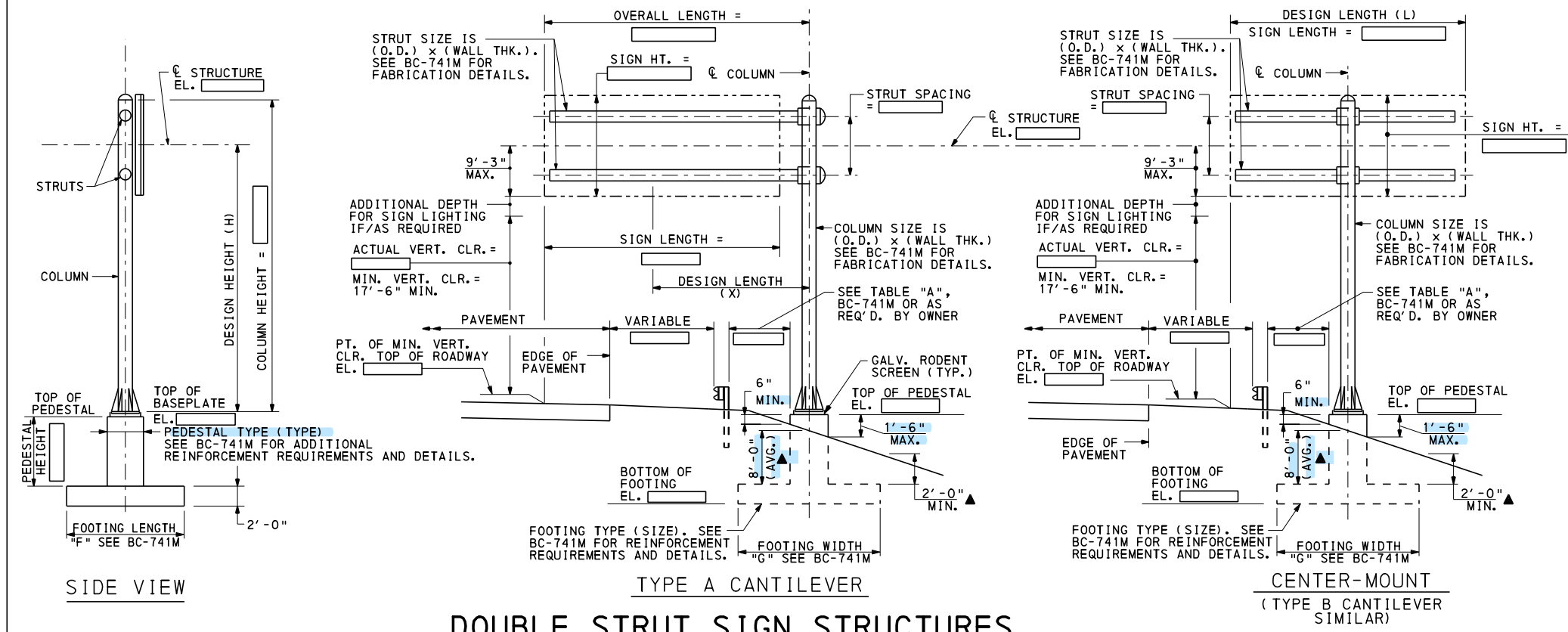
DESIGN HEIGHT (H) =

FATIGUE CATEGORY =

NOTE:  
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%,  
OR ACTUAL INCREASED BY 50% SIGN AREA.  
(DESIGNER TO INDICATE CONTROLLING CONDITION)

NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
- PEDESTAL TYPE (TYPE). SEE BC-741M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
- FOOTING TYPE (SIZE). SEE BC-741M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
- COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
- STRUT SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM DESIGN TABLE. DO NOT CAMBER TYPE B CANTILEVER STRUTS.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH
- FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.



COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

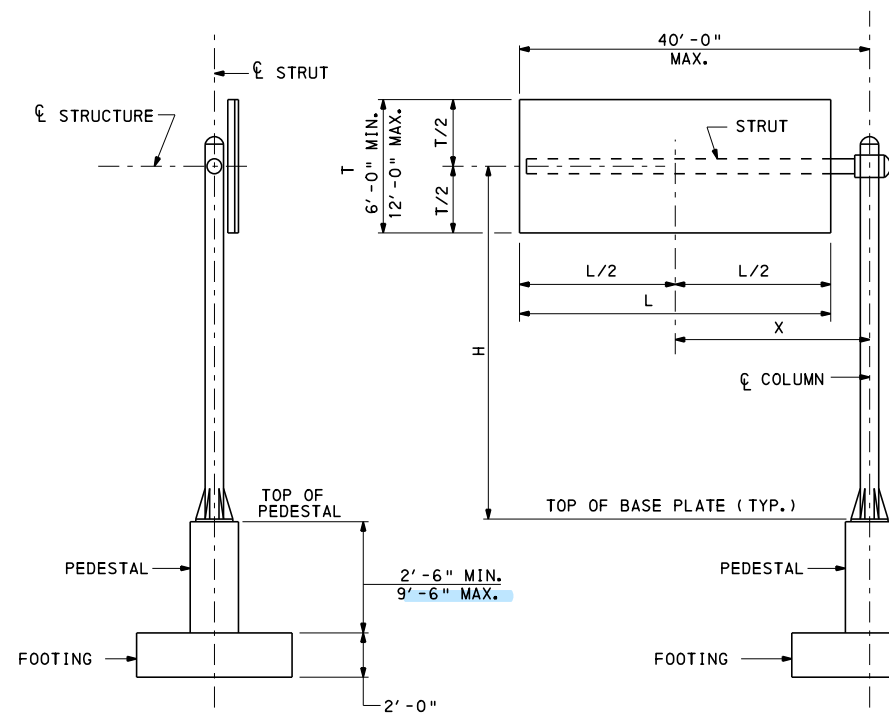
OVERHEAD SIGN STRUCTURES  
CANTILEVER AND CENTER-MOUNT STRUCTURES  
STRUT LENGTHS UP TO 40'

SAMPLE CONTRACT DRAWING

RECOMMENDED JUL. 10, 2025  
CHIEF BRIDGE ENGINEER

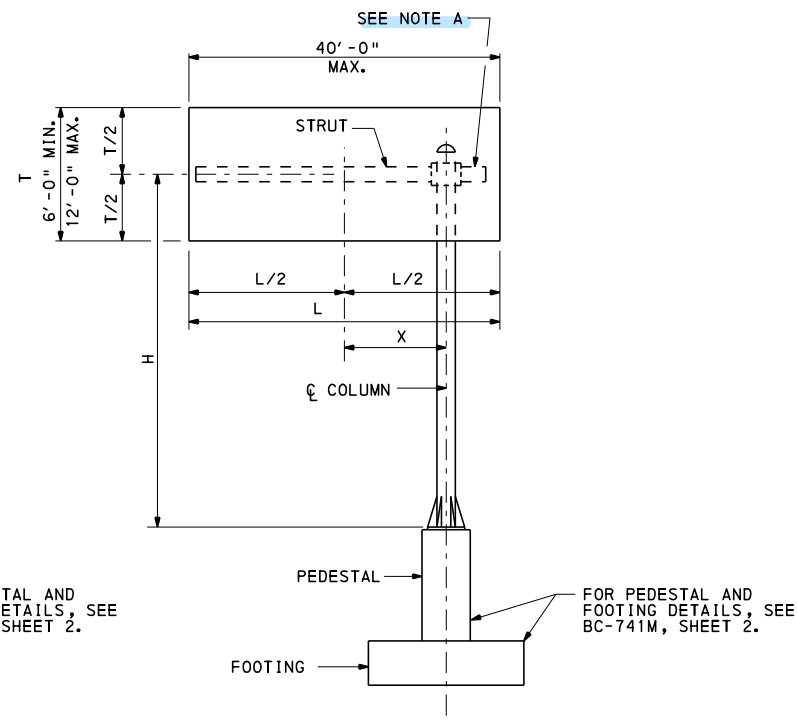
RECOMMENDED JUL. 10, 2025  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 4 OF 7  
BD-641M

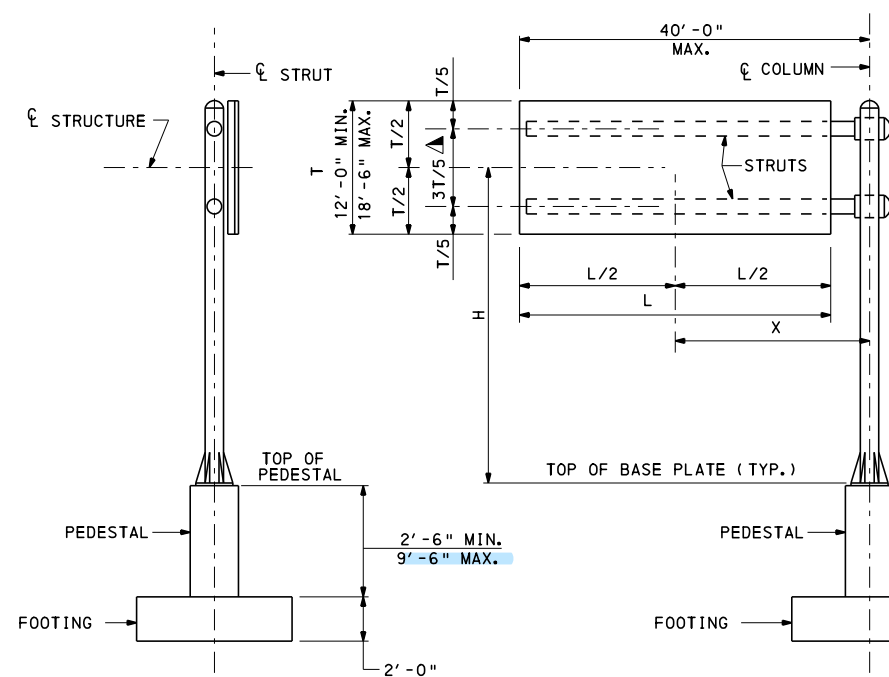


SIDE VIEW

FRONT VIEW (TYPE A)  
SINGLE STRUT SIGN



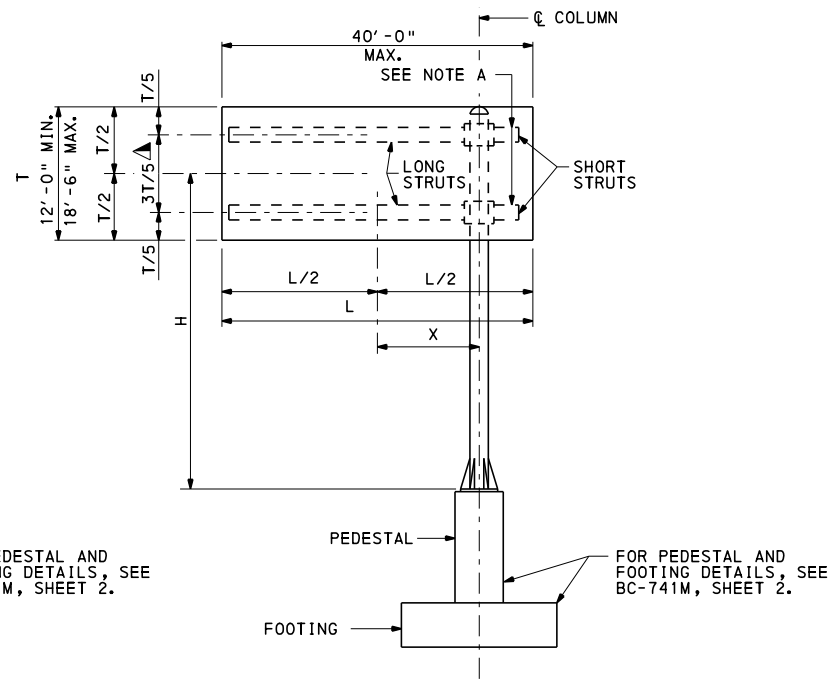
FRONT VIEW (TYPE B)



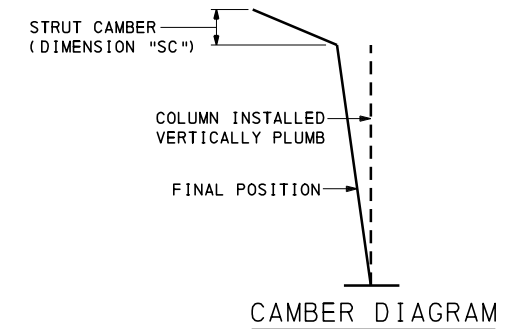
SIDE VIEW

FRONT VIEW (TYPE A)  
DOUBLE STRUT SIGN

▲ - ROUND UP TO NEAREST 3" INCREMENT



FRONT VIEW (TYPE B)



#### NOTES:

CAMBERS SHOWN IN THE DESIGN TABLES ARE BASED ON THE WORST CASE DEFLECTIONS FOR ALL POSSIBLE SIGN COMBINATIONS EXPECTED FOR THE GIVEN STRUCTURE GEOMETRY.

STRUT CAMBER (SC) INCLUDES CAMBER OF STRUT FROM SIGN PROGRAM WHICH INCLUDES DOWNWARD MOVEMENT OF THE STRUT CAUSED BY THE DEFLECTION OF THE COLUMN.

#### NOTE A:

PROVIDE STRUT(S) ON THIS SIDE OF COLUMN WHEN SIGN OVERHANG IS GREATER THAN 3'-0". SEE BC-741M, SHEET 5 FOR DETAILS. TYPE A CANTILEVER HAS STRUTS ON ONE SIDE OF THE COLUMN ONLY. TYPE B CANTILEVER HAS STRUTS ON BOTH SIDES.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES  
CANTILEVER AND CENTER-MOUNT STRUCTURES  
STRUT LENGTHS UP TO 40'

CANTILEVER SINGLE AND DOUBLE  
STRUT STRUCTURES

RECOMMENDED JUL. 10, 2025  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 5 OF 7  
BD-641M

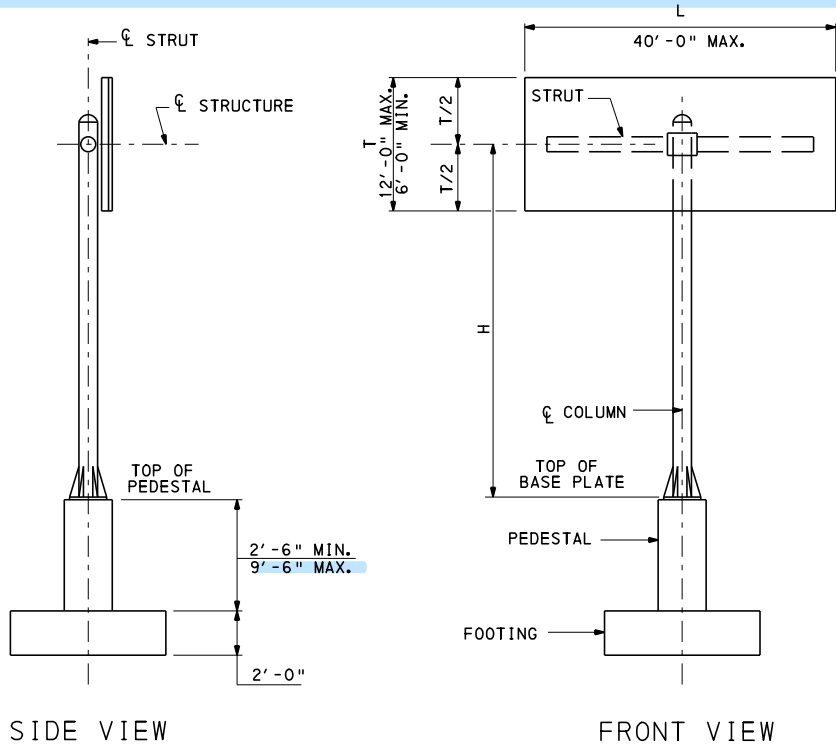
| CANTILEVER COLUMN AND FOOTING DATA |                      |         |         |         |         |         |                        |        |        |        |        |               |        |        |        |        |              |        |        |        |        |
|------------------------------------|----------------------|---------|---------|---------|---------|---------|------------------------|--------|--------|--------|--------|---------------|--------|--------|--------|--------|--------------|--------|--------|--------|--------|
| X (FT)                             | SIGN AREA<br>(SQ FT) | COLUMNS |         |         |         |         | STRUT CAMBER "SC" (IN) |        |        |        |        | PEDESTAL TYPE |        |        |        |        | FOOTING TYPE |        |        |        |        |
|                                    |                      | H       |         |         |         |         | H                      |        |        |        |        | H             |        |        |        |        | H            |        |        |        |        |
|                                    |                      | 12'-0"  | 16'-0"  | 20'-0"  | 24'-0"  | 28'-0"  | 12'-0"                 | 16'-0" | 20'-0" | 24'-0" | 28'-0" | 12'-0"        | 16'-0" | 20'-0" | 24'-0" | 28'-0" | 12'-0"       | 16'-0" | 20'-0" | 24'-0" | 28'-0" |
| 4'-0"                              | 50                   | 12x.330 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 0.620                  | 0.625  | 0.594  | 0.594  | 0.552  | FP1           | FP2    | FP2    | FP2    | FP4    | 0608         | 0609   | 0708   | 0709   | 0710   |
|                                    | 100                  | 12x.330 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 1.358                  | 1.447  | 1.443  | 1.327  | 1.320  | FP1           | FP2    | FP2    | FP2    | FP4    | 0711         | 0811   | 0811   | 0912   | 0912   |
|                                    | 150                  | 14x.312 | 14x.375 | 16x.375 | 18x.375 | 24x.375 | 1.340                  | 1.387  | 1.315  | 1.257  | 1.259  | FP2           | FP2    | FP2    | FP2    | FP4    | 0811         | 0912   | 0912   | 0914   | 1014   |
|                                    | 200                  | 14x.437 | 16x.375 | 18x.375 | 20x.375 | 24x.375 | 2.491                  | 2.500  | 2.432  | 2.372  | 2.241  | FP2           | FP2    | FP2    | FP3    | FP4    | 0912         | 0914   | 1013   | 1015   | 1115   |
|                                    | 250                  | 18x.312 | 18x.375 | 20x.375 | 24x.375 | 24x.375 | 2.656                  | 2.715  | 2.663  | 2.507  | 2.564  | FP2           | FP2    | FP3    | FP4    | FP4    | 1014         | 1015   | 1115   | 1116   | 1117   |
|                                    | 300                  | 18x.375 | 20x.375 | 24x.375 | 24x.375 | 24x.500 | 2.059                  | 2.044  | 1.920  | 1.983  | 1.941  | FP2           | FP3    | FP4    | FP4    | FP4    | 1015         | 1115   | 1116   | 1217   | 1217   |
|                                    | 400                  | 20x.375 | 24x.375 | 24x.375 | 24x.500 | 24x.562 | 1.830                  | 1.743  | 1.813  | 1.783  | 1.798  | FP3           | FP4    | FP4    | FP4    | FP4    | 1115         | 1215   | 1217   | 1317   | 1318   |
|                                    | 480                  | 24x.375 | 24x.375 | 24x.500 | 24x.500 |         | 1.669                  | 1.760  | 1.742  | 1.811  |        | FP4           | FP4    | FP4    | FP4    |        | 1215         | 1218   | 1317   | 1319   |        |
|                                    | 500                  | 24x.375 | 24x.375 | 24x.500 | 24x.562 |         | 1.604                  | 1.700  | 1.682  | 1.710  |        | FP4           | FP4    | FP4    | FP4    |        | 1216         | 1316   | 1318   | 1418   |        |
|                                    | 600                  | 24x.375 | 24x.500 | 24x.562 |         |         | 1.644                  | 1.649  | 1.689  |        |        | FP4           | FP4    | FP4    |        |        | 1316         | 1319   | 1419   |        |        |
|                                    | 700                  | 24x.500 | 24x.500 |         |         |         | 1.486                  | 1.571  |        |        |        | FP4           | FP4    |        |        |        | 1318         | 1419   |        |        |        |
|                                    | 740                  | 24x.500 | 24x.562 |         |         |         | 1.515                  | 1.567  |        |        |        | FP4           | FP4    |        |        |        | 1319         | 1420   |        |        |        |
| 8'-0"                              | 50                   | 12x.330 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 1.416                  | 1.432  | 1.337  | 1.336  | 1.205  | FP1           | FP2    | FP2    | FP2    | FP4    | 0609         | 0709   | 0709   | 0710   | 0711   |
|                                    | 100                  | 14x.312 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 1.703                  | 1.905  | 1.662  | 1.658  | 1.325  | FP2           | FP2    | FP2    | FP2    | FP4    | 0711         | 0810   | 0812   | 0912   | 0911   |
|                                    | 150                  | 16x.375 | 16x.375 | 16x.375 | 20x.312 | 24x.375 | 2.574                  | 2.819  | 2.773  | 2.513  | 2.625  | FP2           | FP2    | FP2    | FP3    | FP4    | 0912         | 0912   | 0913   | 1014   | 1014   |
|                                    | 200                  | 18x.375 | 18x.375 | 18x.375 | 20x.375 | 24x.375 | 3.127                  | 3.226  | 3.454  | 3.305  | 3.536  | FP2           | FP2    | FP2    | FP3    | FP4    | 0913         | 1014   | 1014   | 1115   | 1115   |
|                                    | 250                  | 20x.375 | 20x.375 | 20x.375 | 24x.375 | 24x.375 | 3.057                  | 3.161  | 3.404  | 3.025  | 3.164  | FP3           | FP3    | FP3    | FP4    | FP4    | 1014         | 1114   | 1115   | 1117   | 1217   |
|                                    | 300                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.500 | 2.571                  | 2.728  | 2.886  | 3.043  | 2.938  | FP4           | FP4    | FP4    | FP4    | FP4    | 1015         | 1115   | 1117   | 1217   | 1218   |
|                                    | 400                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.562 | 2.239                  | 2.421  | 2.386  | 2.525  | 2.563  | FP4           | FP4    | FP4    | FP4    | FP4    | 1116         | 1217   | 1218   | 1317   | 1319   |
|                                    | 480                  | 24x.375 | 24x.500 | 24x.500 | 24x.562 |         | 2.226                  | 2.236  | 2.392  | 2.452  |        | FP4           | FP4    | FP4    | FP4    |        | 1216         | 1316   | 1318   | 1320   |        |
|                                    | 500                  | 24x.500 | 24x.500 | 24x.500 | 24x.562 |         | 2.305                  | 2.495  | 2.685  | 2.757  |        | FP4           | FP4    | FP4    | FP4    |        | 1217         | 1317   | 1319   | 1419   |        |
|                                    | 600                  | 24x.500 | 24x.500 | 24x.562 |         |         | 2.432                  | 2.634  | 2.732  |        |        | FP4           | FP4    | FP4    |        |        | 1317         | 1320   | 1419   |        |        |
|                                    | 700                  | 24x.562 | 24x.562 |         |         |         | 2.420                  | 2.625  |        |        |        | FP4           | FP4    |        |        |        | 1320         | 1420   |        |        |        |
|                                    | 740                  | 24x.562 |         |         |         |         |                        |        |        |        |        |               |        |        |        |        |              |        |        |        |        |
| 12'-0"                             | 50                   | 12x.330 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 2.373                  | 2.409  | 2.198  | 2.195  | 1.906  | FP1           | FP2    | FP2    | FP2    | FP4    | 0709         | 0708   | 0710   | 0711   | 0811   |
|                                    | 100                  | 14x.375 | 14x.375 | 16x.375 | 18x.312 | 24x.375 | 3.077                  | 3.412  | 3.183  | 3.177  | 2.522  | FP2           | FP2    | FP2    | FP2    | FP4    | 0811         | 0811   | 0812   | 0912   | 0912   |
|                                    | 150                  | 18x.375 | 18x.375 | 18x.375 | 20x.312 | 24x.375 | 2.937                  | 3.183  | 3.430  | 3.473  | 2.914  | FP2           | FP2    | FP2    | FP3    | FP4    | 0912         | 0912   | 0914   | 1014   | 1014   |
|                                    | 200                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 3.212                  | 3.512  | 3.812  | 4.113  | 3.749  | FP4           | FP4    | FP4    | FP4    | FP4    | 0914         | 1014   | 1015   | 1115   | 1115   |
|                                    | 250                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 3.841                  | 4.113  | 4.385  | 4.657  | 4.929  | FP4           | FP4    | FP4    | FP4    | FP4    | 1015         | 1115   | 1116   | 1217   | 1217   |
|                                    | 300                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 3.345                  | 3.630  | 3.914  | 3.792  | 4.009  | FP4           | FP4    | FP4    | FP4    | FP4    | 1115         | 1116   | 1217   | 1217   | 1318   |
|                                    | 400                  | 24x.562 | 24x.562 | 24x.562 | 24x.562 | 24x.562 | 2.745                  | 2.969  | 3.192  | 3.416  | 3.639  | FP4           | FP4    | FP4    | FP4    | FP4    | 1217         | 1217   | 1317   | 1318   | 1320   |
|                                    | 480                  | 24x.562 | 24x.562 | 24x.562 | 24x.562 |         | 2.893                  | 3.179  | 3.464  | 3.750  |        | FP4           | FP4    | FP4    | FP4    |        | 1217         | 1317   | 1319   | 1418   |        |
| 16'-0"                             | 50                   | 14x.312 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 3.043                  | 3.396  | 2.971  | 2.965  | 2.460  | FP2           | FP2    | FP2    | FP2    | FP4    | 0709         | 0709   | 0711   | 0810   | 0811   |
|                                    | 100                  | 18x.312 | 18x.312 | 18x.312 | 18x.312 | 24x.375 | 3.332                  | 3.645  | 3.957  | 4.269  | 3.158  | FP2           | FP2    | FP2    | FP2    | FP4    | 0810         | 0812   | 0912   | 0912   | 0913   |
|                                    | 150                  | 20x.375 | 20x.375 | 20x.375 | 20x.375 | 24x.375 | 3.043                  | 3.331  | 3.618  | 3.906  | 3.334  | FP3           | FP3    | FP3    | FP3    | FP4    | 0912         | 0913   | 0914   | 1014   | 1014   |
|                                    | 200                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 4.113                  | 4.416  | 4.719  | 5.022  | 5.325  | FP4           | FP4    | FP4    | FP4    | FP4    | 1014         | 1014   | 1114   | 1115   | 1116   |
|                                    | 250                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 4.569                  | 4.879  | 5.188  | 5.498  | 5.808  | FP4           | FP4    | FP4    | FP4    | FP4    | 1114         | 1115   | 1117   | 1217   | 1217   |
|                                    | 300                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 3.936                  | 4.279  | 4.622  | 4.964  | 5.307  | FP4           | FP4    | FP4    | FP4    | FP4    | 1115         | 1117   | 1217   | 1218   | 1318   |
| 20'-0"                             | 50                   | 14x.312 | 14x.312 | 16x.375 | 18x.312 | 24x.375 | 4.933                  | 5.447  | 4.829  | 4.821  | 3.975  | FP2           | FP2    | FP2    | FP2    | FP4    | 0709         | 0809   | 0809   | 0810   | 0910   |
|                                    | 100                  | 18x.375 | 18x.375 | 18x.375 | 20x.312 | 24x.375 | 3.920                  | 4.344  | 4.767  | 4.841  | 3.881  | FP2           | FP2    | FP2    | FP3    | FP4    | 0910         | 0910   | 0911   | 0912   | 1012   |
|                                    | 150                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 3.961                  | 4.219  | 4.477  | 4.734  | 4.992  | FP4           | FP4    | FP4    | FP4    | FP4    | 0912         | 1012   | 1012   | 1113   | 1113   |
|                                    | 200                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 5.047                  | 5.466  | 5.886  | 6.305  | 6.725  | FP4           | FP4    | FP4    | FP4    | FP4    | 1013         | 1113   | 1114   | 1214   | 1214   |
|                                    | 250                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 5.440                  | 5.894  | 6.348  | 6.802  | 7.256  | FP4           | FP4    | FP4    | FP4    | FP4    | 1114         | 1214   | 1215   | 1315   | 1315   |
| 24'-0"                             | 50                   | 16x.375 | 16x.375 | 16x.375 | 18x.312 | 24x.375 | 4.759                  | 5.447  | 4.829  | 4.821  | 3.975  | FP2           | FP2    | FP2    | FP2    | FP4    | 0809         | 0809   | 0810   | 0909   | 0910   |
|                                    | 100                  | 20x.375 | 20x.375 | 20x.375 | 20x.375 | 24x.375 | 3.920                  | 4.344  | 4.767  | 4.841  | 3.881  | FP3           | FP3    | FP3    | FP3    | FP4    | 0910         | 0911   | 0912   | 1012   | 1012   |
|                                    | 150                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 3.961                  | 4.219  | 4.477  | 4.734  | 4.992  | FP4           | FP4    | FP4    | FP4    | FP4    | 1012         | 1012   | 1013   | 1113   | 1113   |
|                                    | 200                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 5.047                  | 5.466  | 5.886  | 6.305  | 6.725  | FP4           | FP4    | FP4    | FP4    | FP4    | 1113         | 1113   | 1214   | 1214   | 1215   |
| 28'-0"                             | 50                   | 18x.312 | 18x.312 | 18x.312 | 18x.312 | 24x.375 | 5.483                  | 6.173  | 6.863  | 7.553  | 5.100  | FP2           | FP2    | FP2    | FP2    | FP4    | 0809         | 0810   | 0909   | 0910   | 0911   |
|                                    | 100                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 6.024                  | 6.377  | 6.729  | 7.081  | 7.433  | FP4           | FP4    | FP4    | FP4    | FP4    | 0910         | 0911   | 1011   | 1012   | 1013   |
|                                    | 150                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 5.008                  | 5.409  | 5.809  | 6.210  | 6.611  | FP4           | FP4    | FP4    | FP4    | FP4    | 1012         | 1013   | 1113   | 1113   | 1114   |
|                                    | 200                  | 24x.562 | 24x.562 | 24x.562 | 24x.562 | 24x.562 | 5.302                  | 5.742  | 6.183  | 6.624  | 7.064  | FP4           | FP4    | FP4    | FP4    | FP4    | 1112         | 1114   | 1214   | 1214   | 1215   |
| 32'-0"                             | 50                   | 18x.312 | 18x.312 | 18x.312 | 18x.312 | 24x.375 | 7.618                  | 8.340  | 9.063  | 9.785  | 7.217  | FP2           | FP2    | FP2    | FP2    | FP4    | 0909         | 0909   | 0910   | 0911   | 0912   |
|                                    | 100                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 6.566                  | 7.056  | 7.545  | 8.034  | 8.524  | FP4           | FP4    | FP4    | FP4    | FP4    | 0911         | 1012   | 1012   | 1012   | 1113   |
|                                    | 150                  | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 24x.500 | 5.778                  | 6.228  | 6.677  | 7.127  | 7.577  | FP4           | FP4    | FP4    | FP4    | FP4    | 1012         | 1113   | 1113   | 1114   | 1214   |
| 36'-0"                             | 50                   | 20x.312 | 20x.312 | 20x.312 | 20x.312 | 24x.375 | 8.308                  | 9.007  | 9.707  | 10.406 | 8.567  | FP3           | FP3    | FP3    | FP3    | FP4    | 0910         | 0911   | 0912   | 1012   | 1011   |
|                                    | 100                  | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 24x.375 | 6.820                  | 7.374  | 7.928  | 8.481  | 9.035  | FP4           | FP4    | FP4    | FP4    | FP4    | 1012         | 1011   | 1012   | 1113   | 1112   |

| SINGLE STRUT DATA     |          |          |          |          |          |          |          |          |          |
|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| SIGN AREA<br>(SQ. FT) | X        |          |          |          |          |          |          |          |          |
|                       | 4' - 0"  | 8' - 0"  | 12' - 0" | 16' - 0" | 20' - 0" | 24' - 0" | 28' - 0" | 32' - 0" | 36' - 0" |
| 50                    | 5x. 375  | 6x. 432  | 8x. 322  | 8x. 406  | 10x. 365 | 10x. 365 | 12x. 330 | 14x. 312 | 14x. 312 |
| 100                   | 6x. 432  | 8x. 322  | 10x. 365 | 12x. 330 | 12x. 375 | 14x. 312 | 14x. 375 | 16x. 375 |          |
| 150                   | 8x. 406  | 10x. 365 | 12x. 330 | 14x. 312 | 14x. 375 | 16x. 375 | 18x. 375 | 18x. 375 |          |
| 200                   | 10x. 365 | 12x. 330 | 14x. 375 | 14x. 437 | 16x. 375 | 18x. 375 | 18x. 500 |          |          |
| 250                   | 12x. 330 | 14x. 312 | 14x. 437 | 16x. 375 | 18x. 375 |          |          |          |          |
| 300                   | 12x. 330 | 14x. 375 | 16x. 375 | 18x. 375 |          |          |          |          |          |
| 400                   | 14x. 312 | 16x. 375 | 18x. 500 |          |          |          |          |          |          |
| 480                   | 14x. 437 | 18x. 312 | 18x. 500 |          |          |          |          |          |          |

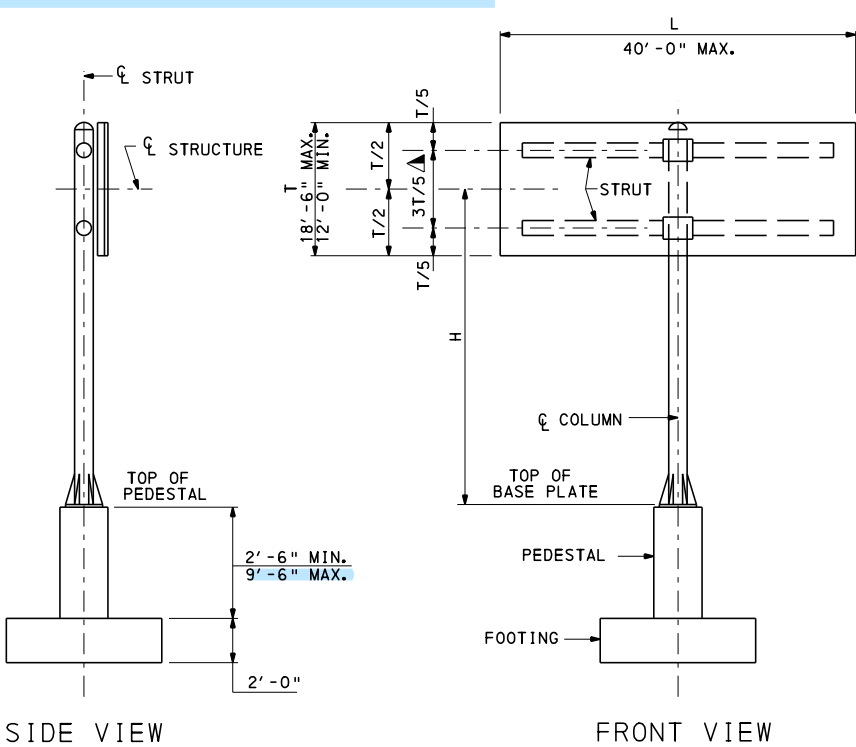
| CENTER-MOUNT COLUMN AND FOOTING DATA |                      |         |         |         |         |         |               |        |        |        |        |              |        |        |        |        |
|--------------------------------------|----------------------|---------|---------|---------|---------|---------|---------------|--------|--------|--------|--------|--------------|--------|--------|--------|--------|
| L (FT)                               | SIGN AREA<br>(SQ FT) | COLUMNS |         |         |         |         | PEDESTAL TYPE |        |        |        |        | FOOTING TYPE |        |        |        |        |
|                                      |                      | H       |         |         |         |         | H             |        |        |        |        | H            |        |        |        |        |
|                                      |                      | 12'-0"  | 16'-0"  | 20'-0"  | 24'-0"  | 28'-0"  | 12'-0"        | 16'-0" | 20'-0" | 24'-0" | 28'-0" | 12'-0"       | 16'-0" | 20'-0" | 24'-0" | 28'-0" |
| TO 40'-0"                            | 50                   | 10x.365 | 12x.330 | 16x.375 | 18x.312 | 20x.312 | FP1           | FP1    | FP2    | FP2    | FP3    | 0607         | 0608   | 0708   | 0709   | 0809   |
|                                      | 100                  | 10x.365 | 12x.330 | 16x.375 | 18x.312 | 20x.312 | FP1           | FP1    | FP2    | FP2    | FP3    | 0809         | 0809   | 0810   | 0910   | 0911   |
|                                      | 150                  | 12x.330 | 14x.375 | 16x.375 | 18x.312 | 20x.312 | FP1           | FP2    | FP2    | FP2    | FP3    | 0910         | 0910   | 0912   | 1012   | 1012   |
|                                      | 200                  | 14x.375 | 16x.375 | 18x.375 | 20x.375 | 24x.375 | FP2           | FP2    | FP2    | FP3    | FP4    | 0912         | 1012   | 1013   | 1113   | 1113   |
|                                      | 250                  | 16x.375 | 18x.375 | 20x.375 | 24x.375 | 24x.375 | FP2           | FP2    | FP3    | FP4    | FP4    | 1012         | 1113   | 1113   | 1214   | 1214   |
|                                      | 300                  | 18x.312 | 20x.375 | 24x.375 | 24x.375 | 24x.500 | FP2           | FP3    | FP4    | FP4    | FP4    | 1113         | 1113   | 1214   | 1215   | 1315   |
|                                      | 400                  | 20x.312 | 24x.375 | 24x.375 | 24x.500 | 24x.500 | FP3           | FP4    | FP4    | FP4    | FP4    | 1214         | 1214   | 1315   | 1316   | 1417   |
|                                      | 480                  | 20x.375 | 24x.375 | 24x.500 | 24x.562 |         | FP3           | FP4    | FP4    | FP4    |        | 1215         | 1315   | 1317   | 1416   |        |
|                                      | 500                  | 24x.375 | 24x.375 | 24x.500 | 24x.562 |         | FP4           | FP4    | FP4    | FP4    |        | 1215         | 1315   | 1317   | 1417   |        |
|                                      | 600                  | 24x.375 | 24x.500 | 24x.562 |         |         | FP4           | FP4    | FP4    |        |        | 1315         | 1415   | 1418   |        |        |
|                                      | 700                  | 24x.375 | 24x.500 |         |         |         | FP4           | FP4    |        |        |        | 1317         | 1418   |        |        |        |
|                                      | 740                  | 24x.500 | 24x.500 |         |         |         | FP4           | FP4    |        |        |        | 1416         | 1516   |        |        |        |

| SINGLE STRUT DATA    |       |        |        |        |        |        |        |        |         |         |         |
|----------------------|-------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| SIGN AREA<br>(SQ FT) | L     |        |        |        |        |        |        |        |         |         |         |
|                      | 4'-0" | 8'-0"  | 12'-0" | 16'-0" | 20'-0" | 24'-0" | 28'-0" | 32'-0" | 36'-0"  | 40'-0"  |         |
| 50                   |       | 4x.337 |        |        |        |        |        |        |         |         |         |
| 100                  |       |        | 4x.337 | 5x.375 |        |        |        |        |         |         |         |
| 150                  |       |        |        | 5x.375 | 5x.375 | 6x.432 |        |        |         |         |         |
| 200                  |       |        |        |        | 6x.432 | 6x.432 | 8x.322 | 8x.322 |         |         |         |
| 250                  |       |        |        |        |        | 8x.322 | 8x.322 | 8x.406 | 8x.406  | 10x.365 |         |
| 300                  |       |        |        |        |        |        | 8x.406 | 8x.406 |         | 10x.365 | 10x.365 |
| 400                  |       |        |        |        |        |        |        |        | 10x.365 | 12x.330 |         |
| 480                  |       |        |        |        |        |        |        |        |         | 12x.375 |         |

| DOUBLE STRUT DATA    |        |        |        |        |        |        |        |        |         |         |         |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| SIGN AREA<br>(SQ FT) | L      |        |        |        |        |        |        |        |         |         |         |
|                      | 4'-0"  | 8'-0"  | 12'-0" | 16'-0" | 20'-0" | 24'-0" | 28'-0" | 32'-0" | 36'-0"  | 40'-0"  |         |
| 50                   | 4x.337 |        |        |        |        |        |        |        |         |         |         |
| 100                  |        | 4x.337 |        |        |        |        |        |        |         |         |         |
| 150                  |        |        | 4x.337 |        |        |        |        |        |         |         |         |
| 200                  |        |        | 4x.337 | 4x.337 |        |        |        |        |         |         |         |
| 250                  |        |        |        | 5x.375 | 5x.375 |        |        |        |         |         |         |
| 300                  |        |        |        |        | 5x.375 | 6x.432 |        |        |         |         |         |
| 400                  |        |        |        |        |        | 6x.432 | 8x.322 | 8x.322 |         |         |         |
| 480                  |        |        |        |        |        |        | 8x.322 | 8x.406 | 8x.406  | 10x.365 |         |
| 500                  |        |        |        |        |        |        | 8x.322 | 8x.406 |         | 10x.365 | 10x.365 |
| 600                  |        |        |        |        |        |        |        |        | 10x.365 | 10x.365 |         |
| 700                  |        |        |        |        |        |        |        |        |         | 12x.330 |         |
| 740                  |        |        |        |        |        |        |        |        |         | 12x.330 |         |



SINGLE STRUT SIGN



DOUBLE STRUT SIGN

- NOTES:**
- FOR GENERAL NOTES, SEE SHEET 1.
  - FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
  - COLUMN SIZES SHOWN ARE FOR SINGLE AND DOUBLE STRUT STRUCTURES.
  - "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 0708 INDICATES A FOOTING 7'-0" WIDE x 8'-0" LONG). SEE BC-741M, SHEET 2, FOR FOUNDATION DETAILS.
  - "PEDESTAL TYPE" DESIGNATES ALL DETAILS FOR THE PEDESTALS. SEE BC-741M, SHEET 2.
  - FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.
  - CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
  - ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE x WALL THICKNESS AND ARE BASED ON ALL COMMERCIALLY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES  
CANTILEVER AND CENTER-MOUNT STRUCTURES  
STRUT LENGTHS UP TO 40'

CENTER-MOUNT DESIGN TABLES

RECOMMENDED JUL. 10, 2025  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 7 OF 7  
BD-641M



CHANGE 1

CHANGE 8

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-744M, SHEET 2.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:

BD-644M:

TWO-POST TRI-CHORD TRUSS, SPANS FROM 60’ TO 100’.  
FOUR-POST TRI-CHORD TRUSS, SPANS 60’ TO 200’.
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. ALTERNATE CAISSON FOUNDATIONS ARE PERMITTED FOR TWO-POST STRUCTURES WHERE SITE CONDITIONS DO NOT ALLOW FOR THE SPREAD FOOTING. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL AND THE CORRESPONDING INFORMATION SHOWN ON THE CONTRACT DRAWINGS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-744M.
- THE FOLLOWING CRITERIA WERE USED TO DEVELOP THE DESIGN TABLES IN THIS STANDARD. DEVIATION FROM ANY OF THESE ASSUMPTIONS REQUIRE THE DESIGNER TO VERIFY THE DETAILS INCLUDED IN BD-644M AND BC-744M.
  - DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II.
  - STRUCTURES WERE DESIGNED ASSUMING THE SIGN PANELS AND LUMINAIRES BEING MOUNTED ON ONLY ONE SIDE OF THE TRUSS.
  - LUMINAIRES AND SUPPORT ARM WEIGHT OF 400 LBS AND WIND AREA OF 9.92 SF (FOR BOTH TRUCK GUST AND NORMAL WIND LOADS).
  - CATWALKS WERE NOT CONSIDERED FOR THESE STRUCTURES. DESIGNER MUST CHECK STRUCTURES FOR CATWALKS WHEN REQUIRED BY DISTRICT ENGINEER.
  - HEIGHT ABOVE GROUND FOR NORMAL WIND PRESSURE CALCULATION WAS ASSUMED TO BE 33 FT.
  - TRAFFIC DESIGN SPEED OF 70 MPH WAS USED FOR TRUCK GUST LOAD CALCULATION.
  - SOIL FRICTION COEFFICIENT OF TAN(30°) 0.58 WAS USED FOR SLIDING RESISTANCE.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f’c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS AND CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB.408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE DIAMETER OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE AS DETAILED IN BC-744M. IF THESE MINIMUMS ARE NOT PROVIDED, BOLT BEARING MUST BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. ANCHOR BOLTS WERE DESIGNED AND DETAILED IN ACCORDANCE WITH ACI 318-14 AND AISC DESIGN GUIDE 1, 2ND EDITION. A MINIMUM EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS MUST BE PROVIDED.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS WITH THICKNESSES GREATER THAN 1/2" REQUIRE CHARPY V-NOTCH TESTING AND ARE DESIGNATED ON THE PLANS BY (CVN). PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, LOAD PATH REDUNDANT MEMBER AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
18. ONE TEST BORING SHALL BE PROVIDED AT EACH DRILLED CAISSON FOUNDATION LOCATION.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

| PENNDOT STD. DWGS. (U.N.O.) *                                                                                                                                                                                                                            |                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SIGN PANELS<br>LIGHT FIXTURES<br>SIGN SUPPORT BEAM<br>COLUMNS, STRUTS                                                                                                                                                                                    | TC-8701E OR TC-8701S<br>BC-744M, SHT. 12<br>BC-744M, SHT. 8<br>CALCULATED INTERNALLY WITHIN PROGRAM                                                                     |
| AASHTO LRFD SIGN                                                                                                                                                                                                                                         |                                                                                                                                                                         |
| BASIC WIND SPEED<br>SERVICE WIND SPEED<br>LIVE LOAD (CATWALKS ONLY)<br>MEAN WIND SPEED                                                                                                                                                                   | STR/EXT 120 MPH (1700 YR MR1)<br>SER 76 MPH (10 YR MR1)<br>500 LBS (AASHTO LRFD SIGN 3.6)<br>FAT 11.2 MPH                                                               |
| AASHTO LRFD SIGN 3.4                                                                                                                                                                                                                                     |                                                                                                                                                                         |
| AASHTO LRFD SIGN                                                                                                                                                                                                                                         |                                                                                                                                                                         |
| SECTION PROPERTIES FOR TUBULAR SHAPES<br>COMBINED FORCE INTERACTIONS<br>FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)<br>ALLOWABLE DEFLECTION<br>PERMANENT CAMBER<br>STRUCTURAL STEEL DESIGN                                                                | APPENDIX B, TABLE B.2.1<br>5.12<br>SECTION 11<br>10.4<br>10.5<br>SECTION 5                                                                                              |
| AASHTO LRFD BRIDGES (U.N.O.)                                                                                                                                                                                                                             |                                                                                                                                                                         |
| SLIP-CRITICAL BOLT<br>BOLT PRYING ACTION<br>COMBINED BOLT SHEAR AND TENSION<br>ANCHOR BOLT DESIGN                                                                                                                                                        | 6.13.2.8<br>6.13.2.10.4<br>6.13.2.11<br>SEE NOTE 15                                                                                                                     |
| AASHTO LRFD BRIDGES & ACI 318-14                                                                                                                                                                                                                         |                                                                                                                                                                         |
| BEARING RESISTANCE<br>SHEAR RESISTANCE OF FOOTINGS<br>SHEAR RESISTANCE OF CONCRETE<br>SLENDERNESS OF COLUMNS<br>MINIMUM REINF. OF FLEXURAL MEMBERS<br>SPACING LIMITS FOR REINFORCEMENT<br>MINIMUM CONCRETE COVER<br>TORSION<br>COLUMN DESIGN (PEDESTALS) | 5.6.5<br>5.7.1.4<br>5.7.1<br>5.6.4.3<br>DM-4, D5.6.3.3<br>DM-4, D5.10.3<br>DM-4, D5.10.1<br>5.7.2.1<br>5.6.4                                                            |
| AASHTO LRFD BRIDGES & ACI 318-14                                                                                                                                                                                                                         |                                                                                                                                                                         |
| MAXIMUM FACTORED BEARING RESISTANCE<br>MINIMUM AREA IN BEARING<br>UNIT WEIGHT OF SOIL<br>PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS<br>SLIDING RESISTANCE                                                                                               | 3 TONS PER SQUARE FOOT<br>75% (STRENGTH) 95% (SERVICE)<br>100 POUNDS PER CUBIC FOOT<br>DM-4, D10.6.1.4<br>DM-4, D10.6.3.4                                               |
| DM-4, SECTION 10.8                                                                                                                                                                                                                                       |                                                                                                                                                                         |
| MAXIMUM DESIGN LATERAL DISPLACEMENT<br>ANALYSES                                                                                                                                                                                                          | 0.5"<br>PENNDOT COM624 OR L-PILE                                                                                                                                        |
| AASHTO LRFD BRIDGES & ACI 318-14                                                                                                                                                                                                                         |                                                                                                                                                                         |
| SEISMIC DESIGN CRITERIA                                                                                                                                                                                                                                  | SEISMIC LOADS WERE NOT CONSIDERED IN THE DEVELOPMENT OF THIS STANDARD. THE DESIGNER MUST CHECK THE ADEQUACY OF THESE STANDARDS WHEN SEISMIC LOADS ARE TO BE CONSIDERED. |

\* LEGEND:

- AASHTO LRFD SIGN: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO LRFD BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-14).
- CVN: CHARPY V-NOTCH.
- AISC: AMERICAN INSTITUTE OF STEEL CONSTRUCTION - DESIGN GUIDE 1, BASE PLATE AND ANCHOR ROD DESIGN, 2ND EDITION

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORK: PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS & PIPE STRUTS:

SEE PUBLICATION 408, SECTION 948.2.

ANGLES, SHAPES, AND PLATES:

AASHTO M270, GRADE 36 OR 50  
ASTM A709, GRADE 36 OR 50
- ALTERNATE PRESS-BREAK MEMBERS: ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 3/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBERS FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR STRUTS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS:

ASTM F1554, GRADE 55 PER PUBLICATION 408  
SECTION 1105.02(c) 3.

BOLTS:

ASTM F3125, GRADE A325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS: AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 1ST EDITION, 2015 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, PENNDOT DESIGN MANUAL - PART 4, DECEMBER 2019 EDITION
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE ROLLING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE YEAR AND CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- CHANGEABLE MESSAGE SIGNS (CMS) ARE PROHIBITED ON 2-POST AND 4-POST TRI-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS.
- DURING THE REVIEW PROCESS OF THE SHOP DRAWINGS, CALLING FOR "VERIFICATION" OF AN ITEM, SIZE, DIMENSION, WELD, OR ANY DETAIL IS INSUFFICIENT. SUCH DETAILS AND/OR CORRECTIONS SHALL BE NOTED ON THE SHOP DRAWINGS BY THE REVIEWING AUTHORITY. ANY DISCREPANCIES OF QUESTIONS SHALL BE REFERRED TO PENNDOT FOR REVIEW AND RESOLUTION.
- IF CONTRACT DRAWINGS INDICATE A "SCALE" THEN ALL DETAILS, LAYOUTS OF SIGN PANELS/BOXES, SIGN/WALKWAY SUPPORTS, HANDRAILS AND ALL ITEMS RELATED TO THE STRUCTURE SHALL BE DEPICTED PER "SCALE" SHOWN.

|          |                                                                                            |
|----------|--------------------------------------------------------------------------------------------|
| TC-8700C | SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS                                  |
| TC-8701D | SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS                                            |
| TC-8701E | EXTRUDED ALUMINUM CHANNEL SIGN                                                             |
| TC-8701S | FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS                                |
| TC-8715  | SIGN LIGHTING                                                                              |
| BC-736M  | REINFORCEMENT BAR FABRICATION DETAILS                                                      |
| BC-744M  | OVERHEAD SIGN STRUCTURE - TWO POST AND FOUR POST TRICHORD TRUSS SPANS FROM 60 FT TO 200 FT |
| RC-11M   | CLASSIFICATION OF EARTHWORK FOR STRUCTURES                                                 |
| RC-51M   | TYPE 311 STRONG POST GUIDE RAIL                                                            |
| RC-53M   | TYPE 2 WEAK POST GUIDE RAIL                                                                |
| RC-54M   | BARRIER PLACEMENT AT OBSTRUCTIONS                                                          |
| RC-58M   | SINGLE FACE CONCRETE BARRIER                                                               |

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES

2 POST AND 4 POST TRI-CHORD TRUSS  
SPANS FROM 60’ TO 200’

NOTES AND DESIGN CRITERIA

RECOMMENDED JUL.10, 2025

RECOMMENDED JUL.10, 2025

SHT. 1 OF 10

CHIEF BRIDGE ENGINEER

CHIEF EXECUTIVE, HIGHWAY ADMIN.

BD-644M

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION APPROXIMATELY 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:

1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
4. THE SIGN AREA CALCULATED FOR MULTIPLE SIGN PANELS AS DESCRIBED BELOW.

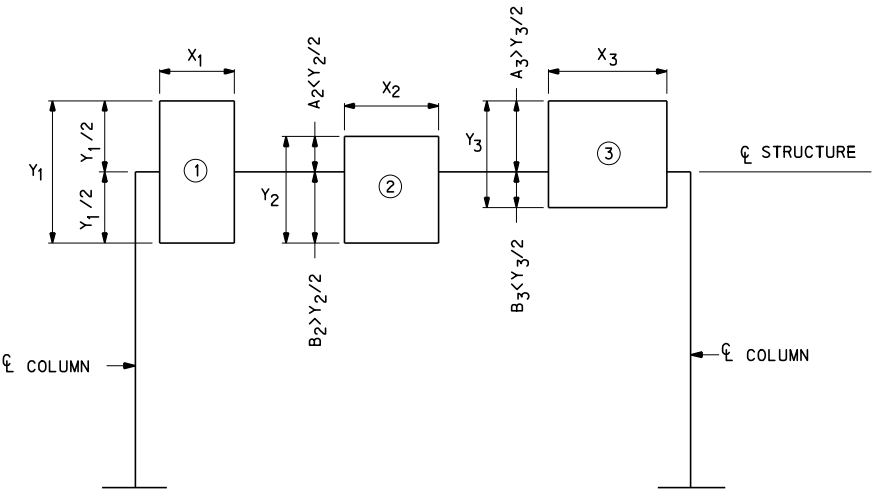
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.

- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

THE SIGN AREA FOR ANY SIGN PANEL OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

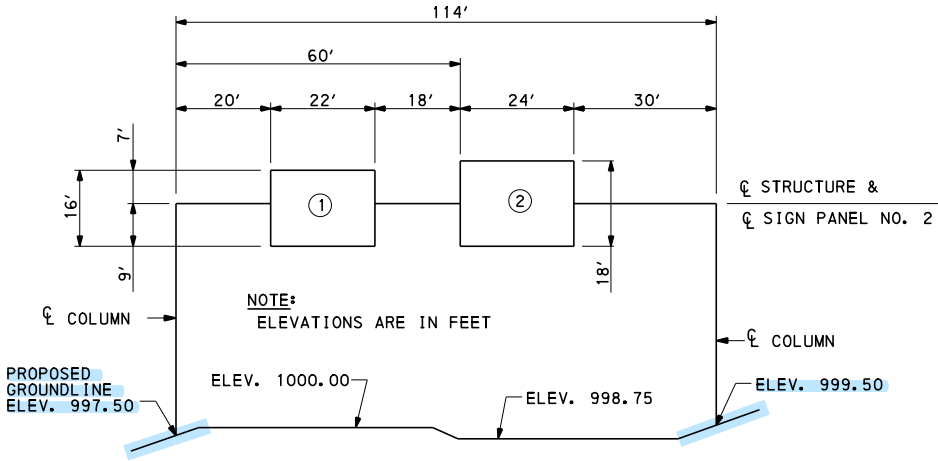
EXAMPLE:  
AREA OF SIGN NO. 1 = (X<sub>1</sub>) x (Y<sub>1</sub>)  
AREA OF SIGN NO. 2 = (X<sub>2</sub>) x (B<sub>2</sub>) x 2  
AREA OF SIGN NO. 3 = (X<sub>3</sub>) x (A<sub>3</sub>) x 2



A = DISTANCE FROM CL STRUCTURE TO TOP OF SIGN  
B = DISTANCE FROM CL STRUCTURE TO BOTTOM OF SIGN  
DESIGN AREA OF SIGN NO.1 = X<sub>1</sub>Y<sub>1</sub>  
DESIGN AREA OF SIGN NO.2 = (X<sub>2</sub>B<sub>2</sub>)x2  
DESIGN AREA OF SIGN NO.3 = (X<sub>3</sub>A<sub>3</sub>)x2

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT.)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN, SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- DESIGNS FOR ALL SIGNS PRESENTED IN THE TABLES IN BD-644M, ALLOW FOR THE LOCATION OF THE CENTROID OF SIGN AREA TO BE LOCATED HORIZONTALLY ANYWHERE ALONG THE LENGTH OF THE SIGN STRUCTURE.
- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL DISTANCE BETWEEN CENTERLINE OF COLUMNS ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL MAXIMUM HEIGHT FROM THE TOP OF LOWER BASE PLATE TO CENTER OF TRUSS ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING  
SIGN AREA, SPAN LENGTH, & POST HEIGHT



- $\Delta \text{ELEV.} = 1000.00 - 998.75 = 1.25 < 2'-6"$
- $Y_1 = 16'$   
 $Y_2 = 18'$  }  $Y_1 < Y_2$  } **USE CASE B**
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION  
ELEV.  $1000.00 + 17'-6" + 1'-9" = 1019.25$   
[1'-9" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]
- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2  
ELEV.  $1019.25 + 18'/2 = 1028.25$
- ACTUAL SPAN LENGTH = 114' → **USE: 120'**
- DESIGN COLUMN HEIGHT (H):  
 $H = 1028.25 - 997.50 - 0.50' = 30.25'$  → **USE H = OVER 24' TO 33'**  
[0.50' = MINIMUM HEIGHT OF PEDESTAL ABOVE GRADE]
- CL SIGN TO BOTTOM OF CATWALK IS  $9'-0" + 1'-8\frac{7}{8}" = 10'-8\frac{7}{8}"$
- 1/2 STRUCTURE DEPTH IS  $2'-7\frac{1}{2}"$ . THEREFORE FROM THE DESIGN TABLES, IT IS DETERMINED THAT THE TOTAL STRUCTURE DEPTH IS 5'-3"
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:  
 $A_1 = 22' \times 9' \times 2 = 396.0 \text{ SF}$   
 $A_2 = 24' \times 18' = 432.0 \text{ SF}$   
 $828.0 \text{ SF}$   
→ **USE 830.0 SF**

COMMONWEALTH OF PENNSYLVANIA  
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BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES  
2 POST AND 4 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 200'

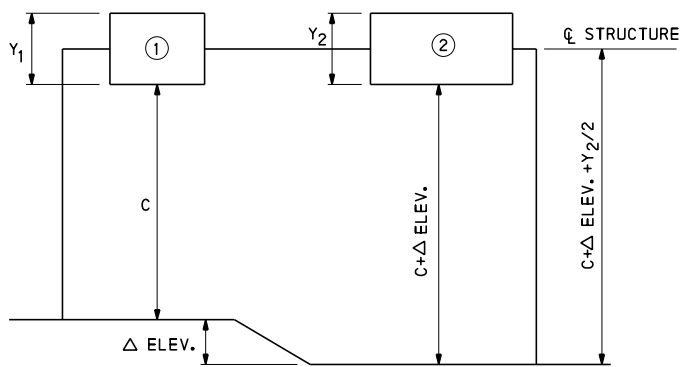
DESIGN INSTRUCTIONS

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
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SHT. 2 OF 10  
BD-644M

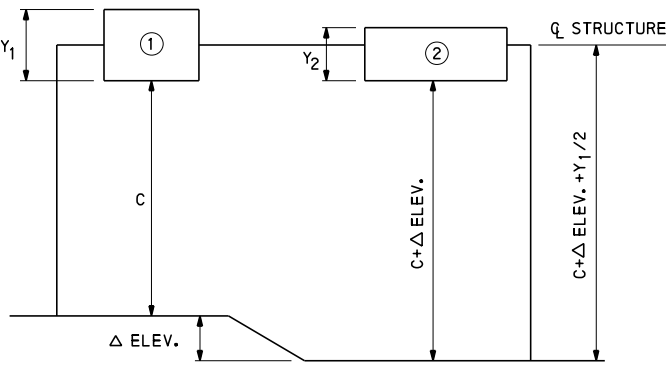




CASE A

$$Y_1 = Y_2$$
$$\Delta \text{ ELEV.} \leq 2' - 6"$$

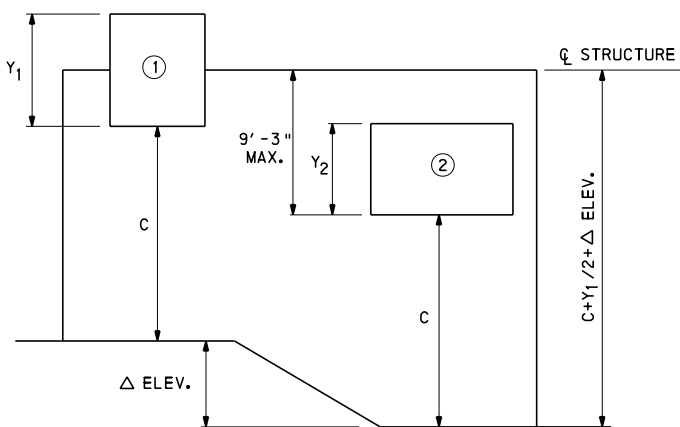
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANELS UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.



CASE C

$$Y_1 \geq Y_2$$
$$\Delta \text{ ELEV.} \leq 2' - 6"$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.  
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF  $Y_1$  AND  $Y_2$  WHERE  $Y_1 \geq Y_2$ .



CASE E

$$Y_1 \geq Y_2$$
$$\Delta \text{ ELEV.} > 2' - 6"$$

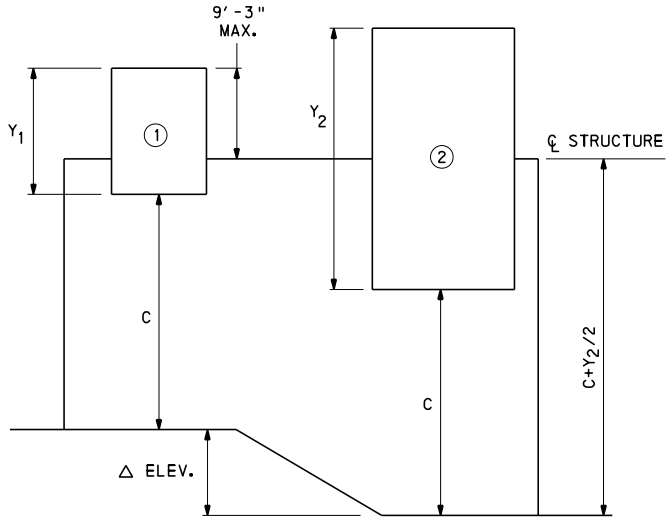
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.  
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF  $\Delta \text{ ELEV.}$  AND  $Y_2$  WHERE  $Y_1 \geq Y_2$ :

| $\Delta \text{ ELEV.}$ | $Y_{1,2}$           |
|------------------------|---------------------|
| 3' - 0"                | 6' - 0" TO 12' - 6" |
| 4' - 0"                | 6' - 0" TO 10' - 6" |
| 5' - 0"                | 6' - 0" TO 8' - 6"  |
| 6' - 0"                | 6' - 0" TO 6' - 6"  |
| 6' - 3"                | 6' - 0"             |

WHEN  $Y_{1,2}$  EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF  $\Delta \text{ ELEV.}$ , THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

**NOTE:**

C IS VERTICAL CLEARANCE FROM ROADWAY TO BOTTOM OF STRUCTURE, SIGN PANEL, OR LUMINAIRE.



CASE F

$$Y_1 < Y_2$$
$$\Delta \text{ ELEV.} > 2' - 6"$$

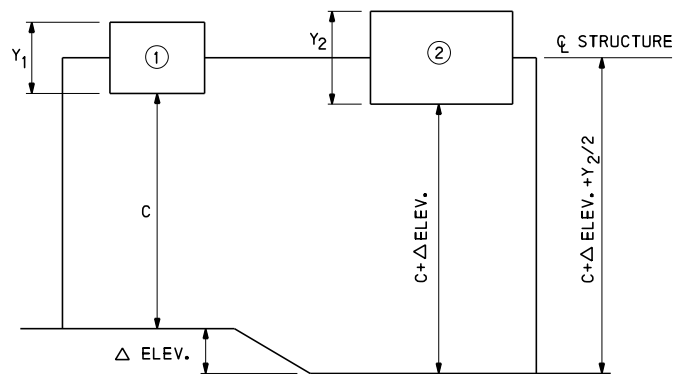
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.  
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF  $\Delta \text{ ELEV.}$ ,  $Y_1$ , AND  $Y_2$  WHERE  $Y_1 < Y_2$ :

| $\Delta \text{ ELEV.}$ | LIMITS OF $Y_1$ AND $Y_2$  |
|------------------------|----------------------------|
| 3' - 0"                | $2Y_1 - Y_2 \leq 12' - 6"$ |
| 4' - 0"                | $2Y_1 - Y_2 \leq 10' - 6"$ |
| 5' - 0"                | $2Y_1 - Y_2 \leq 8' - 6"$  |
| 6' - 0"                | $2Y_1 - Y_2 \leq 6' - 6"$  |
| 7' - 0"                | $2Y_1 - Y_2 \leq 4' - 6"$  |

GENERAL EQUATION FOR CASE F:  
 $2(\Delta \text{ ELEV.}) + 2(Y_1) - Y_2 \leq 18' - 6"$

IF THE PARAMETERS OF THE GENERAL EQUATION ARE EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

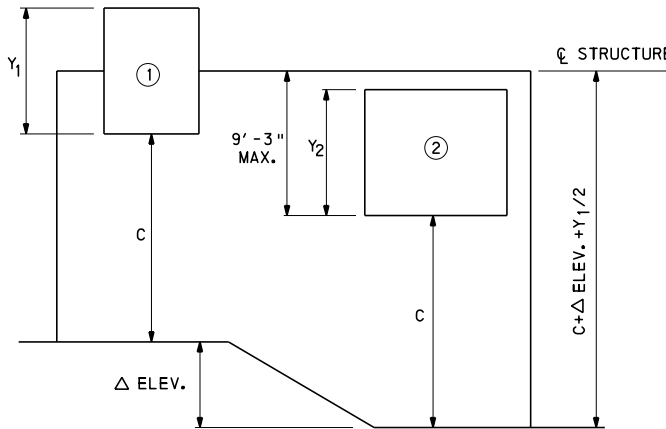
- 1) RESET  $\phi$  STRUCTURE SO THAT PARAMETERS ARE MET
- 2) USE SEPARATE STRUCTURES
- 3) USE A SPECIAL DESIGN
- 4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE OF 17' - 6" MUST BE MAINTAINED



CASE B

$$Y_1 \leq Y_2$$
$$\Delta \text{ ELEV.} \leq 2' - 6"$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 2 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.  
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF  $Y_1$  AND  $Y_2$  WHERE  $Y_1 \leq Y_2$ .



CASE D

$$Y_1 = Y_2$$
$$\Delta \text{ ELEV.} > 2' - 6"$$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.  
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF  $\Delta \text{ ELEV.}$  AND  $Y_{1,2}$ :

| $\Delta \text{ ELEV.}$ | $Y_{1,2}$           |
|------------------------|---------------------|
| 3' - 0"                | 6' - 0" TO 12' - 6" |
| 4' - 0"                | 6' - 0" TO 10' - 6" |
| 5' - 0"                | 6' - 0" TO 8' - 6"  |
| 6' - 0"                | 6' - 0" TO 6' - 6"  |
| 6' - 3"                | 6' - 0"             |

WHEN  $Y_{1,2}$  EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF  $\Delta \text{ ELEV.}$ , THIS CASE DOES NOT APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A SPECIAL DESIGN.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF BRIDGE**

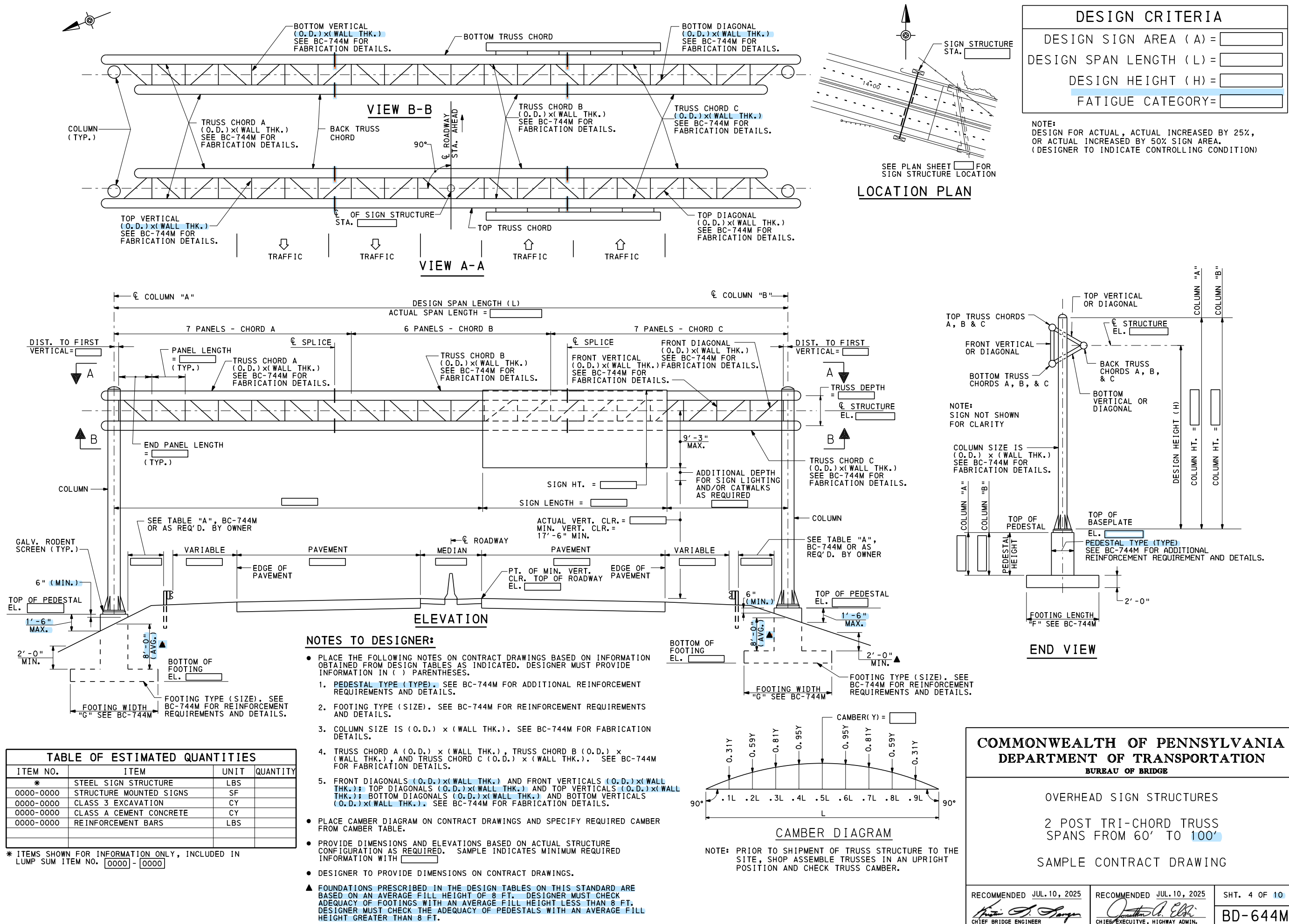
OVERHEAD SIGN STRUCTURES  
2 POST AND 4 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 200'

INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
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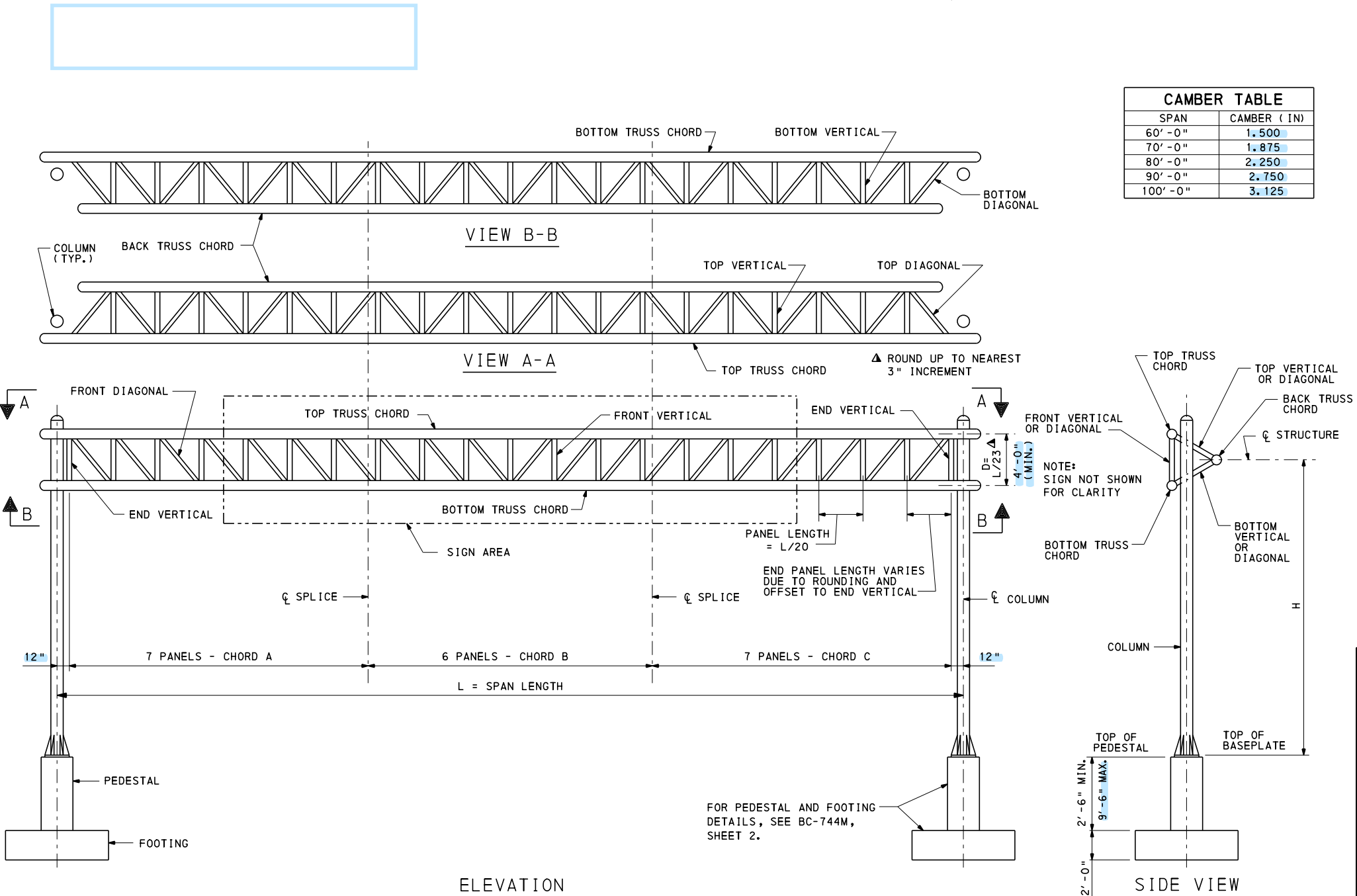
SHT. 3 OF 10  
BD-644M



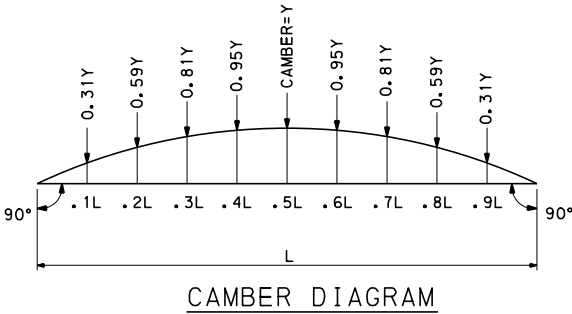
2 POST TRI-CHORD DESIGN TABLE

| DESIGN<br>SPAN<br>(L) | SIGN AREA<br>(SQ FT) | TRUSS MEMBERS |         |           |           |                 |           |                 |          | TOWER MEMBERS        |                      |                      |          | FOUNDATION           |                      |                      |          |                      |                      |                      |  |
|-----------------------|----------------------|---------------|---------|-----------|-----------|-----------------|-----------|-----------------|----------|----------------------|----------------------|----------------------|----------|----------------------|----------------------|----------------------|----------|----------------------|----------------------|----------------------|--|
|                       |                      | CHORDS        |         |           | DIAGONALS |                 | VERTICALS |                 |          | COLUMNS              |                      |                      |          | PEDESTAL TYPE        |                      |                      |          | FOOTING TYPE         |                      |                      |  |
|                       |                      | A             | B       | C         | FRONT     | TOP &<br>BOTTOM | FRONT     | TOP &<br>BOTTOM | H TO 12' | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' | H TO 12' | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' | H TO 12' | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' |  |
| TO 60'                | 125                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 12x. 375 | 14x. 437             | 18x. 375             | 24x. 375             | FP1      | FP2                  | FP2                  | FP4                  | 0811     | 0911                 | 0913                 | 1013                 |  |
|                       | 250                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 14x. 375 | 18x. 375             | 20x. 375             | 24x. 375             | FP2      | FP2                  | FP3                  | FP4                  | 0912     | 0914                 | 1014                 | 1115                 |  |
|                       | 375                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 18x. 312 | 20x. 375             | 24x. 375             | 24x. 500             | FP2      | FP3                  | FP4                  | FP4                  | 1013     | 1015                 | 1115                 | 1216                 |  |
|                       | 500                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 18x. 375 | 24x. 375             | 24x. 500             |                      | FP2      | FP4                  | FP4                  | FP4                  | 1015     | 1115                 | 1216                 |                      |  |
|                       | 625                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 20x. 375 | 24x. 375             | 24x. 500             |                      | FP3      | FP4                  | FP4                  |                      | 1115     | 1216                 | 1218                 |                      |  |
|                       | 750                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 500             | 24x. 562             |                      | FP4      | FP4                  | FP4                  |                      | 1215     | 1218                 | 1318                 |                      |  |
|                       | 875                  | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 500             | 24x. 562             |                      | FP4      | FP4                  | FP4                  |                      | 1216     | 1317                 | 1320                 |                      |  |
|                       | 1000                 | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1218     | 1319                 |                      |                      |  |
| OVER 60'<br>TO 70'    | 1110                 | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1317     | 1418                 |                      |                      |  |
|                       | 175                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 14x. 375 | 16x. 375             | 20x. 375             | 24x. 375             | FP2      | FP2                  | FP3                  | FP4                  | 0911     | 0913                 | 1013                 | 1015                 |  |
|                       | 300                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 16x. 375 | 20x. 375             | 24x. 375             | 24x. 500             | FP2      | FP3                  | FP4                  | FP4                  | 0913     | 1014                 | 1114                 | 1116                 |  |
|                       | 425                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 18x. 375 | 24x. 375             | 24x. 375             | 24x. 562             | FP2      | FP4                  | FP4                  | FP4                  | 1014     | 1114                 | 1116                 | 1217                 |  |
|                       | 550                  | 4x. 337       | 4x. 337 | 4x. 337   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 20x. 375 | 24x. 375             | 24x. 500             |                      | FP3      | FP4                  | FP4                  |                      | 1114     | 1117                 | 1217                 |                      |  |
|                       | 675                  | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 20x. 375 | 24x. 375             | 24x. 562             |                      | FP3      | FP4                  | FP4                  |                      | 1116     | 1217                 | 1317                 |                      |  |
|                       | 800                  | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1216     | 1317                 |                      |                      |  |
|                       | 925                  | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1218     | 1318                 |                      |                      |  |
|                       | 1050                 | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 562             |                      |                      | FP4      | FP4                  |                      |                      | 1317     | 1418                 |                      |                      |  |
|                       | 1175                 | 5x. 375       | 5x. 375 | 5x. 375   | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 2.5x. 203       | 24x. 375 | 24x. 562             |                      |                      | FP4      | FP4                  |                      |                      | 1319     | 1419                 |                      |                      |  |
| 1295                  | 5x. 375              | 5x. 375       | 5x. 375 | 2.5x. 203 | 2.5x. 203 | 2.5x. 203       | 2.5x. 203 | 24x. 500        | 24x. 562 |                      |                      | FP4                  | FP4      |                      |                      | 1320                 | 1421     |                      |                      |                      |  |

FOR CONTINUATION OF CHART, SEE SHEET 6



| CAMBER TABLE |             |
|--------------|-------------|
| SPAN         | CAMBER (IN) |
| 60'-0"       | 1.500       |
| 70'-0"       | 1.875       |
| 80'-0"       | 2.250       |
| 90'-0"       | 2.750       |
| 100'-0"      | 3.125       |



NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR GENERAL DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR. IN CASE OF THE ADDITION OR ELIMINATION OF SPLICES, THE HEAVIER CHORD MATERIAL MUST BE EXTENDED TOWARD THE LIGHTER CHORD MATERIAL TO THE DESIRED SPLICE LOCATION.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH X LENGTH (FOR EXAMPLE, FOOTING TYPE 1214 INDICATES A FOOTING 12'-0" WIDE X 14'-0" LONG). SEE BC-744M, SHEET 2 FOR FOUNDATION DETAILS.
- "PEDESTAL TYPE" DESIGNATES ALL DETAILS FOR THE PEDESTALS. SEE BC-744M, SHEET 2.
- FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.
- FOR STRUCTURAL DETAILS, SEE BC-744M.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").
- ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 100'

DESIGN TABLES

RECOMMENDED JUL. 10, 2025  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
CHIEF EXECUTIVE, HIGHWAY ADMIN.


SHT. 5 OF 10  
BD-644M

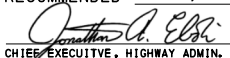
| 2 POST TRI-CHORD DESIGN TABLE ( CONTINUED) |                       |               |          |          |            |                 |            |                 |          |                      |                      |                      |          |                      |                      |                      |          |                      |                      |                      |
|--------------------------------------------|-----------------------|---------------|----------|----------|------------|-----------------|------------|-----------------|----------|----------------------|----------------------|----------------------|----------|----------------------|----------------------|----------------------|----------|----------------------|----------------------|----------------------|
| DESIGN<br>SPAN<br>( L )                    | SIGN AREA<br>( SQ FT) | TRUSS MEMBERS |          |          |            |                 |            |                 |          | TOWER MEMBERS        |                      |                      |          | FOUNDATION           |                      |                      |          |                      |                      |                      |
|                                            |                       | CHORDS        |          |          | DIAGONALS  |                 | VERTICALS  |                 |          | COLUMNS              |                      |                      |          | PEDESTAL TYPE        |                      |                      |          | FOOTING TYPE         |                      |                      |
|                                            |                       | A             | B        | C        | FRONT      | TOP &<br>BOTTOM | FRONT      | TOP &<br>BOTTOM | H TO 12' | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' | H TO 12' | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' | H TO 12' | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' |
| OVER 70'<br>TO 80'                         | 150                   | 4x. 337       | 4x. 337  | 4x. 337  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 14x. 375 | 16x. 375             | 20x. 312             | 24x. 375             | FP2      | FP2                  | FP3                  | FP4                  | 0812     | 0912                 | 1013                 | 1015                 |
|                                            | 300                   | 4x. 337       | 4x. 337  | 4x. 337  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 16x. 375 | 20x. 375             | 24x. 375             | 24x. 500             | FP2      | FP3                  | FP4                  | FP4                  | 0914     | 1014                 | 1114                 | 1117                 |
|                                            | 450                   | 4x. 337       | 4x. 337  | 4x. 337  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 18x. 375 | 24x. 375             | 24x. 500             |                      | FP2      | FP4                  | FP4                  |                      | 1015     | 1115                 | 1217                 |                      |
|                                            | 600                   | 5x. 375       | 5x. 375  | 5x. 375  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 20x. 375 | 24x. 375             | 24x. 562             |                      | FP3      | FP4                  | FP4                  |                      | 1115     | 1216                 | 1218                 |                      |
|                                            | 750                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1216     | 1318                 |                      |                      |
|                                            | 900                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1218     | 1318                 |                      |                      |
|                                            | 1050                  | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 562             |                      |                      | FP4      | FP4                  |                      |                      | 1317     | 1418                 |                      |                      |
| OVER 80'<br>TO 90'                         | 1480                  | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 276      | 2. 5x. 203 | 2. 5x. 203      | 24x. 500 |                      |                      |                      | FP4      |                      |                      |                      | 1420     |                      |                      |                      |
|                                            | 150                   | 4x. 337       | 4x. 337  | 4x. 337  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 14x. 375 | 18x. 312             | 20x. 375             | 24x. 375             | FP2      | FP2                  | FP3                  | FP4                  | 0911     | 0913                 | 1013                 | 1114                 |
|                                            | 300                   | 4x. 337       | 4x. 337  | 4x. 337  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 18x. 312 | 20x. 375             | 24x. 375             | 24x. 500             | FP2      | FP3                  | FP4                  | FP4                  | 1013     | 1014                 | 1115                 | 1216                 |
|                                            | 450                   | 5x. 375       | 5x. 375  | 5x. 375  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 20x. 312 | 24x. 375             | 24x. 500             |                      | FP3      | FP4                  | FP4                  |                      | 1015     | 1116                 | 1216                 |                      |
|                                            | 600                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 20x. 375 | 24x. 500             | 24x. 562             |                      | FP3      | FP4                  | FP4                  |                      | 1116     | 1216                 | 1317                 |                      |
|                                            | 750                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1216     | 1317                 |                      |                      |
|                                            | 900                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 562             |                      |                      | FP4      | FP4                  |                      |                      | 1318     | 1319                 |                      |                      |
|                                            | 1200                  | 8x. 406       | 8x. 406  | 8x. 406  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 500 |                      |                      |                      | FP4      |                      |                      |                      | 1320     |                      |                      |                      |
|                                            | 1350                  | 8x. 406       | 8x. 406  | 8x. 406  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 500 |                      |                      |                      | FP4      |                      |                      |                      | 1419     |                      |                      |                      |
| OVER 90'<br>TO 100'                        | 1500                  | 10x. 365      | 10x. 365 | 10x. 365 | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 562 |                      |                      |                      | FP4      |                      |                      |                      | 1421     |                      |                      |                      |
|                                            | 200                   | 4x. 337       | 4x. 337  | 4x. 337  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 14x. 437 | 18x. 375             | 24x. 375             | 24x. 375             | FP2      | FP2                  | FP4                  | FP4                  | 0913     | 1013                 | 1015                 | 1115                 |
|                                            | 350                   | 5x. 375       | 5x. 375  | 5x. 375  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 18x. 375 | 24x. 375             | 24x. 375             | 24x. 562             | FP2      | FP4                  | FP4                  | FP4                  | 1014     | 1114                 | 1116                 | 1217                 |
|                                            | 500                   | 5x. 375       | 5x. 375  | 5x. 375  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 20x. 375 | 24x. 375             | 24x. 500             |                      | FP3      | FP4                  | FP4                  |                      | 1115     | 1217                 | 1217                 |                      |
|                                            | 650                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1216     | 1218                 |                      |                      |
|                                            | 800                   | 6x. 432       | 6x. 432  | 6x. 432  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 375 | 24x. 500             |                      |                      | FP4      | FP4                  |                      |                      | 1218     | 1318                 |                      |                      |
|                                            | 1100                  | 8x. 406       | 8x. 406  | 8x. 406  | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 500 |                      |                      |                      | FP4      |                      |                      |                      | 1319     |                      |                      |                      |
|                                            | 1250                  | 10x. 365      | 10x. 365 | 10x. 365 | 2. 5x. 203 | 2. 5x. 203      | 2. 5x. 203 | 2. 5x. 203      | 24x. 500 |                      |                      |                      | FP4      |                      |                      |                      | 1418     |                      |                      |                      |
|                                            | 1400                  | 10x. 365      | 10x. 365 | 10x. 365 | 2. 5x. 203 | 2. 5x. 276      | 2. 5x. 203 | 2. 5x. 203      | 24x. 562 |                      |                      |                      | FP4      |                      |                      |                      | 1420     |                      |                      |                      |

- NOTE:**
- FOR DESIGN TABLE NOTES, SEE SHEET 5.
  - ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

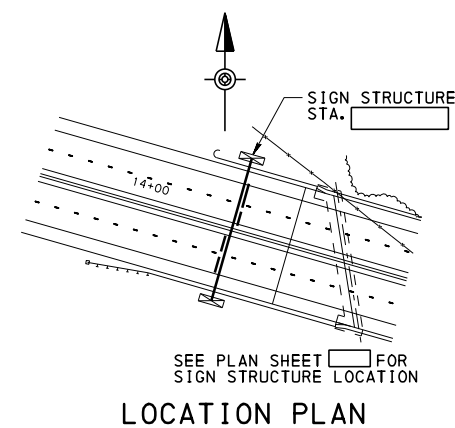
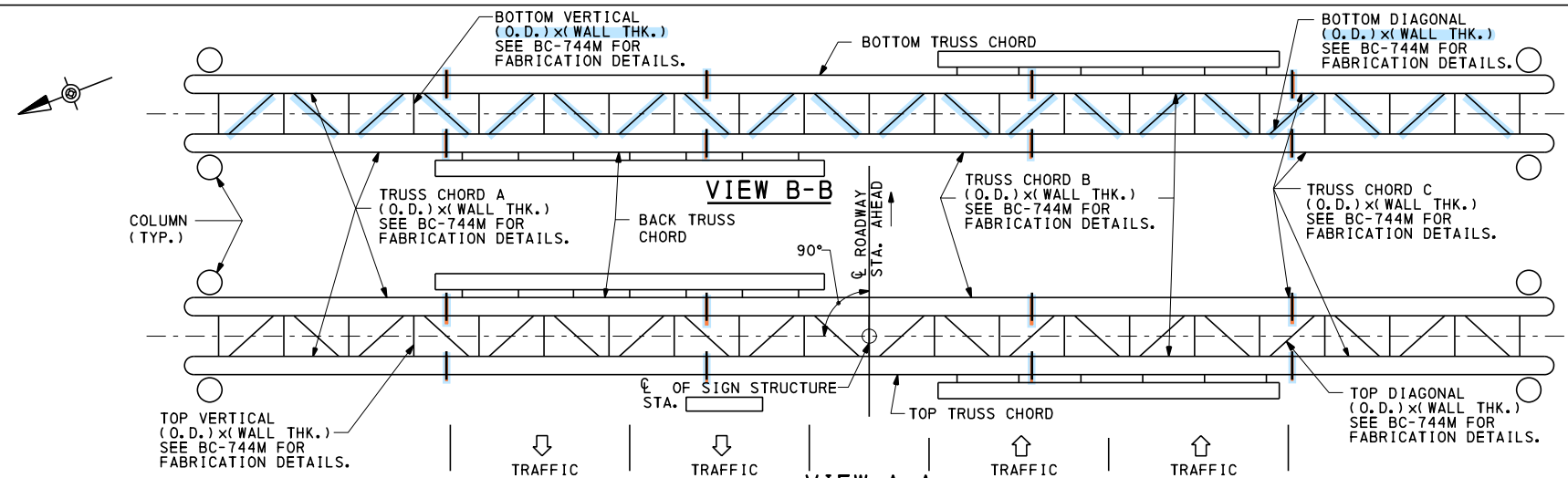
OVERHEAD SIGN STRUCTURES  
  
2 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 100'  
  
DESIGN TABLES

RECOMMENDED JUL.10, 2025  
  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025  
  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 6 OF 10  
BD-644M





### DESIGN CRITERIA

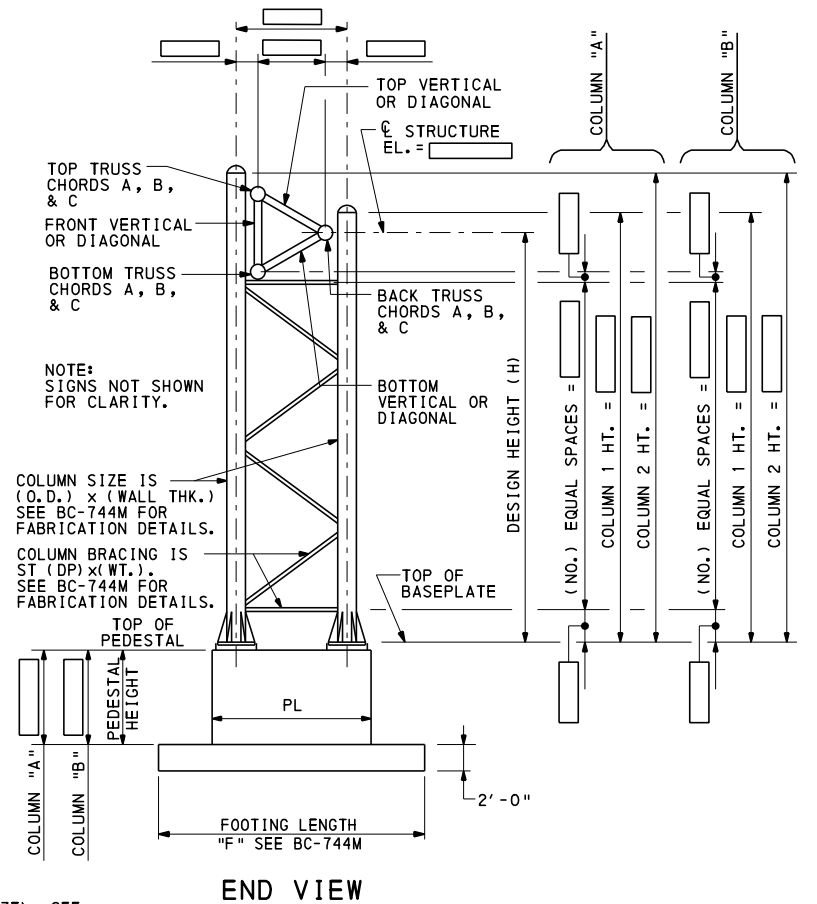
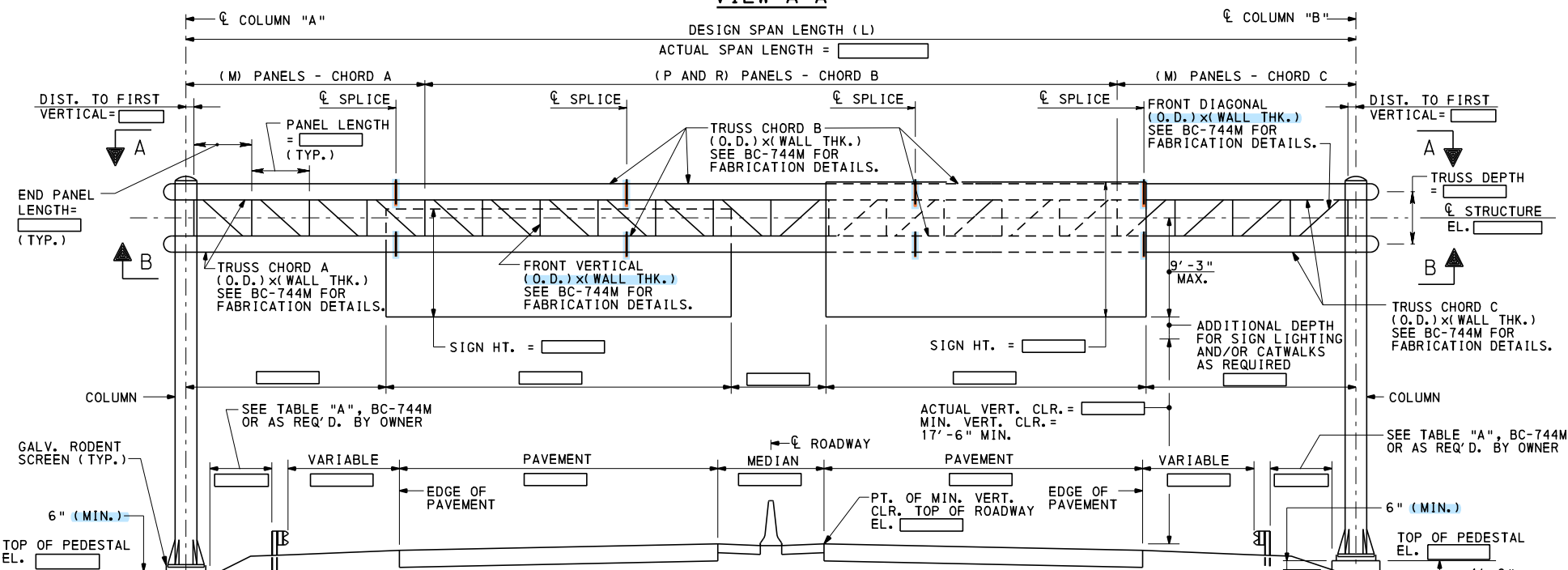
SIGN AREA (A) =

SPAN LENGTH (L) =

STRUCTURE HEIGHT (H) =

FATIGUE CATEGORY =

NOTE: DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%, OR ACTUAL INCREASED BY 50% SIGN AREA. (DESIGNER TO INDICATE CONTROLLING CONDITION)

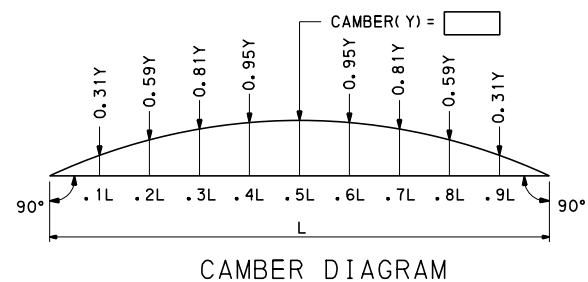


#### NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  - PEDESTAL TYPE (TYPE). SEE BC-744M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  - FOOTING TYPE (SIZE). SEE BC-744M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  - COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-744M FOR FABRICATION DETAILS.
  - COLUMN BRACING IS ST (DP) x (WT.). SEE BC-744M FOR FABRICATION DETAILS.
  - TRUSS CHORD A (O.D.) x (WALL THK.), TRUSS CHORD B (O.D.) x (WALL THK.), TRUSS CHORD C (O.D.) x (WALL THK.), TOP DIAGONALS (O.D.) x (WALL THK.), AND TOP VERTICALS (O.D.) x (WALL THK.); BOTTOM DIAGONALS (O.D.) x (WALL THK.) AND BOTTOM VERTICALS (O.D.) x (WALL THK.). SEE BC-744M FOR FABRICATION DETAILS.
- PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM CAMBER TABLE.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH .
- DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS.
- FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.

| TABLE OF ESTIMATED QUANTITIES |                         |      |          |
|-------------------------------|-------------------------|------|----------|
| ITEM NO.                      | ITEM                    | UNIT | QUANTITY |
| * 0000-0000                   | STEEL SIGN STRUCTURE    | LBS  |          |
| 0000-0000                     | STRUCTURE MOUNTED SIGNS | SF   |          |
| 0000-0000                     | CLASS 3 EXCAVATION      | CY   |          |
| 0000-0000                     | CLASS A CEMENT CONCRETE | CY   |          |
| 0000-0000                     | REINFORCEMENT BARS      | LBS  |          |

\* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 0000-0000.



NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES

4 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 200'

SAMPLE CONTRACT DRAWING

RECOMMENDED JUL. 10, 2025  
CHIEF BRIDGE ENGINEER

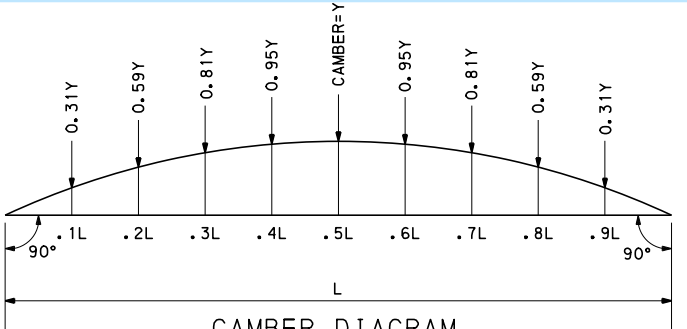
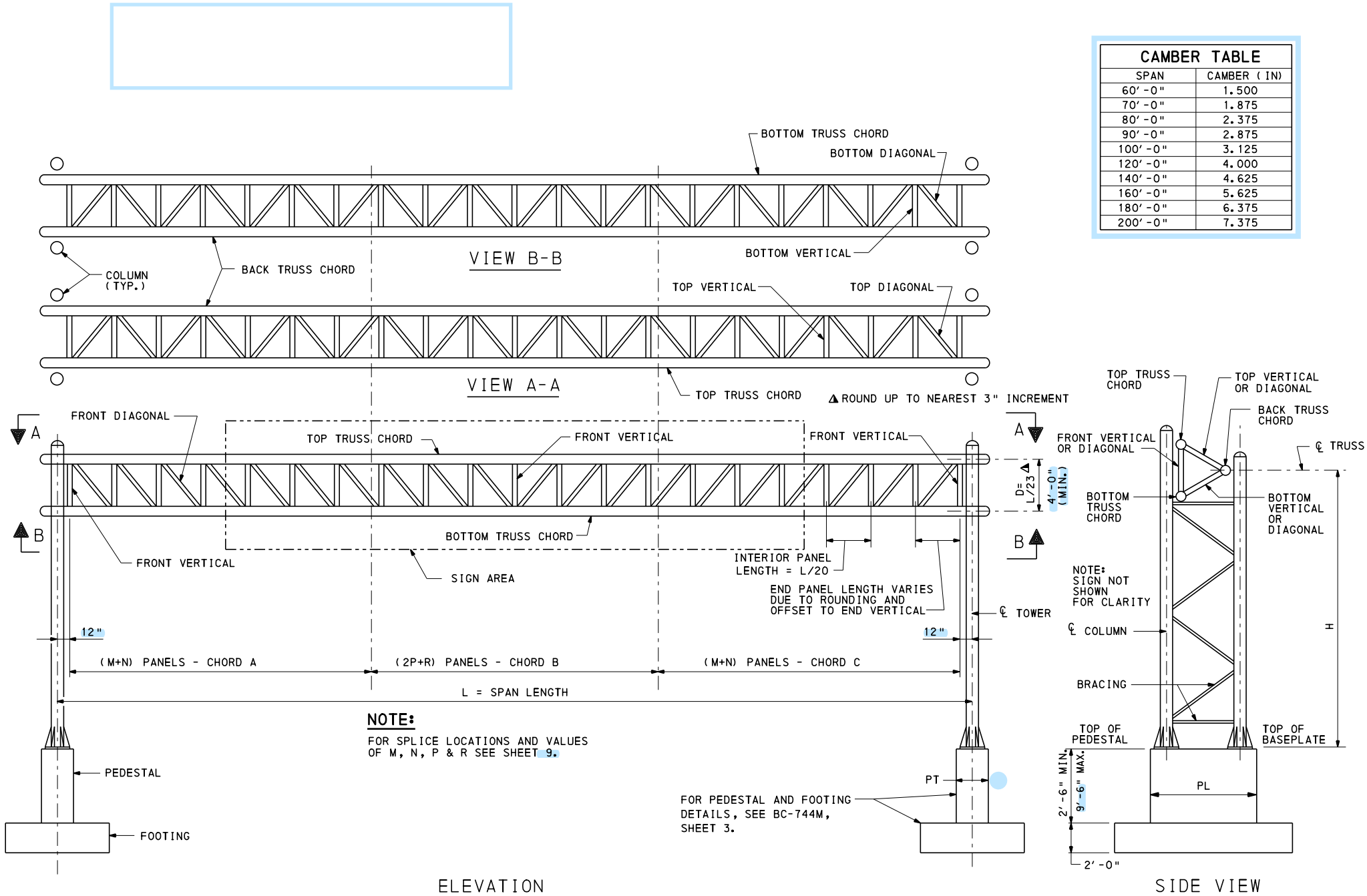
RECOMMENDED JUL. 10, 2025  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 7 OF 10  
BD-644M

4 POST TRI-CHORD DESIGN TABLE

| DESIGN SPAN (L) | SIGN AREA (SQ FT) | TRUSS MEMBERS |         |         |           |              |           |              |          | TOWER MEMBERS |                   |                   |                   |                   |                   |                   |          | FOUNDATION        |                   |                   |          |                   |                   |                   |  |
|-----------------|-------------------|---------------|---------|---------|-----------|--------------|-----------|--------------|----------|---------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------|-------------------|-------------------|-------------------|----------|-------------------|-------------------|-------------------|--|
|                 |                   | CHORDS        |         |         | DIAGONALS |              | VERTICALS |              |          | H TO 12'      |                   | H OVER 12' TO 18' |                   | H OVER 18' TO 24' |                   | H OVER 24' TO 33' |          | PEDESTAL TYPE     |                   |                   |          | FOOTING TYPE      |                   |                   |  |
|                 |                   | A             | B       | C       | FRONT     | TOP & BOTTOM | FRONT     | TOP & BOTTOM | H TO 12' |               | H OVER 12' TO 18' |                   | H OVER 18' TO 24' |                   | H OVER 24' TO 33' |                   | H TO 12' | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' | H TO 12' | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' |  |
|                 |                   |               |         |         |           |              |           |              | COLUMN   | BRACING       | COLUMN            | BRACING           | COLUMN            | BRACING           | COLUMN            | BRACING           |          |                   |                   |                   |          |                   |                   |                   |  |
| TO 60'          | 125               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 10x. 365 | 2x4. 75       | 12x. 330          | 2.5x5             | 16x. 375          | 3x6. 25           | 24x. 375          | 4x9. 2            | FP109    | FP109             | FP210             | FP411             | 0811     | 0812              | 0913              | 1014              |  |
|                 | 250               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 10x. 365 | 2. 5x5        | 12x. 330          | 3x6. 25           | 16x. 375          | 3x6. 25           | 24x. 375          | 4x9. 2            | FP109    | FP109             | FP210             | FP411             | 0912     | 0914              | 1014              | 1115              |  |
|                 | 375               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 12x. 330 | 3x6. 25       | 14x. 375          | 3x6. 25           | 16x. 375          | 3x8. 625          | 24x. 375          | 4x9. 2            | FP109    | FP210             | FP210             | FP411             | 0914     | 1014              | 1115              | 1216              |  |
|                 | 500               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 12x. 375 | 3x6. 25       | 16x. 375          | 3x8. 625          | 18x. 375          | 4x9. 2            | 24x. 375          | 4x9. 2            | FP109    | FP210             | FP210             | FP411             | 1014     | 1115              | 1216              | 1317              |  |
|                 | 625               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 14x. 375 | 3x8. 625      | 16x. 375          | 4x9. 2            | 18x. 375          | 4x9. 2            | 24x. 375          | 4x9. 2            | FP210    | FP210             | FP210             | FP411             | 1114     | 1117              | 1218              | 1319              |  |
|                 | 750               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 14x. 375 | 3x8. 625      | 18x. 375          | 4x9. 2            | 20x. 375          | 4x9. 2            | 24x. 375          | 4x11. 5           | FP210    | FP210             | FP311             | FP411             | 1116     | 1217              | 1318              | 1419              |  |
|                 | 875               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 16x. 375 | 3x8. 625      | 18x. 375          | 4x9. 2            | 24x. 375          | 5x12. 7           | 24x. 500          | 4x11. 5           | FP210    | FP210             | FP411             | FP411             | 1216     | 1317              | 1320              | 1421              |  |
|                 | 1000              | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 16x. 375 | 4x9. 2        | 20x. 375          | 4x9. 2            | 24x. 375          | 5x12. 7           | 24x. 500          | 5x12. 7           | FP210    | FP311             | FP411             | FP411             | 1217     | 1318              | 1419              | 1521              |  |
| OVER 60' TO 70' | 1100              | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 18x. 375 | 3x8. 625      | 20x. 375          | 4x9. 2            | 24x. 375          | 5x12. 7           | 24x. 500          | 5x12. 7           | FP210    | FP311             | FP411             | FP411             | 1218     | 1319              | 1420              | 1523              |  |
|                 | 175               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 10x. 365 | 2x4. 75       | 12x. 330          | 2.5x5             | 16x. 375          | 3x6. 25           | 24x. 375          | 4x9. 2            | FP109    | FP109             | FP210             | FP411             | 0812     | 0912              | 1014              | 1114              |  |
|                 | 300               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 10x. 365 | 3x6. 25       | 12x. 375          | 3x6. 25           | 16x. 375          | 3x6. 25           | 24x. 375          | 4x9. 2            | FP109    | FP109             | FP210             | FP411             | 0913     | 1014              | 1015              | 1117              |  |
|                 | 425               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 12x. 330 | 3x6. 25       | 14x. 375          | 3x8. 625          | 16x. 375          | 3x8. 625          | 24x. 375          | 4x9. 2            | FP109    | FP210             | FP210             | FP411             | 1014     | 1115              | 1116              | 1218              |  |
|                 | 550               | 4x. 337       | 4x. 337 | 4x. 337 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 12x. 375 | 3x8. 625      | 16x. 375          | 4x9. 2            | 18x. 375          | 4x9. 2            | 24x. 375          | 4x9. 2            | FP109    | FP210             | FP210             | FP411             | 1115     | 1116              | 1217              | 1318              |  |
|                 | 675               | 5x. 375       | 5x. 375 | 5x. 375 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 14x. 375 | 3x8. 625      | 18x. 375          | 4x9. 2            | 20x. 375          | 4x9. 2            | 24x. 375          | 4x11. 5           | FP210    | FP210             | FP311             | FP411             | 1115     | 1217              | 1317              | 1420              |  |
|                 | 800               | 5x. 375       | 5x. 375 | 5x. 375 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 16x. 375 | 4x9. 2        | 18x. 375          | 4x9. 2            | 20x. 375          | 5x12. 7           | 24x. 500          | 4x11. 5           | FP210    | FP210             | FP311             | FP411             | 1117     | 1218              | 1319              | 1420              |  |
|                 | 925               | 5x. 375       | 5x. 375 | 5x. 375 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 16x. 375 | 4x9. 2        | 20x. 375          | 4x9. 2            | 24x. 375          | 5x12. 7           | 24x. 500          | 5x12. 7           | FP210    | FP311             | FP411             | FP411             | 1217     | 1318              | 1418              | 1520              |  |
|                 | 1050              | 5x. 375       | 5x. 375 | 5x. 375 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 18x. 375 | 4x9. 2        | 20x. 375          | 4x9. 2            | 24x. 375          | 5x12. 7           | 24x. 500          | 5x12. 7           | FP210    | FP311             | FP411             | FP411             | 1218     | 1319              | 1420              | 1522              |  |
|                 | 1175              | 5x. 375       | 5x. 375 | 5x. 375 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 18x. 375 | 4x9. 2        | 20x. 375          | 4x11. 5           | 24x. 375          | 5x12. 7           | 24x. 500          | 5x12. 7           | FP210    | FP311             | FP411             | FP411             | 1317     | 1418              | 1519              | 1524              |  |
|                 | 1295              | 5x. 375       | 5x. 375 | 5x. 375 | 2.5x. 203 | 2.5x. 203    | 2.5x. 203 | 2.5x. 203    | 18x. 375 | 4x9. 2        | 24x. 375          | 4x11. 5           | 24x. 500          | 5x12. 7           | 24x. 562          | 5x12. 7           | FP210    | FP411             | FP411             | FP411             | 1318     | 1419              | 1521              | 1526              |  |

FOR CONTINUATION OF CHART, SEE SHEETS 9 AND 10.

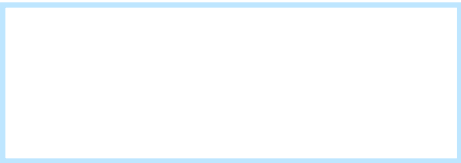


- NOTES:**
- FOR GENERAL NOTES, SEE SHEET 1.
  - FOR GENERAL DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
  - ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR. IN CASE OF THE ADDITION OR ELIMINATION OF SPLICES, THE HEAVIER CHORD MATERIAL MUST BE EXTENDED TOWARD THE LIGHTER CHORD MATERIAL TO THE DESIRED SPLICE LOCATION.
  - "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 0912 INDICATES A FOOTING 9'-0" WIDE x 12'-0" LONG). SEE BC-744M, SHEET 3 FOR FOUNDATION DETAILS.
  - "PEDESTAL TYPE" DESIGNATES ALL DETAILS FOR THE PEDESTALS. SEE BC-744M, SHEET 3.
  - FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.
  - FOR STRUCTURAL DETAILS, SEE BC-744M.
  - CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").
  - ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.
  - TOWER BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



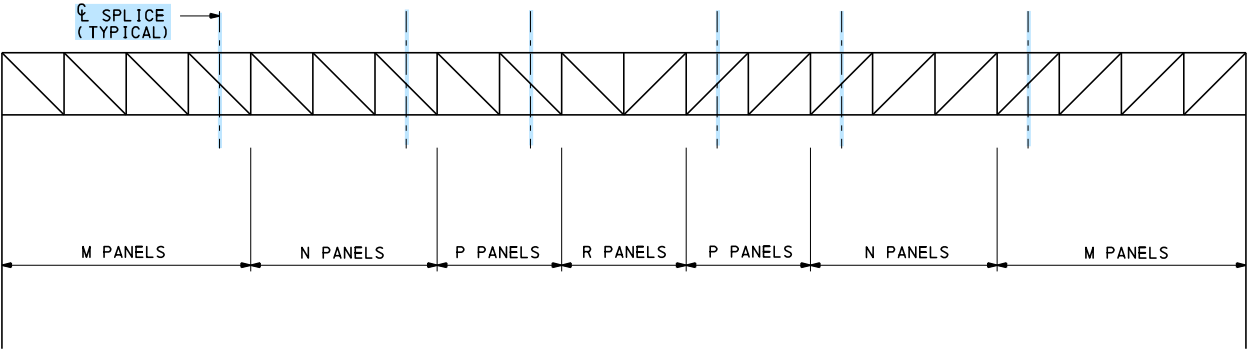
| 4 POST TRI-CHORD DESIGN TABLE ( CONTINUED) |                   |               |         |          |           |              |           |              |          |               |                   |                   |                   |                   |                   |                   |          |                   |                   |                   |          |                   |                   |                   |  |
|--------------------------------------------|-------------------|---------------|---------|----------|-----------|--------------|-----------|--------------|----------|---------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------|-------------------|-------------------|-------------------|----------|-------------------|-------------------|-------------------|--|
| DESIGN SPAN (L)                            | SIGN AREA (SQ FT) | TRUSS MEMBERS |         |          |           |              |           |              |          | TOWER MEMBERS |                   |                   |                   |                   |                   |                   |          | FOUNDATION        |                   |                   |          |                   |                   |                   |  |
|                                            |                   | CHORDS        |         |          | DIAGONALS |              | VERTICALS |              |          | H TO 12'      |                   | H OVER 12' TO 18' |                   | H OVER 18' TO 24' |                   | H OVER 24' TO 33' |          | PEDESTAL TYPE     |                   |                   |          | FOOTING TYPE      |                   |                   |  |
|                                            |                   | A             | B       | C        | FRONT     | TOP & BOTTOM | FRONT     | TOP & BOTTOM | H TO 12' |               | H OVER 12' TO 18' |                   | H OVER 18' TO 24' |                   | H OVER 24' TO 33' |                   | H TO 12' | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' | H TO 12' | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' |  |
|                                            |                   |               |         |          |           |              |           |              | COLUMN   | BRACING       | COLUMN            | BRACING           | COLUMN            | BRACING           | COLUMN            | BRACING           |          |                   |                   |                   |          |                   |                   |                   |  |
| OVER 70' TO 80'                            | 150               | 4x.337        | 4x.337  | 4x.337   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 10x.365  | 2x4.75        | 12x.330           | 2.5x5             | 16x.375           | 2.5x5             | 24x.375           | 4x9.2             | FP109    | FP109             | FP210             | FP411             | 0811     | 0912              | 0914              | 1015              |  |
|                                            | 300               | 4x.337        | 4x.337  | 4x.337   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 10x.365  | 3x6.25        | 12x.375           | 3x6.25            | 16x.375           | 3x6.25            | 24x.375           | 4x9.2             | FP109    | FP109             | FP210             | FP411             | 0913     | 1014              | 1114              | 1117              |  |
|                                            | 450               | 4x.337        | 4x.337  | 4x.337   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 12x.375  | 3x6.25        | 16x.375           | 3x8.625           | 18x.375           | 4x9.2             | 24x.375           | 4x9.2             | FP109    | FP210             | FP210             | FP411             | 1014     | 1115              | 1117              | 1218              |  |
|                                            | 600               | 5x.375        | 5x.375  | 5x.375   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 14x.375  | 3x8.625       | 16x.375           | 4x9.2             | 20x.375           | 4x9.2             | 24x.375           | 4x11.5            | FP210    | FP210             | FP311             | FP411             | 1115     | 1117              | 1218              | 1319              |  |
|                                            | 750               | 5x.375        | 5x.375  | 5x.375   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 16x.375  | 4x9.2         | 18x.375           | 4x9.2             | 20x.375           | 4x9.2             | 24x.375           | 5x12.7            | FP210    | FP210             | FP311             | FP411             | 1117     | 1218              | 1319              | 1420              |  |
|                                            | 900               | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 16x.375  | 4x9.2         | 20x.375           | 4x9.2             | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | FP210    | FP311             | FP412             | FP412             | 1217     | 1318              | 1320              | 1520              |  |
|                                            | 1050              | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 18x.375  | 4x9.2         | 20x.375           | 4x11.5            | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | FP210    | FP311             | FP412             | FP412             | 1218     | 1319              | 1420              | 1522              |  |
|                                            | 1200              | 6x.432        | 6x.432  | 6x.432   | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 18x.375  | 4x9.2         | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | 24x.562           | 5x12.7            | FP210    | FP412             | FP412             | FP412             | 1318     | 1419              | 1520              | 1525              |  |
|                                            | 1350              | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 20x.375  | 4x9.2         | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | 24x.562           | 5x12.7            | FP311    | FP412             | FP412             | FP412             | 1319     | 1420              | 1521              | 1527              |  |
| 1480                                       | 6x.432            | 6x.432        | 6x.432  | 2.5x.276 | 2.5x.276  | 2.5x.276     | 2.5x.276  | 20x.375      | 4x9.2    | 24x.375       | 5x12.7            | 24x.500           | 5x12.7            |                   |                   | FP311             | FP412    | FP412             |                   | 1418              | 1519     | 1523              |                   |                   |  |
| OVER 80' TO 90'                            | 150               | 4x.337        | 4x.337  | 4x.337   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 10x.365  | 2x4.75        | 12x.330           | 2.5x5             | 16x.375           | 3x6.25            | 24x.375           | 4x9.2             | FP109    | FP109             | FP210             | FP411             | 0812     | 0912              | 1013              | 1114              |  |
|                                            | 300               | 4x.337        | 4x.337  | 4x.337   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 10x.365  | 3x6.25        | 14x.375           | 3x6.25            | 16x.375           | 3x8.625           | 24x.375           | 4x9.2             | FP109    | FP210             | FP210             | FP411             | 0913     | 1014              | 1115              | 1216              |  |
|                                            | 450               | 5x.375        | 5x.375  | 5x.375   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 12x.375  | 3x6.25        | 16x.375           | 3x8.625           | 18x.375           | 4x9.2             | 24x.375           | 4x9.2             | FP109    | FP210             | FP210             | FP411             | 1014     | 1115              | 1117              | 1318              |  |
|                                            | 600               | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 14x.375  | 3x8.625       | 16x.375           | 4x9.2             | 20x.375           | 4x9.2             | 24x.375           | 4x11.5            | FP210    | FP210             | FP311             | FP412             | 1115     | 1117              | 1218              | 1320              |  |
|                                            | 750               | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 16x.375  | 4x9.2         | 18x.375           | 4x9.2             | 20x.375           | 4x9.2             | 24x.500           | 5x12.7            | FP210    | FP210             | FP311             | FP412             | 1117     | 1218              | 1319              | 1420              |  |
|                                            | 900               | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 16x.375  | 4x9.2         | 20x.375           | 4x9.2             | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | FP210    | FP311             | FP412             | FP412             | 1217     | 1318              | 1419              | 1521              |  |
|                                            | 1050              | 8x.406        | 8x.406  | 8x.406   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 18x.375  | 4x9.2         | 24x.375           | 5x12.7            | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | FP210    | FP412             | FP412             | FP412             | 1318     | 1319              | 1420              | 1522              |  |
|                                            | 1200              | 8x.406        | 8x.406  | 8x.406   | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 18x.375  | 4x9.2         | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | 24x.562           | 5x12.7            | FP210    | FP412             | FP412             | FP412             | 1318     | 1419              | 1520              | 1525              |  |
|                                            | 1350              | 8x.406        | 8x.406  | 8x.406   | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 20x.375  | 4x9.2         | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            |                   |                   | FP311    | FP412             | FP412             |                   | 1319     | 1420              | 1522              |                   |  |
|                                            | 1500              | 8x.406        | 8x.406  | 8x.406   | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 20x.375  | 4x9.2         | 24x.375           | 5x12.7            | 24x.500           | 6x15.9            |                   |                   | FP311    | FP412             | FP412             |                   | 1419     | 1520              | 1525              |                   |  |
| 1665                                       | 10x.365           | 10x.365       | 10x.365 | 2.5x.276 | 2.5x.276  | 2.5x.276     | 2.5x.276  | 24x.375      | 4x9.2    | 24x.500       | 5x12.7            | 24x.562           | 5x12.7            |                   |                   | FP412             | FP412    | FP412             |                   | 1420              | 1522     | 1526              |                   |                   |  |
| OVER 90' TO 100'                           | 200               | 4x.337        | 4x.337  | 4x.337   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 10x.365  | 2.5x5         | 12x.375           | 3x6.25            | 16x.375           | 3x6.25            | 24x.375           | 4x9.2             | FP109    | FP109             | FP210             | FP412             | 0912     | 0914              | 1014              | 1116              |  |
|                                            | 350               | 5x.375        | 5x.375  | 5x.375   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 12x.330  | 3x6.25        | 14x.375           | 3x8.625           | 16x.375           | 3x8.625           | 24x.375           | 4x9.2             | FP109    | FP210             | FP210             | FP412             | 1013     | 1015              | 1116              | 1217              |  |
|                                            | 500               | 5x.375        | 5x.375  | 5x.375   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 14x.375  | 3x8.625       | 16x.375           | 4x9.2             | 18x.375           | 5x12.7            | 24x.375           | 4x11.5            | FP210    | FP210             | FP210             | FP412             | 1115     | 1117              | 1217              | 1319              |  |
|                                            | 650               | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 14x.375  | 4x9.2         | 18x.375           | 5x12.7            | 20x.375           | 5x12.7            | 24x.375           | 5x12.7            | FP210    | FP210             | FP311             | FP412             | 1116     | 1217              | 1318              | 1419              |  |
|                                            | 800               | 6x.432        | 6x.432  | 6x.432   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 16x.375  | 4x9.2         | 20x.375           | 5x12.7            | 24x.375           | 5x12.7            | 24x.500           | 5x12.7            | FP210    | FP311             | FP412             | FP412             | 1217     | 1318              | 1320              | 1421              |  |
|                                            | 950               | 8x.406        | 8x.406  | 8x.406   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 18x.375  | 4x9.2         | 20x.375           | 5x12.7            | 20x.500           | 5x12.7            | 24x.500           | 6x15.9            | FP211    | FP311             | FP311             | FP412             | 1218     | 1319              | 1420              | 1522              |  |
|                                            | 1100              | 8x.406        | 8x.406  | 8x.406   | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 18x.375  | 4x11.5        | 24x.375           | 5x12.7            | 24x.500           | 6x15.9            | 24x.562           | 6x15.9            | FP211    | FP412             | FP412             | FP412             | 1318     | 1320              | 1421              | 1524              |  |
|                                            | 1250              | 8x.406        | 8x.406  | 8x.406   | 3x.300    | 3x.300       | 3x.300    | 3x.300       | 20x.375  | 5x12.7        | 24x.375           | 6x15.9            | 24x.500           | 6x15.9            | 24x.562           | 6x15.9            | FP311    | FP412             | FP412             | FP412             | 1320     | 1420              | 1521              | 1527              |  |
|                                            | 1400              | 8x.500        | 8x.500  | 8x.500   | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 20x.375  | 4x11.5        | 24x.375           | 6x15.9            | 24x.500           | 6x15.9            |                   |                   | FP311    | FP412             | FP412             |                   | 1419     | 1520              | 1524              |                   |  |
|                                            | 1550              | 8x.500        | 8x.500  | 8x.500   | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 24x.375  | 5x12.7        | 24x.500           | 6x15.9            | 24x.500           | 6x15.9            |                   |                   | FP412    | FP412             | FP412             |                   | 1421     | 1521              | 1526              |                   |  |
|                                            | 1700              | 8x.500        | 8x.500  | 8x.500   | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 20x.500  | 4x11.5        | 24x.500           | 6x15.9            | 24x.562           | 5x17.5            |                   |                   | FP311    | FP412             | FP412             |                   | 1421     | 1523              | 1528              |                   |  |
|                                            | 1850              | 8x.500        | 8x.500  | 8x.500   | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 20x.500  | 4x11.5        | 24x.500           | 6x15.9            | 24x.562           | 5x17.5            |                   |                   | FP311    | FP412             | FP412             |                   | 1520     | 1525              | 1530              |                   |  |

FOR CONTINUATION OF CHART, SEE SHEET 10.



NOTES:

- FOR DESIGN TABLE NOTES, SEE SHEET 8.
- ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.
- TOWER BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) X WEIGHT PER FOOT (WT).



| ACTUAL SPAN (FEET) | DESIGN SPAN (FEET) | NUMBER OF SPLICES | NO. OF PANELS |     |   |   |
|--------------------|--------------------|-------------------|---------------|-----|---|---|
|                    |                    |                   | M             | N** | P | R |
| UP TO 60           | 60                 | 2                 | 7             | 0   | 0 | 6 |
| 60+ TO 70          | 70                 | 2                 | 7             | 0   | 0 | 6 |
| 70+ TO 80          | 80                 | 2                 | 7             | 0   | 0 | 6 |
| 80+ TO 90          | 90                 | 2                 | 7             | 0   | 0 | 6 |
| 90+ TO 100         | 100                | 2                 | 7             | 0   | 0 | 6 |
| 100+ TO 120        | 120                | 3                 | 6             | 0   | 4 | 0 |
| 120+ TO 140        | 140                | 3                 | 5             | 0   | 5 | 0 |
| 140+ TO 160        | 160                | 3                 | 5             | 0   | 5 | 0 |
| 160+ TO 180        | 180                | 4                 | 4             | 0   | 4 | 4 |
| 180+ TO 200        | 200                | 4                 | 4             | 0   | 4 | 4 |

\*\* N PANELS CAN BE USED IF SPANS OVER 200 FT ARE REQUIRED.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES  
4 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 200'

DESIGN TABLE

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 9 OF 10  
BD-644M

| 4 POST TRI-CHORD DESIGN TABLE ( CONTINUED) |                           |               |         |         |           |                 |           |                 |               |         |                      |         |                      |         |                      |         |               |                      |                      |                      |              |                      |                      |                      |
|--------------------------------------------|---------------------------|---------------|---------|---------|-----------|-----------------|-----------|-----------------|---------------|---------|----------------------|---------|----------------------|---------|----------------------|---------|---------------|----------------------|----------------------|----------------------|--------------|----------------------|----------------------|----------------------|
| DESIGN<br>SPAN<br>( L )                    | SIGN<br>AREA<br>( SQ FT ) | TRUSS MEMBERS |         |         |           |                 |           |                 | TOWER MEMBERS |         |                      |         |                      |         |                      |         | FOUNDATION    |                      |                      |                      |              |                      |                      |                      |
|                                            |                           | CHORDS        |         |         | DIAGONALS |                 | VERTICALS |                 | H TO 12'      |         | H OVER<br>12' TO 18' |         | H OVER<br>18' TO 24' |         | H OVER<br>24' TO 33' |         | PEDESTAL TYPE |                      |                      |                      | FOOTING TYPE |                      |                      |                      |
|                                            |                           | A             | B       | C       | FRONT     | TOP &<br>BOTTOM | FRONT     | TOP &<br>BOTTOM | COLUMN        | BRACING | COLUMN               | BRACING | COLUMN               | BRACING | COLUMN               | BRACING | H TO 12'      | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' | H TO 12'     | H OVER<br>12' TO 18' | H OVER<br>18' TO 24' | H OVER<br>24' TO 33' |
| OVER 100'<br>TO 120'                       | 300                       | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 12x.375       | 4x9.2   | 14x.375              | 4x9.2   | 18x.375              | 4x9.2   | 24x.375              | 5x12.7  | FP110         | FP211                | FP211                | FP413                | 1013         | 1015                 | 1116                 | 1217                 |
|                                            | 600                       | 6x.432        | 6x.432  | 6x.432  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 16x.375       | 5x12.7  | 18x.375              | 5x12.7  | 20x.375              | 5x12.7  | 24x.375              | 5x12.7  | FP211         | FP211                | FP312                | FP413                | 1116         | 1217                 | 1318                 | 1419                 |
|                                            | 900                       | 8x.406        | 8x.406  | 8x.406  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 18x.375       | 5x12.7  | 20x.375              | 5x12.7  | 24x.375              | 6x15.9  | 24x.500              | 6x15.9  | FP211         | FP312                | FP413                | FP413                | 1218         | 1319                 | 1420                 | 1522                 |
|                                            | 1200                      | 8x.500        | 8x.500  | 8x.406  | 2.5x.276  | 2.5x.276        | 2.5x.276  | 2.5x.276        | 24x.375       | 5x12.7  | 24x.375              | 6x15.9  | 24x.500              | 6x15.9  |                      |         | FP413         | FP413                | FP413                |                      | 1420         | 1420                 | 1521                 |                      |
|                                            | 1500                      | 8x.500        | 8x.500  | 8x.500  | 2.5x.276  | 2.5x.276        | 2.5x.276  | 2.5x.276        | 24x.375       | 5x12.7  | 24x.500              | 6x15.9  | 24x.562              | 6x17.5  |                      |         | FP413         | FP413                | FP413                |                      | 1421         | 1521                 | 1525                 |                      |
|                                            | 1800                      | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.500       | 5x17.5  | 24x.500              | 6x17.5  |                      |         |                      |         | FP413         | FP413                |                      |                      | 1522         | 1525                 |                      |                      |
|                                            | 2100                      | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.500       | 5x17.5  | 24x.562              | 6x17.5  |                      |         |                      |         | FP413         | FP413                |                      |                      | 1524         | 1529                 |                      |                      |
|                                            | 2220                      | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.562       | 5x17.5  | 24x.562              | 6x17.5  |                      |         |                      |         | FP413         | FP413                |                      |                      | 1526         | 1530                 |                      |                      |
| OVER 120'<br>TO 140'                       | 300                       | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 12x.375       | 5x12.7  | 16x.375              | 5x12.7  | 18x.375              | 5x12.7  | 24x.375              | 5x12.7  | FP111         | FP212                | FP212                | FP413                | 1014         | 1115                 | 1117                 | 1218                 |
|                                            | 600                       | 6x.432        | 6x.432  | 6x.432  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 16x.375       | 5x12.7  | 20x.375              | 5x12.7  | 24x.375              | 6x15.9  | 24x.500              | 6x15.9  | FP212         | FP313                | FP413                | FP413                | 1117         | 1218                 | 1318                 | 1420                 |
|                                            | 900                       | 8x.406        | 8x.406  | 8x.406  | 2.5x.276  | 2.5x.276        | 2.5x.276  | 2.5x.276        | 20x.375       | 6x15.9  | 24x.375              | 6x15.9  | 24x.375              | 6x15.9  | 24x.562              | 6x20.4  | FP313         | FP414                | FP414                | FP414                | 1318         | 1320                 | 1420                 | 1522                 |
|                                            | 1200                      | 8x.500        | 8x.500  | 8x.500  | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.375       | 6x15.9  | 24x.375              | 6x20.4  | 24x.500              | 6x20.4  |                      |         | FP414         | FP414                | FP414                |                      | 1420         | 1521                 | 1523                 |                      |
|                                            | 1500                      | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.500       | 6x17.5  | 24x.500              | 6x20.4  |                      |         |                      |         | FP414         | FP414                |                      |                      | 1521         | 1523                 |                      |                      |
|                                            | 1800                      | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.562       | 6x17.5  | 24x.562              | 6x20.4  |                      |         |                      |         | FP414         | FP414                |                      |                      | 1525         | 1527                 |                      |                      |
|                                            | 2100                      | 10x.500       | 10x.500 | 10x.500 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.562       | 6x17.5  |                      |         |                      |         |                      |         | FP414         |                      |                      |                      | 1527         |                      |                      |                      |
|                                            | 2220                      | 10x.500       | 10x.500 | 10x.500 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.562       | 6x17.5  |                      |         |                      |         |                      |         | FP414         |                      |                      |                      | 1528         |                      |                      |                      |
| OVER 140'<br>TO 160'                       | 300                       | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 14x.375       | 5x12.7  | 16x.375              | 5x12.7  | 18x.375              | 5x12.7  | 24x.375              | 9x27.35 | FP212         | FP212                | FP213                | FP414                | 1015         | 1115                 | 1216                 | 1318                 |
|                                            | 600                       | 6x.432        | 6x.432  | 6x.432  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 18x.375       | 5x12.7  | 20x.375              | 6x15.9  | 20x.500              | 9x27.35 | 24x.500              | 9x27.35 | FP213         | FP313                | FP313                | FP414                | 1216         | 1218                 | 1319                 | 1421                 |
|                                            | 900                       | 10x.365       | 10x.365 | 10x.365 | 2.5x.276  | 2.5x.276        | 2.5x.276  | 2.5x.276        | 24x.375       | 5x12.7  | 24x.375              | 6x17.5  | 24x.500              | 9x27.35 | 24x.562              | 9x27.35 | FP414         | FP414                | FP414                | FP414                | 1319         | 1320                 | 1421                 | 1523                 |
|                                            | 1200                      | 12x.375       | 12x.375 | 12x.375 | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.500       | 6x15.9  | 24x.500              | 6x20.4  | 24x.562              | 9x27.35 |                      |         | FP415         | FP415                | FP415                |                      | 1520         | 1521                 | 1524                 |                      |
|                                            | 1500                      | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.562       | 6x17.5  | 24x.562              | 6x20.4  |                      |         |                      |         | FP415         | FP415                |                      |                      | 1524         | 1524                 |                      |                      |
|                                            | 1800                      | 12x.500       | 12x.500 | 12x.500 | 3.5x.318  | 3.5x.318        | 3.5x.318  | 3.5x.318        | 24x.562       | 6x17.5  | 24x.562              | 6x25    |                      |         |                      |         | FP415         | FP415                |                      |                      | 1525         | 1527                 |                      |                      |
| OVER 160'<br>TO 180'                       | 300                       | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 16x.375       | 5x12.7  | 18x.375              | 5x12.7  | 20x.375              | 9x27.35 | 24x.375              | 9x27.35 | FP213         | FP213                | FP314                | FP415                | 1115         | 1116                 | 1217                 | 1318                 |
|                                            | 600                       | 8x.406        | 8x.406  | 8x.406  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 20x.375       | 6x15.9  | 20x.375              | 6x15.9  | 20x.500              | 10x43   | 24x.500              | 10x43   | FP314         | FP314                | FP314                | FP415                | 1217         | 1318                 | 1320                 | 1421                 |
|                                            | 900                       | 8x.500        | 8x.500  | 8x.500  | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.375       | 6x15.9  | 24x.375              | 6x20.4  | 24x.500              | 10x43   |                      |         | FP415         | FP415                | FP415                |                      | 1419         | 1420                 | 1521                 |                      |
|                                            | 1200                      | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.500       | 6x20.4  | 24x.500              | 6x20.4  |                      |         |                      |         | FP416         | FP416                |                      |                      | 1521         | 1522                 |                      |                      |
|                                            | 1500                      | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.562       | 6x20.4  | 24x.562              | 6x25    |                      |         |                      |         | FP416         | FP416                |                      |                      | 1525         | 1525                 |                      |                      |
| OVER 180'<br>TO 200'                       | 300                       | 6x.432        | 6x.432  | 6x.432  | 2.5x.203  | 2.5x.203        | 2.5x.203  | 2.5x.203        | 18x.375       | 6x15.9  | 20x.375              | 6x20.4  | 24x.375              | 10x43   | 24x.500              | 10x43   | FP214         | FP315                | FP416                | FP416                | 1116         | 1117                 | 1218                 | 1319                 |
|                                            | 600                       | 8x.406        | 8x.406  | 8x.406  | 2.5x.276  | 2.5x.276        | 2.5x.276  | 2.5x.276        | 24x.375       | 6x20.4  | 24x.375              | 10x43   | 24x.500              | 10x43   | 24x.562              | 10x43   | FP416         | FP416                | FP416                | FP416                | 1318         | 1318                 | 1320                 | 1520                 |
|                                            | 900                       | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226        | 3.5x.226  | 3.5x.226        | 24x.500       | 6x20.4  | 24x.500              | 10x43   | 24x.562              | 10x43   |                      |         | FP416         | FP416                | FP416                |                      | 1421         | 1421                 | 1522                 |                      |
|                                            | 1200                      | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237          | 4x.237    | 4x.237          | 24x.562       | 6x20.4  | 24x.562              | 10x43   |                      |         |                      |         | FP416         | FP416                |                      |                      | 1524         | 1523                 |                      |                      |

NOTES:

- FOR DESIGN TABLE NOTES, SEE SHEET 8.
- ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.
- TOWER BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) X WEIGHT PER FOOT (WT).

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES  
4 POST TRI-CHORD TRUSS  
SPANS FROM 60' TO 200'

DESIGN TABLES

RECOMMENDED JUL.10, 2025

*Karin D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025

*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 10 OF 10

BD-644M

CHANGE 1  
CHANGE 8

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-745M, SHEET 2.
- AVOID BRIDGE-MOUNTED SIGN STRUCTURES WHENEVER POSSIBLE. IF AVOIDANCE IS NOT POSSIBLE, THE STRUCTURE SHOULD BE LOCATED AS CLOSE TO A PIER SUPPORT AS IS PRACTICAL. THE AFFECTED BRIDGE COMPONENTS SHALL BE DESIGNED TO CARRY THE ADDITIONAL LOADS DUE TO THE WEIGHT OF THE SIGN STRUCTURE AND THE LOADINGS APPLIED TO SIGN STRUCTURE. IF A BARRIER IS USED OR IS REQUIRED, THE SIGN STRUCTURE SHALL BE LOCATED JUST BEYOND THE DESIGN DEFLECTION DISTANCE OF THE BARRIER.
- DESIGN TABLES DO NOT INCLUDE CMS LOADINGS. DESIGN COMPUTATIONS ARE REQUIRED TO BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER TO VERIFY STRUCTURAL CAPACITY FOR ALL STRUCTURES INTENDED TO SUPPORT CMS LOADS.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:  
BD-645M: FOUR-POST FOUR-CHORD TRUSS, SPANS FROM 100' TO 200'
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-745M.
- THE FOLLOWING CRITERIA WERE USED TO DEVELOP THE DESIGN TABLES IN THIS STANDARD. DEVIATION FROM ANY OF THESE ASSUMPTIONS REQUIRE THE DESIGNER TO VERIFY THE DETAILS INCLUDED IN BD-645M AND BC-745M:
  - DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II.
  - STRUCTURES WERE DESIGNED ASSUMING THE SIGN PANELS AND LUMINAIRES BEING MOUNTED ON ONLY ONE SIDE OF THE TRUSS.
  - LUMINAIRE AND SUPPORT ARM WEIGHT OF 400 LBS AND WIND AREA OF 9.92 SF (FOR BOTH TRUCK GUST AND NORMAL WIND LOADS).
  - CATWALKS WERE NOT CONSIDERED FOR THESE STRUCTURES. DESIGNERS MUST CHECK STRUCTURES FOR CATWALKS WHEN REQUIRED BY DISTRICT ENGINEER.
  - HEIGHT ABOVE GROUND FOR NORMAL WIND PRESSURE CALCULATION WAS ASSUMED TO BE 33 FT.
  - TRAFFIC DESIGN SPEED OF 70 MPH WAS USED FOR TRUCK GUST LOAD CALCULATION.
  - SOIL FRICTION COEFFICIENT OF TAN(30°) 0.58 WAS USED FOR SLIDING RESISTANCE.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB. 408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE DIAMETER OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE AS DETAILED IN BC-745M. IF THESE MINIMUMS ARE NOT PROVIDED, BOLT BEARING MUST BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. ANCHOR BOLTS WERE DESIGNED AND DETAILED IN ACCORDANCE WITH ACI 318-14 AND AISC DESIGN GUIDE 1, 2ND EDITION. A MINIMUM EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS MUST BE PROVIDED.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS WITH THICKNESSES GREATER THAN 1/2" REQUIRE CHARPY V-NOTCH TESTING AND ARE DESIGNATED ON THE PLANS BY (CVN). PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, LOAD PATH REDUNDANT MEMBER AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

| PENNDOT STD. DWGS. (U.N.O.) *                                                                                                                                                                                                                            |                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| • DEAD LOADS                                                                                                                                                                                                                                             | SIGN PANELS<br>LIGHT FIXTURES<br>SIGN SUPPORT BEAM<br>COLUMNS, STRUTS |
| TC-8701E OR TC-8701S<br>BC-745M, SHT. 10<br>BC-745M, SHT. 8<br>CALCULATED INTERNALLY WITHIN PROGRAM                                                                                                                                                      |                                                                       |
| • EXTERNAL LOADS                                                                                                                                                                                                                                         | AASHTO LRFD SIGN                                                      |
| BASIC WIND SPEED<br>SERVICE WIND SPEED<br>LIVE LOAD (CATWALKS ONLY)<br>MEAN WIND SPEED                                                                                                                                                                   |                                                                       |
| STR/EXT 120 MPH (1700 YR MRI)<br>SER 76 MPH (10 YR MRI)<br>500 LBS (AASHTO LRFD SIGN 3.6)<br>FAT 11.2 MPH                                                                                                                                                |                                                                       |
| • GROUP LOADS                                                                                                                                                                                                                                            | AASHTO LRFD SIGN 3.4                                                  |
| • STEEL CRITERIA                                                                                                                                                                                                                                         | AASHTO LRFD SIGN                                                      |
| SECTION PROPERTIES FOR TUBULAR SHAPES<br>COMBINED FORCE INTERACTIONS<br>FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)<br>ALLOWABLE DEFLECTION<br>PERMANENT CAMBER<br>STRUCTURAL STEEL DESIGN                                                                |                                                                       |
| APPENDIX B, TABLE B.2.1<br>5.12<br>SECTION 11<br>10.4<br>10.5<br>SECTION 5                                                                                                                                                                               |                                                                       |
| • BOLT CRITERIA                                                                                                                                                                                                                                          | AASHTO LRFD BRIDGES (U.N.O.)                                          |
| SLIP-CRITICAL BOLT<br>BOLT PRYING ACTION<br>COMBINED BOLT SHEAR AND TENSION<br>ANCHOR BOLT DESIGN                                                                                                                                                        |                                                                       |
| 6.13.2.8<br>6.13.2.10.4<br>6.13.2.11<br>SEE NOTE 15                                                                                                                                                                                                      |                                                                       |
| • CONCRETE CRITERIA                                                                                                                                                                                                                                      | AASHTO LRFD BRIDGES & ACI 318-14                                      |
| BEARING RESISTANCE<br>SHEAR RESISTANCE OF FOOTINGS<br>SHEAR RESISTANCE OF CONCRETE<br>SLENDERNESS OF COLUMNS<br>MINIMUM REINF. OF FLEXURAL MEMBERS<br>SPACING LIMITS FOR REINFORCEMENT<br>MINIMUM CONCRETE COVER<br>TORSION<br>COLUMN DESIGN (PEDESTALS) |                                                                       |
| 5.6.5<br>5.7.1.4<br>5.7.1<br>5.6.4.3<br>DM-4, D5.6.3.3<br>DM-4, D5.10.3<br>DM-4, D5.10.1<br>5.7.2.1<br>5.6.4                                                                                                                                             |                                                                       |
| • SPREAD FOOTINGS ON SOIL                                                                                                                                                                                                                                |                                                                       |
| MAXIMUM FACTORED BEARING RESISTANCE<br>MINIMUM AREA IN BEARING<br>UNIT WEIGHT OF SOIL<br>PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS<br>SLIDING RESISTANCE                                                                                               |                                                                       |
| 3 TONS PER SQUARE FOOT<br>75% (STRENGTH) 95% (SERVICE)<br>100 POUNDS PER CUBIC FOOT<br>DM-4, D10.6.1.4<br>DM-4, D10.6.3.4                                                                                                                                |                                                                       |
| • SEISMIC DESIGN CRITERIA                                                                                                                                                                                                                                |                                                                       |
| SEISMIC LOADS WERE NOT CONSIDERED IN THE DEVELOPMENT OF THIS STANDARD. THE DESIGNER MUST CHECK THE ADEQUACY OF THESE STANDARDS WHEN SEISMIC LOADS ARE TO BE CONSIDERED.                                                                                  |                                                                       |

\* LEGEND:

- AASHTO LRFD SIGN: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO LRFD BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-14).
- CVN: CHARPY V-NOTCH.
- AISC: AMERICAN INSTITUTE OF STEEL CONSTRUCTION - DESIGN GUIDE 1, BASE PLATE AND ANCHOR ROD DESIGN, 2ND EDITION
- CMS: CHANGEABLE MESSAGE SIGN

|          |                                                                                      |
|----------|--------------------------------------------------------------------------------------|
| TC-8700C | SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS                            |
| TC-8701D | SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS                                      |
| TC-8701E | EXTRUDED ALUMINUM CHANNEL SIGN                                                       |
| TC-8701S | FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS                          |
| TC-8715  | SIGN LIGHTING                                                                        |
| BD-650M  | CHANGEABLE MESSAGE SIGNS TRUSS SIGN STRUCTURES                                       |
| BC-736M  | REINFORCEMENT BAR FABRICATION DETAILS                                                |
| BC-745M  | OVERHEAD SIGN STRUCTURES - FOUR POST FOUR CHORD TRUSS<br>SPANS FROM 100 FT TO 200 FT |
| RC-11M   | CLASSIFICATION OF EARTHWORK FOR STRUCTURES                                           |
| RC-51M   | TYPE 31 STRONG POST GUIDE RAIL                                                       |
| RC-53M   | TYPE 2 WEAK POST GUIDE RAIL                                                          |
| RC-54M   | BARRIER PLACEMENT AT OBSTRUCTIONS                                                    |
| RC-58M   | SINGLE FACE CONCRETE BARRIER                                                         |

REFERENCE DRAWINGS

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORK:  
PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:  
COLUMNS & PIPE STRUTS: SEE PUBLICATION 408, SECTION 948.2.  
ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36 OR 50  
ASTM A709, GRADE 36 OR 50
- ALTERNATE PRESS-BREAK MEMBERS:  
ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 3/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBERS FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR STRUTS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:  
ANCHOR BOLTS: ASTM F1554, GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c) 3.  
BOLTS: ASTM F3125, GRADE A325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:  
AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 1ST EDITION, 2015 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, PENNDOT DESIGN MANUAL - PART 4, DECEMBER 2019 EDITION
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE ROLLING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE YEAR AND CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- FOUR-POST FOUR-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS ARE RECOMMENDED TO CARRY CMS. SEE BD-650M FOR INFORMATION ON USE OF THIS SIGN STRUCTURE TYPE TO CARRY CMS. ALL DETAILS PRESENTED IN BD-645M AND BC-745M HAVE NOT BEEN DESIGNED FOR CMS LOADING. INDEPENDENT DESIGN CALCULATIONS ARE REQUIRED TO BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR APPROVAL PRIOR TO USE FOR CMS SUPPORTS.
- DURING THE REVIEW PROCESS OF THE SHOP DRAWINGS, CALLING FOR "VERIFICATION" OF AN ITEM, SIZE, DIMENSION, WELD, OR ANY DETAIL IS INSUFFICIENT. SUCH DETAILS AND/OR CORRECTIONS SHALL BE NOTED ON THE SHOP DRAWINGS BY THE REVIEWING AUTHORITY. ANY DISCREPANCIES OF QUESTIONS SHALL BE REFERRED TO PENNDOT FOR REVIEW AND RESOLUTION.
- IF CONTRACT DRAWINGS INDICATE A "SCALE" THEN ALL DETAILS, LAYOUTS OF SIGN PANELS/BOXES, SIGN/WALKWAY SUPPORTS, HANDRAILS AND ALL ITEMS RELATED TO THE STRUCTURE SHALL BE DEPICTED PER "SCALE" SHOWN.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE

OVERHEAD SIGN STRUCTURES

4 POST 4 CHORD TRUSS  
SPANS FROM 100' TO 200'

NOTES AND DESIGN CRITERIA

RECOMMENDED JUL. 10, 2025

RECOMMENDED JUL. 10, 2025

SHT. 1 OF 6

CHIEF BRIDGE ENGINEER

CHIEF EXECUTIVE, HIGHWAY ADMIN.

BD-645M



HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL ELEVATION APPROXIMATELY 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.
- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2'-0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

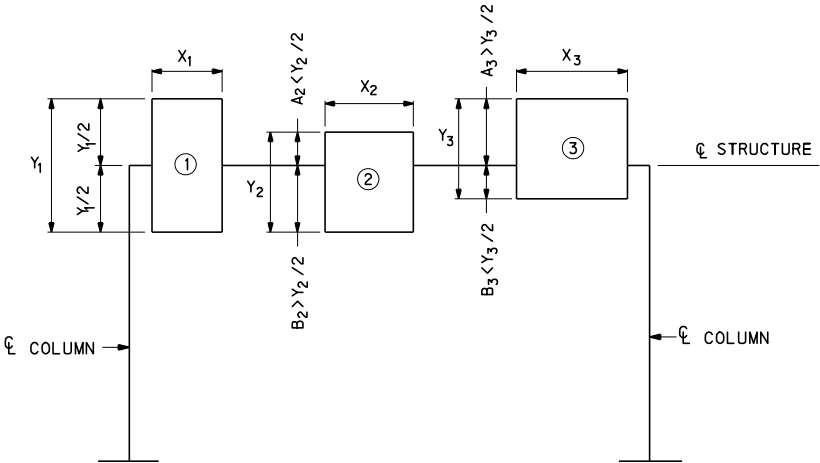
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:
  1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
  2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
  3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
  4. THE SIGN AREA CALCULATED FOR MULTIPLE SIGN PANELS AS DESCRIBED BELOW.
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

THE SIGN AREA FOR ANY SIGN PANEL OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

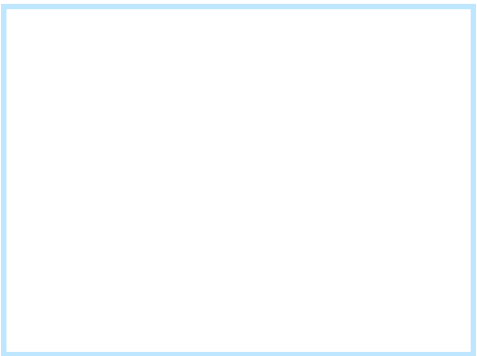
EXAMPLE:  
AREA OF SIGN NO. 1 = (X<sub>3</sub>) x (Y<sub>3</sub>)  
AREA OF SIGN NO. 2 = (X<sub>1</sub>) x (B<sub>1</sub>) x 2  
AREA OF SIGN NO. 3 = (X<sub>2</sub>) x (A<sub>2</sub>) x 2



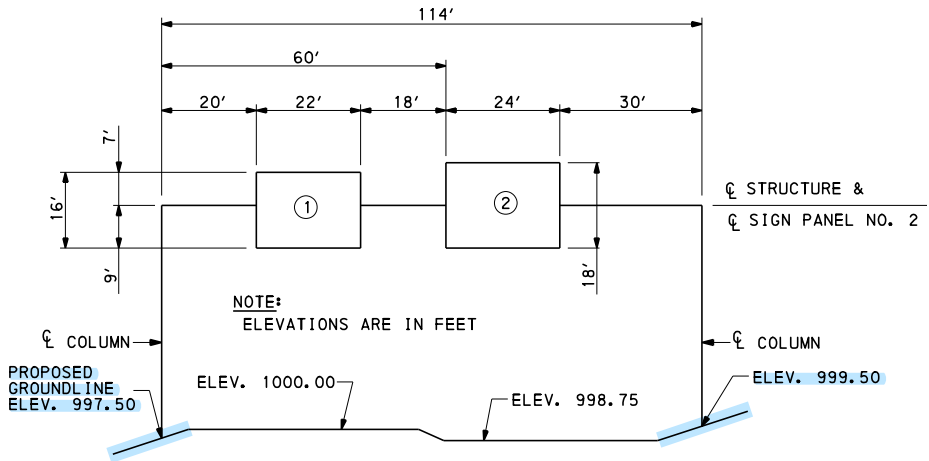
A = DISTANCE FROM CL STRUCTURE TO TOP OF SIGN  
B = DISTANCE FROM CL STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO.1 = X<sub>1</sub>Y<sub>1</sub>  
DESIGN AREA OF SIGN NO.2 = (X<sub>2</sub>B<sub>2</sub>) x 2  
DESIGN AREA OF SIGN NO.3 = (X<sub>3</sub>A<sub>3</sub>) x 2

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT.)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN, SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 9'-3" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.
- DESIGNS FOR ALL SIGNS PRESENTED IN THE TABLES IN BD-645M ALLOW FOR THE LOCATION OF THE CENTROID OF SIGN AREA TO BE LOCATED HORIZONTALLY ANYWHERE ALONG THE LENGTH OF THE SIGN STRUCTURE.
- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL DISTANCE BETWEEN CENTERLINE OF COLUMNS ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL MAXIMUM HEIGHT FROM THE TOP OF LOWER BASE PLATE TO CENTER OF TRUSS ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST HEIGHT SHOWN IN THE DESIGN TABLES.



EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SPAN LENGTH, & POST HEIGHT



- $\Delta \text{ELEV.} = 1000.00 - 998.75 = 1.25 < 2'-6"$
- $Y_1 = 16'$   
 $Y_2 = 18'$  }  $Y_1 < Y_2$  } USE CASE B
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION  
 $\text{ELEV. } 1000.00 + 17'-6" + 1'-9" = 1019.25$   
[ 1'-9" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL ]
- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2  
 $\text{ELEV. } 1019.25 + 18' / 2 = 1028.25$
- ACTUAL SPAN LENGTH = 114' → USE: 120'
- DESIGN COLUMN HEIGHT (H):  
 $H = 1028.25 - 997.50 - 0.50' = 30.25'$  → USE H = OVER 24' TO 33'  
0.50' = MINIMUM HEIGHT OF PEDESTAL ABOVE GRADE
- CL SIGN TO BOTTOM OF CATWALK IS  $9'-0" + 1'-8\frac{7}{8}" = 10'-8\frac{7}{8}"$
- 1/2 STRUCTURE DEPTH IS 2'-7 1/2". THEREFORE FROM THE DESIGN TABLES, IT IS DETERMINED THAT THE TOTAL STRUCTURE DEPTH IS 5'-3"
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:  
 $A_1 = 22' \times 9' \times 2 = 396.0 \text{ SF}$   
 $A_2 = 24' \times 18' = 432.0 \text{ SF}$   
828.0 SF  
→ USE 830.0 SF



COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
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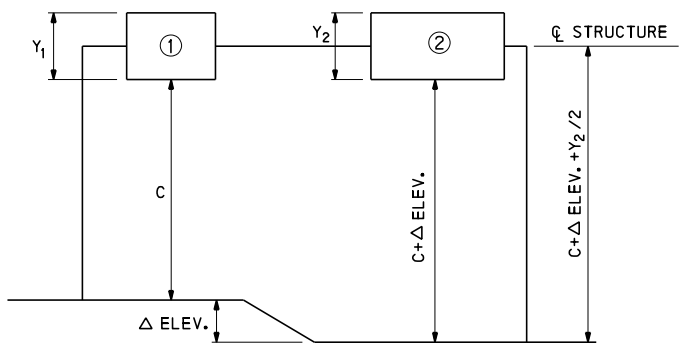
OVERHEAD SIGN STRUCTURES  
4 POST 4 CHORD TRUSS  
SPANS FROM 100' TO 200'

DESIGN INSTRUCTIONS

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

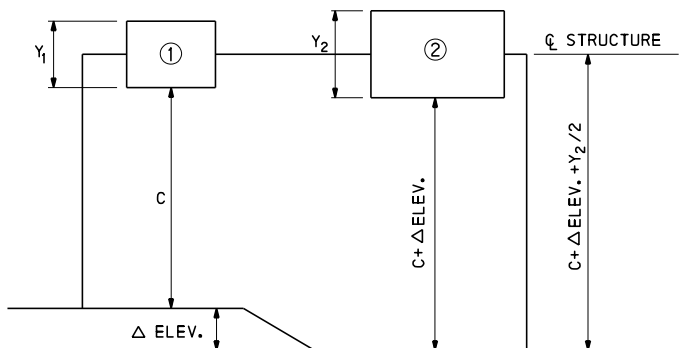
SHT. 2 OF 6  
BD-645M



CASE A

$Y_1 = Y_2$   
 $\Delta \text{ELEV.} < 2' - 6''$

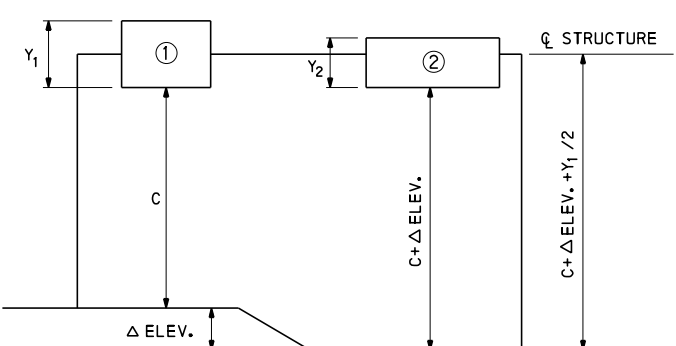
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANELS UNLESS  
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN  
THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE  
CLEARANCE.



CASE B

$Y_1 < Y_2$   
 $\Delta \text{ELEV.} < 2' - 6''$

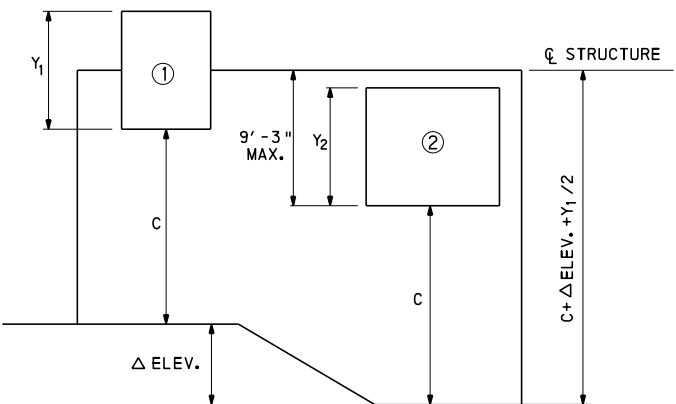
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 2 UNLESS  
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN  
THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE  
CLEARANCE.  
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF  
 $Y_1$  AND  $Y_2$  WHERE  $Y_1 < Y_2$ .



CASE C

$Y_1 > Y_2$   
 $\Delta \text{ELEV.} < 2' - 6''$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 1 UNLESS  
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN  
THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE  
CLEARANCE.  
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF  
 $Y_1$  AND  $Y_2$  WHERE  $Y_1 > Y_2$ .



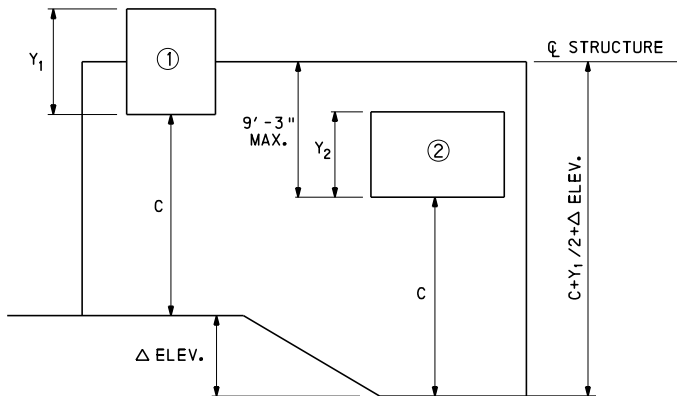
CASE D

$Y_1 = Y_2$   
 $\Delta \text{ELEV.} > 2' - 6''$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL  
CLEARANCE.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 1 UNLESS  
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN  
THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE  
CLEARANCE.  
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF  
 $\Delta \text{ELEV.}$  AND  $Y_{1,2}$ :

| $\Delta \text{ELEV.}$ | $Y_{1,2}$       |
|-----------------------|-----------------|
| 3'-0"                 | 6'-0" TO 12'-6" |
| 4'-0"                 | 6'-0" TO 10'-6" |
| 5'-0"                 | 6'-0" TO 8'-6"  |
| 6'-0"                 | 6'-0" TO 6'-6"  |
| 6'-3"                 | 6'-0"           |

WHEN  $Y_{1,2}$  EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE  
FOR A PARTICULAR VALUE OF  $\Delta \text{ELEV.}$ , THIS CASE DOES NOT  
APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A  
SPECIAL DESIGN.



CASE E

$Y_1 \geq Y_2$   
 $\Delta \text{ELEV.} > 2' - 6''$

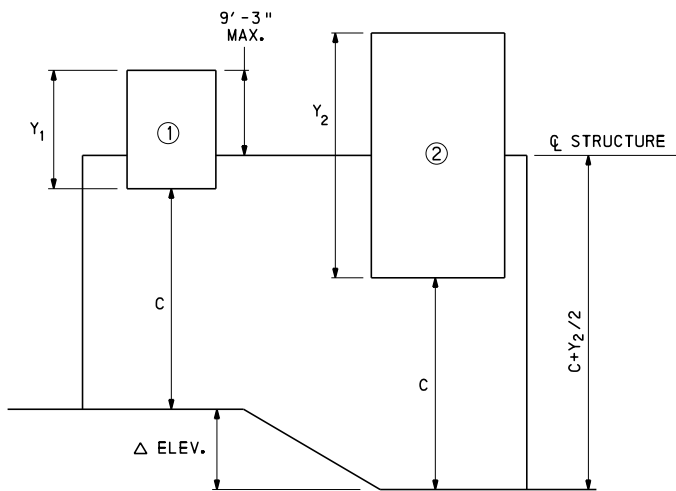
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL  
CLEARANCE.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 1 UNLESS  
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN  
THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE  
CLEARANCE.  
THIS CASE IS APPLICABLE FOR THE FOLLOWING  
COMBINATIONS OF  $\Delta \text{ELEV.}$  AND  $Y_2$  WHERE  $Y_1 > Y_2$ :

| $\Delta \text{ELEV.}$ | $Y_{1,2}$       |
|-----------------------|-----------------|
| 3'-0"                 | 6'-0" TO 12'-6" |
| 4'-0"                 | 6'-0" TO 10'-6" |
| 5'-0"                 | 6'-0" TO 8'-6"  |
| 6'-0"                 | 6'-0" TO 6'-6"  |
| 6'-3"                 | 6'-0"           |

WHEN  $Y_{1,2}$  EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE  
FOR A PARTICULAR VALUE OF  $\Delta \text{ELEV.}$ , THIS CASE DOES NOT  
APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A  
SPECIAL DESIGN.

**NOTE:**

C IS VERTICAL CLEARANCE FROM ROADWAY TO  
BOTTOM OF STRUCTURE, SIGN PANEL, OR LUMINAIRE.



CASE F

$Y_1 < Y_2$   
 $\Delta \text{ELEV.} > 2' - 6''$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL  
CLEARANCE.  
SET  $\phi$  OF STRUCTURE AT  $\phi$  OF SIGN PANEL NO. 2 UNLESS  
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN  
THIS CASE, RESET  $\phi$  STRUCTURE TO OBTAIN ADEQUATE  
CLEARANCE.  
THIS CASE IS APPLICABLE FOR THE FOLLOWING  
COMBINATIONS OF  $\Delta \text{ELEV.}$ ,  $Y_1$ , AND  $Y_2$  WHERE  $Y_1 < Y_2$ :

| $\Delta \text{ELEV.}$ | LIMITS OF $Y_1$ AND $Y_2$   |
|-----------------------|-----------------------------|
| 3'-0"                 | $2Y_1 - Y_2 \leq 12' - 6''$ |
| 4'-0"                 | $2Y_1 - Y_2 \leq 10' - 6''$ |
| 5'-0"                 | $2Y_1 - Y_2 \leq 8' - 6''$  |
| 6'-0"                 | $2Y_1 - Y_2 \leq 6' - 6''$  |
| 7'-0"                 | $2Y_1 - Y_2 \leq 4' - 6''$  |

GENERAL EQUATION FOR CASE F:  
 $2(\Delta \text{ELEV.}) + 2(Y_1) - Y_2 \leq 18' - 6''$

IF THE PARAMETERS OF THE GENERAL EQUATION ARE  
EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

- 1) RESET  $\phi$  STRUCTURE SO THAT PARAMETERS ARE MET
- 2) USE SEPARATE STRUCTURES
- 3) USE A SPECIAL DESIGN
- 4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE  
OF 17'-6" MUST BE MAINTAINED

**COMMONWEALTH OF PENNSYLVANIA**  
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**BUREAU OF BRIDGE**

OVERHEAD SIGN STRUCTURES  
4 POST 4 CHORD TRUSS  
SPANS FROM 100' TO 200'

INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
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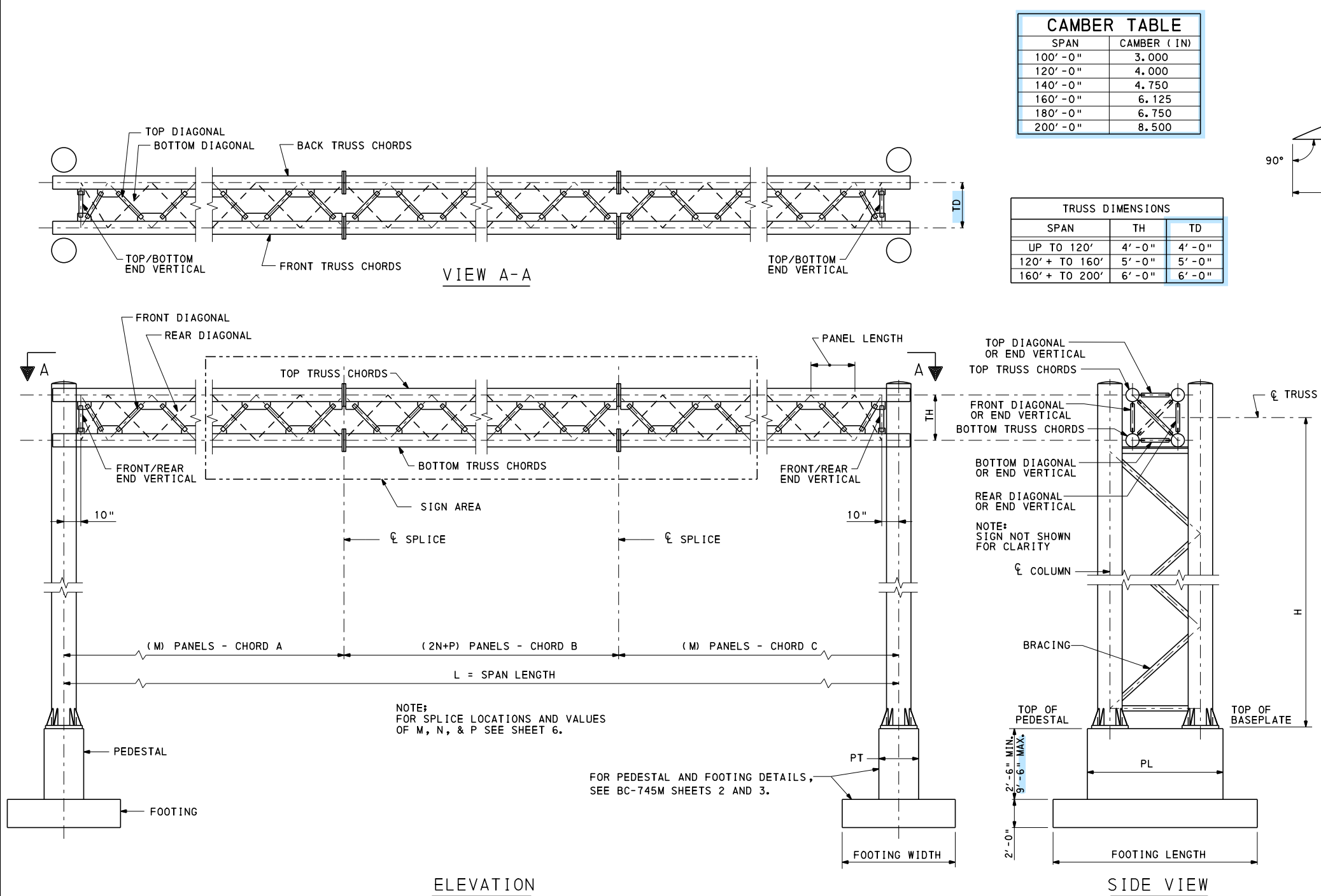
SHT. 3 OF 6  
BD-645M





| 4 POST FOUR-CHORD DESIGN TABLE |                   |               |        |        |           |              |           |              |                     |               |         |                   |         |                   |         |                   |         |               |                   |                   |                   |              |                   |                   |                   |  |  |
|--------------------------------|-------------------|---------------|--------|--------|-----------|--------------|-----------|--------------|---------------------|---------------|---------|-------------------|---------|-------------------|---------|-------------------|---------|---------------|-------------------|-------------------|-------------------|--------------|-------------------|-------------------|-------------------|--|--|
| DESIGN SPAN (L)                | SIGN AREA (SQ FT) | TRUSS MEMBERS |        |        |           |              |           |              |                     | TOWER MEMBERS |         |                   |         |                   |         |                   |         | FOUNDATION    |                   |                   |                   |              |                   |                   |                   |  |  |
|                                |                   | CHORDS        |        |        | DIAGONALS |              | VERTICALS |              | TRUSS CROSS BRACING | H TO 12'      |         | H OVER 12' TO 18' |         | H OVER 18' TO 24' |         | H OVER 24' TO 33' |         | PEDESTAL TYPE |                   |                   |                   | FOOTING TYPE |                   |                   |                   |  |  |
|                                |                   | A             | B      | C      | FRONT     | TOP & BOTTOM | FRONT     | TOP & BOTTOM |                     | COLUMN        | BRACING | COLUMN            | BRACING | COLUMN            | BRACING | COLUMN            | BRACING | H TO 12'      | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' | H TO 12'     | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' |  |  |
| TO 100'                        | 200               | 4x.337        | 4x.337 | 4x.337 | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 10x.365       | 2.5x5   | 12x.375           | 3x6.25  | 16x.375           | 3x6.25  | 24x.375           | 4x9.2   | FP109         | FP109             | FP210             | FP412             | 0816         | 0916              | 1015              | 1020              |  |  |
|                                | 350               | 4x.337        | 4x.337 | 4x.337 | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 12x.330       | 3x6.25  | 14x.375           | 4x9.2   | 16x.375           | 4x9.2   | 24x.375           | 4x9.2   | FP109         | FP210             | FP210             | FP412             | 0917         | 1016              | 1020              | 1121              |  |  |
|                                | 500               | 4x.337        | 4x.337 | 4x.337 | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 14x.375       | 3x8.625 | 16x.375           | 4x9.2   | 18x.375           | 5x12.7  | 24x.375           | 5x12.7  | FP210         | FP210             | FP210             | FP412             | 1017         | 1117              | 1121              | 1222              |  |  |
|                                | 650               | 5x.375        | 5x.375 | 5x.375 | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 16x.375       | 4x9.2   | 18x.375           | 4x11.5  | 20x.375           | 5x12.7  | 24x.375           | 5x12.7  | FP210         | FP210             | FP311             | FP412             | 1117         | 1121              | 1221              | 1323              |  |  |
|                                | 800               | 5x.375        | 5x.375 | 5x.375 | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 16x.375       | 4x9.2   | 20x.375           | 5x12.7  | 24x.375           | 6x15.9  | 24x.500           | 6x15.9  | FP210         | FP311             | FP412             | FP412             | 1121         | 1222              | 1322              | 1424              |  |  |
|                                | 950               | 5x.375        | 5x.375 | 5x.375 | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 18x.375       | 4x9.2   | 20x.375           | 6x15.9  | 24x.375           | 6x15.9  | 24x.500           | 6x15.9  | FP210         | FP311             | FP412             | FP412             | 1220         | 1321              | 1325              | 1427              |  |  |
|                                | 1100              | 6x.432        | 6x.432 | 6x.432 | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 18x.375       | 4x11.5  | 24x.375           | 6x15.9  | 24x.375           | 6x15.9  | 24x.500           | 6x17.5  | FP211         | FP412             | FP412             | FP412             | 1222         | 1323              | 1424              | 1526              |  |  |
|                                | 1250              | 6x.432        | 6x.432 | 6x.432 | 3x.300    | 3x.300       | 3x.300    | 3x.300       | 3x.300              | 18x.375       | 4x11.5  | 24x.375           | 6x15.9  | 24x.500           | 6x17.5  | 24x.562           | 6x17.5  | FP211         | FP412             | FP412             | FP412             | 1224         | 1325              | 1426              | 1528              |  |  |
|                                | 1400              | 6x.432        | 6x.432 | 6x.432 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 20x.375       | 4x11.5  | 24x.375           | 5x17.5  | 24x.500           | 6x17.5  |                   |         | FP311         | FP412             | FP412             |                   | 1323         | 1424              | 1525              |                   |  |  |
|                                | 1550              | 6x.432        | 6x.432 | 6x.432 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 20x.375       | 4x11.5  | 24x.375           | 5x17.5  | 24x.500           | 6x17.5  |                   |         | FP311         | FP412             | FP412             |                   | 1325         | 1426              | 1528              |                   |  |  |
|                                | 1700              | 6x.432        | 6x.432 | 6x.432 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.375       | 4x11.5  | 24x.500           | 6x17.5  | 24x.562           | 6x17.5  |                   |         | FP412         | FP412             | FP412             |                   | 1424         | 1525              | 1530              |                   |  |  |
|                                | 1850              | 6x.432        | 6x.432 | 6x.432 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 20x.500       | 4x11.5  | 24x.500           | 6x17.5  | 24x.562           | 6x17.5  |                   |         | FP311         | FP412             | FP412             |                   | 1426         | 1527              | 1532              |                   |  |  |

FOR CONTINUATION OF CHART, SEE SHEET 6.



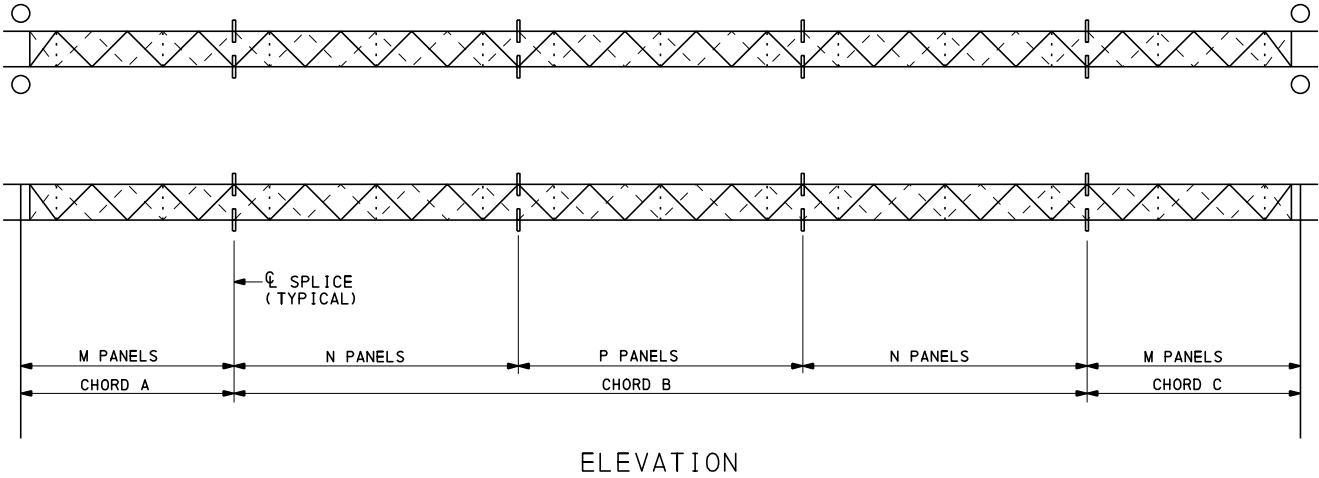
- NOTES:**
- FOR GENERAL NOTES, SEE SHEET 1.
  - FOR GENERAL DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
  - ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR. IN CASE OF THE ADDITION OR ELIMINATION OF SPLICES, THE HEAVIER CHORD MATERIAL MUST BE EXTENDED TOWARD THE LIGHTER CHORD MATERIAL TO THE DESIRED SPLICE LOCATION.
  - "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 1214 INDICATES A FOOTING 12'-0" WIDE x 14'-0" LONG). SEE BC-745M, SHEET 2 AND 3 FOR FOUNDATION DETAILS.
  - "PEDESTAL TYPE" DESIGNATES ALL DETAILS FOR THE PEDESTALS. SEE BC-745M SHEET 2.
  - FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.
  - FOR STRUCTURAL DETAILS, SEE BC-745M.
  - ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.
  - TOWER BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE**

OVERHEAD SIGN STRUCTURES  
4 POST 4 CHORD TRUSS  
SPANS FROM 100' TO 200'

**DESIGN TABLES**

| 4 POST FOUR-CHORD DESIGN TABLE (CONTINUED) |                   |               |         |         |           |              |           |              |                     |               |           |                   |           |                   |           |                   |         |               |                   |                   |                   |              |                   |                   |                   |  |  |
|--------------------------------------------|-------------------|---------------|---------|---------|-----------|--------------|-----------|--------------|---------------------|---------------|-----------|-------------------|-----------|-------------------|-----------|-------------------|---------|---------------|-------------------|-------------------|-------------------|--------------|-------------------|-------------------|-------------------|--|--|
| DESIGN SPAN (L)                            | SIGN AREA (SQ FT) | TRUSS MEMBERS |         |         |           |              |           |              |                     | TOWER MEMBERS |           |                   |           |                   |           |                   |         | FOUNDATION    |                   |                   |                   |              |                   |                   |                   |  |  |
|                                            |                   | CHORDS        |         |         | DIAGONALS |              | VERTICALS |              | TRUSS CROSS BRACING | H TO 12'      |           | H OVER 12' TO 18' |           | H OVER 18' TO 24' |           | H OVER 24' TO 33' |         | PEDESTAL TYPE |                   |                   |                   | FOOTING TYPE |                   |                   |                   |  |  |
|                                            |                   | A             | B       | C       | FRONT     | TOP & BOTTOM | FRONT     | TOP & BOTTOM |                     | COLUMN        | BRACING   | COLUMN            | BRACING   | COLUMN            | BRACING   | COLUMN            | BRACING | H TO 12'      | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' | H TO 12'     | H OVER 12' TO 18' | H OVER 18' TO 24' | H OVER 24' TO 33' |  |  |
| OVER 100' TO 120'                          | 300               | 4x.337        | 4x.337  | 4x.337  | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 12x.375       | 3x8.625   | 14x.375           | 4x9.2     | 16x.375           | 4x9.2     | 24x.375           | 4x11.5  | FP109         | FP210             | FP210             | FP412             | 0917         | 1017              | 1117              | 1122              |  |  |
|                                            | 600               | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 14x.375       | 4x9.2     | 18x.375           | 5x12.7    | 20x.375           | 5x12.7    | 24x.375           | 5x12.7  | FP210         | FP210             | FP311             | FP412             | 1120         | 1121              | 1221              | 1323              |  |  |
|                                            | 900               | 6x.432        | 6x.432  | 6x.432  | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 18x.375       | 4x11.5    | 20x.375           | 6x15.9    | 24x.375           | 6x15.9    | 24x.500           | 6x15.9  | FP211         | FP311             | FP412             | FP412             | 1219         | 1223              | 1324              | 1426              |  |  |
|                                            | 1200              | 8x.406        | 8x.406  | 8x.406  | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 20x.375       | 5x12.7    | 24x.375           | 6x17.5    | 24x.500           | 6x20.4    | 24x.562           | 6x20.4  | FP311         | FP412             | FP412             | FP412             | 1224         | 1325              | 1425              | 1527              |  |  |
|                                            | 1500              | 8x.500        | 8x.500  | 8x.500  | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 20x.375       | 5x12.7    | 24x.375           | 6x20.4    | 24x.500           | 6x20.4    |                   |         | FP311         | FP412             | FP412             |                   | 1325         | 1426              | 1527              |                   |  |  |
|                                            | 1800              | 8x.500        | 8x.500  | 8x.500  | 3x.300    | 3x.300       | 3x.300    | 3x.300       | 3x.300              | 24x.375       | 6x20.4    | 24x.500           | 6x20.4    | 24x.562           | 6x20.4    |                   |         | FP412         | FP412             | FP412             |                   | 1426         | 1526              | 1531              |                   |  |  |
|                                            | 2100              | 8x.500        | 8x.500  | 8x.500  | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.375       | 6x20.4    | 24x.500           | 6x20.4    |                   |           |                   |         | FP412         | FP412             |                   |                   | 1526         | 1531              |                   |                   |  |  |
| OVER 120' TO 140'                          | 2220              | 8x.500        | 8x.500  | 8x.500  | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.500       | 6x17.5    | 24x.562           | 6x20.4    |                   |           |                   |         | FP412         | FP412             |                   |                   | 1528         | 1533              |                   |                   |  |  |
|                                            | 300               | 4x.337        | 4x.337  | 4x.337  | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 12x.375       | 5x12.7    | 16x.375           | 5x12.7    | 18x.375           | 5x12.7    | 24x.375           | 5x12.7  | FP110         | FP211             | FP211             | FP413             | 1016         | 1020              | 1120              | 1221              |  |  |
|                                            | 600               | 5x.375        | 5x.375  | 5x.375  | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 16x.375       | 6x15.9    | 20x.375           | 5x12.7    | 24x.375           | 6x15.9    | 24x.500           | 6x15.9  | FP211         | FP312             | FP413             | FP413             | 1120         | 1220              | 1224              | 1325              |  |  |
|                                            | 900               | 6x.432        | 6x.432  | 6x.432  | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 18x.375       | 6x17.5    | 24x.375           | 6x15.9    | 24x.375           | 6x20.4    | 24x.562           | 6x20.4  | FP212         | FP413             | FP413             | FP413             | 1223         | 1323              | 1423              | 1525              |  |  |
|                                            | 1200              | 8x.406        | 8x.406  | 8x.406  | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 20x.375       | 6x20.4    | 24x.375           | 6x20.4    | 24x.500           | 6x20.4    |                   |         | FP312         | FP413             | FP413             |                   | 1323         | 1424              | 1428              |                   |  |  |
|                                            | 1500              | 8x.500        | 8x.500  | 8x.500  | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.375       | 6x20.4    | 24x.500           | 6x20.4    | 24x.562           | 7.5x21.45 |                   |         | FP413         | FP413             | FP413             |                   | 1425         | 1525              | 1530              |                   |  |  |
|                                            | 1800              | 8x.500        | 8x.500  | 8x.500  | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 20x.500       | 6x25      | 24x.500           | 6x20.4    |                   |           |                   |         | FP312         | FP413             |                   |                   | 1428         | 1529              |                   |                   |  |  |
| OVER 140' TO 160'                          | 2100              | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.500       | 6x20.4    | 24x.562           | 6x25      |                   |           |                   |         | FP414         | FP414             |                   |                   | 1529         | 1533              |                   |                   |  |  |
|                                            | 2400              | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.500       | 6x20.4    |                   |           |                   |           |                   |         | FP414         |                   |                   |                   | 1532         |                   |                   |                   |  |  |
|                                            | 300               | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 14x.375       | 5x12.7    | 16x.375           | 5x12.7    | 18x.375           | 5x12.7    | 24x.375           | 5x12.7  | FP211         | FP211             | FP211             | FP413             | 1018         | 1118              | 1121              | 1222              |  |  |
|                                            | 600               | 6x.432        | 6x.432  | 6x.432  | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 16x.375       | 6x15.9    | 20x.375           | 5x12.7    | 24x.375           | 6x15.9    | 24x.500           | 6x15.9  | FP211         | FP312             | FP413             | FP413             | 1121         | 1221              | 1321              | 1326              |  |  |
|                                            | 900               | 8x.406        | 8x.406  | 8x.406  | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 20x.375       | 6x20.4    | 24x.375           | 6x15.9    | 24x.500           | 6x20.4    | 24x.562           | 6x20.4  | FP312         | FP413             | FP413             | FP413             | 1324         | 1325              | 1424              | 1526              |  |  |
|                                            | 1200              | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 24x.375       | 6x20.4    | 24x.500           | 6x20.4    | 24x.562           | 6x20.4    |                   |         | FP414         | FP414             | FP414             |                   | 1426         | 1426              | 1526              |                   |  |  |
|                                            | 1500              | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.375       | 6x20.4    | 24x.500           | 6x20.4    |                   |           |                   |         | FP414         | FP414             |                   |                   | 1427         | 1527              |                   |                   |  |  |
| OVER 160' TO 180'                          | 1800              | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.500       | 6x20.4    | 24x.562           | 6x25      |                   |           |                   |         | FP414         | FP414             |                   |                   | 1528         | 1531              |                   |                   |  |  |
|                                            | 2100              | 12x.500       | 12x.500 | 12x.500 | 3.5x.318  | 3.5x.318     | 3.5x.318  | 3.5x.318     | 3.5x.318            | 24x.500       | 6x25      |                   |           |                   |           |                   |         | FP414         |                   |                   |                   | 1530         |                   |                   |                   |  |  |
|                                            | 2400              | 12x.500       | 12x.500 | 12x.500 | 3.5x.318  | 3.5x.318     | 3.5x.318  | 3.5x.318     | 3.5x.318            | 24x.500       | 6x25      |                   |           |                   |           |                   |         | FP414         |                   |                   |                   | 1533         |                   |                   |                   |  |  |
|                                            | 300               | 5x.375        | 5x.375  | 5x.375  | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 14x.375       | 5x12.7    | 18x.375           | 5x12.7    | 20x.375           | 5x12.7    | 24x.375           | 6x15.9  | FP212         | FP212             | FP313             | FP414             | 1020         | 1121              | 1220              | 1322              |  |  |
|                                            | 600               | 6x.432        | 6x.432  | 6x.432  | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 18x.375       | 6x15.9    | 24x.375           | 6x15.9    | 24x.375           | 9x27.35   | 24x.562           | 9x27.35 | FP213         | FP414             | FP414             | FP414             | 1220         | 1224              | 1323              | 1425              |  |  |
|                                            | 900               | 8x.406        | 8x.406  | 8x.406  | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 20x.375       | 6x20.4    | 24x.375           | 6x20.4    | 24x.500           | 9x27.35   |                   |         | FP313         | FP414             | FP414             |                   | 1323         | 1423              | 1427              |                   |  |  |
|                                            | 1200              | 12x.406       | 12x.406 | 12x.406 | 3x.300    | 3x.300       | 3x.300    | 3x.300       | 3x.300              | 20x.500       | 6x20.4    | 24x.500           | 6x20.4    |                   |           |                   |         | FP314         | FP415             |                   |                   | 1423         | 1427              |                   |                   |  |  |
| OVER 180' TO 200'                          | 1500              | 12x.406       | 12x.406 | 12x.406 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.500       | 6x20.4    | 24x.562           | 6x25      |                   |           |                   |         | FP415         | FP415             |                   |                   | 1527         | 1529              |                   |                   |  |  |
|                                            | 1800              | 12x.406       | 12x.406 | 12x.406 | 3.5x.318  | 3.5x.318     | 3.5x.318  | 3.5x.318     | 3.5x.318            | 24x.500       | 6x25      | 24x.562           | 9x27.35   |                   |           |                   |         | FP415         | FP415             |                   |                   | 1530         | 1533              |                   |                   |  |  |
|                                            | 2100              | 14x.437       | 14x.437 | 14x.437 | 3.5x.318  | 3.5x.318     | 3.5x.318  | 3.5x.318     | 3.5x.318            | 24x.500       | 9x27.35   |                   |           |                   |           |                   |         | FP415         |                   |                   |                   | 1533         |                   |                   |                   |  |  |
|                                            | 2400              | 14x.437       | 14x.437 | 14x.437 | 3.5x.318  | 3.5x.318     | 3.5x.318  | 3.5x.318     | 3.5x.318            | 24x.562       | 9x27.35   |                   |           |                   |           |                   |         | FP415         |                   |                   |                   | 1537         |                   |                   |                   |  |  |
|                                            | 300               | 6x.432        | 6x.432  | 6x.432  | 2.5x.203  | 2.5x.203     | 2.5x.203  | 2.5x.203     | 2.5x.203            | 16x.375       | 5x12.7    | 18x.375           | 5x12.7    | 24x.375           | 9x27.35   | 24x.375           | 9x27.35 | FP212         | FP213             | FP414             | FP414             | 1118         | 1122              | 1222              | 1323              |  |  |
|                                            | 600               | 8x.406        | 8x.406  | 8x.406  | 2.5x.276  | 2.5x.276     | 2.5x.276  | 2.5x.276     | 2.5x.276            | 20x.375       | 6x15.9    | 24x.375           | 6x15.9    | 24x.500           | 9x27.35   | 24x.562           | 9x27.35 | FP313         | FP414             | FP414             | FP414             | 1222         | 1321              | 1325              | 1426              |  |  |
|                                            | 900               | 12x.406       | 12x.406 | 12x.406 | 3.5x.226  | 3.5x.226     | 3.5x.226  | 3.5x.226     | 3.5x.226            | 24x.375       | 6x15.9    | 24x.500           | 6x20.4    | 24x.562           | 9x27.35   |                   |         | FP415         | FP415             | FP415             |                   | 1423         | 1425              | 1525              |                   |  |  |
| OVER 180' TO 200'                          | 1200              | 14x.437       | 14x.437 | 14x.437 | 4x.237    | 4x.237       | 4x.237    | 4x.237       | 4x.237              | 24x.375       | 6x20.4    | 24x.500           | 6x20.4    |                   |           |                   |         | FP415         | FP415             |                   |                   | 1428         | 1527              |                   |                   |  |  |
|                                            | 1500              | 14x.437       | 14x.437 | 14x.437 | 3.5x.318  | 3.5x.318     | 3.5x.318  | 3.5x.318     | 3.5x.318            | 24x.500       | 7.5x21.45 | 24x.562           | 7.5x21.45 |                   |           |                   |         | FP415         | FP415             |                   |                   | 1529         | 1530              |                   |                   |  |  |
|                                            | 1800              | 14x.500       | 14x.500 | 14x.500 | 4x.337    | 4x.337       | 4x.337    | 4x.337       | 4x.337              | 24x.562       | 7.5x21.45 |                   |           |                   |           |                   |         | FP415         |                   |                   |                   | 1533         |                   |                   |                   |  |  |



| ACTUAL SPAN    | DESIGN SPAN | NUMBER OF SPLICES | NO. OF PANELS |    |    |
|----------------|-------------|-------------------|---------------|----|----|
|                |             |                   | M             | N  | P  |
| UP TO 100'     | 100'        | 2                 | 8             | 0  | 10 |
| 100' + TO 120' | 120'        | 2                 | 10            | 0  | 10 |
| 120' + TO 140' | 140'        | 4                 | 6             | 8  | 8  |
| 140' + TO 160' | 160'        | 4                 | 8             | 8  | 8  |
| 160' + TO 180' | 180'        | 4                 | 8             | 10 | 10 |
| 180' + TO 200' | 200'        | 4                 | 10            | 10 | 10 |

**NOTE:**

- FOR DESIGN TABLE NOTES, SEE SHEET 5.
- ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.
- TOWER BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) X WEIGHT PER FOOT (WT).

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF BRIDGE**

OVERHEAD SIGN STRUCTURES  
4 POST 4 CHORD TRUSS  
SPANS FROM 100' TO 200'

DESIGN TABLES

RECOMMENDED JUL.10, 2025  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025  
*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHT. 6 OF 6  
**BD-645M**

CHANGE 1

CHANGE 8

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-747M, SHEET 6.
- CHANGEABLE MESSAGE SIGNS (CMS) ARE PROHIBITED ON MONOPIPE STRUCTURES.

INFORMATION CONTAINED IN THE DESIGN TABLES

- DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
- THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:  
  
BD-647M\* FRAME STRUCTURE SPANS UP TO 160’ AND CANTILEVER MONOPIPE STRUCTURE STRUT LENGTHS UP TO 27’
- THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THESE STRUCTURES REQUIRE CAISSON FOUNDATIONS. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL AND THE CORRESPONDING INFORMATION SHOWN ON THE CONTRACT DRAWINGS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-747M.
- THE FOLLOWING CRITERIA WERE USED TO DEVELOP THE DESIGN TABLES IN THIS STANDARD. DEVIATION FROM ANY OF THESE ASSUMPTIONS REQUIRE THE DESIGNER TO VERIFY THE DETAILS INCLUDED IN BD-647M AND BC-747M.
  - THE MEMBER SIZES INDICATED IN THE DESIGN TABLES UTILIZE THE FOLLOWING FATIGUE IMPORTANCE FACTORS:
    - MONOPIPE FRAME - CATEGORY II
    - MONOPIPE CANTILEVER - CATEGORY I
  - LUMINAIRE AND SUPPORT ARM WEIGHT OF 400 LBS AND WIND AREA OF 9.92 SF (FOR BOTH TRUCK GUST AND NORMAL WIND LOADS).
  - CATWALKS WERE NOT CONSIDERED FOR THESE STRUCTURES. DESIGNERS MUST CHECK STRUCTURES FOR CATWALKS WHEN REQUIRED BY DISTRICT ENGINEER.
  - TRAFFIC DESIGN SPEED OF 70 MPH WAS USED FOR TRUCK GUST LOAD CALCULATION.
  - THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f’c = 3000 PSI IN PEDESTALS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. DRILLED CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUBLICATION 408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN IN THE DESIGN TABLES ARE OUTSIDE DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE WIDTH OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE AS DETAILED IN BC-747M. IF THESE MINIMUMS ARE NOT APPROVED, BOLT BEARING MUST BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. ANCHOR BOLTS WERE DESIGNED AND DETAILED IN ACCORDANCE WITH ACI 318-14 AND AISC DESIGN GUIDE 1, 2ND EDITION. A MINIMUM EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS MUST BE PROVIDED.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS WITH THICKNESS GREATER THAN 1/2" REQUIRE CHARPY V-NOTCH TESTING AND ARE DESIGNATED ON THE PLANS BY (CVN). PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, LOAD PATH REDUNDANT MEMBER AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
18. ONE TEST BORING SHALL BE PROVIDED AT EACH DRILLED CAISSON FOUNDATION LOCATION.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

| DEAD LOADS                                                                                                                                                                                                               |                                                                                                    | PENNDOT STD. DWGS. (U.N.O.) *    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------|
| SIGN PANELS<br>LIGHT FIXTURES<br>SIGN SUPPORT BEAM<br>COLUMNS, STRUTS                                                                                                                                                    | TC-8701E OR TC-8701S<br>BC-747M, SHT. 5<br>BC-747M, SHT. 4<br>CALCULATED INTERNALLY WITHIN PROGRAM |                                  |
| EXTERNAL LOADS                                                                                                                                                                                                           |                                                                                                    | AASHTO LRFD SIGN                 |
| BASIC WIND SPEED<br>SERVICE WIND SPEED<br>MEAN WIND SPEED                                                                                                                                                                | STR/EXT 120 MPH (1700 YR MRI)<br>SER 76 MPH (10 YR MRI)<br>FAT 11.2 MPH                            |                                  |
| GROUP LOADS                                                                                                                                                                                                              |                                                                                                    | AASHTO LRFD SIGN 3.4             |
| STEEL CRITERIA                                                                                                                                                                                                           |                                                                                                    | AASHTO LRFD SIGN                 |
| SECTION PROPERTIES FOR TUBULAR SHAPES<br>COMBINED FORCE INTERACTIONS<br>FATIGUE REQUIREMENTS<br>ALLOWABLE DEFLECTION<br>PERMANENT CAMBER<br>STRUCTURAL STEEL DESIGN                                                      | APPENDIX B, TABLE B.2.1<br>5.12<br>SECTION 11<br>10.4<br>10.5<br>SECTION 5                         |                                  |
| BOLT CRITERIA                                                                                                                                                                                                            |                                                                                                    | AASHTO LRFD BRIDGES (U.N.O.)     |
| SLIP-CRITICAL BOLT<br>BOLT PRYING ACTION<br>COMBINED BOLT SHEAR AND TENSION<br>ANCHOR BOLT DESIGN                                                                                                                        | 6.13.2.8<br>6.13.2.10.4<br>6.13.2.11<br>SEE NOTE 12                                                |                                  |
| CONCRETE CRITERIA                                                                                                                                                                                                        |                                                                                                    | AASHTO LRFD BRIDGES & ACI 318-14 |
| BEARING RESISTANCE<br>SHEAR RESISTANCE OF CONCRETE<br>SLENDERNESS OF COLUMNS<br>MINIMUM REINF. OF FLEXURAL MEMBERS<br>SPACING LIMITS FOR REINFORCEMENT<br>MINIMUM CONCRETE COVER<br>TORSION<br>COLUMN DESIGN (PEDESTALS) | 5.6.5<br>5.7.1<br>5.6.4.3<br>DM-4, D5.6.3.3<br>DM-4, D5.10.3<br>DM-4, D5.10.1<br>5.7.2.1<br>5.6.4  |                                  |
| DRILLED CAISSONS                                                                                                                                                                                                         |                                                                                                    | DM-4, SECTION 10.8               |
| MAXIMUM DESIGN LATERAL DISPLACEMENT<br>ANALYSES                                                                                                                                                                          | 0.5"<br>PENNDOT COM624 OR L-PILE                                                                   |                                  |
| SEISMIC DESIGN CRITERIA                                                                                                                                                                                                  |                                                                                                    |                                  |
| SEISMIC LOADS WERE NOT CONSIDERED IN THE DEVELOPMENT OF THIS STANDARD. THE DESIGNER MUST CHECK THE ADEQUACY OF THESE STANDARDS WHEN SEISMIC LOADS ARE TO BE CONSIDERED.                                                  |                                                                                                    |                                  |

\* LEGEND:

- AASHTO LRFD SIGN: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO LRFD BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-14).
- CVN: CHARPY V-NOTCH.
- AISC: AMERICAN INSTITUTE OF STEEL CONSTRUCTION - DESIGN GUIDE 1, BASE PLATE AND ANCHOR ROD DESIGN, 2ND EDITION

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORK:  
  
PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:  
  
COLUMNS & PIPE STRUTS: SEE PUBLICATION 408, SECTION 948.2.  
  
ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36 OR 50  
ASTM A709, GRADE 36 OR 50
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:  
  
ANCHOR BOLTS: ASTM F1554, GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c)3.  
  
BOLTS: ASTM F3125, GRADE A325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:  
  
AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 1ST EDITION, 2015 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH EDITION, 2017; PENNDOT DESIGN MANUAL - PART 4, DECEMBER 2019 EDITION
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

FABRICATION

- CONSTRUCT SIGN STRUCTURES TRUE TO DIMENSION, FREE FROM KINKS, TWISTS OR BENDS, AND UNIFORM IN APPEARANCE. ASSEMBLE COMPLETED SECTIONS IN THE SHOP AND CHECK FOR STRAIGHTNESS, ALIGNMENT, DIMENSION, AND THE FIRM SEATING OF THE SPLICE PLATES. CORRECT ANY VARIATIONS TO THE SATISFACTION OF THE ENGINEER.
- FORM MASTS FOR SIGN STRUCTURES TO THE RADII SHOWN ON THE PLANS IN ACCORDANCE WITH THE TUBE AND PIPE ASSOCIATION INTERNATIONAL RECOMMENDED STANDARDS FOR INDUCTION BENDING OF PIPE AND TUBE (TPA-IBS-98).
- AFFIX CLIPS, EYES, OR REMOVABLE BRACKETS TO ALL MASTS AND MAST ARMS, AS NECESSARY, TO SECURE THE SIGN STRUCTURE DURING SHIPPING AND FOR LIFTING AND MOVING DURING ERECTION. THIS IS TO PREVENT DAMAGE TO THE FINISHED GALVANIZED OR PAINTED SURFACES. REMOVE BRACKETS ON SIGN STRUCTURES AFTER ERECTION. INCLUDE DETAILS OF SUCH DEVICES ON THE SHOP DRAWINGS.
- FABRICATE ALL SIGN STRUCTURES INTO THE LARGEST PRACTICAL SECTIONS PRIOR TO GALVANIZING. SUBMIT SPLICE LOCATIONS TO THE ENGINEER FOR APPROVAL. DO NOT COMMENCE FABRICATION UNTIL SUCH SPLICE LOCATIONS ARE APPROVED.
- GRIND ALL AREAS TO BE WELDED TO BRIGHT METAL. BUTT WELD SPLICES ARE NOT PERMITTED, UNLESS SHOWN ON THE PLANS. COMPLETE ALL WELDING AND REQUIRED TESTING BEFORE ANY MATERIAL IS GALVANIZED. NON-DESTRUCTIVELY TEST ALL CIRCUMFERENTIAL AND STIFFENER WELDS USING THE METHODS AND PROCEDURES IN ACCORDANCE WITH SECTION 948. THE ACCEPTABLE CRITERIA ARE STATED IN TABLE 6.1 OF AASHTO/AWS D1.1. PROVIDE FULL PENETRATION GROOVE WELDS FOR ALL LONGITUDINAL WELDS WITHIN 6" OF A FULL PENETRATION CIRCUMFERENTIAL GROOVE WELD AND INSPECT AS SPECIFIED ABOVE. PROVIDE MAXIMUM WELD UNDERCUT OF 0.01".
- HOT-DIP GALVANIZE ALL COMPONENTS (EXCEPT REINFORCEMENT BARS, ALUMINUM, AND NON-FERROUS INCIDENTALS) AFTER FABRICATION PER ASTM A123 OR ASTM A153, AS APPROPRIATE.

CONSTRUCTION

- USE TEMPLATES TO ACCURATELY SET BASE PLATE ANCHOR BOLTS TO CORRECT ELEVATION AND ALIGNMENT. SECURELY BRACE ANCHOR BOLTS AGAINST DISPLACEMENT BEFORE CAISSON CONCRETE IS PLACED AND DURING CONCRETE CURING.
- ERECT SIGN STRUCTURE ONLY AFTER CAISSON CONCRETE MEETS 7 DAY STRENGTH REQUIREMENTS.
- TEMPORARILY SUPPORT MAST ARMS TO RELIEVE LOAD FROM THE SPLICES WHILE HIGH-STRENGTH BOLTS ARE BEING TIGHTENED IN ORDER TO FIRMLY SEAT THE CONNECTION PLATES.
- PRIOR TO ERECTION, DEMONSTRATE TO THE ENGINEER BY PREASSEMBLY OR OTHER APPROVED METHOD THAT FRAME STRUCTURE LENGTH IN A NO-LOAD CONDITION MATCHES FIELD MEASURED CAISSON SPACING WITHIN 1/2".
- ADEQUATELY SUSPEND FRAME STRUCTURES TO AVOID DISTORTIONS OR CHANGES IN SPAN LENGTH IF ERECTED ONTO FOUNDATIONS AS ONE UNIT.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE

MONOPIPE SIGN STRUCTURES  
FRAME STRUCTURE SPANS UP TO 160’  
AND CANTILEVER MONOPIPE STRUCTURE  
STRUT LENGTHS UP TO 27’

NOTES AND DESIGN CRITERIA

RECOMMENDED JUL.10, 2025

CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025

CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 1 OF 7

BD-647M

|          |                                                             |
|----------|-------------------------------------------------------------|
| TC-8700C | SPACING CHARTS/DIRECT APPLIED LETTERS, NUMERALS, & ARROWS   |
| TC-8701D | SIGN DETAILS/FREEWAY AND EXPRESSWAY GUIDE SIGNS             |
| TC-8701E | EXTRUDED ALUMINUM CHANNEL SIGN                              |
| TC-8701S | FLAT SHEET ALUMINUM SIGNS WITH EXTRUDED ALUMINUM STIFFENERS |
| TC-8715  | SIGN LIGHTING                                               |
| BC-736M  | REINFORCEMENT BAR FABRICATION DETAILS                       |
| BC-747M  | MONOPIPE SIGN STRUCTURES                                    |
| RC-11M   | CLASSIFICATION OF EARTHWORK FOR STRUCTURES                  |
| RC-51M   | TYPE 31 STRONG POST GUIDE RAIL                              |
| RC-53M   | TYPE 2 WEAK POST GUIDE RAIL                                 |
| RC-54M   | BARRIER PLACEMENT AT OBSTRUCTIONS                           |
| RC-58M   | SINGLE FACE CONCRETE BARRIER                                |

REFERENCE DRAWINGS



- ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN  $\frac{1}{2}$ ".
- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
- DURING THE REVIEW PROCESS OF THE SHOP DRAWINGS, CALLING FOR "VERIFICATION" OF AN ITEM, SIZE, DIMENSION WELD, OR ANY DETAIL IS INSUFFICIENT. SUCH DETAILS AND/OR CORRECTIONS SHALL BE NOTED ON THE SHOP DRAWINGS BY THE REVIEWING AUTHORITY. ANY DISCREPANCIES OF QUESTIONS SHALL BE REFERRED TO PENNDOT FOR REVIEW AND RESOLUTION.
- IF CONTRACT DRAWINGS INDICATE A "SCALE" THEN ALL DETAILS, LAYOUTS OF SIGN PANELS/BOXES, SIGN/WALKWAY SUPPORTS, HANDRAILS AND ALL ITEMS RELATED TO THE STRUCTURE SHALL BE DEPICTED PER "SCALE" SHOWN.
- WHEN SIZING FRAME COMPONENTS AND THE HORIZONTAL CENTERLINE OF THE SIGN PANEL IS NOT LOCATED AT THE CENTERLINE OF MAST ARM, CALCULATE PANEL AREA AS TWICE THE VERTICAL DIMENSION FROM THE CENTERLINE OF MAST ARM TO EITHER THE TOP OR BOTTOM OF THE SIGN PANEL, WHICHEVER IS GREATER, MULTIPLIED BY THE SIGN PANEL LENGTH.
- USE A MINIMUM OF 2" THICKNESS FOR ALL SPLICE PLATES TO PREVENT DISTORTION DURING WELDING.

### SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION A MINIMUM OF 6 INCHES ABOVE THE HIGHEST SURROUNDING FINISHED GRADE ELEVATION.

- SEE THE FOLLOWING DIAGRAMS FOR ADDITIONAL INSTRUCTIONS FOR POSITIONING THE SIGN PANELS AND SIGN STRUCTURE.
- THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:

1. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
2. THE ACTUAL SIGN AREA INCREASED BY 25%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (RURAL HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
3. THE ACTUAL SIGN AREA INCREASED BY 50%, BASED ON THE PROBABILITY OF SIGNS BEING ADDED OR INCREASED IN SIZE. (URBAN HIGHWAY DEFINITION OF "DESIGN SIGN AREA").
4. THE SIGN AREA CALCULATED FOR MULTIPLE SIGN PANELS AS DESCRIBED BELOW.

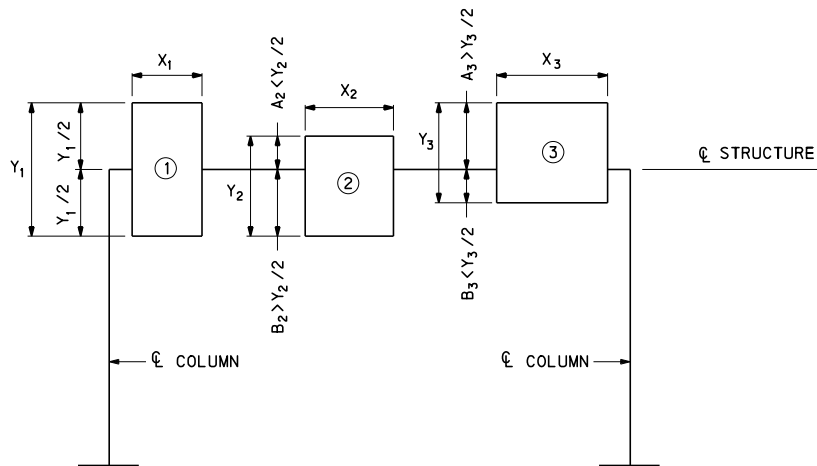
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.
- WHEN MULTIPLE SIGN PANELS ARE PLACED ON ONE STRUCTURE AND ONE OR MORE OF THE SIGN PANELS IS NOT CENTERED IN THE VERTICAL DIRECTION, COMPUTE THE DESIGN SIGN AREA IN THE FOLLOWING MANNER:

THE SIGN AREA FOR ANY SIGN PANEL CENTERED IN THE VERTICAL DIRECTION IS (X) x (Y)

THE SIGN AREA FOR ANY SIGN PANEL PLACED OFF-CENTER IN THE VERTICAL DIRECTION IS  $(X) \times (B) \times 2$  WHEN  $B > A$  OR  $(X) \times (A) \times 2$  WHEN  $A > B$ .

EXAMPLE:

AREA OF SIGN NO. 1 =  $(X_1) \times (Y_1)$   
 AREA OF SIGN NO. 2 =  $(X_2) \times (B_2) \times 2$   
 AREA OF SIGN NO. 3 =  $(X_3) \times (A_3) \times 2$



A = DISTANCE FROM  $\text{CL}$  STRUCTURE TO TOP OF SIGN  
B = DISTANCE FROM  $\text{CL}$  STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO.1 =  $X_1 Y_1$   
DESIGN AREA OF SIGN NO.2 =  $(X_2 B_2) \times 2$   
DESIGN AREA OF SIGN NO.3 =  $(X_3 A_3) \times 2$

- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 10'-0" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT)
- SET THE STRUCTURE, SIGN PANELS, AND LUMINAIRES TO AN ELEVATION THAT WILL PROVIDE A MINIMUM OF 17'-6" VERTICAL CLEARANCE ABOVE THE HIGHEST POINT OF THE ENTIRE ROADWAY WIDTH (INCLUDING THE ROADWAY PAVEMENT AND SHOULDERS) PASSING UNDER THE STRUCTURE. SET THE BOTTOM OF ALL SIGN PANELS TO GENERALLY THE SAME ELEVATION. IN THE CASE OF A STRUCTURE SPANNING DUAL ROADWAYS WHERE THE DIFFERENCE IN ELEVATIONS OF THE HIGHEST POINT ON EACH ROADWAY IS GREATER THAN 2'-6", SET THE BOTTOM OF ALL SIGN PANELS OVER EACH ROADWAY TO THE SAME VERTICAL CLEARANCE.
- WHEN THE MAXIMUM SIGN HEIGHT IS USED FOR DESIGN, SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 10'-0" ABOVE THE BOTTOM OF THE SIGN PANELS. WHEN THE STRUCTURE SPANS DUAL ROADWAYS WITH THE DIFFERENCE IN HIGH POINT ELEVATIONS GREATER THAN 2'-6", SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 10'-0" ABOVE THE BOTTOM OF THE SIGN PANELS OVER THE UPPER ROADWAY.
- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE SHEETS 3 AND 4.
- THE DESIGN POST HEIGHT SHALL BE THE ACTUAL DESIGN POST HEIGHT ROUNDED UP TO THE NEAREST FOOT.
- THE DESIGN SIGN PANEL LENGTH AND "X" DIMENSION SHALL BE THE DIMENSIONS AS DETERMINED IN THE FOLLOWING EXAMPLE ROUNDED UP TO THE NEXT HIGHEST INCREMENTS SHOWN IN THE DESIGN TABLES.

78'

10' 18' 20' 16' 14'

5' 7' 14'

① ②

CL STRUCTURE &  
CL SIGN PANEL NO. 2

CL COLUMN CL COLUMN

PROPOSED  
GROUNDLINE  
ELEV. 997.50

ELEV. 1000.00

ELEV. 999.50

**NOTE:**  
ELEVATIONS ARE IN  
FEET

- $\Delta$  ELEV. = 999.50 - 997.50  $\leq$  5'-0" OK
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION  
ELEV. 1000.00 + 17'-6" + 1'-9" = 1019.25  
[1'-9" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]
- SET  $\mathcal{C}$  STRUCTURE AT  $\mathcal{C}$  OF SIGN PANEL NO. 2  
ELEV. 1019.25 + 14'/2 = 1026.25
- ACTUAL SPAN LENGTH = 78'  $\rightarrow$  USE: 80'
- DESIGN COLUMN HEIGHT (H):  
H = 1026.25 - 997.50 - 0.50' = 28.25' USE H = 29'  
[0.50' = MINIMUM HEIGHT OF PEDESTAL ABOVE GRADE]
- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:  

$$A_1 = 18' \times 7' \times 2 = 252.0 \text{ SF}$$

$$A_2 = \frac{16' \times 14'}{2} = 112.0 \text{ SF}$$

$$A_3 = 476.0 \text{ SF}$$

$$\rightarrow \text{USE } 500.0 \text{ SF}$$

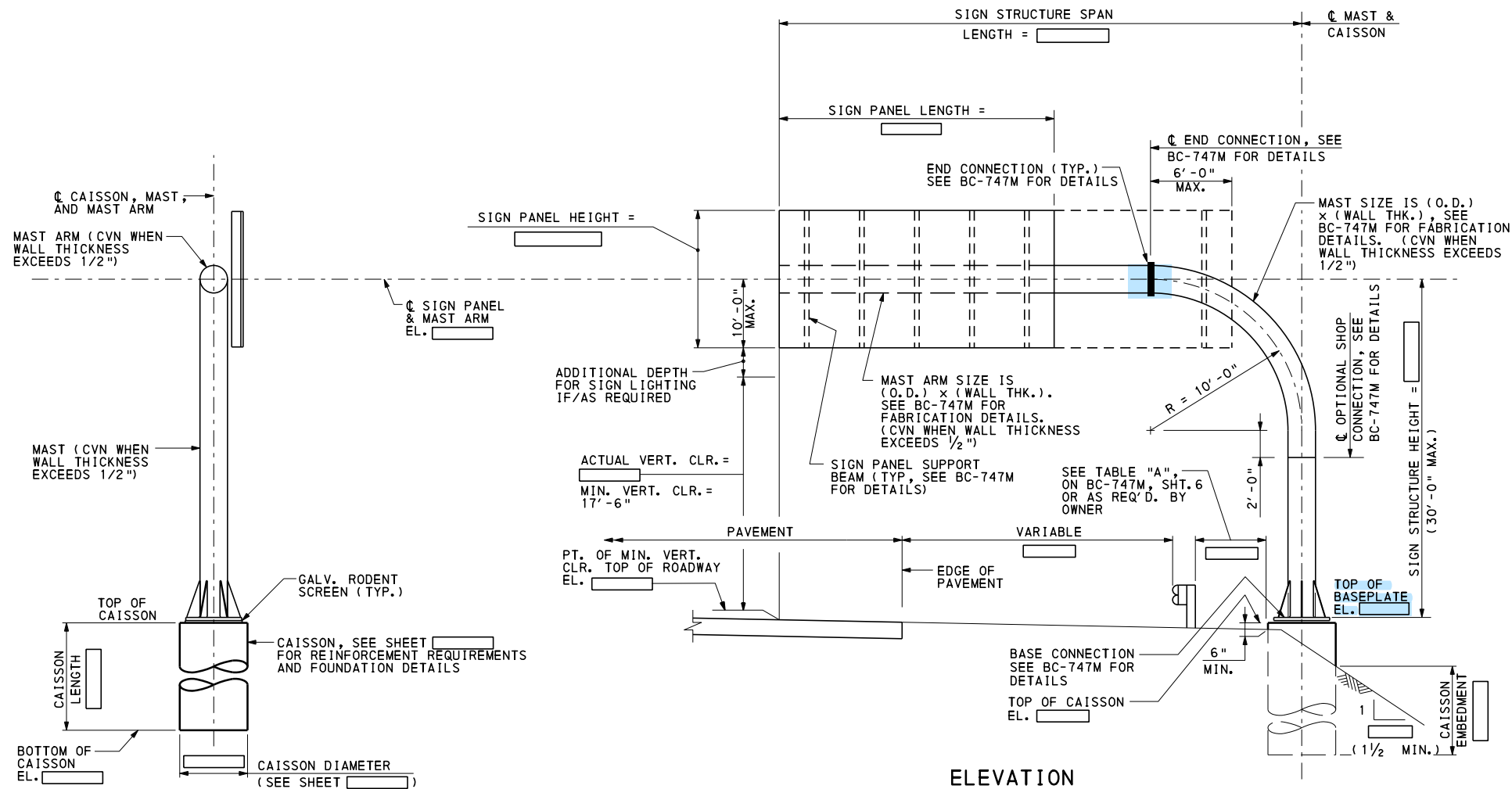
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|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>MONOPIPE SIGN STRUCTURES</p> <p>FRAME STRUCTURE SPANS UP TO 160'</p> <p>AND CANTILEVER MONOPIPE STRUCTURE</p> <p>STRUT LENGTHS UP TO 27'</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------|

RECOMMENDED JUL. 10, 2025  
*Kristin D. Lange*  
 CHIEF BRIDGE ENGINEER

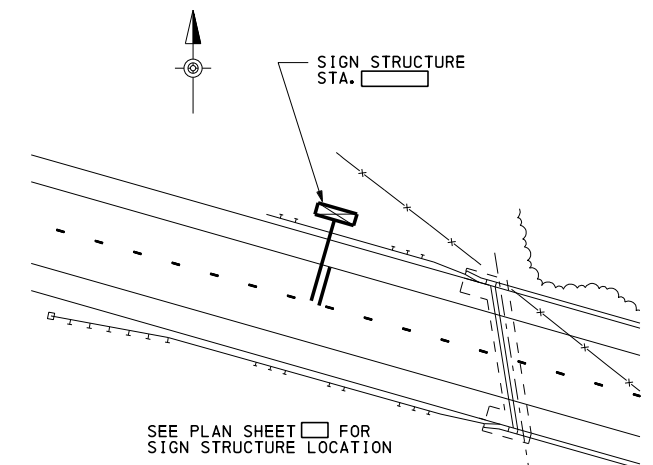
RECOMMENDED JUL. 10, 2025  
*Jonathan A. Elser*  
 CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 2 OF 7

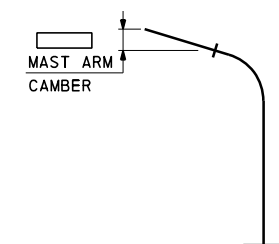
BD-647M



SIDE VIEW



LOCATION PLAN



CAMBER DIAGRAM

NOTES TO DESIGNER:

- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH [ ]
- DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES ON ELEVATION BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED.
- DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER ON DESIGN PLAN FOR EACH SPECIFIC STRUCTURE SPAN.
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS:

GENERAL NOTES:

1. FOR GENERAL NOTES, SEE BC-747M.
2. PROVIDE A SPACE OF 2'-0" OR LESS, OR ONE-HALF THE TALLER PANEL HEIGHT OR MORE, BETWEEN ADJACENT SIGN PANELS WHEN PRESENT.
3. TERMINATE WELDS 1/4" SHORT OF STIFFENER ENDS AND STIFFENER CHAMFER.
4. SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, 1/2" BY 1/2" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.
5. CONTRACTOR HAS THE OPTION TO ADD OR ELIMINATE CONNECTIONS.

DESIGN CRITERIA

DESIGN SIGN AREA (A) = [ ]  
DESIGN SPAN = [ ]  
FATIGUE CATEGORY = [ ]

NOTE:  
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%,  
OR ACTUAL INCREASED BY 50% SIGN AREA.  
(DESIGNER TO INDICATE CONTROLLING CONDITION)

TABLE OF ESTIMATED QUANTITIES

| ITEM NO.  | ITEM                    | UNIT | QUANTITY |
|-----------|-------------------------|------|----------|
| *         | STEEL SIGN STRUCTURE    | LBS  |          |
| 0000-0000 | STRUCTURE MOUNTED SIGNS | SF   |          |
| 0000-0000 | CLASS 3 EXCAVATION      | CY   |          |
| 0000-0000 | CLASS A CEMENT CONCRETE | CY   |          |
| 0000-0000 | REINFORCEMENT BARS      | LBS  |          |

\* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000]

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

MONOPIPE SIGN STRUCTURES

CANTILEVER MONOPIPE STRUCTURE  
STRUT LENGTHS UP TO 27'

CANTILEVER STRUCTURE  
SAMPLE CONTRACT DRAWING

RECOMMENDED JUL. 10, 2025

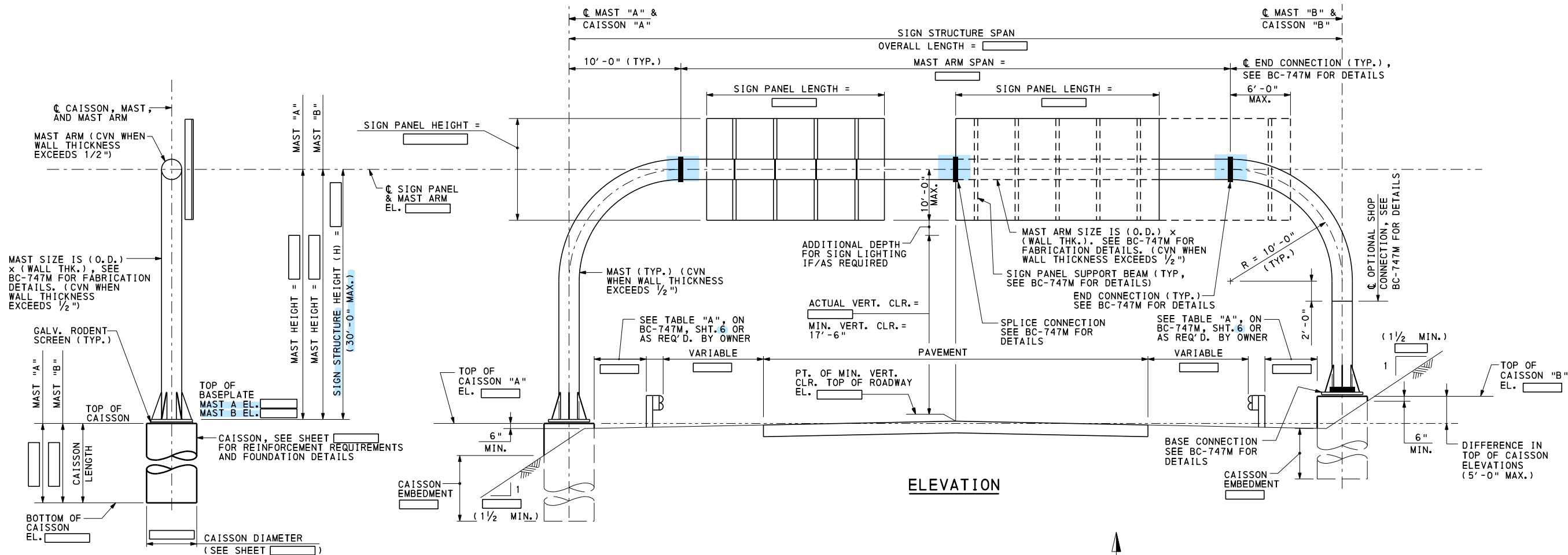
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025

*[Signature]*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 3 OF 7

BD-647M

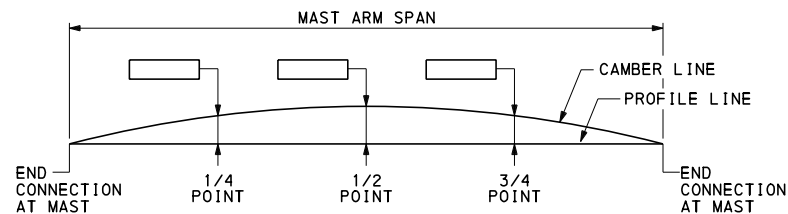


#### NOTES TO DESIGNER:

- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH [ ]
- DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES ON ELEVATION AND SIDE VIEW BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED.
- DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER ON DESIGN PLAN FOR EACH SPECIFIC STRUCTURE SPAN.
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS:

#### GENERAL NOTES:

1. FOR GENERAL NOTES, SEE BC-747M.
2. PROVIDE A SPACE OF 2'-0" OR LESS, OR ONE-HALF THE TALLER PANEL HEIGHT OR MORE, BETWEEN ADJACENT SIGN PANELS WHEN PRESENT.
3. TERMINATE WELDS 1/4" SHORT OF STIFFENER ENDS AND STIFFENER CHAMFER.
4. SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, 1/2" BY 1/2" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.
5. CONTRACTOR HAS THE OPTION TO ADD OR ELIMINATE CONNECTIONS.



#### CAMBER DIAGRAM

CAMBER VALUES REPRESENTS MAXIMUM PERMANENT CAMBER VALUES BETWEEN END CONNECTIONS AND SPAN LENGTH EQUALS DISTANCE BETWEEN MASTS.

#### DESIGN CRITERIA

DESIGN SIGN AREA (A) = [ ]

DESIGN SPAN = [ ]

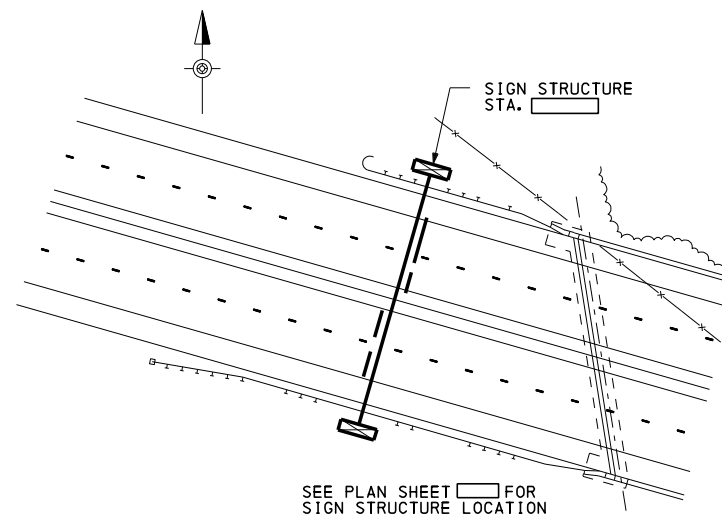
FATIGUE CATEGORY = [ ]

NOTE:  
DESIGN FOR ACTUAL, ACTUAL INCREASED BY 25%,  
OR ACTUAL INCREASED BY 50% SIGN AREA.  
(DESIGNER TO INDICATE CONTROLLING CONDITION)

#### TABLE OF ESTIMATED QUANTITIES

| ITEM NO.  | ITEM                    | UNIT | QUANTITY |
|-----------|-------------------------|------|----------|
| *         | STEEL SIGN STRUCTURE    | LBS  |          |
| 0000-0000 | STRUCTURE MOUNTED SIGNS | SF   |          |
| 0000-0000 | CLASS 3 EXCAVATION      | CY   |          |
| 0000-0000 | CLASS A CEMENT CONCRETE | CY   |          |
| 0000-0000 | REINFORCEMENT BARS      | LBS  |          |

\* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000]



#### LOCATION PLAN

### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE

#### MONOPIPE SIGN STRUCTURES

FRAME STRUCTURE SPANS UP TO 160'

#### FRAME STRUCTURE SAMPLE CONTRACT DRAWING

RECOMMENDED JUL. 10, 2025

*John D. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025

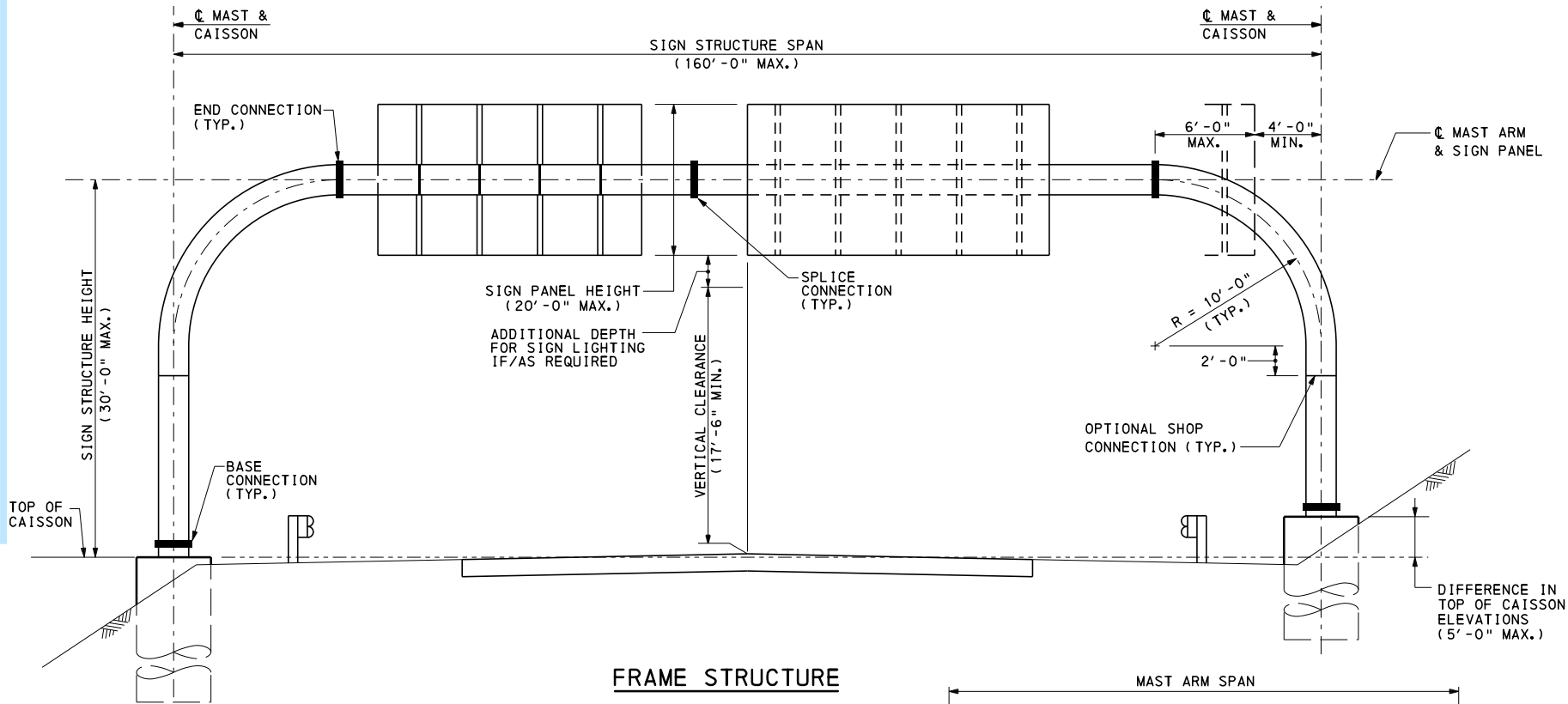
*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 4 OF 7

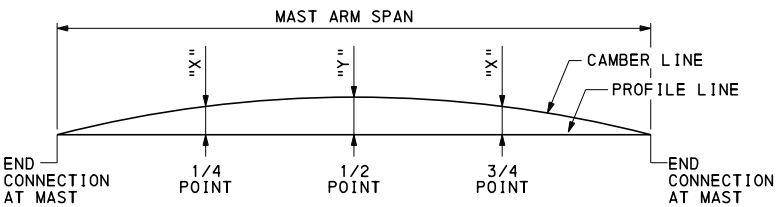
BD-647M



| MAST & MAST ARM SELECTION TABLE (FRAME STRUCTURES) |                       |              |                    |                                              |                    |                        |                                              |                    |                        |
|----------------------------------------------------|-----------------------|--------------|--------------------|----------------------------------------------|--------------------|------------------------|----------------------------------------------|--------------------|------------------------|
| SPAN<br>(FT)                                       | PANEL<br>AREA<br>(SF) | MAST         |                    | MAST ARM                                     |                    |                        |                                              |                    |                        |
|                                                    |                       | DIA.<br>(IN) | THICK.<br>(IN)     | USING MAXIMUM LENGTH<br>OF MAST ARM SEGMENTS |                    |                        | USING MINIMUM LENGTH<br>OF MAST ARM SEGMENTS |                    |                        |
|                                                    |                       |              |                    | DIA.<br>(IN)                                 | THICK.<br>(IN)     | SEGMENT<br>ARRANGEMENT | DIA.<br>(IN)                                 | THICK.<br>(IN)     | SEGMENT<br>ARRANGEMENT |
| 60                                                 | 760                   | 24           | 0.562<br>(SCH. 30) | 24                                           | 0.375<br>(SCH. 20) | A                      | 24                                           | 0.375<br>(SCH. 20) | B                      |
|                                                    | 440                   | 24           | 0.375<br>(SCH. 20) | 24                                           | 0.375<br>(SCH. 20) | A                      | 24                                           | 0.375<br>(SCH. 20) | B                      |
| 80                                                 | 600                   | 24           | 0.562<br>(SCH. 30) | 24                                           | 0.375<br>(SCH. 20) | B                      | 24                                           | 0.375<br>(SCH. 20) | C                      |
|                                                    | 500                   | 24           | 0.500<br>(WT. XS)  | 24                                           | 0.375<br>(SCH. 20) | B                      | 24                                           | 0.375<br>(SCH. 20) | C                      |
|                                                    | 360                   | 24           | 0.375<br>(SCH. 20) | 24                                           | 0.375<br>(SCH. 20) | B                      | 24                                           | 0.375<br>(SCH. 20) | C                      |
| 100                                                | 520                   | 24           | 0.562<br>(SCH. 30) | 24                                           | 0.375<br>(SCH. 20) | B                      | 24                                           | 0.375<br>(SCH. 20) | C                      |
|                                                    | 280                   | 24           | 0.500<br>(WT. XS)  | 24                                           | 0.375<br>(SCH. 20) | B                      | 24                                           | 0.375<br>(SCH. 20) | C                      |
| 120                                                | 500                   | 24           | 0.562<br>(SCH. 30) | 24                                           | 0.500<br>(WT. XS)  | C                      | 24                                           | 0.500<br>(WT. XS)  | D                      |
|                                                    | 360                   | 24           | 0.500<br>(WT. XS)  | 24                                           | 0.375<br>(SCH. 20) | C                      | 24                                           | 0.375<br>(SCH. 20) | D                      |
| 140                                                | 420                   | 24           | 0.562<br>(SCH. 30) | 24                                           | 0.500<br>(WT. XS)  | C                      | 24                                           | 0.500<br>(WT. XS)  | D                      |
|                                                    | 300                   | 24           | 0.500<br>(WT. XS)  | 24                                           | 0.375<br>(SCH. 20) | C                      | 24                                           | 0.375<br>(SCH. 20) | D                      |
| 160                                                | 400                   | 24           | 0.562<br>(SCH. 30) | 24                                           | 0.500<br>(WT. XS)  | D                      | 24                                           | 0.500<br>(WT. XS)  | E                      |
|                                                    | 340                   | 24           | 0.500<br>(WT. XS)  | 24                                           | 0.500<br>(WT. XS)  | D                      | 24                                           | 0.500<br>(WT. XS)  | E                      |



FRAME STRUCTURE



CAMBER DIAGRAM

| MAST ARM SEGMENT ARRANGEMENT TABLE (FRAME STRUCTURES) |                                  |
|-------------------------------------------------------|----------------------------------|
| ARRANGEMENT                                           | SEGMENT LENGTH / MAST ARM LENGTH |
| A                                                     | 1.00                             |
| B                                                     | 0.50   0.50                      |
| C                                                     | 0.33   0.33   0.33               |
| D                                                     | 0.25   0.25   0.25   0.25        |
| E                                                     | 0.20   0.20   0.20   0.20   0.20 |

| CAMBER           |        |        |
|------------------|--------|--------|
| SPAN *<br>(FEET) | X (IN) | Y (IN) |
| 60               | 3/4    | 1      |
| 80               | 1 1/4  | 1 5/8  |
| 100              | 1 1/2  | 2 5/8  |
| 120              | 3 1/8  | 4 1/4  |
| 140              | 4 7/8  | 6 3/4  |
| 160              | 7 1/4  | 10 1/8 |

\* SIGN STRUCTURE SPAN  
CAMBER VALUES REPRESENTS MAXIMUM  
PERMANENT CAMBER VALUES BETWEEN END  
CONNECTIONS AND SPAN LENGTH EQUALS  
DISTANCE BETWEEN MASTS.

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DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

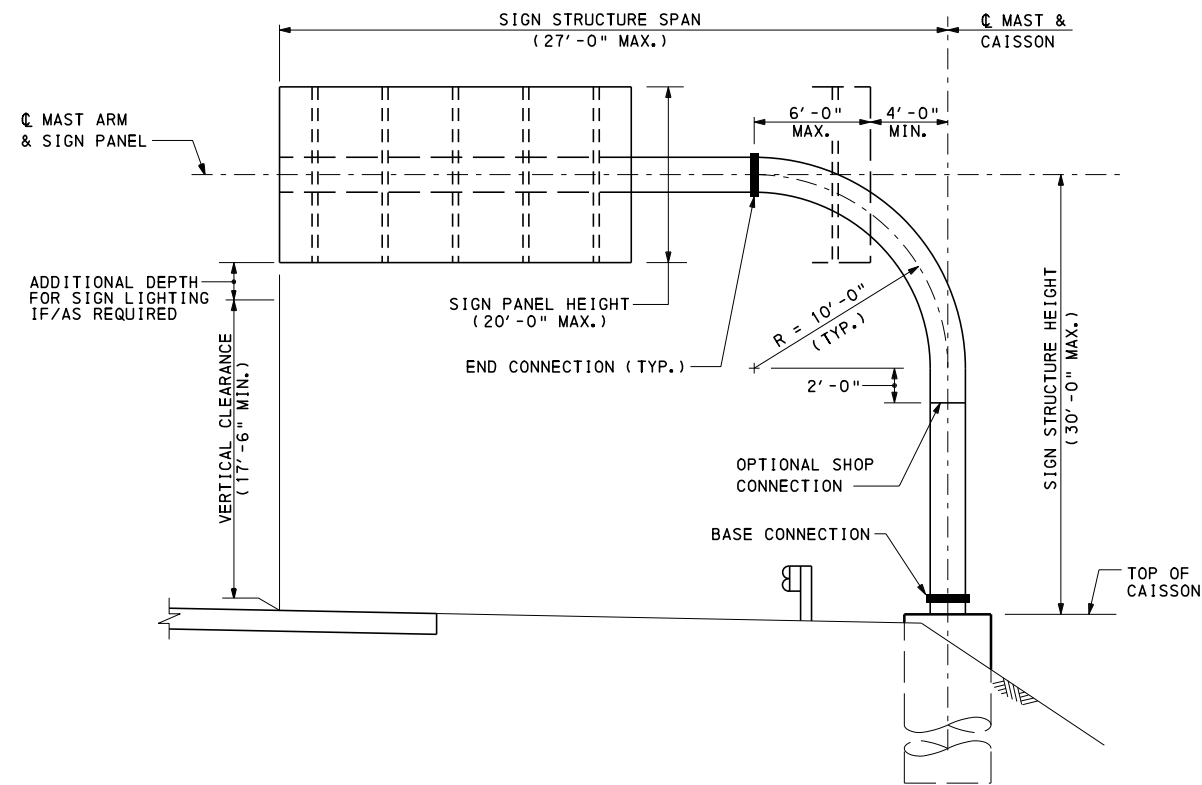
MONOPIPE SIGN STRUCTURES  
FRAME STRUCTURE SPANS UP TO 160'

DESIGN TABLES  
MAST AND MAST ARM SELECTION

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 5 OF 7  
BD-647M



CANTILEVER STRUCTURE

| MAST & MAST ARM SELECTION TABLE<br>(CANTILEVER STRUCTURES) |                       |              |                    |              |                    |
|------------------------------------------------------------|-----------------------|--------------|--------------------|--------------|--------------------|
| SPAN<br>(FT)                                               | PANEL<br>AREA<br>(SF) | MAST         |                    | MAST ARM     |                    |
|                                                            |                       | DIA.<br>(IN) | THICK.<br>(IN)     | DIA.<br>(IN) | THICK.<br>(IN)     |
| 27                                                         | 180                   | 24           | 0.562<br>(SCH. 30) | 24           | 0.375<br>(SCH. 20) |
|                                                            | 160                   | 24           | 0.500<br>(SCH. 30) | 24           | 0.375<br>(SCH. 20) |

MAST ARM  
CAMBER

CAMBER DIAGRAM

| CAMBER             |             |
|--------------------|-------------|
| PANEL AREA (S. F.) | CAMBER (IN) |
| 180                | 1 3/4       |
| 160                | 1 3/4       |

NOTES:

1. FOR GENERAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

MONOPIPE SIGN STRUCTURES  
CANTILEVER MONOPIPE STRUCTURE  
STRUT LENGTHS UP TO 27'

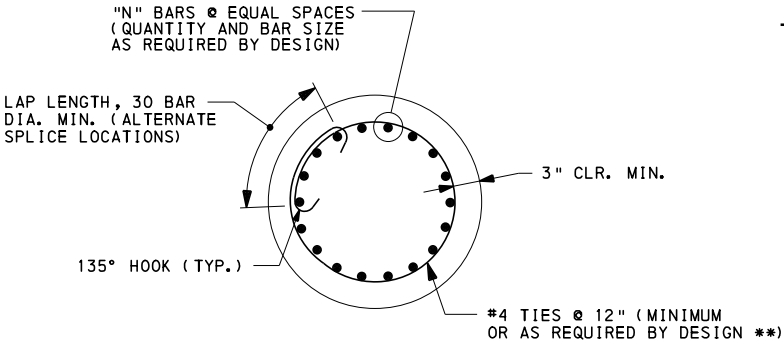
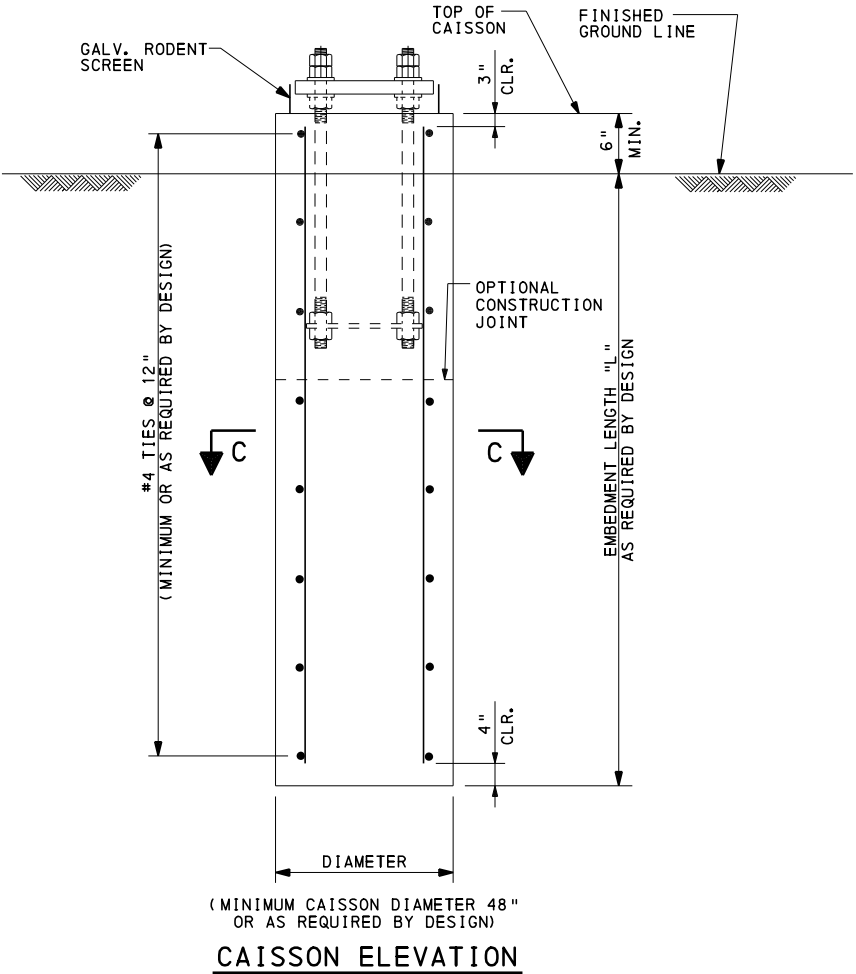
DESIGN TABLES  
MAST AND MAST ARM SELECTION

RECOMMENDED JUL. 10, 2025  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
*[Signature]*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

| CAISSON FOUNDATION LOADS (FRAME STRUCTURES) |                       |                                              |              |              |                   |                                              |              |              |                   |
|---------------------------------------------|-----------------------|----------------------------------------------|--------------|--------------|-------------------|----------------------------------------------|--------------|--------------|-------------------|
| SPAN<br>(FEET)                              | PANEL<br>AREA<br>(SF) | MAXIMUM LOADS AT TOP OF<br>CAISSON (EXTREME) |              |              |                   | MAXIMUM LOADS AT TOP OF<br>CAISSON (SERVICE) |              |              |                   |
|                                             |                       | MOMENT<br>(K-FT)                             | SHEAR<br>(K) | AXIAL<br>(K) | TORSION<br>(K-FT) | MOMENT<br>(K-FT)                             | SHEAR<br>(K) | AXIAL<br>(K) | TORSION<br>(K-FT) |
| 60                                          | 760                   | 754.0                                        | 33.0         | 22.0         | 136.0             | 321.0                                        | 16.0         | 17.0         | 55.0              |
|                                             | 440                   | 479.0                                        | 22.0         | 16.0         | 70.0              | 203.0                                        | 10.0         | 12.0         | 28.0              |
| 80                                          | 600                   | 715.0                                        | 31.0         | 20.0         | 176.0             | 305.0                                        | 15.0         | 16.0         | 71.0              |
|                                             | 500                   | 603.0                                        | 27.0         | 18.0         | 140.0             | 256.0                                        | 13.0         | 14.0         | 57.0              |
|                                             | 360                   | 465.0                                        | 21.0         | 15.0         | 93.0              | 199.0                                        | 11.0         | 12.0         | 38.0              |
| 100                                         | 520                   | 699.0                                        | 31.0         | 20.0         | 214.0             | 301.0                                        | 17.0         | 17.0         | 86.0              |
|                                             | 280                   | 439.0                                        | 21.0         | 16.0         | 128.0             | 198.0                                        | 12.0         | 13.0         | 52.0              |
| 120                                         | 500                   | 714.0                                        | 36.0         | 22.0         | 246.0             | 336.0                                        | 21.0         | 18.0         | 99.0              |
|                                             | 360                   | 567.0                                        | 28.0         | 18.0         | 205.0             | 260.0                                        | 16.0         | 15.0         | 83.0              |
| 140                                         | 420                   | 699.0                                        | 36.0         | 23.0         | 279.0             | 335.0                                        | 23.0         | 19.0         | 112.0             |
|                                             | 300                   | 558.0                                        | 28.0         | 19.0         | 230.0             | 262.0                                        | 18.0         | 16.0         | 93.0              |
| 160                                         | 400                   | 734.0                                        | 39.0         | 25.0         | 331.0             | 360.0                                        | 26.0         | 21.0         | 133.0             |
|                                             | 340                   | 651.0                                        | 36.0         | 24.0         | 279.0             | 323.0                                        | 25.0         | 19.0         | 112.0             |

| CAISSON FOUNDATION LOADS (CANTILEVER STRUCTURES) |                       |                                              |              |              |                   |                                              |              |              |                   |
|--------------------------------------------------|-----------------------|----------------------------------------------|--------------|--------------|-------------------|----------------------------------------------|--------------|--------------|-------------------|
| SPAN<br>(FEET)                                   | PANEL<br>AREA<br>(SF) | MAXIMUM LOADS AT TOP OF<br>CAISSON (EXTREME) |              |              |                   | MAXIMUM LOADS AT TOP OF<br>CAISSON (SERVICE) |              |              |                   |
|                                                  |                       | MOMENT<br>(K-FT)                             | SHEAR<br>(K) | AXIAL<br>(K) | TORSION<br>(K-FT) | MOMENT<br>(K-FT)                             | SHEAR<br>(K) | AXIAL<br>(K) | TORSION<br>(K-FT) |
| 27                                               | 180                   | 499.0                                        | 15.0         | 13.0         | 194.0             | 256.0                                        | 6.0          | 10.0         | 78.0              |
|                                                  | 160                   | 450.0                                        | 14.0         | 11.0         | 179.0             | 228.0                                        | 6.0          | 9.0          | 72.0              |



SECTION C-C

\*\* IN PLACE OF #4 TIES AT 12", A #4 BAR SPIRAL WITH A 3" PITCH MAY BE USED. THE #4 TIES AT 12" ARE THE MINIMUM OR AS REQUIRED BY DESIGN.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

MONOPIPE SIGN STRUCTURES  
CANTILEVER MONOPIPE STRUCTURE  
STRUT LENGTHS UP TO 27'

DESIGN TABLES  
FOUNDATION LOADS AND DETAILS

RECOMMENDED JUL. 10, 2025  
*Kevin J. Lange*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 7 OF 7

BD-647M

CHANGE 1  
CHANGE 8

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS. THE DESIGNER MUST PROVIDE THE SIGN AREA, STRUCTURE HEIGHT, AND SIGN LOCATION USED TO OBTAIN MEMBER SIZES FROM THE DESIGN TABLES ON THE CONTRACT DRAWINGS.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE DESIGN TABLES CONTAINED IN THESE STANDARDS. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
- ALL SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-741M SHEET 2.
- THE FOLLOWING DETAILS FROM BC-741M HAVE BEEN VERIFIED FOR CMS LOADINGS AS PRESENTED IN BD-649M. ANY DETAIL THAT DOES NOT USE THE ASSUMPTIONS LISTED WITHIN BD-649M OR IS NOT INCLUDED IN THE FOLLOWING LIST NEEDS TO BE INDEPENDENTLY VERIFIED FOR CMS LOADINGS:
  - PEDESTALS
  - BASE PLATES
  - ANCHOR BOLTS
  - STRUT SLEEVE CONNECTIONS.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE  $f'c$  = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS OR CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB.408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE DIAMETER OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE AS DETAILED IN THIS STANDARD. IF THESE MINIMUMS ARE NOT PROVIDED, BOLT BEARING MUST BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. ANCHOR BOLTS MUST BE DESIGNED AND DETAILED IN ACCORDANCE WITH ACI 318-14 AND AISC DESIGN GUIDE 1, 2ND EDITION. A MINIMUM EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS MUST BE PROVIDED.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS WITH THICKNESSES GREATER THAN 1/2" REQUIRE CHARPY V-NOTCH TESTING AND ARE DESIGNATED ON THE PLANS BY (CVN). PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, LOAD PATH REDUNDANT MEMBER AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
18. PROVIDE A CERTIFICATION LETTER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA, CERTIFYING THAT THE INTERNAL STRUCTURE OF THE CMS AND THE CONNECTION TO THE SIGN STRUCTURE MEET THE REQUIREMENT OF THE AASHTO LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS. THE CERTIFICATION LETTER SHALL BE PREPARED BY THE CMS MANUFACTURER'S PROFESSIONAL ENGINEER AND SUBMITTED BY THE CONTRACTOR.
19. ONE TEST BORING SHALL BE PROVIDED AT EACH CMS AND DRILLED CAISSON FOUNDATION LOCATION.
20. ALTERNATIVE CAISSON FOUNDATIONS ARE PERMITTED FOR THESE STRUCTURES. DESIGN COMPUTATIONS ARE REQUIRED FOR CMS SIGN STRUCTURES TO BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS PENNDOT STD. DWGS. (U.N.O.) \*

|                                                                    |                                                                                              |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| SIGN SUPPORT BEAM COLUMNS, STRUTS CMS SIZE AND WEIGHT PER SUPPLIER | BD-649M, SHT. 6<br>CALCULATED INTERNALLY WITHIN PROGRAM<br>MAX. LIMITS PER BD-649M SHT 4 & 5 |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
  - EXTERNAL LOADS AASHTO LRFD SIGN

|                                                                                                                 |                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| BASIC WIND SPEED<br>SERVICE WIND SPEED<br>LIVE LOAD (CATWALKS ONLY)<br>MEAN WIND SPEED<br>WIND DRAG COEFFICIENT | STR/EXT 120 MPH (1700 YR MR1)<br>SER 76 MPH (10 YR MR1)<br>500 LBS (PER AASHTO LRFD SIGN SECTION 3.6)<br>FAT 11.2 MPH<br>Cd=1.7 FOR CMS |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
  - GROUP LOADS AASHTO LRFD SIGN 3.4
  - FATIGUE CRITERIA AASHTO LRFD SIGN

|                                                                                                             |               |
|-------------------------------------------------------------------------------------------------------------|---------------|
| CENTER-MOUNT CMS SUPPORT STRUCTURES SHALL BE DESIGNED AS FATIGUE CATEGORY 1.                                |               |
| CENTER-MOUNT CMS SUPPORT SHALL BE DESIGNED FOR GALLOPING WIND, NATURAL WIND GUSTS, AND TRUCK-INDUCED GUSTS. | AASHTO 11.7.1 |
  - STEEL CRITERIA AASHTO LRFD SIGN

|                                                                                                                                                                                          |                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| SECTION PROPERTIES FOR TUBULAR SHAPES<br>COMBINED FORCE INTERACTIONS<br>FATIGUE REQUIREMENTS (FATIGUE CATEGORY 1)<br>ALLOWABLE DEFLECTION<br>PERMANENT CAMBER<br>STRUCTURAL STEEL DESIGN | APPENDIX B, TABLE B.2.1<br>5.12<br>SECTION 11<br>10.4<br>10.5<br>SECTION 5 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
  - BOLT CRITERIA AASHTO LRFD BRIDGES (U.N.O.)

|                                                                                                   |                                                     |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| SLIP-CRITICAL BOLT<br>BOLT PRYING ACTION<br>COMBINED BOLT SHEAR AND TENSION<br>ANCHOR BOLT DESIGN | 6.13.2.8<br>6.13.2.10.4<br>6.13.2.11<br>SEE NOTE 15 |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------|
  - CONCRETE CRITERIA AASHTO LRFD BRIDGES & ACI 318-14

|                                                                                                                                                                                                                                                          |                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| BEARING RESISTANCE<br>SHEAR RESISTANCE OF FOOTINGS<br>SHEAR RESISTANCE OF CONCRETE<br>SLENDERNESS OF COLUMNS<br>MINIMUM REINF. OF FLEXURAL MEMBERS<br>SPACING LIMITS FOR REINFORCEMENT<br>MINIMUM CONCRETE COVER<br>TORSION<br>COLUMN DESIGN (PEDESTALS) | 5.6.5<br>5.7.1.4<br>5.7.1<br>5.6.4.3<br>DM-4, D5.6.3.3<br>DM-4, D5.10.3<br>DM-4, D5.10.1<br>5.7.2.1<br>5.6.4 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
  - SPREAD FOOTINGS ON SOIL

|                                                                                                                                                            |                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| MAXIMUM FACTORED BEARING RESISTANCE<br>MINIMUM AREA IN BEARING<br>UNIT WEIGHT OF SOIL<br>PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS<br>SLIDING RESISTANCE | 3 TONS PER SQUARE FOOT<br>95% (STRENGTH) 75% (SERVICE)<br>100 POUNDS PER CUBIC FOOT<br>DM-4, D10.6.1.4<br>DM-4, D10.6.3.4 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
  - DRILLED CAISSONS DM-4, SECTION 10.8

|                                              |                                  |
|----------------------------------------------|----------------------------------|
| MAXIMUM DESIGN LATERAL DISPLACEMENT ANALYSES | 0.5"<br>PENNDOT COM624 OR L-PILE |
|----------------------------------------------|----------------------------------|
  - SEISMIC DESIGN CRITERIA

|                                                                                                                                                                         |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| SEISMIC LOADS WERE NOT CONSIDERED IN THE DEVELOPMENT OF THIS STANDARD. THE DESIGNER MUST CHECK THE ADEQUACY OF THESE STANDARDS WHEN SEISMIC LOADS ARE TO BE CONSIDERED. |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
- \* LEGEND:
- AASHTO LRFD SIGN: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS
  - AASHTO LRFD BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
  - DM4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES.
  - U.N.O.: UNLESS NOTED OTHERWISE
  - ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-14).
  - CVN: CHARPY V-NOTCH.
  - AISC: AMERICAN INSTITUTE OF STEEL CONSTRUCTION - DESIGN GUIDE 1, BASE PLATE AND ANCHOR ROD DESIGN, 2ND EDITION
  - CMS: CHANGEABLE MESSAGE SIGN

|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| ITS-10             | STRUCTURE MOUNTED ENCLOSURES                                                              |
| ITS-11             | MAINTAINER PADS                                                                           |
| ITS-62             | CMS CONNECTION DETAILS                                                                    |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                                                     |
| BC-741M            | OVERHEAD SIGN STRUCTURES - CANTILEVER AND CENTER-MOUNT STRUCTURES STRUT LENGTHS UP TO 40' |
| RC-11M             | CLASSIFICATION OF EARTHWORK FOR STRUCTURES                                                |
| RC-51M             | TYPE 31 STRONG POST GUIDE RAIL                                                            |
| RC-53M             | TYPE 2 WEAK POST GUIDE RAIL                                                               |
| RC-54M             | BARRIER PLACEMENT AT OBSTRUCTIONS                                                         |
| RC-58M             | SINGLE FACE CONCRETE BARRIER                                                              |
| REFERENCE DRAWINGS |                                                                                           |

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORK:

PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

|                             |                                                          |
|-----------------------------|----------------------------------------------------------|
| COLUMNS & PIPE STRUTS:      | SEE PUBLICATION 408, SECTION 948.2.                      |
| ANGLES, SHAPES, AND PLATES: | AASHTO M270, GRADE 36 OR 50<br>ASTM A709, GRADE 36 OR 50 |
- ALTERNATE PRESS-BREAK MEMBERS:

ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 3/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBERS FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR STRUTS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

|               |                                                                   |
|---------------|-------------------------------------------------------------------|
| ANCHOR BOLTS: | ASTM F1554, GRADE 55 PER PUBLICATION 408<br>SECTION 1105.02(c) 3. |
| BOLTS:        | ASTM F3125, GRADE A325 H.S. BOLTS EXCEPT AS NOTED                 |
- DESIGN SPECIFICATIONS:

AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 1ST EDITION, 2015 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, PENNDOT DESIGN MANUAL - PART 4, DECEMBER 2019 EDITION
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

INFORMATION CONTAINED IN THE DESIGN TABLES

DESIGN TABLES INCLUDED IN THIS STANDARD WERE DEVELOPED USING A COMPUTER PROGRAM AND ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.

THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:

BD-649M: CMS CENTER-MOUNT STRUCTURES, CMS LENGTHS UP TO 40'

THE DESIGN TABLES INCLUDE MEMBER SIZES FOR THE STRUCTURES FOR VARIOUS COMBINATIONS OF DESIGN HEIGHT, SPAN LENGTH, AND SIGN AREA. THEY ALSO INCLUDE SPREAD FOOTING DESIGNS. ALTERNATE CAISSON FOUNDATIONS ARE PERMITTED WHERE SITE CONDITIONS DO NOT ALLOW FOR THE SPREAD FOOTING. DESIGN COMPUTATIONS ARE REQUIRED TO DETERMINE THE REQUIRED CAISSON EMBEDMENT AND REINFORCEMENT. THE DESIGN COMPUTATION MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL AND THE CORRESPONDING INFORMATION SHOWN ON THE CONTRACT DRAWINGS. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-741M.

THE FOLLOWING CRITERIA WERE USED TO DEVELOP THE DESIGN TABLES IN THIS STANDARD. DEVIATION FROM ANY OF THESE ASSUMPTIONS REQUIRE THE DESIGNER TO VERIFY THE DETAILS INCLUDED IN BD-641M, BD-649M, AND BC-741M.

- DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY 1.
- STRUCTURES WERE DESIGNED ASSUMING THE CMS SIGN IS CENTERED ABOUT THE COLUMN.
- SINGLE SIGNS ASSUMED AN OFFSET (ECCENTRICITY) OF 1/2 OF THE STRUT DIAMETER + 1.5" + SIGN SUPPORT BRACKET DEPTH + 3" + 1/2" SIGN PANEL THICKNESS (SEE SHEET 6).
- DOUBLE SIGN PANELS ASSUMED SAME SIZE CMS ON FRONT AND BACK WITH ZERO ECCENTRICITY.
- STRUT SPACING BASED ON 3/8 OF SIGN HEIGHT (DY).
- HEIGHT ABOVE GROUND FOR NORMAL WIND PRESSURE CALCULATION WAS ASSUMED TO BE 33 FT.
- TRAFFIC DESIGN SPEED OF 70 MPH WAS USED FOR TRUCK GUST LOAD CALCULATION.
- CATWALKS AND WALK-IN ACCESS PLATFORMS WERE CONSIDERED FOR THESE STRUCTURES WITH A WEIGHT OF 54 LBS/FT, NORMAL WIND AREA OF 0.33 SF/FT AND TRUCK GUST AREA OF 1.88 SF/FT.
- THE DEAD LOAD DUE TO THE CMS AND CATWALK/WALK-IN ACCESS PLATFORM WAS DOUBLED TO ACCOUNT FOR FRONT AND BACK CMS.
- CATWALKS ASSUMED TO BE THE LENGTH OF THE CMS MINUS 1'-0" FROM EACH END OF THE SIGN.
- WALK-IN ACCESS PLATFORMS ASSUMED TO BE 4' WIDE IN ELEVATION VIEW. STRUT LENGTHS WERE MODELED ASYMMETRICALLY TO ACCOUNT FOR THE PLATFORM BEING PLACED ON ONE SIDE OF THE ENCLOSURE. A CATWALK EXTENDING FROM THE WALK-IN PLATFORM TO 1'-0" FROM THE FAR END OF THE SIGN WAS INCLUDED IN THE DESIGN.
- SOIL FRICTION COEFFICIENT OF TAN(30°) 0.58 USED FOR SLIDING RESISTANCE.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
CHANGEABLE MESSAGE SIGNS  
CENTER-MOUNT SIGN STRUCTURES  
DESIGN CRITERIA AND  
GENERAL NOTES

|                                                                            |                                                                                         |                         |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------|
| RECOMMENDED JUL.10, 2025<br><i>Karin D. Lange</i><br>CHIEF BRIDGE ENGINEER | RECOMMENDED JUL.10, 2025<br><i>Jonathan A. Elser</i><br>CHIEF EXECUTIVE, HIGHWAY ADMIN. | SHEET 1 OF 6<br>BD-649M |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------|

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWING IN ACCORDANCE WITH PENNDOT DESIGN MANUAL PART 4, AND THESE STANDARDS.
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS ( IF APPLICABLE):
  - LATITUDE AND LONGITUDE OR STATION AND OFFSET OF THE CENTER OF THE POLE
  - CMS HEIGHT AND LENGTH
  - CMS AREA
  - DESIGN HEIGHT
  - DESIGN ECCENTRICITY
  - DESIGN WEIGHT OF CMS
  - ACCESS CONFIGURATION (FRONT ACCESS CATWALK OR WALK-IN)
  - IF THE STRUCTURE IS TO SUPPORT A BACK TO BACK MOUNT
  - TOP OF PEDESTAL ELEVATION
  - BOTTOM OF FOOTING ELEVATION
  - MINIMUM VERTICAL CLEARANCE PROJECTED TO EDGE OF PAVEMENT
3. IDENTIFY IF AN ENCLOSURE IS REQUIRED AND SPECIFY TYPE.
4. IDENTIFY IF A MAINTAINER PAD IS REQUIRED AND LOCATE.
5. IDENTIFY IF A SEPARATE CMS CABINET IS REQUIRED AND LOCATE.
6. IDENTIFY IF A LADDER IS REQUIRED AND LOCATE.
7. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE NOT TAKEN FROM THE CMS CENTER-MOUNT STRUCTURE STANDARDS, BD-649M, ITS STANDARDS OR BC-741M ITEMS LISTED IN THE INFORMATIONAL NOTES ON SHEET 1.
8. IDENTIFY THE PRESENCE OF GUIDE RAIL , BARRIER OR PLACEMENT OUTSIDE THE CLEAR ZONE.
9. THE DESIGNER MUST DETAIL THE LEAST DISTANCE FROM EDGE OF PEDESTAL TO REAR OF GUIDE RAIL POST OR BARRIER AND INSURE IT IS IN ACCORDANCE WITH BC-741M, SEE SHEET 2 TABLE A.
10. IF NEEDED DETAILS ARE NOT FOUND IN THE CMS CENTER-MOUNT STRUCTURE STANDARDS OR BC-741M ITEMS LISTED IN THE INFORMATIONAL NOTES ON SHEET 1, A SPECIAL SUBMISSION REQUESTING APPROVAL MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.
11. SUPPORT SIGN STRUCTURES INTENDED TO CARRY CMS NOT COVERED IN THESE STANDARDS MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THIS STANDARD MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF SUPPORT STRUCTURES CARRYING NON-STANDARD CMS.
12. ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. CATWALK IS LOCATED ON THE FRONT FACE OF EACH SIGN ON A FRONT AND BACK CMS. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH CMS. IDENTIFY CATWALK AND WALK-IN ACCESS PLATFORM LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN MINIMUM VERTICAL CLEARANCE.
13. FOR CAISSON ALTERNATIVE, PROVIDE CAISSON DIAMETER, TOP OF CAISSON ELEVATION, BOTTOM OF CAISSON ELEVATION, EMBEDMENT DEPTH, TOTAL CAISSON LENGTH, VERTICAL AND TIE REINFORCEMENT BAR NUMBER AND SIZE, AND ROCK SOCKET REQUIREMENTS AS REQUIRED.
14. THE DESIGNER IS RESPONSIBLE FOR VERIFYING THE STRUCTURAL CAPACITY OF ALL MEMBERS AND DETAILS SHOWN ON THE CONSTRUCTION PLANS. DETAILS FOR THE BC-741M ITEMS LISTED IN THE INFORMATIONAL NOTES ON SHEET 1 HAVE ALREADY BEEN ANALYZED FOR CMS LOADING. PIPE CAP AND HAND HOLE DETAILS FROM BC-741M CAN BE USED WITHOUT ANALYSIS.
15. ANY PIPE SIZE OTHER THAN THAT SHOWN ON THE STANDARD IS A PROJECT SPECIFIC DESIGN. THE DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE ROLLING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1#2".
16. PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".
17. DURING THE REVIEW PROCESS OF THE SHOP DRAWINGS, CALLING FOR "VERIFICATION" OF AN ITEM, SIZE, DIMENSION, WELD, OR ANY DETAIL IS INSUFFICIENT. SUCH DETAILS AND/OR CORRECTIONS SHALL BE NOTED ON THE SHOP DRAWINGS BY THE REVIEWING AUTHORITY. ANY DISCREPANCIES OF QUESTIONS SHALL BE REFERRED TO PENNDOT FOR REVIEW AND RESOLUTION.
18. IF CONTRACT DRAWINGS INDICATE A "SCALE" THEN ALL DETAILS, LAYOUTS OF SIGN PANELS/BOXES, SIGN/WALKWAY SUPPORTS, HANDRAILS AND ALL ITEMS RELATED TO THE STRUCTURE SHALL BE DEPICTED PER "SCALE" SHOWN.

NOTES TO FABRICATOR

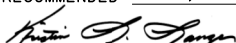
1. PROVIDE SHOP DRAWINGS IN ACCORDANCE WITH PUBLICATION 408, SECTION 105.02(D) AND CONTRACT SPECIAL PROVISIONS.
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE SHOP DRAWINGS:
  - GENERAL NOTES AND CONSTRUCTION NOTES, SEE SHEET 1 (AS APPLICABLE)
  - FABRICATION NOTES
  - TRANSPORTATION NOTES
  - LIFTING AND ERECTION NOTES
  - INSTALLATION NOTES
  - PROVIDE A TABLE OF QUANTITIES INCLUDING:
    - WEIGHT OF STEEL SIGN STRUCTURE
    - CLASS 3 EXCAVATION
    - CLASS A CEMENT CONCRETE
    - POUNDS OF REINFORCEMENT BARS

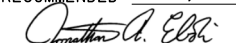
- FRONT AND SIDE ELEVATIONS WITH THE MINIMUM INFORMATION LISTED BELOW:
    - COLUMN SIZE
    - COLUMN HEIGHT
    - STRUT SIZE
    - STRUT SPACING
    - ACTUAL VERTICAL CLEAR
    - ACTUAL OFFSET FROM EDGE OF SHOULDER
    - FOOTING ELEVATION
    - FOOTING LENGTH AND WIDTH
    - PEDESTAL LENGTH AND WIDTH
    - PEDESTAL HEIGHT
    - TOP OF PEDESTAL ELEVATION
    - SIZE, NUMBER AND EMBEDMENT OF ANCHOR BOLTS
    - ECCENTRICITY
    - LATITUDE AND LONGITUDE OR STATION AND OFFSET OR THE CENTER OF THE COLUMN
    - CMS HEIGHT AND LENGTH
    - CMS AREA
    - DESIGN HEIGHT
    - DESIGN ECCENTRICITY
    - DESIGN WEIGHT OF CMS
    - SIZE AND TYPE OF PIPE CAPS
    - IDENTIFY ALL WELDS BY SIZE AND TYPE
3. IF AN ALTERNATE CAISSON FOUNDATION IS TO BE USED , THE DRAWINGS MUST INCLUDE THE FOLLOWING:
  - CONTROLLING LIMIT STATE FOR AXIAL LOAD
  - LOAD CASE
  - FACTORED LOAD
  - RESISTANCE
  - CONTROLLING STATE FOR LATERAL LOAD
  - LOAD CASE
  - DEFLECTION
  - ALLOWABLE DEFLECTION

4. ALUMINUM CMS SUPPORT STRUCTURES ARE PROHIBITED.
5. TELESOPING (SLIP-FIT) FIELD SPLICES FOR CMS SUPPORT STRUCTURES ARE PROHIBITED.
6. INDICATE THE SUPPLIER FOR CATWALK GRATING ON THE SHOP DRAWINGS.
7. PROVIDE HAND HOLE , STRUCTURE MOUNTED ENCLOSURE , AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON SHOP DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.
8. DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE CONTRACT DRAWINGS OR THE DETAILS CONTAINED IN THIS STANDARD. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THE DESIGN TABLES AND THE DETAILS IN THIS STANDARD.
9. FABRICATOR TO PROVIDE CERTIFIED/NOTARIZED COPIES OF MILL CERTS OF ALL MATERIALS USED ON PROJECT.
10. FABRICATOR TO PROVIDE CERTIFIED/NOTARIZED COPIES OF ALL QC/INSPECTION REPORTS AND A COPY TO ACCOMPANY EACH LOAD TO JOB SITE.
11. FABRICATOR TO REPORT ANY DAMAGE TO ANY ITEM TO DEPARTMENT WITH AN APPROPRIATE REPAIR PROCEDURE. DEPARTMENT WILL REVIEW SUCH A REQUEST, AND REPAIR PROCEDURE AND RESPOND. NO REPAIRS TO BE DONE PRIOR TO DEPARTMENT APPROVAL. IF DEEMED NECESSARY, THE DEPARTMENT MAY REQUEST CALCULATIONS FOR A REPAIR BY A PA REGISTERED PROFESSIONAL ENGINEER.
12. INSTALLING CONTRACTOR MUST CHECK ANCHORAGE ASSEMBLY IN FIELD FOR REQUIRED PROJECTION ETC. AND THEN AT INSTALLATION CHECK AND VERIFY ORIENTATION OF BASE AND ANCHOR BOLTS.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
CHANGEABLE MESSAGE SIGNS  
CENTER-MOUNT SIGN STRUCTURES  
NOTES TO DESIGNER  
AND FABRICATOR

RECOMMENDED JUL.10, 2025  
  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025  
  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

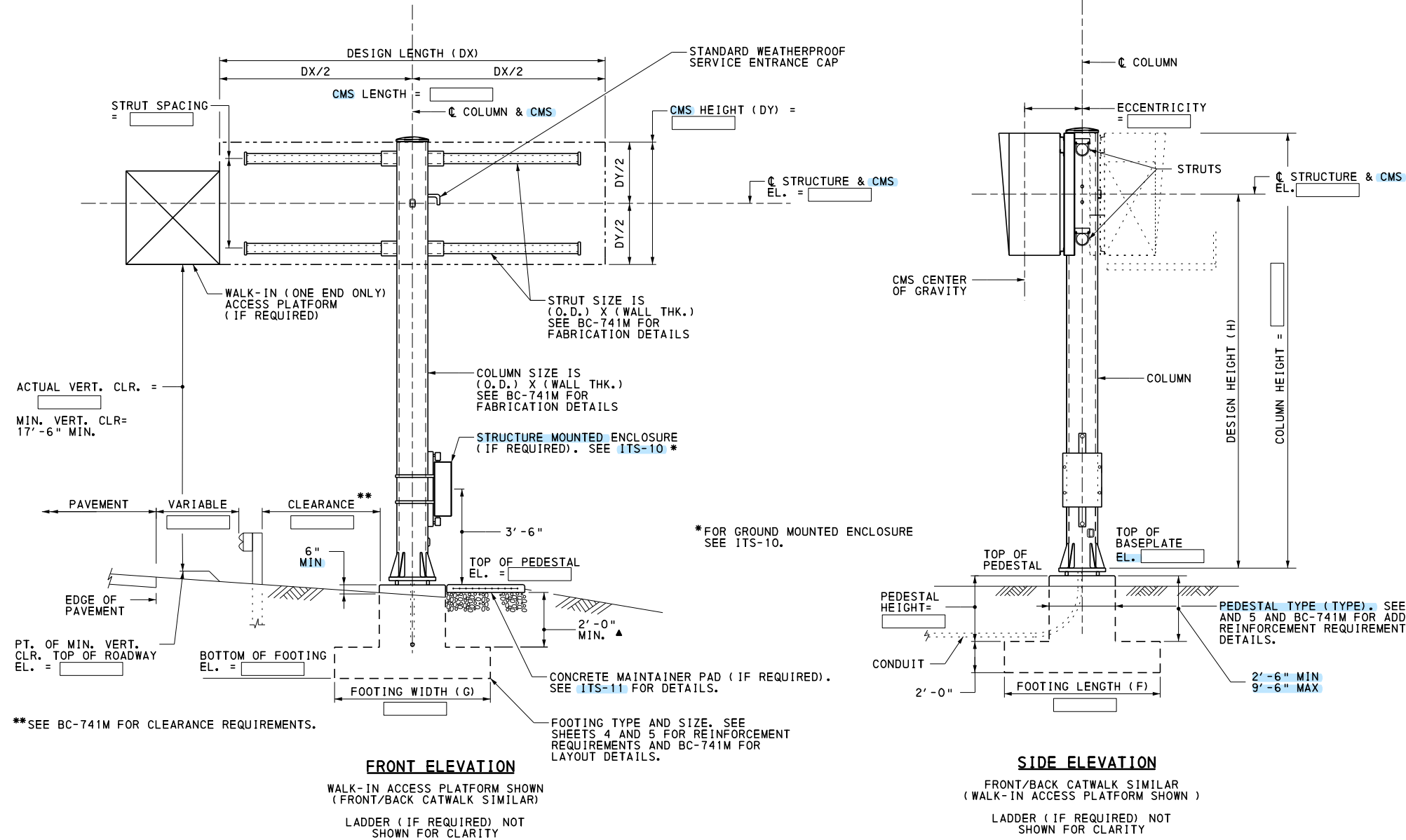
SHEET 2 OF 6  
BD-649M



NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON DESIGN REQUIREMENTS. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  - PEDESTAL TYPE (TYPE). SEE BC-741M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
  - FOOTING TYPE (SIZE). SEE SHEETS 4 AND 5 FOR REINFORCEMENT REQUIREMENTS AND BC-741M FOR DETAILS.
  - COLUMN SIZE IS (O.D.) X (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
  - STRUT SIZE IS (O.D.) X (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
  - SEE BC-741M FOR ADDITIONAL FABRICATION DETAILS, INCLUDING HAND HOLE, STRUCTURE MOUNTED ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP.
  - SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, 1/2" BY 1/2" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.
- PROVIDE HAND HOLE, STRUCTURE MOUNTED ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON CONTRACT PLANS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS FROM BC-741M MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.
- PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH ( ).
- ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. CATWALK IS LOCATED ON THE FRONT FACE OF EACH SIGN ON A FRONT AND BACK CMS. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH CMS. IDENTIFY CATWALK AND WALK-IN ACCESS LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN MINIMUM VERTICAL CLEARANCE.
- FOR CAISSON ALTERNATIVE, PROVIDE CAISSON DIAMETER, TOP OF CAISSON ELEVATION, BOTTOM OF CAISSON ELEVATION, EMBEDMENT DEPTH, TOTAL CAISSON LENGTH, VERTICAL AND TIE REINFORCEMENT NUMBER OF BARS AND BAR SIZE, AND ROCK SOCKET REQUIREMENTS AS REQUIRED.
- PROVIDE GENERAL NOTES FROM SHEET 1 ON THE CONTRACT DRAWINGS.
- PROVIDE CMS CONNECTION DETAILS ON THE CONTRACT DRAWINGS IN ACCORDANCE WITH SHEET 6.
- TOP OF ACCESS PLATFORM TO MATCH THE CMS DOORWAY OPENING, PROVIDING CLEARANCE FOR DOOR TO SWING OPEN.

▲ FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.



CENTER-MOUNT CMS SUPPORT STRUCTURE  
WITH WALK-IN ACCESS PLATFORM OR CATWALK

| DESIGN CRITERIA                                            |             |
|------------------------------------------------------------|-------------|
| DESIGN CMS AREA (A) =                                      |             |
| DESIGN CMS LENGTH (DX) =                                   |             |
| DESIGN CMS HEIGHT (DY) =                                   |             |
| DESIGN HEIGHT (H) =                                        |             |
| CMS ECCENTRICITY =                                         |             |
| DESIGN WEIGHT OF CMS (W) =                                 |             |
| LATITUDE                                                   | LONGITUDE** |
| OR                                                         |             |
| STATION                                                    | OFFSET**    |
| **PROVIDE EITHER LATITUDE/LONGITUDE OR STATION AND OFFSET. |             |

| TABLE OF ESTIMATED QUANTITIES                                                     |                         |      |          |
|-----------------------------------------------------------------------------------|-------------------------|------|----------|
| ITEM NO.                                                                          | ITEM                    | UNIT | QUANTITY |
| ■                                                                                 | STEEL SIGN STRUCTURE    | LBS  |          |
| 0000-0000                                                                         | CLASS 3 EXCAVATION      | CY   |          |
| 0000-0000                                                                         | CLASS A CEMENT CONCRETE | CY   |          |
| 0000-0000                                                                         | REINFORCEMENT BARS      | LBS  |          |
| ■ ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000] |                         |      |          |

COMMONWEALTH OF PENNSYLVANIA  
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STANDARD  
CHANGEABLE MESSAGE SIGNS  
CENTER-MOUNT SIGN STRUCTURES  
SAMPLE CONTRACT PLAN FOR  
CENTER MOUNT STRUCTURES

RECOMMENDED JUL. 10, 2025  
[Signature]  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025  
[Signature]  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 3 OF 6  
BD-649M

TABLE 1: SINGLE SIGN FRONT CMS PANEL WITH FRONT ACCESS CATWALK

| DESIGN HEIGHT (FT) | SIGN AREA (FT) | MAX CMS LENGTH (DX) (FT) | MAX CMS HEIGHT (DY) (FT) | MAX CMS THICKNESS (FT) | MAXIMUM CMS WEIGHT (LB) | MAXIMUM ECCENTRICITY (FT) | STRUT SIZE | COLUMN SIZE | PEDESTAL TYPE | FOOTING TYPE |
|--------------------|----------------|--------------------------|--------------------------|------------------------|-------------------------|---------------------------|------------|-------------|---------------|--------------|
| 16                 | 50             | 10.00                    | 5.00                     | 2.00                   | 550                     | 2.23                      | 4 x .337   | 12 x .330   | FP1           | 0708         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 1030                    | 2.23                      | 4 x .337   | 14 x .375   | FP2           | 0910         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 1800                    | 1.86                      | 5 x .375   | 18 x .312   | FP2           | 1011         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 2300                    | 2.32                      | 6 x .432   | 18 x .500   | FP2           | 1112         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 2105                    | 2.40                      | 8 x .322   | 24 x .375   | FP4           | 1114         |
|                    | 300            | 40.00                    | 7.50                     | 1.17                   | 2660                    | 1.99                      | 8 x .406   | 24 x .375   | FP4           | 1215         |
| 20                 | 50             | 10.00                    | 5.00                     | 2.00                   | 550                     | 2.23                      | 4 x .337   | 14 x .312   | FP2           | 0709         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 1030                    | 2.23                      | 4 x .337   | 16 x .375   | FP2           | 0911         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 1800                    | 1.86                      | 5 x .375   | 18 x .500   | FP2           | 1013         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 2300                    | 2.32                      | 6 x .432   | 24 x .375   | FP4           | 1113         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 2105                    | 2.40                      | 8 x .322   | 24 x .375   | FP4           | 1214         |
|                    | 300            | 40.00                    | 7.50                     | 1.17                   | 2660                    | 1.99                      | 8 x .406   | 24 x .500   | FP4           | 1314         |
| 24                 | 50             | 10.00                    | 5.00                     | 2.00                   | 550                     | 2.23                      | 4 x .337   | 16 x .375   | FP2           | 0808         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 1030                    | 2.23                      | 4 x .337   | 18 x .375   | FP2           | 0912         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 1800                    | 1.86                      | 5 x .375   | 18 x .500   | FP2           | 1112         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 2300                    | 2.32                      | 6 x .432   | 24 x .375   | FP4           | 1213         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 2105                    | 2.40                      | 8 x .322   | 24 x .500   | FP4           | 1314         |
|                    | 300            | 40.00                    | 7.50                     | 1.17                   | 2660                    | 1.99                      | 8 x .406   | 24 x .562   | FP4           | 1316         |
| 28                 | 50             | 10.00                    | 5.00                     | 2.00                   | 550                     | 2.23                      | 4 x .337   | 18 x .312   | FP2           | 0809         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 1030                    | 2.23                      | 4 x .337   | 20 x .312   | FP3           | 1011         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 1800                    | 1.86                      | 5 x .375   | 24 x .375   | FP4           | 1113         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 2300                    | 2.32                      | 6 x .432   | 24 x .500   | FP4           | 1214         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 2105                    | 2.40                      | 8 x .322   | 24 x .562   | FP4           | 1315         |

TABLE 2: DOUBLE SIGN FRONT AND BACK CMS PANELS WITH FRONT ACCESS CATWALK

| DESIGN HEIGHT (FT) | SIGN AREA (FT) | MAX CMS LENGTH (DX) (FT) | MAX CMS HEIGHT (DY) (FT) | MAX CMS THICKNESS (FT) | MAXIMUM CMS WEIGHT (LB) | MAXIMUM ECCENTRICITY (FT) | STRUT SIZE | COLUMN SIZE | PEDESTAL TYPE | FOOTING TYPE |
|--------------------|----------------|--------------------------|--------------------------|------------------------|-------------------------|---------------------------|------------|-------------|---------------|--------------|
| 16                 | 50             | 10.00                    | 5.00                     | 2.00                   | 1100                    | 0.00                      | 4 x .337   | 12 x .330   | FP1           | 0708         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 2060                    | 0.00                      | 4 x .337   | 14 x .375   | FP2           | 0910         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 3600                    | 0.00                      | 5 x .375   | 18 x .312   | FP2           | 1011         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 4600                    | 0.00                      | 6 x .432   | 18 x .500   | FP2           | 1112         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 4210                    | 0.00                      | 6 x .432   | 24 x .375   | FP4           | 1213         |
|                    | 300            | 40.00                    | 7.50                     | 1.17                   | 5320                    | 0.00                      | 8 x .406   | 24 x .375   | FP4           | 1215         |
| 20                 | 50             | 10.00                    | 5.00                     | 2.00                   | 1100                    | 0.00                      | 4 x .337   | 14 x .312   | FP2           | 0709         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 2060                    | 0.00                      | 4 x .337   | 16 x .375   | FP2           | 0911         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 3600                    | 0.00                      | 5 x .375   | 18 x .500   | FP2           | 1013         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 4600                    | 0.00                      | 6 x .432   | 24 x .375   | FP4           | 1114         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 4210                    | 0.00                      | 6 x .432   | 24 x .375   | FP4           | 1214         |
|                    | 300            | 40.00                    | 7.50                     | 1.17                   | 5320                    | 0.00                      | 8 x .406   | 24 x .500   | FP4           | 1315         |
| 24                 | 50             | 10.00                    | 5.00                     | 2.00                   | 1100                    | 0.00                      | 4 x .337   | 16 x .375   | FP2           | 0809         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 2060                    | 0.00                      | 4 x .337   | 18 x .375   | FP2           | 1011         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 3600                    | 0.00                      | 5 x .375   | 18 x .500   | FP2           | 1112         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 4600                    | 0.00                      | 6 x .432   | 24 x .375   | FP4           | 1213         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 4210                    | 0.00                      | 6 x .432   | 24 x .500   | FP4           | 1314         |
|                    | 300            | 40.00                    | 7.50                     | 1.17                   | 5320                    | 0.00                      | 8 x .406   | 24 x .562   | FP4           | 1317         |
| 28                 | 50             | 10.00                    | 5.00                     | 2.00                   | 1100                    | 0.00                      | 4 x .337   | 18 x .312   | FP2           | 0810         |
|                    | 100            | 17.50                    | 5.71                     | 2.00                   | 2060                    | 0.00                      | 4 x .337   | 20 x .375   | FP3           | 1011         |
|                    | 150            | 20.00                    | 7.50                     | 1.17                   | 3600                    | 0.00                      | 5 x .375   | 24 x .375   | FP4           | 1113         |
|                    | 200            | 25.00                    | 8.00                     | 2.00                   | 4600                    | 0.00                      | 6 x .432   | 24 x .500   | FP4           | 1215         |
|                    | 250            | 31.25                    | 8.00                     | 2.00                   | 4210                    | 0.00                      | 6 x .432   | 24 x .562   | FP4           | 1316         |

NOTES:

- FOR GENERAL NOTES SEE SHEET 1.
- THE SIGN AREA REPRESENTS THE AREA FOR ONE CMS.
- THE TABLES FOR DOUBLE SIGN PANELS REPRESENT THE USE OF THE SAME SIZE FOR BOTH FRONT AND BACK PANELS. USE MEMBERS LISTED IN THE TABLE FOR EACH SIGN PANEL.
- ALL SIGNS ARE TO BE CENTERED ON THE COLUMN.
- FOR PEDESTAL AND FOOTING TYPES, SEE SHEET 5.

HOW TO USE THE TABLES:

- DETERMINE THE DESIGN HEIGHT AND MAXIMUM DIMENSIONS (AREA, LENGTH, HEIGHT, ECCENTRICITY AND WEIGHT). SIGN HEIGHT SHOULD BE CHOSEN AS TO SATISFY ALL VERTICAL CLEARANCE REQUIREMENTS.
- DETERMINE IF THE SIGN STRUCTURE WILL HAVE A SIGN MOUNTED ON ONE SIDE ONLY OR ON BOTH SIDES (CONSIDER FUTURE USE).
- DETERMINE IF THE SIGN STRUCTURE WILL UTILIZE A FRONT ACCESS CATWALK OR A WALK-IN ACCESS PLATFORM.
- LOCATE THESE PARAMETERS IN THE APPROPRIATE DESIGN TABLE. IF ANY OF THE PARAMETERS EXCEEDS THE VALUES SHOWN IN THE DESIGN TABLE, USE THE NEXT LARGER VALUE. ANY DEVIATION FROM THE DESIGN ASSUMPTIONS USED IN PRODUCING THESE TABLES REQUIRES ADDITIONAL ANALYSIS TO BE PERFORMED BY THE DESIGNER.

TABLE 3: SINGLE SIGN CMS PANEL WITH WALK-IN ACCESS PLATFORM

| DESIGN HEIGHT (FT) | SIGN AREA (FT) | MAX CMS LENGTH (DX) (FT) | MAX CMS HEIGHT (DY) (FT) | MAX CMS THICKNESS (FT) | MAXIMUM CMS WEIGHT (LB) | MAXIMUM ECCENTRICITY (FT) | STRUT SIZE | COLUMN SIZE | PEDESTAL TYPE | FOOTING TYPE |
|--------------------|----------------|--------------------------|--------------------------|------------------------|-------------------------|---------------------------|------------|-------------|---------------|--------------|
| 16                 | 105            | 13.13                    | 8.00                     | 4.00                   | 1300                    | 3.23                      | 4 x .337   | 14 x .375   | FP2           | 0910         |
|                    | 165            | 20.63                    | 8.00                     | 4.00                   | 2300                    | 3.32                      | 6 x .432   | 18 x .375   | FP2           | 1012         |
|                    | 185            | 23.13                    | 8.00                     | 4.00                   | 3000                    | 3.32                      | 6 x .432   | 18 x .375   | FP2           | 1112         |
|                    | 205            | 25.63                    | 8.00                     | 4.00                   | 3800                    | 3.32                      | 6 x .432   | 18 x .500   | FP2           | 1112         |
|                    | 225            | 28.13                    | 8.00                     | 4.00                   | 4500                    | 3.40                      | 8 x .322   | 18 x .500   | FP2           | 1113         |
|                    | 250            | 31.25                    | 8.00                     | 4.00                   | 5500                    | 3.40                      | 8 x .406   | 24 x .375   | FP4           | 1213         |
| 20                 | 200            | 25.00                    | 8.00                     | 4.00                   | 3530                    | 3.32                      | 6 x .432   | 24 x .375   | FP4           | 1114         |
|                    | 250            | 31.25                    | 8.00                     | 4.00                   | 4080                    | 3.40                      | 8 x .406   | 24 x .375   | FP4           | 1214         |
|                    | 300            | 37.50                    | 8.00                     | 4.00                   | 4750                    | 3.49                      | 10 x .365  | 24 x .500   | FP4           | 1315         |
| 24                 | 200            | 25.00                    | 8.00                     | 4.00                   | 3530                    | 3.32                      | 6 x .432   | 24 x .375   | FP4           | 1213         |
|                    | 250            | 31.25                    | 8.00                     | 4.00                   | 4080                    | 3.40                      | 8 x .406   | 24 x .500   | FP4           | 1314         |
| 28                 | 200            | 25.00                    | 8.00                     | 4.00                   | 3530                    | 3.32                      | 6 x .432   | 24 x .500   | FP4           | 1215         |

TABLE 4: DOUBLE SIGN CMS PANELS WITH WALK-IN ACCESS PLATFORMS

| DESIGN HEIGHT (FT) | SIGN AREA (FT) | MAX CMS LENGTH (DX) (FT) | MAX CMS HEIGHT (DY) (FT) | MAX CMS THICKNESS (FT) | MAXIMUM CMS WEIGHT (LB) | MAXIMUM ECCENTRICITY (FT) | STRUT SIZE | COLUMN SIZE | PEDESTAL TYPE | FOOTING TYPE |
|--------------------|----------------|--------------------------|--------------------------|------------------------|-------------------------|---------------------------|------------|-------------|---------------|--------------|
| 16                 | 105            | 13.13                    | 8.00                     | 4.00                   | 2060                    | 0.00                      | 4 x .337   | 14 x .375   | FP2           | 0910         |
|                    | 165            | 20.63                    | 8.00                     | 4.00                   | 3600                    | 0.00                      | 5 x .375   | 18 x .375   | FP2           | 1013         |
|                    | 185            | 23.13                    | 8.00                     | 4.00                   | 4100                    | 0.00                      | 6 x .432   | 18 x .500   | FP2           | 1112         |
|                    | 205            | 25.63                    | 8.00                     | 4.00                   | 4600                    | 0.00                      | 6 x .432   | 18 x .500   | FP2           | 1113         |
|                    | 225            | 28.13                    | 8.00                     | 4.00                   | 5300                    | 0.00                      | 6 x .432   | 18 x .500   | FP2           | 1114         |
|                    | 250            | 31.25                    | 8.00                     | 4.00                   | 6000                    | 0.00                      | 8 x .322   | 24 x .375   | FP4           | 1213         |
| 20                 | 200            | 25.00                    | 8.00                     | 4.00                   | 7060                    | 0.00                      | 6 x .432   | 24 x .375   | FP4           | 1114         |
|                    | 250            | 31.25                    | 8.00                     | 4.00                   | 8160                    | 0.00                      | 8 x .322   | 24 x .375   | FP4           | 1215         |
|                    | 300            | 37.50                    | 8.00                     | 4.00                   | 9500                    | 0.00                      | 10 x .365  | 24 x .500   | FP4           | 1315         |
| 24                 | 200            | 25.00                    | 8.00                     | 4.00                   | 7060                    | 0.00                      | 6 x .432   | 24 x .375   | FP4           | 1213         |
|                    | 250            | 31.25                    | 8.00                     | 4.00                   | 8160                    | 0.00                      | 8 x .322   | 24 x .500   | FP4           | 1314         |
| 28                 | 200            | 25.00                    | 8.00                     | 4.00                   | 7060                    | 0.00                      | 6 x .432   | 24 x .500   | FP4           | 1215         |

NOTES:

- FOUNDATIONS PRESCRIBED IN THE DESIGN TABLES ON THIS STANDARD ARE BASED ON AN AVERAGE FILL HEIGHT OF 8 FT. DESIGNER MUST CHECK ADEQUACY OF FOOTINGS WITH AN AVERAGE FILL HEIGHT LESS THAN 8 FT. DESIGNER MUST CHECK THE ADEQUACY OF PEDESTALS WITH AN AVERAGE FILL HEIGHT GREATER THAN 8 FT.
- SEE STANDARD DRAWING BC-736M FOR REINFORCEMENT BAR FABRICATION DETAILS.
- SEE STANDARD DRAWING RC-11M FOR LIMITS OF CLASS 3 EXCAVATION.
- CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
- ALL MEMBER SIZES SHOWN IN DESIGN TABLES ARE PIPE NOMINAL SIZE X WALL THICKNESS AND ARE BASED ON ALL COMMERCIALLY AVAILABLE SECTIONS. CONTRACTOR MAY SUBSTITUTE THE NEXT THICKEST STANDARD SECTION IF A NON-STANDARD THICKNESS IS NOT AVAILABLE AT NO ADDITIONAL COST TO THE DEPARTMENT. SEE GENERAL NOTE 11 ON SHEET 1.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
CHANGEABLE MESSAGE SIGNS  
CENTER-MOUNT SIGN STRUCTURES

DESIGN TABLES

RECOMMENDED JUL.10, 2025

*Kevin J. Sargent*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025

*Jonathan A. Elser*  
CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 4 OF 6

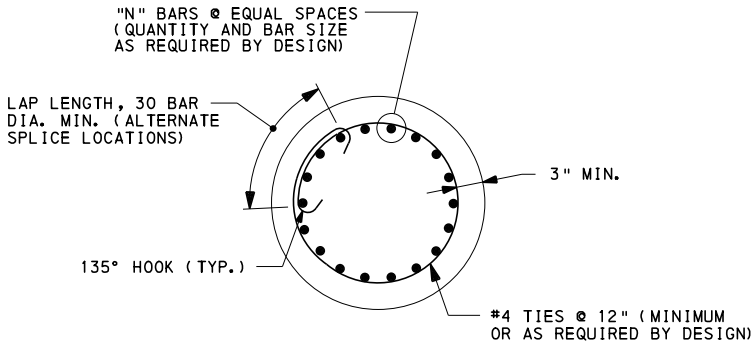
BD-649M

| FOOTING TYPE & REINFORCEMENT |           |        |         |          |      |    |      |        |    |          |    |      |        |  |  |
|------------------------------|-----------|--------|---------|----------|------|----|------|--------|----|----------|----|------|--------|--|--|
| TYPE                         | DIMENSION |        | CY CONC | "L" BARS |      |    |      |        |    | "T" BARS |    |      |        |  |  |
|                              | G         | F      |         | L1       |      | L2 |      | LENGTH | T1 |          | T2 |      | LENGTH |  |  |
|                              |           |        |         | NO       | SIZE | NO | SIZE |        | NO | SIZE     | NO | SIZE |        |  |  |
| 0708                         | 7'-0"     | 8'-0"  | 4.1     | 9        | 4    | 10 | 4    | 7'-4"  | 10 | 4        | 10 | 4    | 6'-4"  |  |  |
| 0709                         | 7'-0"     | 9'-0"  | 4.7     | 9        | 4    | 10 | 4    | 8'-4"  | 11 | 4        | 12 | 4    | 6'-4"  |  |  |
| 0808                         | 8'-0"     | 8'-0"  | 4.7     | 10       | 4    | 10 | 4    | 7'-4"  | 10 | 4        | 10 | 4    | 7'-4"  |  |  |
| 0809                         | 8'-0"     | 9'-0"  | 5.3     | 10       | 4    | 10 | 4    | 8'-4"  | 11 | 4        | 12 | 4    | 7'-4"  |  |  |
| 0810                         | 8'-0"     | 10'-0" | 5.9     | 10       | 4    | 10 | 4    | 9'-4"  | 12 | 4        | 14 | 4    | 7'-4"  |  |  |
| 0910                         | 9'-0"     | 10'-0" | 6.7     | 11       | 4    | 12 | 4    | 9'-4"  | 12 | 4        | 14 | 4    | 8'-4"  |  |  |
| 0911                         | 9'-0"     | 11'-0" | 7.3     | 11       | 4    | 12 | 4    | 10'-4" | 13 | 4        | 14 | 4    | 8'-4"  |  |  |
| 0912                         | 9'-0"     | 12'-0" | 8.0     | 11       | 4    | 12 | 4    | 11'-4" | 14 | 4        | 15 | 4    | 8'-4"  |  |  |
| 1011                         | 10'-0"    | 11'-0" | 8.1     | 12       | 4    | 14 | 4    | 10'-4" | 13 | 4        | 14 | 4    | 9'-4"  |  |  |
| 1012                         | 10'-0"    | 12'-0" | 8.9     | 12       | 4    | 14 | 4    | 11'-4" | 14 | 4        | 15 | 4    | 9'-4"  |  |  |
| 1013                         | 10'-0"    | 13'-0" | 9.6     | 12       | 4    | 14 | 4    | 12'-4" | 15 | 4        | 17 | 4    | 9'-4"  |  |  |
| 1112                         | 11'-0"    | 12'-0" | 9.8     | 13       | 4    | 14 | 4    | 11'-4" | 14 | 4        | 15 | 4    | 10'-4" |  |  |
| 1113                         | 11'-0"    | 13'-0" | 10.6    | 13       | 4    | 14 | 4    | 12'-4" | 15 | 4        | 17 | 4    | 10'-4" |  |  |
| 1114                         | 11'-0"    | 14'-0" | 11.4    | 13       | 4    | 14 | 4    | 13'-4" | 16 | 4        | 17 | 4    | 10'-4" |  |  |
| 1213                         | 12'-0"    | 13'-0" | 11.6    | 14       | 4    | 15 | 4    | 12'-4" | 15 | 4        | 17 | 4    | 11'-4" |  |  |
| 1214                         | 12'-0"    | 14'-0" | 12.4    | 14       | 4    | 15 | 4    | 13'-4" | 16 | 4        | 17 | 4    | 11'-4" |  |  |
| 1215                         | 12'-0"    | 15'-0" | 13.3    | 14       | 4    | 17 | 4    | 14'-4" | 17 | 4        | 18 | 4    | 11'-4" |  |  |
| 1314                         | 13'-0"    | 14'-0" | 13.5    | 15       | 4    | 17 | 4    | 13'-4" | 16 | 4        | 17 | 4    | 12'-4" |  |  |
| 1315                         | 13'-0"    | 15'-0" | 14.4    | 15       | 4    | 18 | 4    | 14'-4" | 17 | 4        | 18 | 4    | 12'-4" |  |  |
| 1316                         | 13'-0"    | 16'-0" | 15.4    | 16       | 4    | 14 | 5    | 15'-4" | 18 | 4        | 20 | 4    | 12'-4" |  |  |
| 1317                         | 13'-0"    | 17'-0" | 16.4    | 16       | 4    | 15 | 5    | 16'-4" | 19 | 4        | 20 | 4    | 12'-4" |  |  |

FOOTING TYPE & REINFORCEMENT NOTES:

PROVIDE 90° OR 180° HOOKS ON ALL "L" AND "T" BARS

LENGTH FOR "L" AND "T" BARS DOES NOT INCLUDE 90° OR 180° HOOK LENGTHS



SECTION C-C

• IN PLACE OF #4 TIES AT 12", A #4 BAR SPIRAL WITH A 3" PITCH MAY BE USED. THE #4 TIES AT 12" ARE THE MINIMUM OR AS REQUIRED BY DESIGN.

| PEDESTAL TYPE & REINFORCEMENT |         |                      |                  |                     |     |         |                     |     |         |                    |    |
|-------------------------------|---------|----------------------|------------------|---------------------|-----|---------|---------------------|-----|---------|--------------------|----|
| TYPE                          | E       | CU YDS<br>CONC ( 1 ) | TYPE "P"<br>BARS | TYPE "M" BARS ( 2 ) |     |         | TYPE "X" BARS ( 2 ) |     |         | WT<br>( LB ) ( 3 ) |    |
|                               |         |                      |                  | LENGTH              | A   | B       | LENGTH              | A   | B       |                    |    |
|                               |         |                      |                  |                     |     |         |                     |     |         |                    | C  |
| FP1                           | 3' - 0" | 0.33                 | 18 - #6          | 10' - 9"            | 4½" | 2' - 6" | 3' - 3"             | 4½" | 2' - 6" | 4½"                | 16 |
| FP2                           | 3' - 6" | 0.45                 | 24 - #6          | 12' - 9"            | 4½" | 3' - 0" | 3' - 9"             | 4½" | 3' - 0" | 4½"                | 19 |
| FP3                           | 4' - 0" | 0.59                 | 26 - #7          | 14' - 11"           | 5½" | 3' - 6" | 4' - 5½"            | 5½" | 3' - 6" | 6"                 | 35 |
| FP4                           | 4' - 6" | 0.75                 | 32 - #7          | 16' - 11"           | 5½" | 4' - 0" | 4' - 11½"           | 5½" | 4' - 0" | 6"                 | 39 |

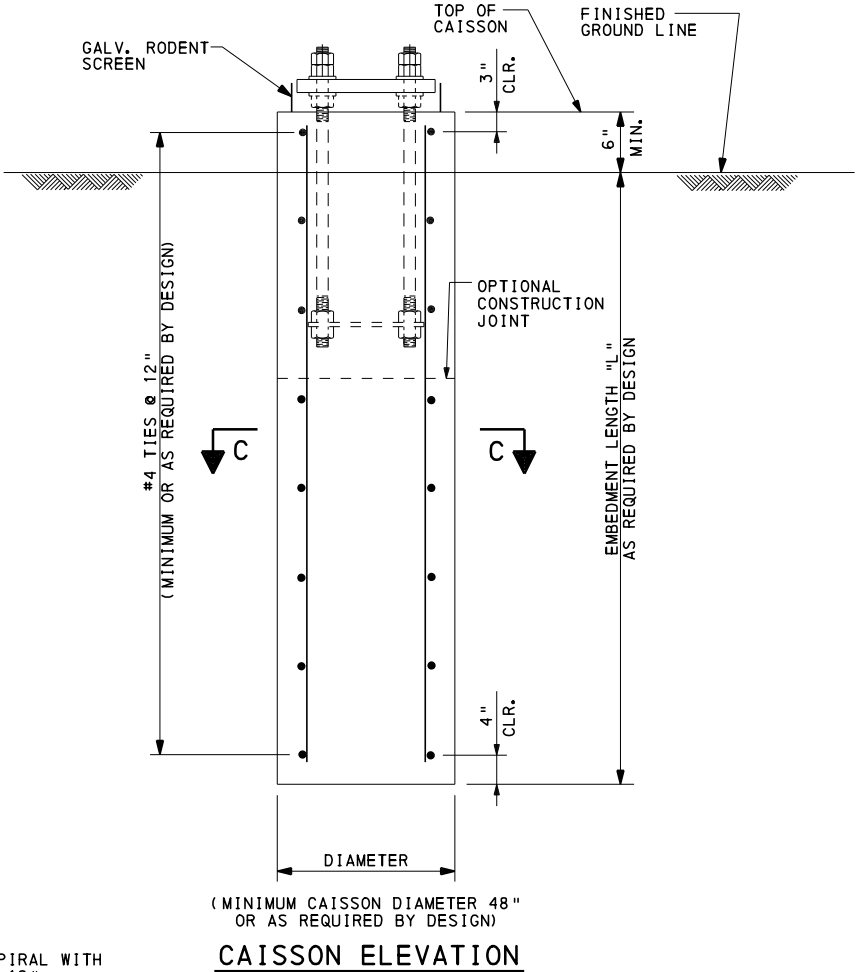
PEDESTAL TYPE & REINFORCEMENT NOTES:

(1) CUBIC YARDS OF CONCRETE PER 1 FOOT HEIGHT OF PEDESTAL

(2) USE #5 BARS WHEN "P" BARS ARE LARGER THAN #6 BARS, OTHERWISE USE #4 BARS

(3) WEIGHT OF 1 TYPE "M" BAR PLUS 4 TYPE "X" BARS

| CMS ALTERNATE CAISSON FOUNDATION LOADS |                      |                                           |           |           |                |                                           |           |           |                |
|----------------------------------------|----------------------|-------------------------------------------|-----------|-----------|----------------|-------------------------------------------|-----------|-----------|----------------|
| COLUMN NOMINAL DIA.                    | MINIMUM DIAMETER "D" | MAXIMUM LOADS AT TOP OF CAISSON (EXTREME) |           |           |                | MAXIMUM LOADS AT TOP OF CAISSON (SERVICE) |           |           |                |
|                                        |                      | MOMENT (K-FT)                             | SHEAR (K) | AXIAL (K) | TORSION (K-FT) | MOMENT (K-FT)                             | SHEAR (K) | AXIAL (K) | TORSION (K-FT) |
| 12                                     | 4'-0"                | 90.0                                      | 6.0       | 5.0       | 5.0            | 40.0                                      | 3.0       | 4.0       | 2.0            |
| 14                                     | 4'-0"                | 180.0                                     | 12.0      | 8.0       | 15.0           | 80.0                                      | 5.0       | 6.0       | 6.0            |
| 16                                     | 4'-6"                | 220.0                                     | 11.0      | 8.0       | 15.0           | 90.0                                      | 5.0       | 7.0       | 6.0            |
| 18                                     | 4'-6"                | 380.0                                     | 24.0      | 17.0      | 58.0           | 170.0                                     | 10.0      | 14.0      | 24.0           |
| 20                                     | 5'-0"                | 310.0                                     | 12.0      | 9.0       | 15.0           | 130.0                                     | 5.0       | 8.0       | 6.0            |
| 24                                     | 5'-6"                | 730.0                                     | 31.0      | 27.0      | 100.0          | 300.0                                     | 13.0      | 22.0      | 40.0           |



NOTES:

1. FOR ADDITIONAL FOUNDATION AND REINFORCEMENT DETAILS NOT MODIFIED BY BD-649M, REFER TO BC-741M.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
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CENTER-MOUNT SIGN STRUCTURES

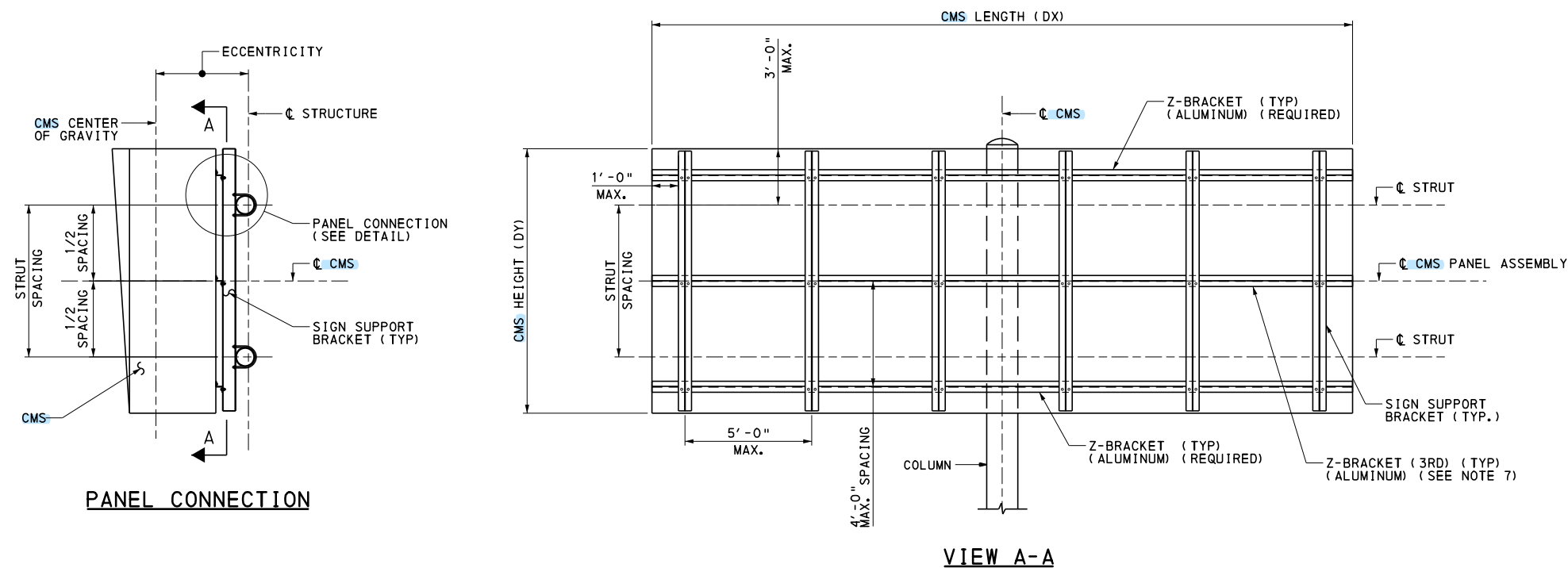
FOUNDATION TABLES

RECOMMENDED JUL.10, 2025  
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CHIEF BRIDGE ENGINEER

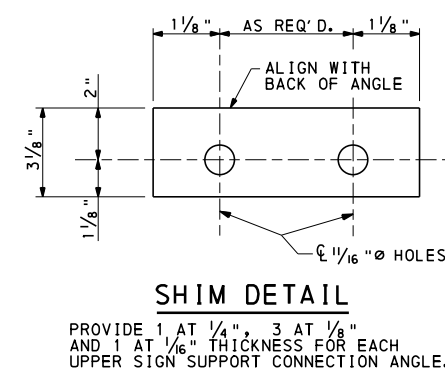
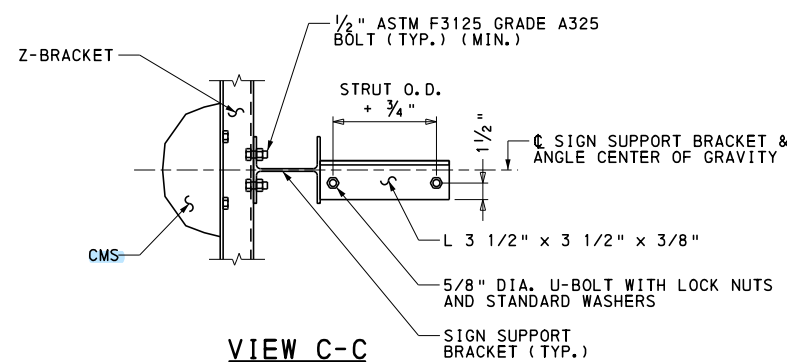
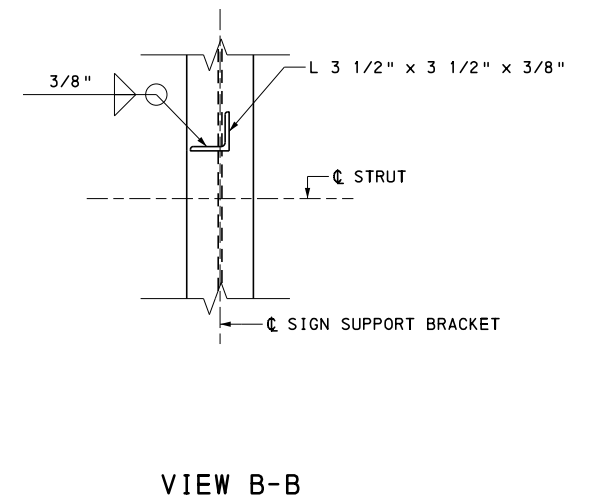
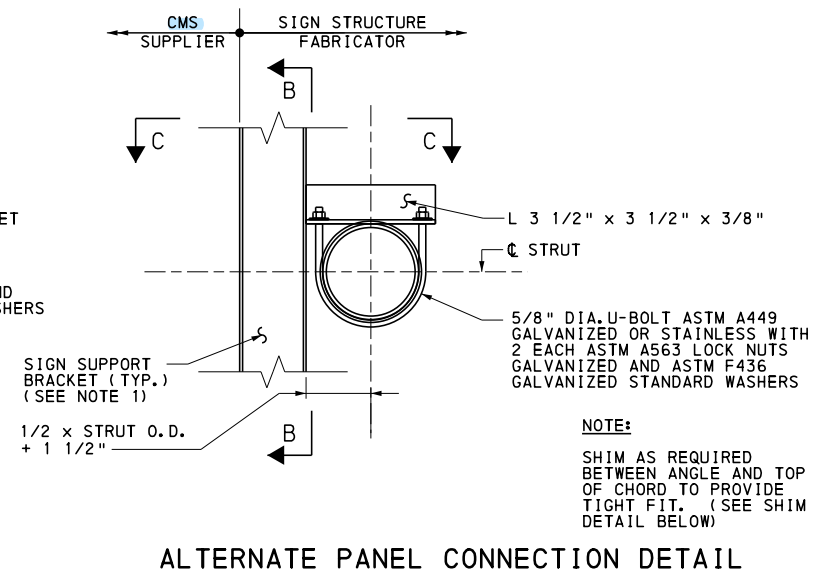
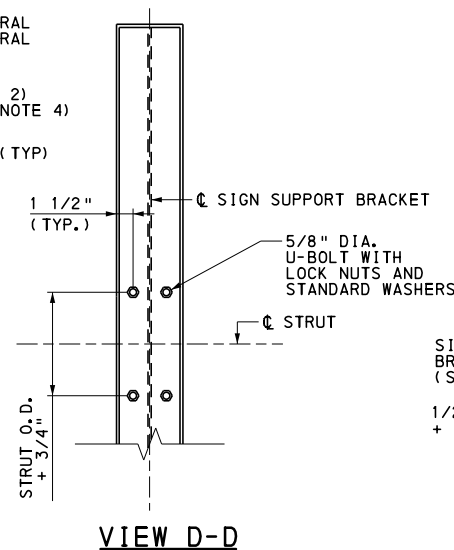
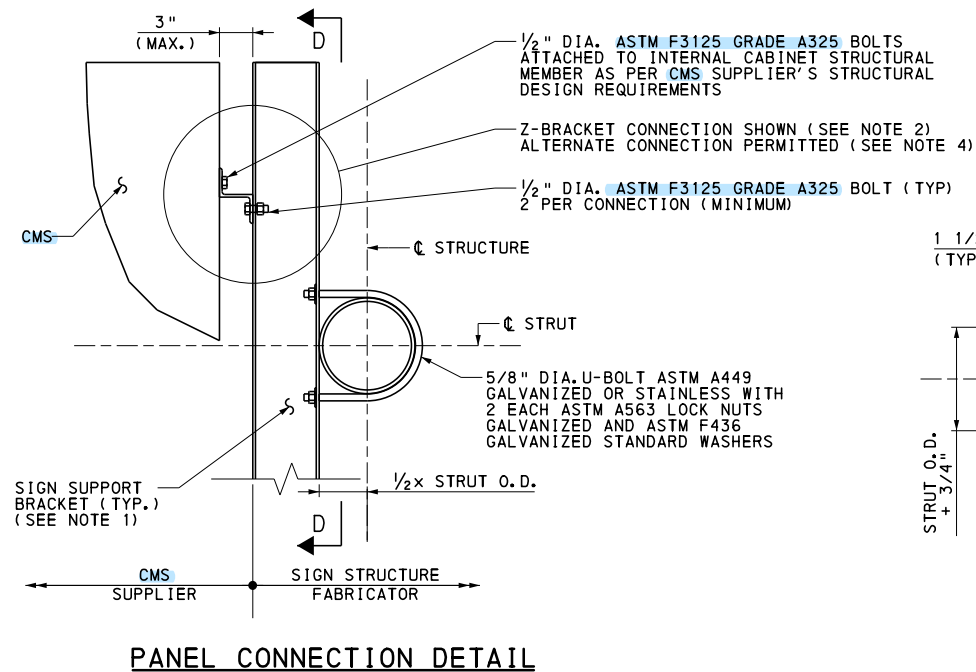
RECOMMENDED JUL.10, 2025  
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SHEET 5 OF 6

BD-649M



- NOTES TO DESIGNER:**
1. MINIMUM SIZE OF SIGN SUPPORT BRACKET IS W6x15. LARGER SIGN SUPPORTS MAY BE REQUIRED FOR CENTER-MOUNT STRUCTURE TO PROVIDE CLEARANCE BETWEEN HORIZONTAL Z-BRACKETS AND COLUMN.
  2. HORIZONTAL Z-BRACKETS SHALL BE MADE OF ALUMINUM ALLOY 6061-T6 OR AS APPROVED BY THE DISTRICT BRIDGE ENGINEER AND SHALL BE A MINIMUM OF 1/4" THICK.
  3. CONNECTION DETAILS PROVIDED ON THIS SHEET HAVE BEEN DESIGNED BASED ON THE FOLLOWING CMS ASSUMPTIONS:  
 MAXIMUM DEAD LOAD 6000 LBS  
 MAXIMUM ECCENTRICITY 5' - 0"  
 MAXIMUM HEIGHT (DY) 8' - 0"  
 MAXIMUM DEPTH 4' - 0"  
 DESIGN CALCULATIONS ARE REQUIRED FOR DEVIATIONS TO THESE ASSUMPTIONS.
  4. ALTERNATE CONNECTION DETAILS ARE PERMITTED, BUT REQUIRE CALCULATIONS PREPARED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA AND VERIFIED BY A SECONDARY INDEPENDENT PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA. THE CMS MANUFACTURER IS RESPONSIBLE FOR PROVIDING THESE CALCULATIONS AND HAVING THEM SIGNED AND SEALED BY BOTH THE PROFESSIONAL ENGINEERS.
  5. DETAILS PROVIDED ARE THE MINIMUM REQUIREMENTS. ANY DEVIATIONS REQUIRE SPECIAL DESIGN.
  6. FIELD WELDED CMS CONNECTIONS ARE NOT PERMITTED.
  7. USE OF 3RD Z-BRACKET IS BASED ON PROJECT AND WIND LOADING REQUIREMENTS. MOUNTING CALCULATIONS TO BE COMPLETED TO AASHTO LRFD SIGN SPECIFICATIONS AND SUBMITTED BY THE FABRICATOR.





CHANGE 1

CHANGE 8

INFORMATIONAL NOTES

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS FOR OVERHEAD SIGN STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS. REFERENCE TO THESE STANDARDS ON OVERHEAD SIGN STRUCTURES PLANS IS PROHIBITED.
- DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM BD-650M.
- ALL SIGN SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-745M, SHEET 2.
- THE INTENT FOR ANY REFERENCE TO BC-745M DETAILS WITHIN THIS STANDARD IS FOR CONSISTENCY PURPOSES ONLY. ALL DETAILS USED FROM BC-745M STANDARDS NEED TO BE INDEPENDENTLY VERIFIED FOR CMS LOADINGS.

GENERAL NOTES

1. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
2. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
3. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
4. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
5. VERIFY ALL DIMENSIONS AND GEOMETRY OF THE EXISTING STRUCTURES IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
6. CHAMFER EXPOSED CONCRETE EDGES 1 INCH BY 1 INCH.
7. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
8. DIMENSIONS ARE BASED ON A NORMAL TEMPERATURE OF 68 DEGREES F.
9. SPREAD FOOTINGS OR CAISSONS MAY BE ORDERED BY THE ENGINEER TO BE AT ANY ELEVATION OR OF ANY DIMENSIONS NECESSARY TO PROVIDE A PROPER FOUNDATION.
10. GALVANIZE ALL STRUCTURAL STEEL, BOLTS, NUTS & WASHERS IN ACCORDANCE WITH PUB.408, UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
12. USE STANDARD SIZE HOLE. THE STANDARD HOLE DIAMETER FOR BOLTS SMALLER THAN 1" DIAMETER SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/16". FOR BOLTS 1" DIAMETER AND LARGER, THE DIAMETER OF EACH STANDARD HOLE SHALL BE THE NOMINAL DIAMETER OF THE BOLT PLUS 1/8".
13. CLEAR DISTANCE BETWEEN BOLT HOLES OR BETWEEN THE BOLT HOLE AND THE END OF THE MEMBER IN THE DIRECTION OF THE APPLIED BEARING FORCE SHALL BE AS DETAILED IN THIS STANDARD. IF THESE MINIMUMS ARE NOT PROVIDED, BOLT BEARING MUST BE CHECKED.
14. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
15. ANCHOR BOLTS MUST BE DESIGNED AND DETAILED IN ACCORDANCE WITH ACI 318-14 AND AISC DESIGN GUIDE 1, 2ND EDITION. A MINIMUM EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS MUST BE PROVIDED.
16. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
17. STEEL MEMBER COMPONENTS WITH THICKNESSES GREATER THAN 1/2" REQUIRE CHARPY V-NOTCH TESTING AND ARE DESIGNATED ON THE PLANS BY (CVN). PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, LOAD PATH REDUNDANT MEMBER AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
18. CATWALKS ARE ONLY TO BE PROVIDED ON SIGN STRUCTURES WHEN REQUIRED BY DISTRICT BRIDGE ENGINEER.
19. PROVIDE A CERTIFICATION LETTER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA, CERTIFYING THAT THE INTERNAL STRUCTURE OF THE CMS AND THE CONNECTION TO THE SIGN STRUCTURE MEET THE REQUIREMENT OF THE AASHTO LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS. THE CERTIFICATION LETTER SHALL BE PREPARED BY THE CMS MANUFACTURER'S PROFESSIONAL ENGINEER AND SUBMITTED BY THE CONTRACTOR.
20. ONE TEST BORING SHALL BE PROVIDED AT EACH CMS AND DRILLED CAISSON FOUNDATION LOCATION.
21. ALTERNATIVE CAISSON FOUNDATIONS ARE PERMITTED FOR THESE STRUCTURES. DESIGN COMPUTATIONS ARE REQUIRED FOR CMS SIGN STRUCTURES TO BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR REVIEW AND APPROVAL.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

| PENNDOT STD. DWGS. (U.N.O.) *                                                                                                                                                                                                                            |                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| CMS<br>LIGHT FIXTURES<br>SIGN SUPPORT BEAM<br>COLUMNS, STRUTS                                                                                                                                                                                            | BD-650M, SHT. 4<br>BC-745M, SHT. 10<br>BC-745M, SHT. 8<br>CALCULATED INTERNALLY WITHIN PROGRAM                            |
| AASHTO LRFD SIGN                                                                                                                                                                                                                                         |                                                                                                                           |
| BASIC WIND SPEED<br>SERVICE WIND SPEED<br>LIVE LOAD (CATWALKS ONLY)<br>MEAN WIND SPEED                                                                                                                                                                   | STR/EXT 120 MPH (1700 YR MRL)<br>SER 76 MPH (10 YR MRL)<br>500 LBS<br>FAT 11.2 MPH                                        |
| AASHTO LRFD SIGN 3.4                                                                                                                                                                                                                                     |                                                                                                                           |
| AASHTO LRFD SIGN                                                                                                                                                                                                                                         |                                                                                                                           |
| CMS SUPPORT STRUCTURES SHALL BE DESIGNED AS FATIGUE CATEGORY I, UNLESS THE STRUCTURE IS LOCATED ON A MINOR ARTERIAL, COLLECTOR, OR LOCAL ROAD. IN THAT CASE IT MAY BE DESIGNED AS CATEGORY II.                                                           |                                                                                                                           |
| FULL SPAN CMS SUPPORT STRUCTURES SHALL BE DESIGNED FOR NATURAL WIND GUSTS, AND TRUCK INDUCED GUSTS                                                                                                                                                       |                                                                                                                           |
| AASHTO 11.7.1                                                                                                                                                                                                                                            |                                                                                                                           |
| AASHTO LRFD SIGN                                                                                                                                                                                                                                         |                                                                                                                           |
| SECTION PROPERTIES FOR TUBULAR SHAPES<br>COMBINED FORCE INTERACTIONS<br>FATIGUE REQUIREMENTS (FATIGUE CATEGORY II )<br>ALLOWABLE DEFLECTION<br>PERMANENT CAMBER<br>STRUCTURAL STEEL DESIGN                                                               | APPENDIX B, TABLE B.2.1<br>5.12<br>SECTION 11<br>10.4<br>10.5<br>SECTION 5                                                |
| AASHTO LRFD BRIDGES (U.N.O.)                                                                                                                                                                                                                             |                                                                                                                           |
| SLIP-CRITICAL BOLT<br>BOLT PRYING ACTION<br>COMBINED BOLT SHEAR AND TENSION<br>ANCHOR BOLT DESIGN                                                                                                                                                        | 6.13.2.8<br>6.13.2.10.4<br>6.13.2.11<br>SEE NOTE 15                                                                       |
| AASHTO LRFD BRIDGES & ACI 318-14                                                                                                                                                                                                                         |                                                                                                                           |
| BEARING RESISTANCE<br>SHEAR RESISTANCE OF FOOTINGS<br>SHEAR RESISTANCE OF CONCRETE<br>SLENDERNESS OF COLUMNS<br>MINIMUM REINF. OF FLEXURAL MEMBERS<br>SPACING LIMITS FOR REINFORCEMENT<br>MINIMUM CONCRETE COVER<br>TORSION<br>COLUMN DESIGN (PEDESTALS) | 5.6.5<br>5.7.1.4<br>5.7.1<br>5.6.4.3<br>DM-4, D5.6.3.3<br>DM-4, D5.10.3<br>DM-4, D5.10.1<br>5.7.2.1<br>5.6.4              |
| AASHTO LRFD BRIDGES                                                                                                                                                                                                                                      |                                                                                                                           |
| MAXIMUM FACTORED BEARING RESISTANCE<br>MINIMUM AREA IN BEARING<br>UNIT WEIGHT OF SOIL<br>PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS<br>SLIDING RESISTANCE                                                                                               | 3 TONS PER SQUARE FOOT<br>95% (STRENGTH) 75% (SERVICE)<br>100 POUNDS PER CUBIC FOOT<br>DM-4, D10.6.1.4<br>DM-4, D10.6.3.4 |
| DM-4, SECTION 10.8                                                                                                                                                                                                                                       |                                                                                                                           |
| MAXIMUM DESIGN LATERAL DISPLACEMENT<br>ANALYSES                                                                                                                                                                                                          | 0.5"<br>PENNDOT COM624 OR L-PILE                                                                                          |
| SEISMIC DESIGN CRITERIA                                                                                                                                                                                                                                  |                                                                                                                           |
| SEISMIC LOADS WERE NOT CONSIDERED IN THE DEVELOPMENT OF THIS STANDARD. THE DESIGNER MUST CHECK THE ADEQUACY OF THESE STANDARDS WHEN SEISMIC LOADS ARE TO BE CONSIDERED.                                                                                  |                                                                                                                           |

\* LEGEND:

- AASHTO LRFD SIGN: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO LRFD BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- DM-4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318-14).
- CVN: CHARPY V-NOTCH.
- AISC: AMERICAN INSTITUTE OF STEEL CONSTRUCTION - DESIGN GUIDE 1, BASE PLATE AND ANCHOR ROD DESIGN, 2ND EDITION
- CMS: CHANGEABLE MESSAGE SIGN

|         |                                                                         |
|---------|-------------------------------------------------------------------------|
| ITS-10  | STRUCTURE MOUNTED ENCLOSURES                                            |
| ITS-11  | MAINTAINER PADS                                                         |
| ITS-62  | CMS CONNECTION DETAILS                                                  |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                                   |
| BC-745M | OVERHEAD SIGN STRUCTURES - 4 POST 4 CHORD TRUSS SPANS FROM 100' TO 200' |
| RC-11M  | CLASSIFICATION OF EARTHWORK FOR STRUCTURES                              |
| RC-51M  | TYPE 31 STRONG POST GUIDE RAIL                                          |
| RC-53M  | TYPE 2 WEAK POST GUIDE RAIL                                             |
| RC-54M  | BARRIER PLACEMENT AT OBSTRUCTIONS                                       |
| RC-58M  | SINGLE FACE CONCRETE BARRIER                                            |

REFERENCE DRAWINGS

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORK: PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:  
  
COLUMNS & PIPE STRUTS: SEE PUBLICATION 408, SECTION 948.2.  
  
ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36 OR 50  
ASTM A709, GRADE 36 OR 50
- ALTERNATE PRESS-BREAK MEMBERS: ALTERNATE PRESS-BREAK MEMBERS MUST HAVE THE EQUIVALENT STRENGTH OF THE MEMBER THEY ARE REPLACING. EQUIVALENT RADIUS FOR PRESS-BREAK MEMBERS IS MEASURED FROM THE CENTER OF THE MEMBER TO THE MID-POINT OF ANY CHORD OF THE MEMBER. MINIMUM THICKNESS OF PRESS-BREAK MEMBERS TO BE 5/16". PENNDOT'S SIGN STRUCTURE PROGRAM OR AN APPROVED FINITE ELEMENT ANALYSIS COMPUTER PROGRAM MUST BE RUN TO VERIFY THE ADEQUACY OF PRESS-BREAK MEMBERS FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR STRUTS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:  
  
ANCHOR BOLTS: ASTM F1554, GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c) 3.  
  
BOLTS: ASTM F3125, GRADE A325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS: AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 1ST EDITION, 2015 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, PENNDOT DESIGN MANUAL - PART 4, DECEMBER 2019 EDITION.
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
CHANGEABLE MESSAGE SIGNS  
TRUSS SIGN STRUCTURES  
DESIGN CRITERIA AND  
GENERAL NOTES

RECOMMENDED JUL.10, 2025

CHIEF BRIDGE ENGINEER

RECOMMENDED JUL.10, 2025

CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 1 OF 4

BD-650M



NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWING IN ACCORDANCE WITH PENNDOT DESIGN MANUAL PART 4, AND THESE STANDARDS

2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS ( IF APPLICABLE):
  - LATITUDE AND LONGITUDE OR STATION AND OFFSET OF THE CENTER OF BOTH FOUNDATIONS
  - CMS HEIGHT AND LENGTH
  - CMS AREA
  - DESIGN HEIGHT
  - DESIGN ECCENTRICITY
  - DESIGN WEIGHT OF CMS
  - ACCESS CONFIGURATION (FRONT ACCESS CATWALK OR WALK-IN)
  - IF THE STRUCTURE IS TO SUPPORT A BACK TO BACK MOUNT
  - TOP OF PEDESTAL ELEVATION(S)
  - BOTTOM OF FOOTING ELEVATION(S)
  - MINIMUM VERTICAL CLEARANCE(S) PROJECTED TO EDGE OF PAVEMENT

3. IDENTIFY IF AN ENCLOSURE IS REQUIRED AND SPECIFY TYPE

4. IDENTIFY IF A MAINTAINER PAD IS REQUIRED AND LOCATE

5. IDENTIFY IF A SEPARATE CMS CABINET IS REQUIRED AND LOCATE

6. IDENTIFY IF A LADDER IS REQUIRED AND LOCATE

7. IDENTIFY THE PRESENCE OF GUIDE RAIL, BARRIER OR PLACEMENT OUTSIDE THE CLEAR ZONE

8. THE DESIGNER MUST DETAIL THE LEAST DISTANCE FROM EDGE OF PEDESTAL TO REAR OF GUIDE RAIL POST OR BARRIER AND INSURE IT IS IN ACCORDANCE WITH BC-745M, SHEET 2 TABLE A

9. IF NEEDED DETAILS ARE NOT FOUND IN THIS CMS TRUSS SIGN STRUCTURE STANDARD OR BC-745M A SPECIAL SUBMISSION REQUESTING APPROVAL MUST BE MADE TO THE CHIEF BRIDGE ENGINEER

10. TRUSS SUPPORT SIGN STRUCTURES INTENDED TO CARRY CMS MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THIS STANDARD AND BD-645M STANDARD MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF SUPPORT STRUCTURES CARRYING CMS.

11. ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH CMS. IDENTIFY CATWALK AND WALK-IN ACCESS LATFORM LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN INIMUM VERTICAL CLEARANCE.

12. THE DESIGNER IS RESPONSIBLE FOR VERIFYING THE STRUCTURAL CAPACITY OF ALL MEMBERS AND DETAILS SHOWN ON THE CONSTRUCTION PLANS. THE DESIGN TABLES AND STRUCTURAL DETAILS PROVIDED IN BD-645M AND BC-745M CAN BE USED AS A REFERENCE. HOWEVER, THESE STANDARDS WERE NOT ANALYZED FOR CMS LOADINGS.

13. THE DESIGNER MUST ENSURE THE AVAILABILITY OF THE SELECTED PIPE SIZES. THE DESIGNER MUST SEND THE DOCUMENT OF AVAILABLE PIPE SIZES TO THE CHIEF BRIDGE ENGINEER PRIOR TO PS&E SUBMITTAL. THE DESIGNER DOCUMENTS THAT AN INVENTORY OF PIPE IS AVAILABLE AND/OR THE MANUFACTURER PIPE RULING SCHEDULE IS COMPATIBLE WITH THE CONSTRUCTION SCHEDULE. IN GENERAL, 30" DIAMETER PIPE IS MORE READILY AVAILABLE THAN 24" OR 26" DIAMETER PIPE WITH WALL THICKNESS GREATER THAN 1/2".

14. PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 - (INDICATE CHANGE NUMBER), AASHTO/AWS D1.5, BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5".

15. FOUR-POST FOUR-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS ARE RECOMMENDED TO CARRY CMS.

16. DURING THE REVIEW PROCESS OF THE SHOP DRAWINGS, CALLING FOR "VERIFICATION" OF AN ITEM, SIZE, DIMENSION, WELD, OR ANY DETAIL IS INSUFFICIENT. SUCH DETAILS AND/OR CORRECTIONS SHALL BE NOTED ON THE SHOP DRAWINGS BY THE REVIEWING AUTHORITY. ANY DISCREPANCIES OF QUESTIONS SHALL BE REFERRED TO PENNDOT FOR REVIEW AND RESOLUTION.

17. IF CONTRACT DRAWINGS INDICATE A "SCALE" THEN ALL DETAILS, LAYOUTS OF SIGN PANELS/BOXES, SIGN/WALKWAY SUPPORTS, HANDRAILS AND ALL ITEMS RELATED TO THE STRUCTURE SHALL BE DEPICTED PER "SCALE" SHOWN.

NOTES TO FABRICATOR

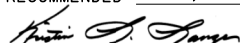
1. PROVIDE SHOP DRAWINGS IN ACCORDANCE WITH PUBLICATION 408, SECTION 105.02(D) AND CONTRACT SPECIAL PROVISIONS
2. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE SHOP DRAWINGS:
  - GENERAL NOTES AND CONSTRUCTION NOTES, SEE SHEET 1 (AS APPLICABLE)
  - FABRICATION NOTES
  - TRANSPORTATION NOTES
  - LIFTING AND ERECTION NOTES
  - INSTALLATION NOTES
  - PROVIDE A TABLE OF QUANTITIES INCLUDING:
    - WEIGHT OF STEEL SIGN STRUCTURE
    - CLASS 3 EXCAVATION
    - CLASS A CEMENT CONCRETE
    - POUNDS OF REINFORCEMENT BARS

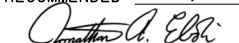
- FRONT AND SIDE ELEVATIONS WITH THE MINIMUM INFORMATION LISTED BELOW:
  - COLUMN SIZE
  - COLUMN BRACING
  - CMS HEIGHT
  - TRUSS SPACING AND CONFIGURATION
  - CHORD DIAMETER
  - PANEL LENGTHS
  - ACTUAL MINIMUM VERTICAL CLEAR
  - ACTUAL OFFSET(S) FROM EDGE OF SHOULDER
  - FOOTING ELEVATION(S)
  - FRONT AND REAR DIAGONALS DIAMETER
  - VERTICAL DIAMETER
  - BOTTOM DIAGONAL DIAMETER
  - TOP AND BOTTOM VERTICALS DIAMETER
  - FOOTING(S) LENGTH AND WIDTH(S)
  - PEDESTAL(S) LENGTH AND WIDTH(S)
  - PEDESTAL HEIGHT(S)
  - TOP OF PEDESTAL ELEVATION(S)
  - SIZE, NUMBER AND EMBEDMENT OF ANCHOR BOLTS
  - ECCENTRICITY
  - LATITUDE AND LONGITUDE OR STATION AND OFFSET OR THE CENTER OF THE COLUMNS
  - CMS HEIGHT AND LENGTH
  - CMS AREA
  - DESIGN HEIGHT
  - DESIGN ECCENTRICITY
  - DESIGN WEIGHT OF CMS
  - SIZE AND TYPE OF PIPE CAPS
  - IDENTIFY ALL WELDS BY SIZE AND TYPE
  - COMPLETED CAMBER DIAGRAM

3. ALUMINUM CMS SUPPORT STRUCTURES ARE PROHIBITED.
4. TELESCOPING (SLIP-FIT) FIELD SPLICES FOR CMS SUPPORT STRUCTURES ARE PROHIBITED.
5. INDICATE THE SUPPLIER FOR CATWALK GRATING ON THE SHOP DRAWINGS.
6. PROVIDE HAND HOLE, STRUCTURE MOUNTED ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON SHOP DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.
7. DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF A STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE CONTRACT DRAWINGS OR THE DETAILS CONTAINED IN THIS STANDARD. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THE DESIGN TABLES ON STANDARD DRAWING BD-645M AND THE DETAILS IN THIS STANDARD.
8. FABRICATOR TO PROVIDE CERTIFIED/NOTARIZED COPIES OF MILL CERTS OF ALL MATERIALS USED ON PROJECT.
9. FABRICATOR TO PROVIDE CERTIFIED/NOTARIZED COPIES OF ALL QC/INSPECTION REPORTS AND A COPY TO ACCOMPANY EACH LOAD TO JOB SITE.
10. FABRICATOR TO REPORT ANY DAMAGE TO ANY ITEM TO DEPARTMENT WITH AN APPROPRIATE REPAIR PROCEDURE. DEPARTMENT WILL REVIEW SUCH A REQUEST, AND REPAIR PROCEDURE AND RESPOND. NO REPAIRS TO BE DONE PRIOR TO DEPARTMENT APPROVAL. IF DEEMED NECESSARY, THE DEPARTMENT MAY REQUEST CALCULATIONS FOR A REPAIR BY A PA REGISTERED PROFESSIONAL ENGINEER.
11. INSTALLING CONTRACTOR MUST CHECK ANCHORAGE ASSEMBLY IN FIELD FOR REQUIRED PROJECTION ETC. AND THEN AT INSTALLATION CHECK AND VERIFY ORIENTATION OF BASE AND ANCHOR BOLTS.

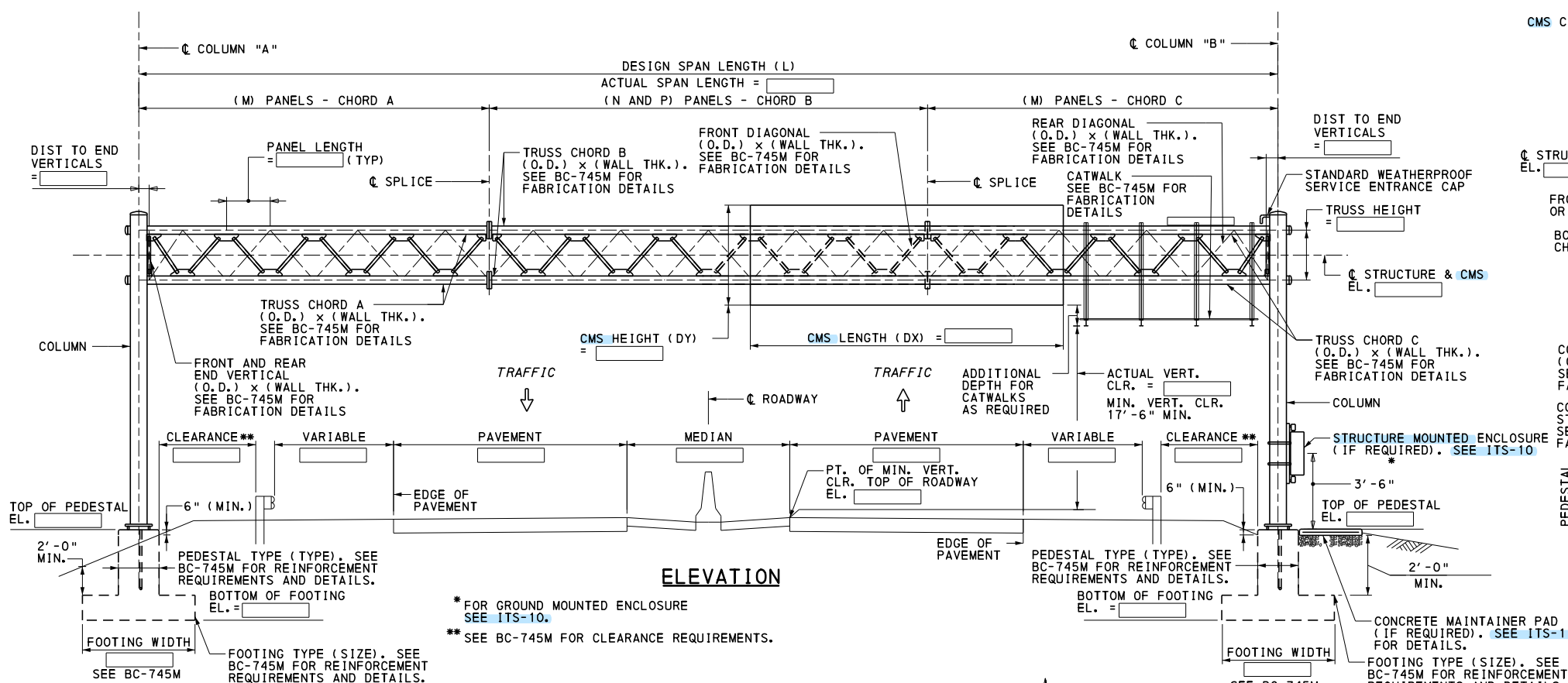
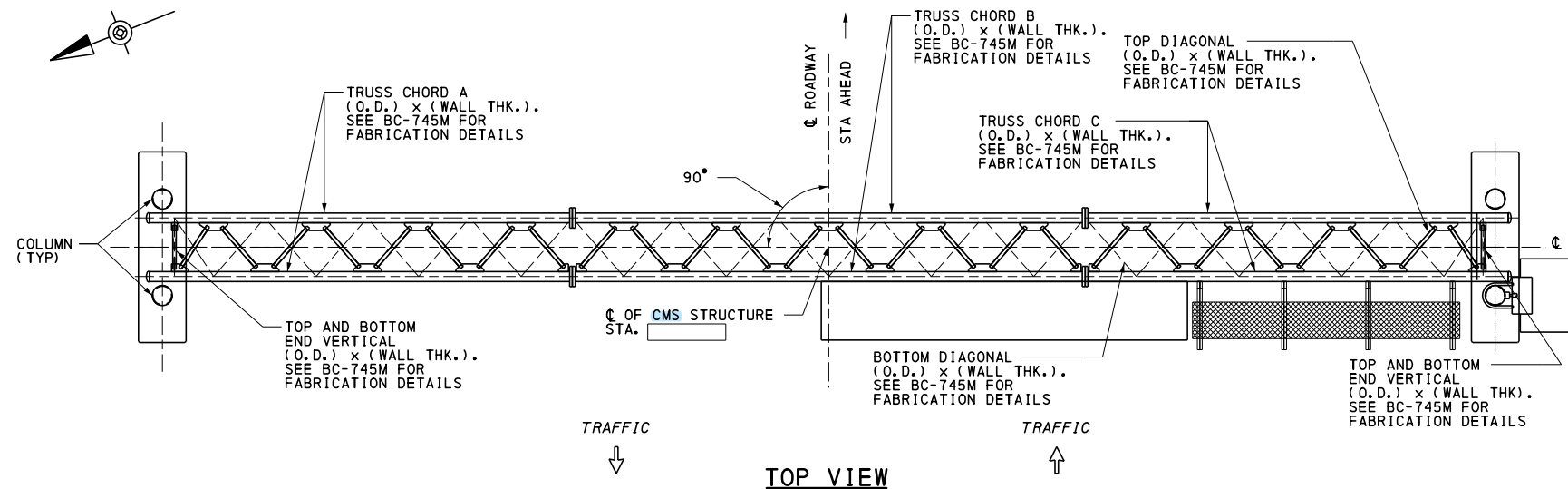
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
CHANGEABLE MESSAGE SIGNS  
TRUSS SIGN STRUCTURES  
NOTES TO DESIGNER  
AND FABRICATOR

RECOMMENDED JUL.10, 2025  
  
CHIEF BRIDGE ENGINEER

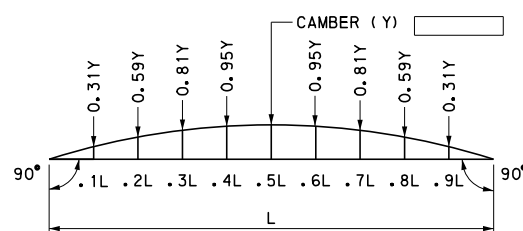
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CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 2 OF 4  
BD-650M



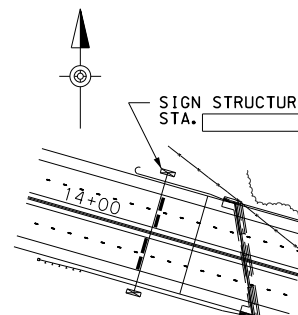
| TABLE OF ESTIMATED QUANTITIES |                         |      |          |
|-------------------------------|-------------------------|------|----------|
| ITEM NO.                      | ITEM                    | UNIT | QUANTITY |
| ■                             | STEEL SIGN STRUCTURE    | LBS  |          |
| 0000-0000                     | CLASS 3 EXCAVATION      | CY   |          |
| 0000-0000                     | CLASS A CEMENT CONCRETE | CY   |          |
| 0000-0000                     | REINFORCEMENT BARS      | LBS  |          |

■ ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000]



CAMBER DIAGRAM

NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

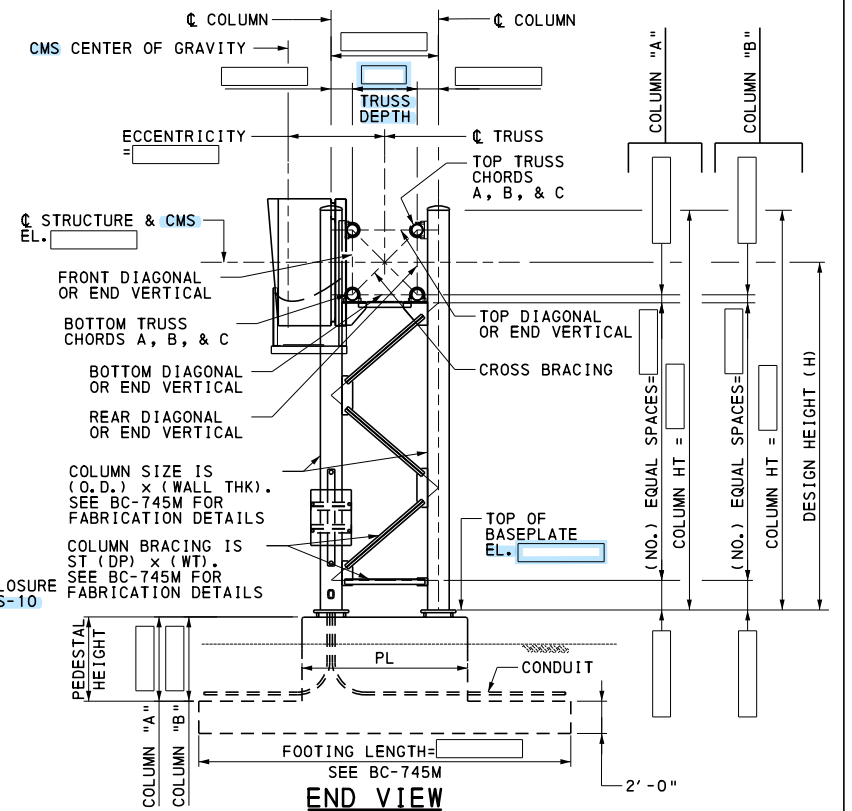


SEE PLAN SHEET [ ] FOR SIGN STRUCTURE LOCATION

LOCATION PLAN

## NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN ( ) PARENTHESES.
  - PEDESTAL TYPE (TYPE). SEE BC-745M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  - FOOTING TYPE (SIZE). SEE BC-745M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
  - COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  - COLUMN BRACING IS ST(DP) x (WT.). SEE BC-745M FOR FABRICATION DETAILS.
  - TRUSS CHORD A (O.D.) x (WALL THK.), TRUSS CHORD B (O.D.) x (W. THK.), AND TRUSS CHORD C (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  - FRONT & REAR DIAGONALS (O.D.) x (WALL THK.) AND FRONT & REAR END VERTICALS (O.D.) x (WALL THK.); TOP & BOTTOM DIAGONALS (O.D.) x (WALL THK.) AND TOP & BOTTOM END VERTICALS (O.D.) x (WALL THK.). SEE BC-745M FOR FABRICATION DETAILS.
  - SEE BC-745M FOR ADDITIONAL FABRICATION DETAILS INCLUDING HAND HOLE, STRUCTURE MOUNTED ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP.
  - SEAL BASE PLATE TO FOUNDATION GAP WITH GALVANIZED STEEL SCREEN, 1/2" BY 1/2" MESH AND 0.063" DIAMETER WIRES. SCREEN IS TO PREVENT ENTRY OF RODENTS WHILE PERMITTING DRAINAGE. SCREEN IS TO BE REMOVABLE AND ATTACHED TO BASEPLATE WITH STAINLESS STEEL HARDWARE.
- PROVIDE HAND HOLE, STRUCTURE MOUNTED ENCLOSURE, AND STANDARD WEATHERPROOF SERVICE ENTRANCE CAP SIZE AND LOCATIONS ON CONTRACT PLANS BASED ON SITE SPECIFIC REQUIREMENTS. ALTERNATE DETAILS FROM BC-745M MAY BE REQUIRED TO MEET CABLE BENDING RADIUS AND PROJECT SPECIFIC REQUIREMENTS.
  - PLACE CAMBER DIAGRAM ON CONTRACT DRAWINGS AND SPECIFY REQUIRED CAMBER FROM DESIGN TABLE.
  - PROVIDE DIMENSIONS AND ELEVATIONS BASED ON ACTUAL STRUCTURE CONFIGURATION AS REQUIRED. SAMPLE INDICATES MINIMUM REQUIRED INFORMATION WITH [ ]
  - PROVIDE GENERAL NOTES FROM SHEET 1 ON THE CONTRACT DRAWINGS.
  - PROVIDE CMS CONNECTION DETAILS ON THE CONTRACT DRAWINGS IN ACCORDANCE WITH SHEET 4.
  - SEE BD-645M FOR STRUCTURE COMPONENT DESIGNATIONS.



## COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF BRIDGE

### STANDARD CHANGEABLE MESSAGE SIGNS TRUSS SIGN STRUCTURES SAMPLE CONTRACT PLAN FOR TRUSS STRUCTURES

RECOMMENDED JUL. 10, 2025

CHIEF BRIDGE ENGINEER

RECOMMENDED JUL. 10, 2025

CHIEF EXECUTIVE, HIGHWAY ADMIN.

SHEET 3 OF 4

BD-650M

## DESIGN CRITERIA

DESIGN CMS AREA (A) = [ ]

DESIGN CMS LENGTH (DX) = [ ]

DESIGN CMS HEIGHT (DY) = [ ]

DESIGN HEIGHT (H) = [ ]

CMS ECCENTRICITY = [ ]

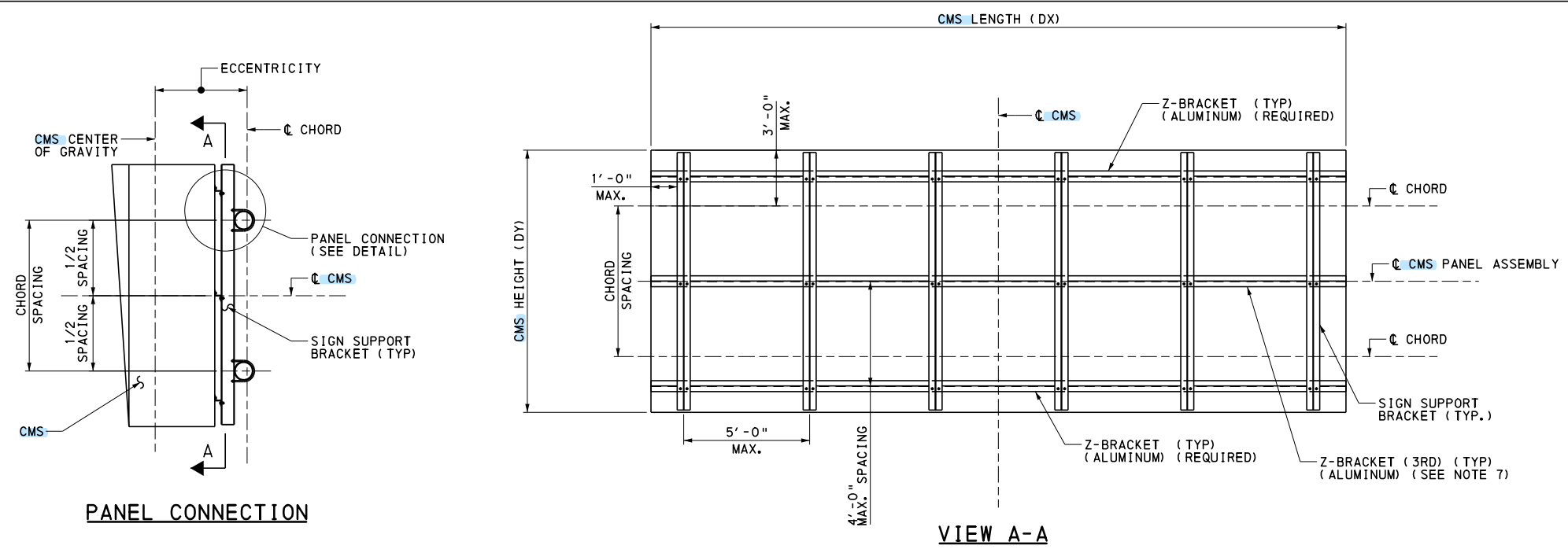
DESIGN WEIGHT OF CMS (W) = [ ]

LATITUDE [ ] LONGITUDE [ ]

OR

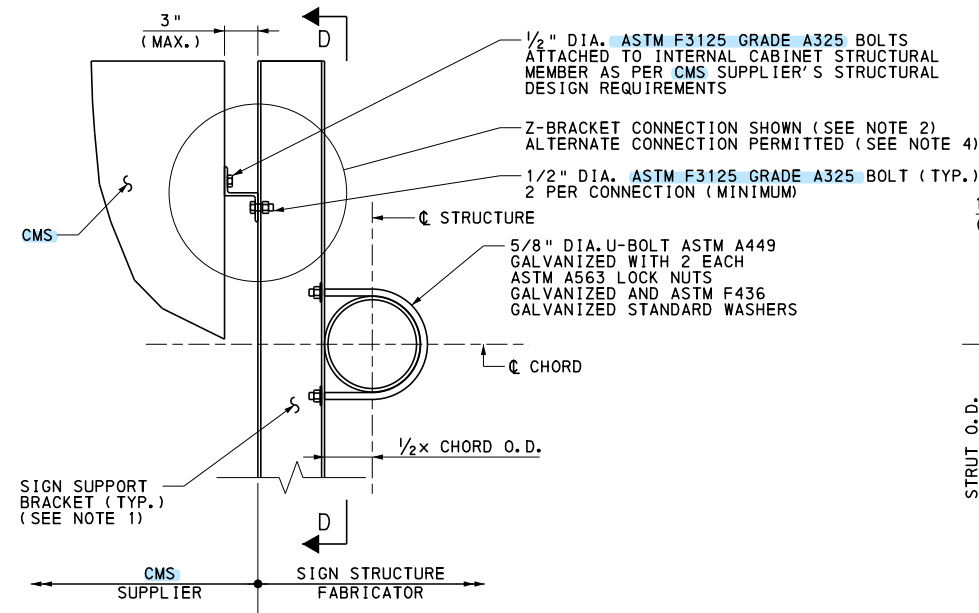
STATION [ ] OFFSET [ ]

▲ PROVIDE EITHER LATITUDE/LONGITUDE OR STATION AND OFFSET.

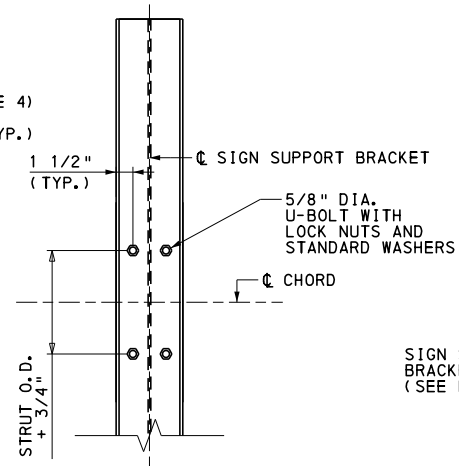


PANEL CONNECTION

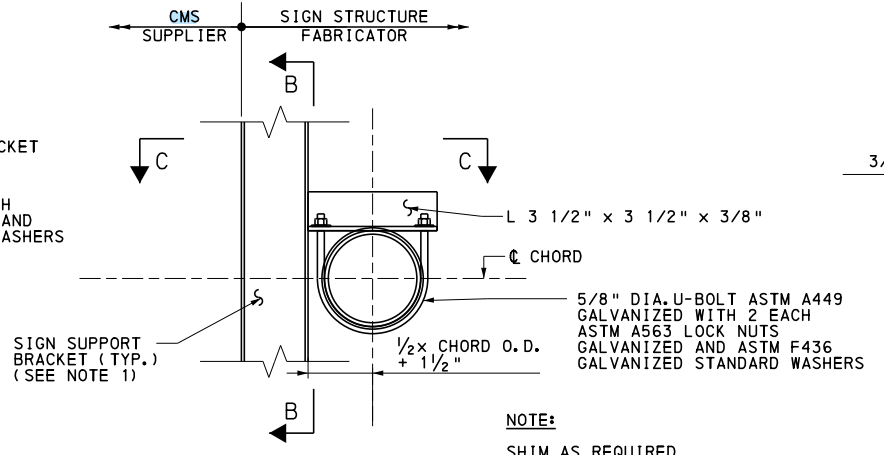
VIEW A-A



PANEL CONNECTION DETAIL

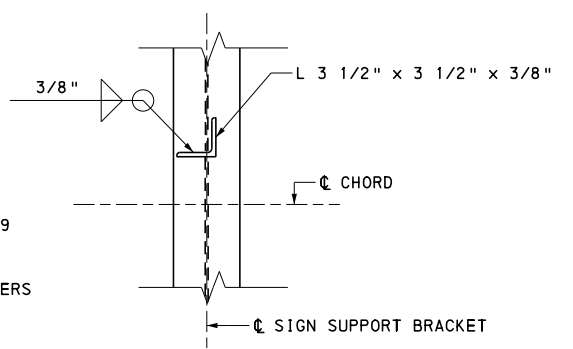


VIEW D-D

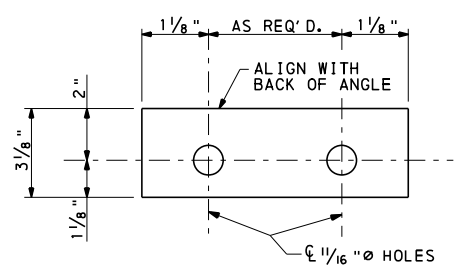


ALTERNATE PANEL CONNECTION DETAIL

NOTE:  
SHIM AS REQUIRED BETWEEN ANGLE AND TOP OF CHORD TO PROVIDE TIGHT FIT. (SEE SHIM DETAIL THIS SHEET)

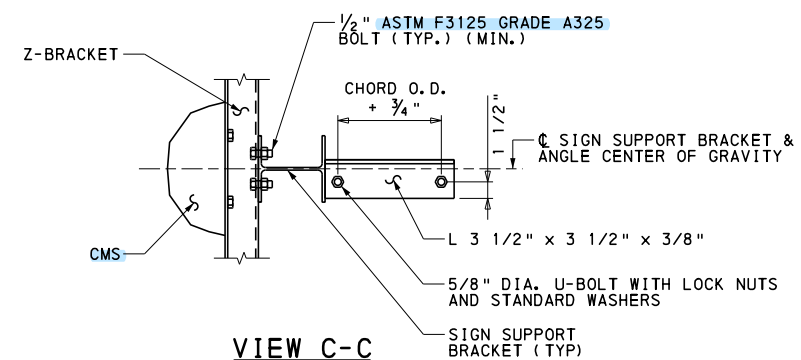


VIEW B-B



SHIM DETAIL

PROVIDE 1 AT 1/4", 3 AT 1/8" AND 1 AT 1/16" THICKNESS FOR EACH UPPER SIGN SUPPORT CONNECTION ANGLE.



VIEW C-C

NOTES TO DESIGNER:

1. MINIMUM SIZE OF SIGN SUPPORT BRACKET IS W6x15. LARGER SIGN SUPPORTS MAY BE REQUIRED TO PROVIDE CLEARANCE BETWEEN HORIZONTAL Z-BRACKETS AND COLUMN.
2. HORIZONTAL Z-BRACKETS SHALL BE MADE OF ALUMINUM ALLOY 6061-T6 OR AS APPROVED BY THE CHIEF BRIDGE ENGINEER AND SHALL BE A MINIMUM OF 1/4" THICK.
3. CONNECTION DETAILS PROVIDED ON THIS SHEET HAVE BEEN
 

|                      |          |
|----------------------|----------|
| MAXIMUM DEAD LOAD    | 6000 LBS |
| MAXIMUM ECCENTRICITY | 5'-0"    |
| MAXIMUM HEIGHT (DY)  | 10'-0"   |
| MAXIMUM DEPTH        | 4'-0"    |

 DESIGN CALCULATIONS ARE REQUIRED FOR DEVIATIONS TO THESE ASSUMPTIONS.
4. ALTERNATE CONNECTION DETAILS ARE PERMITTED, BUT REQUIRE CALCULATIONS PREPARED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA AND VERIFIED BY A SECONDARY INDEPENDENT PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA. THE CMS MANUFACTURER IS RESPONSIBLE FOR PROVIDING THESE CALCULATIONS AND HAVING THEM SIGNED AND SEALED BY BOTH THE PROFESSIONAL ENGINEERS.
5. DETAILS PROVIDED ARE THE MINIMUM REQUIREMENTS. ANY DEVIATIONS REQUIRE SPECIAL DESIGN.
6. FIELD WELDED CMS CONNECTIONS ARE NOT PERMITTED.
7. USE OF 3RD Z-BRACKET IS BASED ON PROJECT AND WIND LOADING REQUIREMENTS. MOUNTING CALCULATIONS TO BE COMPLETED TO AASHTO LRFD SIGN AND SUBMITTED BY THE FABRICATOR.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF BRIDGE

STANDARD  
CHANGEABLE MESSAGE SIGNS  
TRUSS SIGN STRUCTURES  
CMS ATTACHMENT DETAILS

CHANGE 5

| STANDARD BEAM SIZES AND ALLOWABLE<br>SKEW LIMITATIONS |                     |     |     |     |         |     |         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-------------------------------------------------------|---------------------|-----|-----|-----|---------|-----|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| SIZE OF BEAM SECTION                                  |                     |     |     |     |         |     |         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| BEAM DEPTH ( IN )                                     | 12                  |     | 17  |     | 21 & 24 |     | 27 & 30 |     | 33  |     | 36  |     | 39  |     | 42  |     | 45  |     | 48  |     | >48 |     |
| BEAM WIDTH ( IN )                                     | 36                  | 48  | 36  | 48  | 36      | 48  | 36      | 48  | 36  | 48  | 36  | 48  | 36  | 48  | 36  | 48  | 36  | 48  | 36  | 48  | 36  | 48  |
| ADJ. BOX ( COMP. )                                    | 60°                 | 60° | 60° | 60° | 60°     | 60° | 55°     | 60° | 50° | 55° | 45° | 50° | 45° | 50° | 45° | 50° | 40° | 50° | 40° | 50° | 40° | 50° |
| SPREAD BOX                                            |                     |     | 35° | 40° | 35°     | 45° | 35°     | 45° | 35° | 45° | 35° | 45° | 35° | 45° | 35° | 45° | 40° | 50° | 50° | 55° | 50° | 55° |
| I-BEAMS &<br>PA BULB-TEE BEAMS                        | FOR ALL SIZES - 30° |     |     |     |         |     |         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

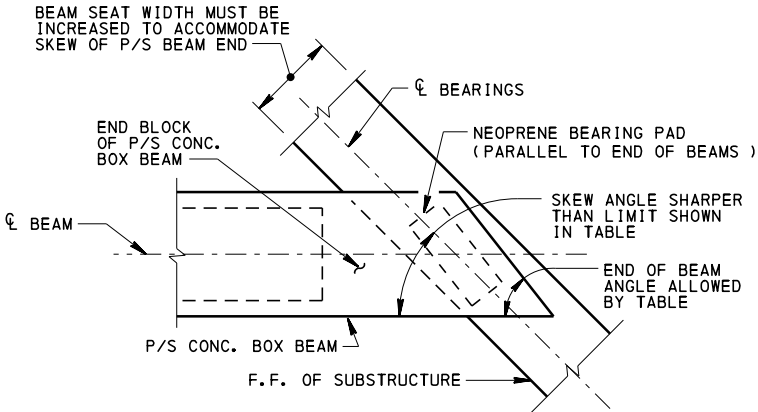
NOTE:  
FOR BOX BEAMS WITH SKEW ANGLES SHARPER THAN THOSE LISTED IN THE ABOVE TABLE IT IS PERMITTED TO SKEW THE END OF BEAM AT THE LIMIT SHOWN ABOVE AND PLACE THE BEARING PAD(S) AND BEAM ENDS AT THE REQUIRED SKEW ANGLE. SEE "SHARP SKEW DETAIL" ON THIS SHEET. DESIGNERS ARE TO VERIFY THAT THE COST OF ADDITIONAL BRIDGE SEAT WIDTH IS CONSIDERED IN EVALUATING THE COST SAVINGS OBTAINED BY USE OF THIS DETAIL.

| MID-SPAN DIAPHRAGM REQUIREMENTS FOR SPREAD BOX BEAMS, PA BULB-TEE BEAMS AND I-BEAMS (SIMPLE AND CONTINUOUS SPAN BRIDGES)                                                                                                                                                                                                                                                                         |                                                               |                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
| BOX BEAMS                                                                                                                                                                                                                                                                                                                                                                                        | INTERIOR DIAPHRAGMS                                           | EXTERIOR DIAPHRAGMS                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                  | (1)(2)<br>PROVIDE AT $\frac{1}{4}$ FOR SPANS GREATER THAN 45' | PROVIDE AT $\frac{1}{4}$ FOR SPANS 80' AND GREATER        |
| I-BEAMS & PA BULB-TEE                                                                                                                                                                                                                                                                                                                                                                            | INTERIOR DIAPHRAGMS                                           | EXTERIOR DIAPHRAGMS                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                  | NOT APPLICABLE                                                | (3)<br>PROVIDE AT $\frac{1}{4}$ FOR SPANS 40' AND GREATER |
| (1) PROVIDE ADDITIONAL INTERNAL DIAPHRAGMS AS NEEDED, WITH MAX. DIAPHRAGM SPACING OF 45'.<br>(2) PROVIDE DIAPHRAGMS AT DRAPE POINTS. WHEN INTERNAL DIAPHRAGMS ARE PROVIDED AT DRAPE POINTS, AN ADDITIONAL MIDSPAN INTERNAL DIAPHRAGM WILL ONLY BE REQUIRED WHEN AN EXTERNAL DIAPHRAGM IS USED AT MIDSPAN.<br>(3) PROVIDE EXTERIOR DIAPHRAGMS @ $\frac{1}{2}$ POINTS FOR SPANS GREATER THAN 160'. |                                                               |                                                           |

| BACKWALL REQUIREMENTS |                                                                                                                                                                                                                     |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ALL BEAM TYPES        |                                                                                                                                                                                                                     |
| FIX                   | GIRDER DEPTH EXCEEDS 6' OR THE TOP OF THE DECK MOVEMENT CAUSED BY THE ROTATION DUE TO DESIGN LIVE LOAD PLUS IMPACT EXCEEDS 0.5", WHICHEVER CONTROLS.                                                                |
| EXP.                  | GIRDER DEPTH EXCEEDS 6' OR THE TOP OF THE DECK MOVEMENT CAUSED BY THE COMBINATION OF THE MOVEMENTS DUE TO TEMPERATURE CHANGE AND ROTATION DUE TO THE DESIGN LIVE LOAD PLUS IMPACT EXCEEDS 0.5", WHICHEVER CONTROLS. |

DEFINITIONS  
SHEAR BLOCK: A REINFORCED CONCRETE BLOCK, GENERALLY HAVING HEIGHT TO WIDTH OR LENGTH RATIO EQUAL TO OR LESS THAN 1. ITS PURPOSE IS TO RESIST SHEAR.  
CURTAIN WALL: A REINFORCED CONCRETE WALL TO CONCEAL UNSIGHTLY DETAILS.  
CHEEKWALL: A REINFORCED CONCRETE WALL WHICH ACCOMPLISHES THE FUNCTIONS OF SHEAR BLOCK AND CURTAIN WALL.

| END DIAPHRAGMS, SHEAR BLOCKS AND DOWEL<br>REQUIREMENTS FOR<br>SPREAD BOX BEAMS, PA BULB-TEE BEAMS AND I-BEAMS<br>(SIMPLE AND CONTINUOUS SPAN BRIDGES)                                                                                                                                                                                                                                                                                                |                                         |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                         | ABUTMENTS                                                            |                                                           |                                                                |                                                                                     | PIERS                                                                                             |                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                         | FIXED <sup>(1)</sup><br>WITHOUT<br>BACKWALL                          | FIXED<br>WITH<br>BACKWALL                                 | EXPANSION <sup>(1)</sup><br>WITHOUT<br>BACKWALL                | EXPANSION<br>WITH<br>BACKWALL                                                       | FIXED                                                                                             | EXPANSION                                                                              |
| DIAPHRAGMS,<br>SHEAR BLOCKS<br>AND<br>CHEEK WALLS                                                                                                                                                                                                                                                                                                                                                                                                    | SPREAD<br>BOX<br>BEAM                   | FULL DEPTH<br>DIAPHRAGMS                                             | ALTERNATING<br>FULL AND<br>PARTIAL<br>DEPTH<br>DIAPHRAGMS | FULL DEPTH<br>DIAPHRAGMS,<br>SHEAR BLKS,<br>& CURTAIN<br>WALLS | PARTIAL<br>DEPTH<br>DIAPHRAGMS,<br>SHEAR BLKS,<br>& CURTAIN<br>WALLS (IF<br>NEEDED) | <sup>(2)</sup><br>ALTERNATING<br>FULL AND<br>PARTIAL<br>DEPTH<br>DIAPHRAGMS<br>AND<br>CHEEK WALLS | <sup>(2)</sup><br>PARTIAL<br>DEPTH<br>DIAPHRAGMS,<br>SHEAR BLKS,<br>& CURTAIN<br>WALLS |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                      | I-BEAMS &<br>PA BULB-TEE                |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
| DOWELS                                                                                                                                                                                                                                                                                                                                                                                                                                               | <sup>(3)</sup><br>SPREAD<br>BOX<br>BEAM | USE 3-1"Ø<br>DOWELS PER<br>DIAPHRAGM                                 | <sup>(4)</sup><br>USE 3-1"Ø<br>DOWELS PER<br>DIAPHRAGM    | NONE REQUIRED                                                  |                                                                                     | <sup>(4)</sup><br>USE 3-1"Ø<br>DOWELS PER<br>FULL DEPTH<br>DIAPHRAGM                              | NONE<br>REQUIRED                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                      | I-BEAMS &<br>PA BULB-TEE                | <sup>(4)</sup><br>USE 3-1"Ø<br>DOWELS PER<br>FULL DEPTH<br>DIAPHRAGM |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
| SYMBOLS                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                         |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
| <sup>(1)</sup> DENOTES CONDITIONS THAT PERTAIN TO SIMPLE SPAN BRIDGES.<br><sup>(2)</sup> FULL DEPTH DIAPHRAGMS ARE TO BE USED FOR CONTINUOUS SPAN BRIDGES.<br><sup>(3)</sup> THE DOWELS IN THE DIAPHRAGMS MAY BE REPLACED WITH DOWELS IN THE BEAMS.<br>(SEE DOWEL REQUIREMENTS FOR ADJACENT BOX BEAM BRIDGES)<br><sup>(4)</sup> THE DOWELS SHOWN ARE FOR A MAXIMUM DIAPHRAGM LENGTH OF 10'.<br>FOR EACH 2' OR PART THEREOF, ADD AN ADDITIONAL DOWEL. |                                         |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
| NOTES:                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
| 1. FOR CONTINUOUS SPAN BRIDGES, DESIGN THE DOWELS AT THE FIXED ENDS<br>TO RESIST ALL LONGITUDINAL FORCES.                                                                                                                                                                                                                                                                                                                                            |                                         |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |
| 2. USE STAINLESS STEEL DOWEL BARS PER PUB 408 SECTION 709.1(f).                                                                                                                                                                                                                                                                                                                                                                                      |                                         |                                                                      |                                                           |                                                                |                                                                                     |                                                                                                   |                                                                                        |



PLAN  
SHARP SKEW DETAIL  
NO SCALE

GENERAL NOTES:  
1. REFER TO BD-668M FOR PRECAST CHANNEL BEAM TIE BOLT REQUIREMENTS.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
REQUIREMENTS FOR TENDONS,  
DOWELS, SHEAR BLOCKS,  
DIAPHRAGMS, SKEW LIMITATIONS  
AND BACKWALLS  
P/S CONCRETE I-BEAM,  
PA BULB-TEE BEAM AND BOX BEAM BRIDGES

BD-668M PRECAST CHANNEL BEAM  
BC-775M MISCELLANEOUS PRESTRESS DETAILS  
REFERENCE DRAWINGS

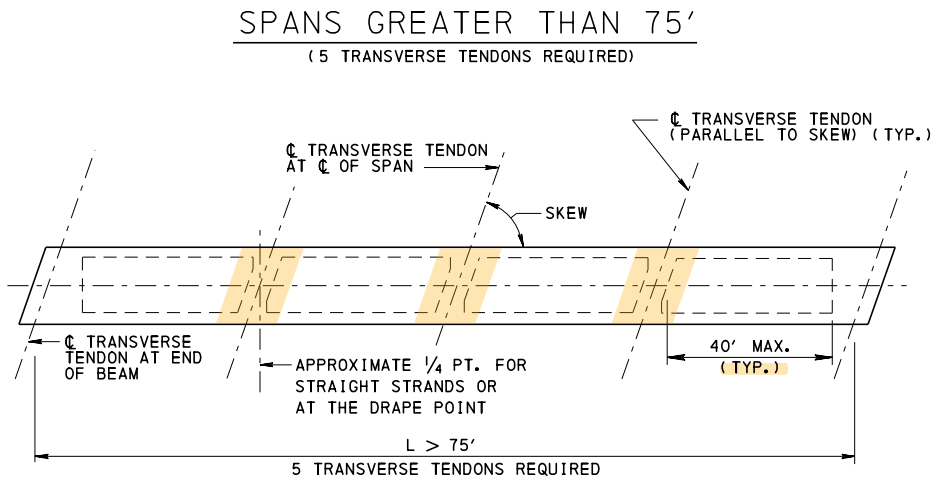
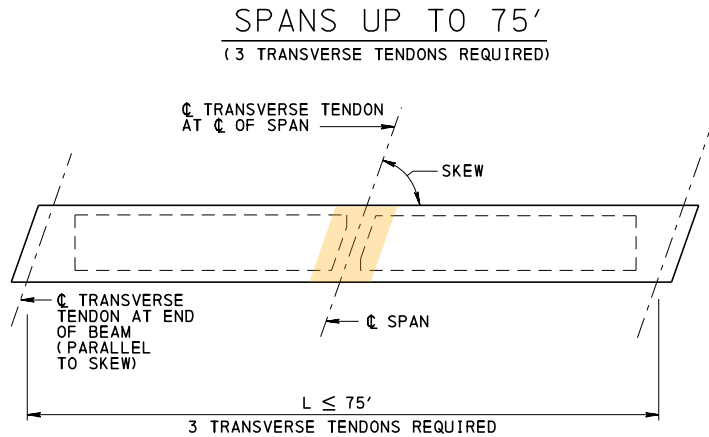
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 1 OF 2  
BD-651M



TENDON AND DIAPHRAGM REQUIREMENTS FOR  
ADJACENT BOX BEAM BRIDGES  
(SIMPLE AND CONTINUOUS SPAN BRIDGES)



NOTES:

- FOR DIAPHRAGM DETAILS, SEE BC-775M.
- DETAILS ALSO APPLY TO PLANK BEAMS.
- BEAMS WITH DRAPED STRANDS ARE TO HAVE DIAPHRAGMS PLACED AT THE DRAPE POINTS.
- INTERMEDIATE DIAPHRAGM IS NOT REQUIRED FOR SPANS LESS THAN OR EQUAL TO 40 FEET.

DOWEL AND SHEAR BLOCK REQUIREMENTS  
FOR COMPOSITE ADJACENT BOX BEAMS  
(SIMPLE AND CONTINUOUS SPAN BRIDGES)

| FIXED END                 | EXPANSION END                                                                                                                                                                                 |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1-1 1/4" Ø DOWEL PER BEAM | 1 1/4" Ø DOWEL ONLY REQUIRED WHEN USED TO MEET TOTAL ANCHORAGE FOR SPAN LENGTHS LESS THAN OR EQUAL TO 50 FT. FOR SPAN LENGTHS GREATER THAN 50 FT. CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED. |

NOTES:

- INVESTIGATE THE ADEQUACY OF DOWELS AND SHEAR BLOCKS WHEN BRIDGE IS SUBJECT TO INUNDATION DURING FLOOD CONDITIONS (100 YEAR MINIMUM).
- FOR MINIMUM ALLOWABLE SKEW, SEE STANDARD BEAM SIZES AND ALLOWABLE SKEW LIMITATIONS, THIS SHEET.
- SINGLE SPAN BRIDGES WITH SPANS OF 35' AND LESS, PROVIDE FIXED CONDITION AT BOTH ABUTMENTS.
- ARRANGE FIXED AND EXPANSION CONDITIONS SO THAT THE BRIDGE IS EXPANDING UPHILL.
- FOR CONTINUOUS SPANS, PROVIDE DOWELS AT FIXED LOCATIONS. DESIGN DOWELS TO RESIST ALL LONGITUDINAL FORCES.
- FOR MULTI-SPAN BRIDGES (NON-CONTINUOUS), WITHOUT BACKWALLS, ABUTMENTS ARE TO BE FIXED.
- THE SHEAR BLOCK AND DOWEL REQUIREMENTS ARE APPLICABLE TO BRIDGES WITH OR WITHOUT BACKWALLS.
- IF A CHEEKWALL IS TO BE USED AS A SHEAR BLOCK, IT IS TO BE DESIGNED ACCORDINGLY.
- USE STAINLESS STEEL DOWEL BARS PER PUB 408 SECTION 709.1(f).

| SKEW LIMITATIONS<br>FOR INTEGRAL ABUTMENT BRIDGES |                      |              |
|---------------------------------------------------|----------------------|--------------|
| NO. OF SPANS                                      | SPAN LENGTH, L       | MINIMUM SKEW |
| 1                                                 | L ≤ 90 FT.           | 45°          |
| 1                                                 | 90 FT. < L ≤ 130 FT. | 60°          |
| 1                                                 | L > 130 FT.          | 70°          |
| >1                                                | ALL SPAN LENGTHS     | 70°          |

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
REQUIREMENTS FOR TENDONS,  
DOWELS, SHEAR BLOCKS,  
DIAPHRAGMS, SKEW LIMITATIONS  
AND BACKWALLS  
P/S CONCRETE I-BEAM,  
PA BULB-TEE BEAM AND BOX BEAM BRIDGES

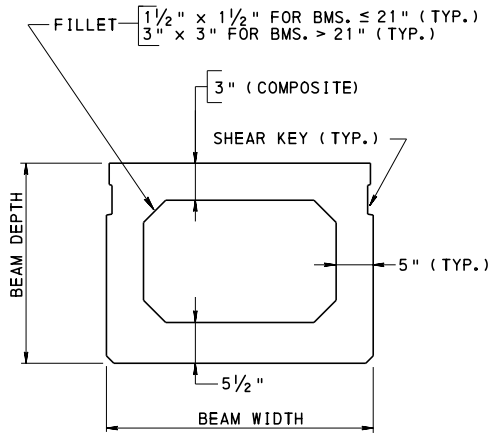
RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

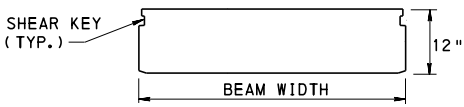
SHEET 2 OF 2

BD-651M





ADJACENT BOX BEAM



PLANK BEAM

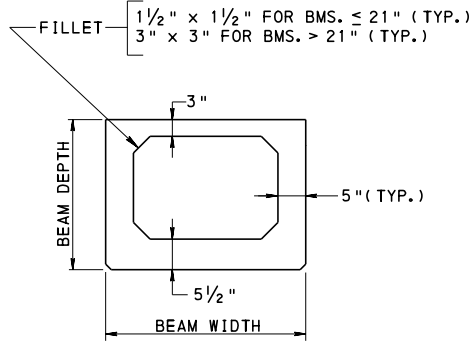
| ADJACENT BOX BEAM DATA ( COMPOSITE CONSTRUCTION ) |                                           |                          |               |                      |                       |                                    |                                    |                                           |                          |               |                      |                       |                                    |                                    |
|---------------------------------------------------|-------------------------------------------|--------------------------|---------------|----------------------|-----------------------|------------------------------------|------------------------------------|-------------------------------------------|--------------------------|---------------|----------------------|-----------------------|------------------------------------|------------------------------------|
| BEAM DEPTH (in.)                                  | BASIC BEAM DATA - 48" BEAMS ( COMPOSITE ) |                          |               |                      |                       |                                    |                                    | BASIC BEAM DATA - 36" BEAMS ( COMPOSITE ) |                          |               |                      |                       |                                    |                                    |
|                                                   | CONC. (CY/ft.)                            | AREA (in. <sup>2</sup> ) | WT/FT. (KIPS) | Y <sub>b</sub> (in.) | I (in. <sup>4</sup> ) | S <sub>t</sub> (in. <sup>3</sup> ) | S <sub>b</sub> (in. <sup>3</sup> ) | CONC. (CY/ft.)                            | AREA (in. <sup>2</sup> ) | WT/FT. (KIPS) | Y <sub>b</sub> (in.) | I (in. <sup>4</sup> ) | S <sub>t</sub> (in. <sup>3</sup> ) | S <sub>b</sub> (in. <sup>3</sup> ) |
| 17                                                | 0.126                                     | 489                      | 0.510         | 7.61                 | 16693                 | 1778                               | 2193                               | 0.100                                     | 387                      | 0.403         | 7.71                 | 12697                 | 1366                               | 1648                               |
| 21                                                | 0.136                                     | 529                      | 0.551         | 9.29                 | 29123                 | 2487                               | 3136                               | 0.110                                     | 427                      | 0.445         | 9.44                 | 22344                 | 1933                               | 2368                               |
| 24                                                | 0.147                                     | 573                      | 0.579         | 10.64                | 41828                 | 3131                               | 3932                               | 0.121                                     | 471                      | 0.490         | 10.84                | 32444                 | 2465                               | 2993                               |
| 27                                                | 0.155                                     | 603                      | 0.628         | 11.95                | 56630                 | 3763                               | 4740                               | 0.129                                     | 501                      | 0.522         | 12.19                | 44213                 | 2985                               | 3627                               |
| 30                                                | 0.163                                     | 633                      | 0.659         | 13.28                | 74106                 | 4432                               | 5581                               | 0.137                                     | 531                      | 0.553         | 13.56                | 58215                 | 3540                               | 4295                               |
| 33                                                | 0.169                                     | 658                      | 0.685         | 14.57                | 94221                 | 5112                               | 6467                               | 0.143                                     | 556                      | 0.579         | 14.88                | 74436                 | 4107                               | 5004                               |
| 36                                                | 0.177                                     | 688                      | 0.716         | 15.92                | 117332                | 5842                               | 7372                               | 0.151                                     | 586                      | 0.610         | 16.26                | 93196                 | 4721                               | 5732                               |
| 39                                                | 0.185                                     | 718                      | 0.747         | 17.28                | 143507                | 6606                               | 8306                               | 0.158                                     | 616                      | 0.641         | 17.65                | 114576                | 5367                               | 6491                               |
| 42                                                | 0.192                                     | 748                      | 0.779         | 18.65                | 172885                | 7404                               | 9271                               | 0.166                                     | 646                      | 0.672         | 19.06                | 138713                | 6046                               | 7279                               |
| 45                                                | 0.200                                     | 778                      | 0.810         | 20.03                | 205604                | 8234                               | 10265                              | 0.174                                     | 676                      | 0.704         | 20.47                | 165744                | 6756                               | 8098                               |
| 48                                                | 0.208                                     | 808                      | 0.841         | 21.42                | 241802                | 9097                               | 11289                              | 0.181                                     | 706                      | 0.735         | 21.89                | 195805                | 7498                               | 8946                               |
| 54                                                | 0.223                                     | 868                      | 0.904         | 24.22                | 325181                | 10921                              | 13424                              | 0.197                                     | 766                      | 0.797         | 24.74                | 265562                | 9077                               | 10732                              |
| 60                                                | 0.239                                     | 928                      | 0.966         | 27.05                | 424117                | 12872                              | 15678                              | 0.212                                     | 826                      | 0.860         | 27.62                | 349072                | 10782                              | 12637                              |
| 66                                                | 0.254                                     | 988                      | 1.029         | 29.90                | 539700                | 14951                              | 18049                              | 0.228                                     | 886                      | 0.922         | 30.52                | 447420                | 12610                              | 14661                              |
| PLANK BEAM DATA ( COMPOSITE CONSTRUCTION )        |                                           |                          |               |                      |                       |                                    |                                    |                                           |                          |               |                      |                       |                                    |                                    |
| BEAM DEPTH (in.)                                  | BASIC BEAM DATA - 48" BEAMS ( COMPOSITE ) |                          |               |                      |                       |                                    |                                    | BASIC BEAM DATA - 36" BEAMS ( COMPOSITE ) |                          |               |                      |                       |                                    |                                    |
|                                                   | CONC. (CY/ft.)                            | AREA (in. <sup>2</sup> ) | WT/FT. (KIPS) | Y <sub>b</sub> (in.) | I (in. <sup>4</sup> ) | S <sub>t</sub> (in. <sup>3</sup> ) | S <sub>b</sub> (in. <sup>3</sup> ) | CONC. (CY/ft.)                            | AREA (in. <sup>2</sup> ) | WT/FT. (KIPS) | Y <sub>b</sub> (in.) | I (in. <sup>4</sup> ) | S <sub>t</sub> (in. <sup>3</sup> ) | S <sub>b</sub> (in. <sup>3</sup> ) |
| 12                                                | 0.146                                     | 568                      | 0.591         | 5.97                 | 6850                  | 1136                               | 1147                               | 0.109                                     | 424                      | 0.441         | 5.96                 | 5122                  | 848                                | 859                                |

NOTES:

1. SHOWN ARE THE BEAM SIZES WHICH ACCOMMODATE MOST DESIGN SITUATIONS. SPECIAL BEAMS CAN BE UTILIZED IF JUSTIFIED BY ECONOMICS AND APPROVED BY THE CHIEF BRIDGE ENGINEER.
2. SHOWN DIMENSIONS ARE FOR BOX BEAMS, PA BULB-TEE BEAMS, AND I-BEAMS WITH REGULAR AND OVERSIZED 1/2 " Ø STRANDS. CERTIFY AS SPECIFIED PUBLICATION 408 SECTION 106.03.
3. SHOWN WEIGHTS ARE FOR 150 LBS. PER CUBIC FOOT CONCRETE.
4. FOR DAP BEAM DESIGN, LIMIT THE MAXIMUM DAP THICKNESS TO 1.5" AND MAINTAIN A 1" MINIMUM CONCRETE COVER ON THE CONFINEMENT REINFORCEMENT. ADJUST STRAND PATTERNS AND VOID DIMENSIONS. BEAM PROPERTIES MUST BE RECOMPUTED.
5. ALL CHAMFERS 3/4 " x 3/4 " UNLESS AS NOTED.

TABLE NOTATION

in. = INCHES  
CY = CUBIC YARD  
I = MOMENT OF INERTIA  
Y<sub>b</sub> = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY  
S<sub>t</sub> = SECTION MODULUS, TOP BEAM  
S<sub>b</sub> = SECTION MODULUS, BOTTOM BEAM



SPREAD BOX BEAM

| SPREAD BOX BEAM DATA   |                             |                |                  |                         |             |                          |                          |                             |                |                  |                         |             |                          |                          |
|------------------------|-----------------------------|----------------|------------------|-------------------------|-------------|--------------------------|--------------------------|-----------------------------|----------------|------------------|-------------------------|-------------|--------------------------|--------------------------|
| BEAM<br>DEPTH<br>(In.) | BASIC BEAM DATA - 48" BEAMS |                |                  |                         |             |                          |                          | BASIC BEAM DATA - 36" BEAMS |                |                  |                         |             |                          |                          |
|                        | CONC.<br>(CY/ft.)           | AREA<br>(In.²) | WT/FT.<br>(KIPS) | Y <sub>b</sub><br>(In.) | I<br>(In.⁴) | S <sub>t</sub><br>(In.³) | S <sub>b</sub><br>(In.³) | CONC.<br>(CY/ft.)           | AREA<br>(In.²) | WT/FT.<br>(KIPS) | Y <sub>b</sub><br>(In.) | I<br>(In.⁴) | S <sub>t</sub><br>(In.³) | S <sub>b</sub><br>(In.³) |
| 17                     | 0.128                       | 498            | 0.519            | 7.70                    | 16955       | 1823                     | 2202                     | 0.102                       | 396            | 0.412            | 7.82                    | 12949       | 1410                     | 1657                     |
| 21                     | 0.138                       | 538            | 0.560            | 9.41                    | 29630       | 2556                     | 3150                     | 0.112                       | 436            | 0.454            | 9.58                    | 22831       | 1999                     | 2383                     |
| 24                     | 0.149                       | 581            | 0.605            | 10.77                   | 42564       | 3218                     | 3952                     | 0.123                       | 479            | 0.499            | 11.0                    | 33148       | 2549                     | 3015                     |
| 27                     | 0.157                       | 611            | 0.636            | 12.10                   | 57646       | 3868                     | 4765                     | 0.131                       | 509            | 0.530            | 12.36                   | 45183       | 3087                     | 3655                     |
| 30                     | 0.165                       | 641            | 0.668            | 13.44                   | 75444       | 4556                     | 5613                     | 0.139                       | 539            | 0.561            | 13.75                   | 59493       | 3660                     | 4328                     |
| 33                     | 0.173                       | 671            | 0.699            | 14.80                   | 96098       | 5280                     | 6493                     | 0.146                       | 569            | 0.593            | 15.14                   | 76215       | 4267                     | 5034                     |
| 36                     | 0.180                       | 701            | 0.730            | 16.17                   | 119747      | 6038                     | 7406                     | 0.154                       | 599            | 0.624            | 16.55                   | 95487       | 4908                     | 5771                     |
| 39                     | 0.188                       | 731            | 0.761            | 17.55                   | 146528      | 6831                     | 8350                     | 0.162                       | 629            | 0.655            | 17.96                   | 117444      | 5582                     | 6539                     |
| 42                     | 0.196                       | 761            | 0.793            | 18.94                   | 176579      | 7657                     | 9324                     | 0.169                       | 659            | 0.686            | 19.38                   | 142223      | 6288                     | 7338                     |
| 45                     | 0.203                       | 791            | 0.824            | 20.34                   | 210038      | 8516                     | 10328                    | 0.177                       | 689            | 0.718            | 20.81                   | 169961      | 7026                     | 8167                     |
| 48                     | 0.211                       | 821            | 0.855            | 21.74                   | 247041      | 9408                     | 11362                    | 0.185                       | 719            | 0.749            | 22.25                   | 200793      | 7797                     | 9026                     |
| 54                     | 0.227                       | 881            | 0.918            | 24.57                   | 332226      | 11290                    | 13520                    | 0.200                       | 779            | 0.811            | 25.13                   | 272281      | 9431                     | 10835                    |
| 60                     | 0.242                       | 941            | 0.980            | 27.42                   | 433225      | 13299                    | 15797                    | 0.215                       | 839            | 0.874            | 28.03                   | 357774      | 11192                    | 12763                    |
| 66                     | 0.257                       | 1001           | 1.043            | 30.29                   | 551125      | 15435                    | 18193                    | 0.231                       | 899            | 0.936            | 30.95                   | 458355      | 13076                    | 14811                    |

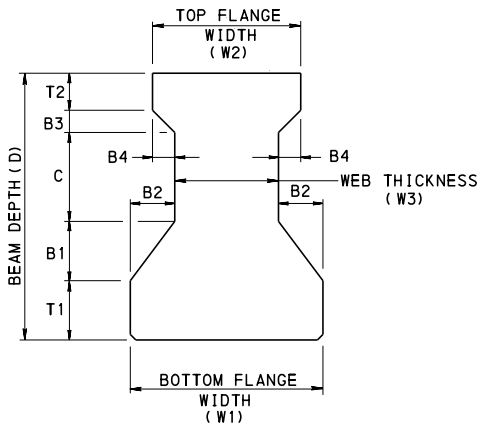
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
PRESTRESSED BEAM SIZES  
AND SECTION PROPERTIES

RECOMMENDED APR. 29, 2016  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

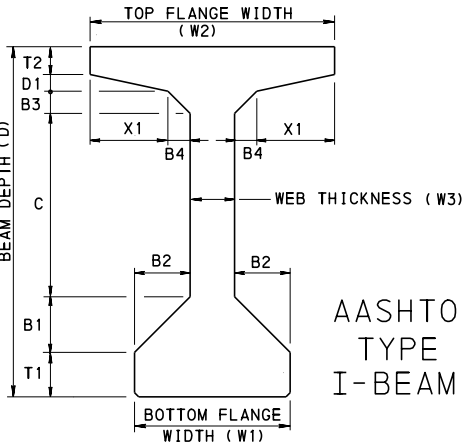
RECOMMENDED APR. 29, 2016  
Brenda S. Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 3  
BD-652M



PA. I-BEAM

| PA. I-BEAMS         |                                 |                                    |                     |                  |    |    |    |    |                      |    |                              |                       |                |             |             |                          |                          |                  |
|---------------------|---------------------------------|------------------------------------|---------------------|------------------|----|----|----|----|----------------------|----|------------------------------|-----------------------|----------------|-------------|-------------|--------------------------|--------------------------|------------------|
| BEAM<br>DESIGNATION | TOP FLANGE<br>WIDTH (in.)<br>W2 | BOTTOM FLANGE<br>WIDTH (in.)<br>W1 | DEPTH<br>(in.)<br>D | DEPTH DATA (in.) |    |    |    |    | FLANGE DATA<br>(in.) |    | WEB<br>THICKNESS<br>(in.) W3 | BASIC BEAM PROPERTIES |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     | T2               | B3 | C  | B1 | T1 | B4                   | B2 |                              | CONC.<br>(CY/ft.)     | AREA<br>(in.2) | Yb<br>(in.) | I<br>(in.4) | S <sub>t</sub><br>(in.3) | S <sub>b</sub><br>(in.3) | WT/FT.<br>(KIPS) |
| 18/30               | 12                              | 18                                 | 30                  | 3                | 3  | 12 | 8  | 4  | 3                    | 6  | 6                            | 0.078                 | 303            | 12.75       | 28032       | 1625                     | 2199                     | 0.316            |
| 20/30               | 14                              | 20                                 | 30                  | 3                | 3  | 12 | 8  | 4  | 3                    | 6  | 8                            | 0.093                 | 363            | 13.12       | 32786       | 1942                     | 2499                     | 0.377            |
| 18/33               | 12                              | 18                                 | 33                  | 4                | 3  | 12 | 8  | 6  | 3                    | 6  | 6                            | 0.090                 | 351            | 13.95       | 38405       | 2016                     | 2754                     | 0.365            |
| 20/33               | 14                              | 20                                 | 33                  | 4                | 3  | 12 | 8  | 6  | 3                    | 6  | 8                            | 0.107                 | 417            | 14.35       | 44757       | 2400                     | 3119                     | 0.433            |
| 24/33               | 18                              | 24                                 | 33                  | 4                | 3  | 12 | 8  | 6  | 3                    | 6  | 12                           | 0.141                 | 549            | 14.87       | 57200       | 3155                     | 3847                     | 0.571            |
| 26/33               | 20                              | 26                                 | 33                  | 4                | 3  | 12 | 8  | 6  | 3                    | 6  | 14                           | 0.158                 | 615            | 15.04       | 63346       | 3528                     | 4211                     | 0.640            |
| 18/36               | 12                              | 18                                 | 36                  | 5                | 3  | 12 | 8  | 8  | 3                    | 6  | 6                            | 0.103                 | 399            | 15.18       | 50818       | 2442                     | 3347                     | 0.417            |
| 20/36               | 14                              | 20                                 | 36                  | 5                | 3  | 12 | 8  | 8  | 3                    | 6  | 8                            | 0.121                 | 471            | 15.61       | 59077       | 2898                     | 3783                     | 0.490            |
| 24/36               | 18                              | 24                                 | 36                  | 5                | 3  | 12 | 8  | 8  | 3                    | 6  | 12                           | 0.158                 | 615            | 16.17       | 75256       | 3796                     | 4653                     | 0.640            |
| 26/36               | 20                              | 26                                 | 36                  | 5                | 3  | 12 | 8  | 8  | 3                    | 6  | 14                           | 0.177                 | 687            | 16.36       | 83247       | 4240                     | 5087                     | 0.717            |
| 20/39               | 14                              | 20                                 | 39                  | 8                | 3  | 12 | 8  | 8  | 3                    | 6  | 8                            | 0.132                 | 513            | 17.41       | 77576       | 3593                     | 4457                     | 0.535            |
| 24/42               | 18                              | 24                                 | 42                  | 4                | 4  | 17 | 10 | 7  | 5                    | 8  | 8                            | 0.151                 | 588            | 18.04       | 107967      | 4504                     | 5985                     | 0.612            |
| 24/45               | 18                              | 24                                 | 45                  | 7                | 4  | 17 | 10 | 7  | 5                    | 8  | 8                            | 0.165                 | 642            | 20.18       | 140065      | 5644                     | 6940                     | 0.668            |
| 24/48               | 18                              | 24                                 | 48                  | 8                | 4  | 17 | 10 | 9  | 5                    | 8  | 8                            | 0.182                 | 708            | 21.39       | 172712      | 6491                     | 8075                     | 0.737            |
| 24/51               | 18                              | 24                                 | 51                  | 11               | 4  | 17 | 10 | 9  | 5                    | 8  | 8                            | 0.196                 | 762            | 23.39       | 212399      | 7691                     | 9084                     | 0.794            |
| 24/54               | 18                              | 24                                 | 54                  | 14               | 4  | 17 | 10 | 9  | 5                    | 8  | 8                            | 0.210                 | 816            | 25.31       | 255194      | 8895                     | 10083                    | 0.850            |
| 26/54               | 20                              | 26                                 | 54                  | 8                | 6  | 23 | 9  | 8  | 6                    | 9  | 8                            | 0.203                 | 789            | 24.73       | 260741      | 8908                     | 10543                    | .822             |
| 24/60               | 24                              | 24                                 | 60                  | 6                | 6  | 29 | 10 | 9  | 8                    | 8  | 8                            | 0.218                 | 848            | 28.31       | 355185      | 11206                    | 12549                    | 0.883            |
| 26/60               | 26                              | 26                                 | 60                  | 6                | 6  | 29 | 10 | 9  | 8                    | 8  | 10                           | 0.249                 | 968            | 28.52       | 391487      | 12434                    | 13729                    | 1.008            |
| 24/63               | 24                              | 24                                 | 63                  | 9                | 6  | 29 | 10 | 9  | 8                    | 8  | 8                            | 0.237                 | 920            | 30.90       | 428367      | 13346                    | 13862                    | 0.958            |
| 26/63               | 26                              | 26                                 | 63                  | 9                | 6  | 29 | 10 | 9  | 8                    | 8  | 10                           | 0.269                 | 1046           | 30.97       | 470081      | 14678                    | 15176                    | 1.090            |



AASHTO  
TYPE  
I-BEAM

| AASHTO I-BEAMS      |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |
|---------------------|---------------------------------|------------------------------------|---------------------|------------------|----|----|----|----|----------------------|----|----|----|------------------------------|-----------------------|----------------|-------------|-------------|--------------------------|--------------------------|------------------|
| BEAM<br>DESIGNATION | TOP FLANGE<br>WIDTH (in.)<br>W2 | BOTTOM FLANGE<br>WIDTH (in.)<br>W1 | DEPTH<br>(in.)<br>D | DEPTH DATA (in.) |    |    |    |    | FLANGE DATA<br>(in.) |    |    |    | WEB<br>THICKNESS<br>(in.) W3 | BASIC BEAM PROPERTIES |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     | T2               | D1 | B3 | C  | B1 | T1                   | X1 | B4 | B2 |                              | CONC.<br>(CY/ft.)     | AREA<br>(in.²) | Yb<br>(in.) | I<br>(in.⁴) | S <sup>+</sup><br>(in.³) | S <sup>b</sup><br>(in.³) | WT/FT.<br>(KIPS) |
| 28/63               | 42                              | 28                                 | 63                  | 5                | 3  | 4  | 33 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.261                 | 1013           | 31.96       | 521162      | 16788                    | 16308                    | 1.057            |
| 28/66               | 42                              | 28                                 | 66                  | 5                | 3  | 4  | 36 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.267                 | 1037           | 33.43       | 587180      | 18028                    | 17564                    | 1.081            |
| 28/72               | 42                              | 28                                 | 72                  | 5                | 3  | 4  | 42 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.279                 | 1085           | 36.38       | 733319      | 20588                    | 20157                    | 1.130            |
| 28/78               | 42                              | 28                                 | 78                  | 5                | 3  | 4  | 48 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.291                 | 1133           | 39.34       | 898984      | 23251                    | 22854                    | 1.178            |
| 28/84               | 42                              | 28                                 | 84                  | 5                | 3  | 4  | 54 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.304                 | 1181           | 42.29       | 1085040     | 26016                    | 25655                    | 1.231            |
| 28/90               | 42                              | 28                                 | 90                  | 5                | 3  | 4  | 60 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.316                 | 1229           | 45.26       | 1292348     | 28883                    | 28557                    | 1.280            |
| 28/96               | 42                              | 28                                 | 96                  | 5                | 3  | 4  | 66 | 10 | 8                    | 13 | 4  | 10 | 8                            | 0.328                 | 1277           | 48.22       | 1521775     | 31850                    | 31559                    | 1.328            |
|                     |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     |                  |    |    |    |    |                      |    |    |    |                              |                       |                |             |             |                          |                          |                  |

NOTE:  
FOR NOTES , SEE SHEET 1.

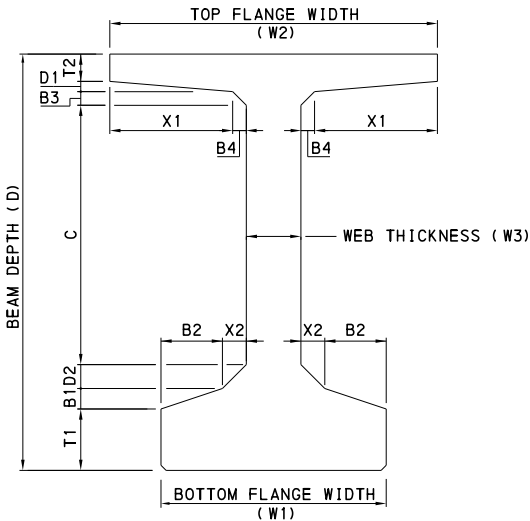
TABLE NOTATION

In. = INCHES  
CY = CUBIC YARD  
I = MOMENT OF INERTIA  
Yb = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY  
S<sub>t</sub> = SECTION MODULUS ,TOP BEAM  
S<sub>b</sub> = SECTION MODULUS , BOTTOM BEAM

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
PRESTRESSED BEAM SIZES  
AND SECTION PROPERTIES

| PA BULB-TEE BEAM    |                                 |                                    |                     |                  |      |    |    |     |    |    |                      |    |    |     |                              |                       |                |             |             |                          |                          |                  |
|---------------------|---------------------------------|------------------------------------|---------------------|------------------|------|----|----|-----|----|----|----------------------|----|----|-----|------------------------------|-----------------------|----------------|-------------|-------------|--------------------------|--------------------------|------------------|
| BEAM<br>DESIGNATION | TOP FLANGE<br>WIDTH (in.)<br>W2 | BOTTOM FLANGE<br>WIDTH (in.)<br>W1 | DEPTH<br>(in.)<br>D | DEPTH DATA (in.) |      |    |    |     |    |    | FLANGE DATA<br>(in.) |    |    |     | WEB<br>THICKNESS<br>(in ) W3 | BASIC BEAM PROPERTIES |                |             |             |                          |                          |                  |
|                     |                                 |                                    |                     | T2               | D1   | B3 | C  | D2  | B1 | T1 | X1                   | B4 | B2 | X2  |                              | CONC.<br>(CY/ft.)     | AREA<br>(In.2) | Yb<br>(In.) | I<br>(In.4) | S <sup>+</sup><br>(In.3) | S <sup>b</sup><br>(In.3) | WT/FT.<br>(KIPS) |
| 33/31               | 36                              | 33                                 | 31                  | 4.5              | 1    | 2  | 8  | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.175                 | 679            | 14.20       | 73400       | 4369                     | 5169                     | 0.708            |
| 33/39               | 36                              | 33                                 | 39                  | 4.5              | 1    | 2  | 16 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.191                 | 743            | 17.57       | 135418      | 6319                     | 7707                     | 0.774            |
| 33/47               | 36                              | 33                                 | 47                  | 4.5              | 1    | 2  | 24 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.208                 | 807            | 21.03       | 220711      | 8499                     | 10495                    | 0.841            |
| 33/55               | 36                              | 33                                 | 55                  | 4.5              | 1    | 2  | 32 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.224                 | 871            | 24.57       | 331440      | 10892                    | 13490                    | 0.908            |
| 33/63               | 36                              | 33                                 | 63                  | 4.5              | 1    | 2  | 40 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.241                 | 935            | 28.18       | 469733      | 13490                    | 16669                    | 0.974            |
| 33/71               | 36                              | 33                                 | 71                  | 4.5              | 1    | 2  | 48 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.257                 | 999            | 31.83       | 637700      | 16280                    | 20035                    | 1.041            |
| 33/79               | 36                              | 33                                 | 79                  | 4.5              | 1    | 2  | 56 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.273                 | 1063           | 35.53       | 837434      | 19265                    | 23570                    | 1.108            |
| 33/87               | 36                              | 33                                 | 87                  | 4.5              | 1    | 2  | 64 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.290                 | 1127           | 39.26       | 1071018     | 22434                    | 27280                    | 1.174            |
| 33/95               | 36                              | 33                                 | 95                  | 4.5              | 1    | 2  | 72 | 3.5 | 3  | 9  | 12                   | 2  | 9  | 3.5 | 8                            | 0.306                 | 1191           | 43.02       | 1340530     | 25789                    | 31161                    | 1.241            |
| 33/29               | 36                              | 33                                 | 29                  | 4.5              | 1    | 2  | 8  | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.158                 | 613            | 13.63       | 60633       | 3945                     | 4448                     | 0.639            |
| 33/37               | 36                              | 33                                 | 37                  | 4.5              | 1    | 2  | 16 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.174                 | 677            | 17.18       | 115518      | 5828                     | 6724                     | 0.705            |
| 33/45               | 36                              | 33                                 | 45                  | 4.5              | 1    | 2  | 24 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.191                 | 741            | 20.81       | 191854      | 7931                     | 9219                     | 0.772            |
| 33/53               | 36                              | 33                                 | 53                  | 4.5              | 1    | 2  | 32 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.207                 | 805            | 24.50       | 291741      | 10237                    | 11908                    | 0.839            |
| 33/61               | 36                              | 33                                 | 61                  | 4.5              | 1    | 2  | 40 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.224                 | 869            | 28.24       | 417265      | 12737                    | 14776                    | 0.905            |
| 33/69               | 36                              | 33                                 | 69                  | 4.5              | 1    | 2  | 48 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.240                 | 933            | 32.01       | 570500      | 15423                    | 17823                    | 0.972            |
| 33/77               | 36                              | 33                                 | 77                  | 4.5              | 1    | 2  | 56 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.256                 | 997            | 35.81       | 753516      | 18294                    | 21042                    | 1.039            |
| 33/85               | 36                              | 33                                 | 85                  | 4.5              | 1    | 2  | 64 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.273                 | 1061           | 39.64       | 968374      | 21349                    | 24429                    | 1.105            |
| 33/93               | 36                              | 33                                 | 93                  | 4.5              | 1    | 2  | 72 | 3.5 | 3  | 7  | 12                   | 2  | 9  | 3.5 | 8                            | 0.289                 | 1125           | 43.49       | 1217135     | 24584                    | 27987                    | 1.172            |
| 33/31.25            | 42                              | 33                                 | 31.25               | 4.5              | 1.25 | 2  | 8  | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.184                 | 716            | 14.99       | 81610       | 5018                     | 5445                     | 0.746            |
| 33/39.25            | 42                              | 33                                 | 39.25               | 4.5              | 1.25 | 2  | 16 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.200                 | 780            | 18.50       | 149377      | 7200                     | 8073                     | 0.813            |
| 33/47.25            | 42                              | 33                                 | 47.25               | 4.5              | 1.25 | 2  | 24 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.217                 | 844            | 22.09       | 241794      | 9612                     | 10944                    | 0.879            |
| 33/55.25            | 42                              | 33                                 | 55.25               | 4.5              | 1.25 | 2  | 32 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.233                 | 908            | 25.74       | 360976      | 12233                    | 14023                    | 0.946            |
| 33/63.25            | 42                              | 33                                 | 63.25               | 4.5              | 1.25 | 2  | 40 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.250                 | 972            | 29.44       | 509017      | 15053                    | 17293                    | 1.013            |
| 33/71.25            | 42                              | 33                                 | 71.25               | 4.5              | 1.25 | 2  | 48 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.266                 | 1036           | 33.17       | 688003      | 18066                    | 20743                    | 1.079            |
| 33/79.25            | 42                              | 33                                 | 79.25               | 4.5              | 1.25 | 2  | 56 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.283                 | 1100           | 36.93       | 900010      | 21267                    | 24371                    | 1.146            |
| 33/87.25            | 42                              | 33                                 | 87.25               | 4.5              | 1.25 | 2  | 64 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.299                 | 1164           | 40.72       | 1147106     | 24653                    | 28171                    | 1.213            |
| 33/95.25            | 42                              | 33                                 | 95.25               | 4.5              | 1.25 | 2  | 72 | 3.5 | 3  | 9  | 15                   | 2  | 9  | 3.5 | 8                            | 0.316                 | 1228           | 44.53       | 1431357     | 28221                    | 32143                    | 1.279            |
| 33/29.25            | 42                              | 33                                 | 29.25               | 4.5              | 1.25 | 2  | 8  | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.167                 | 650            | 14.41       | 67363       | 4539                     | 4675                     | 0.677            |
| 33/37.25            | 42                              | 33                                 | 37.25               | 4.5              | 1.25 | 2  | 16 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.183                 | 714            | 18.12       | 127264      | 6653                     | 7023                     | 0.744            |
| 33/45.25            | 42                              | 33                                 | 45.25               | 4.5              | 1.25 | 2  | 24 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.200                 | 778            | 21.88       | 209914      | 8984                     | 9592                     | 0.810            |
| 33/53.25            | 42                              | 33                                 | 53.25               | 4.5              | 1.25 | 2  | 32 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.216                 | 842            | 25.68       | 317386      | 11512                    | 12359                    | 0.877            |
| 33/61.25            | 42                              | 33                                 | 61.25               | 4.5              | 1.25 | 2  | 40 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.233                 | 906            | 29.51       | 451742      | 14231                    | 15310                    | 0.944            |
| 33/69.25            | 42                              | 33                                 | 69.25               | 4.5              | 1.25 | 2  | 48 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.249                 | 970            | 33.36       | 615042      | 17135                    | 18439                    | 1.010            |
| 33/77.25            | 42                              | 33                                 | 77.25               | 4.5              | 1.25 | 2  | 56 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.266                 | 1034           | 37.22       | 809344      | 20220                    | 21743                    | 1.077            |
| 33/85.25            | 42                              | 33                                 | 85.25               | 4.5              | 1.25 | 2  | 64 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.282                 | 1098           | 41.11       | 1036702     | 23485                    | 25220                    | 1.144            |
| 33/93.25            | 42                              | 33                                 | 93.25               | 4.5              | 1.25 | 2  | 72 | 3.5 | 3  | 7  | 15                   | 2  | 9  | 3.5 | 8                            | 0.299                 | 1162           | 45.00       | 1299169     | 26927                    | 28869                    | 1.210            |
| 33/31.5             | 48                              | 33                                 | 31.5                | 4.5              | 1.5  | 2  | 8  | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.194                 | 754            | 15.74       | 89649       | 5688                     | 5696                     | 0.786            |
| 33/39.5             | 48                              | 33                                 | 39.5                | 4.5              | 1.5  | 2  | 16 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.210                 | 818            | 19.41       | 163021      | 8113                     | 8401                     | 0.852            |
| 33/47.5             | 48                              | 33                                 | 47.5                | 4.5              | 1.5  | 2  | 24 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.227                 | 882            | 23.12       | 262423      | 10764                    | 11350                    | 0.919            |
| 33/55.5             | 48                              | 33                                 | 55.5                | 4.5              | 1.5  | 2  | 32 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.243                 | 946            | 26.88       | 389933      | 13622                    | 14509                    | 0.986            |
| 33/63.5             | 48                              | 33                                 | 63.5                | 4.5              | 1.5  | 2  | 40 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.260                 | 1010           | 30.66       | 547622      | 16676                    | 17861                    | 1.052            |
| 33/71.5             | 48                              | 33                                 | 71.5                | 4.5              | 1.5  | 2  | 48 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.276                 | 1074           | 34.47       | 737558      | 19918                    | 21396                    | 1.119            |
| 33/79.5             | 48                              | 33                                 | 79.5                | 4.5              | 1.5  | 2  | 56 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.293                 | 1138           | 38.30       | 961802      | 23347                    | 25110                    | 1.186            |
| 33/87.5             | 48                              | 33                                 | 87.5                | 4.5              | 1.5  | 2  | 64 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.309                 | 1202           | 42.15       | 1222412     | 26957                    | 28999                    | 1.252            |
| 33/95.5             | 48                              | 33                                 | 95.5                | 4.5              | 1.5  | 2  | 72 | 3.5 | 3  | 9  | 18                   | 2  | 9  | 3.5 | 8                            | 0.325                 | 1266           | 46.02       | 1521445     | 30748                    | 33062                    | 1.319            |
| 33/29.5             | 48                              | 33                                 | 29.5                | 4.5              | 1.5  | 2  | 8  | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.177                 | 688            | 15.15       | 73916       | 5152                     | 4878                     | 0.717            |
| 33/37.5             | 48                              | 33                                 | 37.5                | 4.5              | 1.5  | 2  | 16 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.193                 | 752            | 19.02       | 138679      | 7504                     | 7291                     | 0.784            |
| 33/45.5             | 48                              | 33                                 | 45.5                | 4.5              | 1.5  | 2  | 24 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.210                 | 816            | 22.91       | 227492      | 10070                    | 9930                     | 0.850            |
| 33/53.5             | 48                              | 33                                 | 53.5                | 4.5              | 1.5  | 2  | 32 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.226                 | 880            | 26.82       | 342409      | 12832                    | 12769                    | 0.917            |
| 33/61.5             | 48                              | 33                                 | 61.5                | 4.5              | 1.5  | 2  | 40 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.243                 | 944            | 30.73       | 485479      | 15779                    | 15796                    | 0.984            |
| 33/69.5             | 48                              | 33                                 | 69.5                | 4.5              | 1.5  | 2  | 48 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.259                 | 1008           | 34.66       | 658755      | 18909                    | 19005                    | 1.050            |
| 33/77.5             | 48                              | 33                                 | 77.5                | 4.5              | 1.5  | 2  | 56 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.276                 | 1072           | 38.60       | 864286      | 22218                    | 22391                    | 1.117            |
| 33/85.5             | 48                              | 33                                 | 85.5                | 4.5              | 1.5  | 2  | 64 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.292                 | 1136           | 42.54       | 1104121     | 25703                    | 25953                    | 1.184            |
| 33/93.5             | 48                              | 33                                 | 93.5                | 4.5              | 1.5  | 2  | 72 | 3.5 | 3  | 7  | 18                   | 2  | 9  | 3.5 | 8                            | 0.308                 | 1200           | 46.49       | 1380310     | 29364                    | 29688                    | 1.250            |



PA  
BULB-TEE  
BEAM

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
PRESTRESSED BEAM SIZES  
AND SECTION PROPERTIES

RECOMMENDED APR. 29, 2016  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
Brenda S. Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 3 OF 3

BD-652M

NOTE:

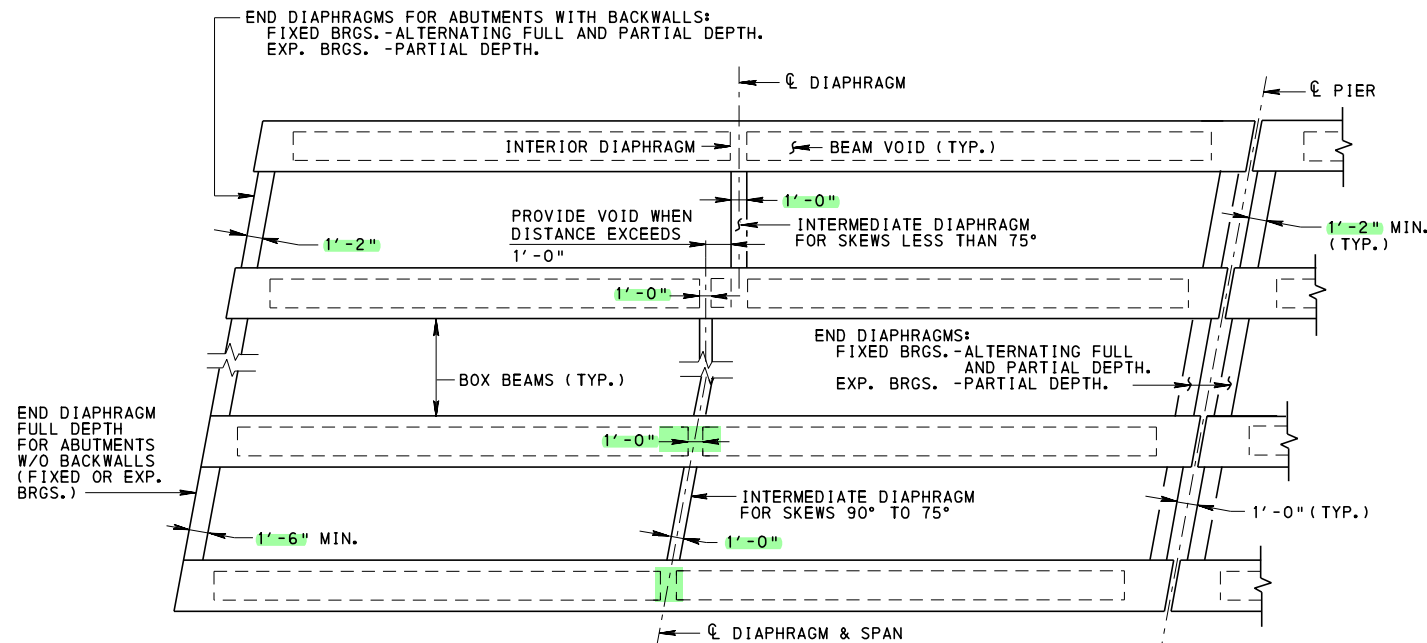
FOR NOTES, SEE SHEET 1.

TABLE NOTATION

in. = INCHES  
CY = CUBIC YARD  
I = MOMENT OF INERTIA

Yb = DISTANCE FROM BOTTOM OF  
BEAM TO CENTER OF GRAVITY  
St = SECTION MODULUS, TOP BEAM  
Sb = SECTION MODULUS, BOTTOM BEAM

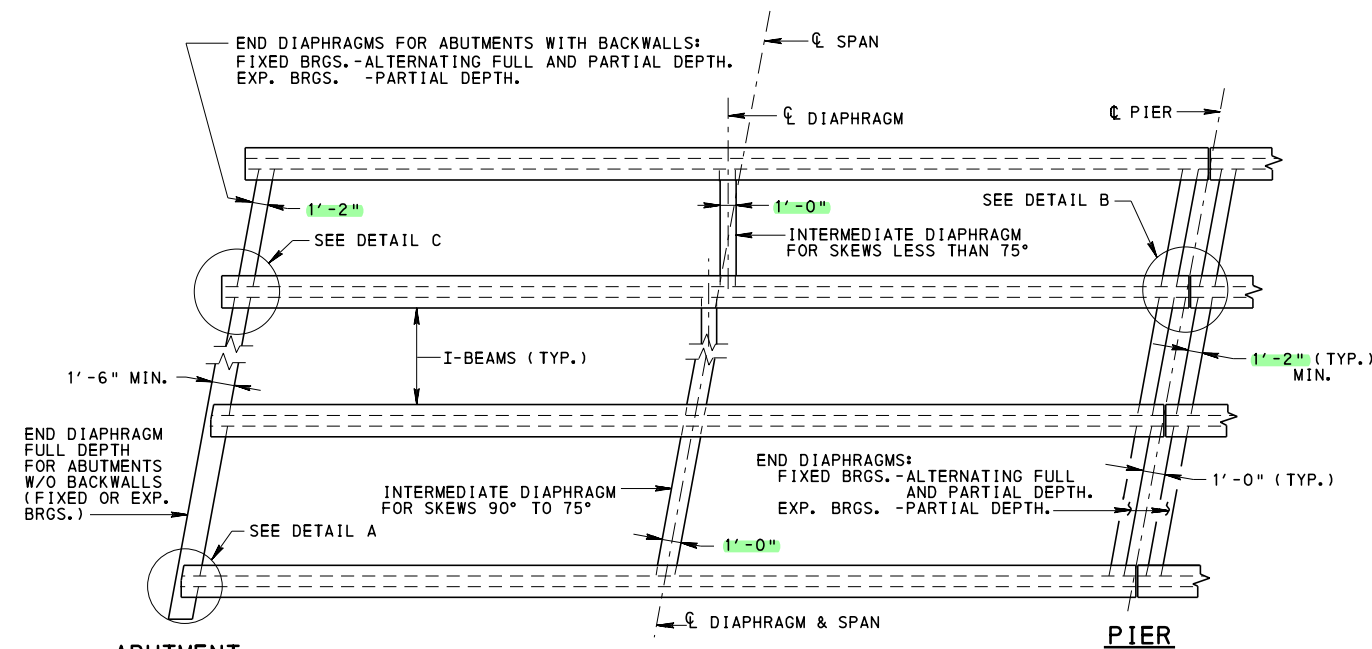
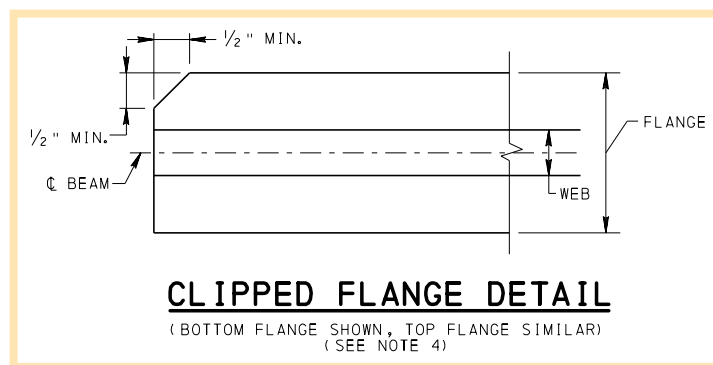
CHANGE 2  
CHANGE 5



ABUTMENT

### FRAMING PLAN FOR SPREAD BOX BEAMS

PIER



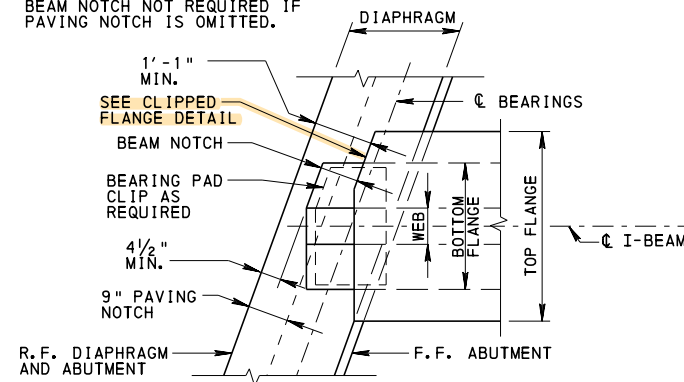
ABUTMENT

### FRAMING PLAN FOR I-BEAMS

PIER

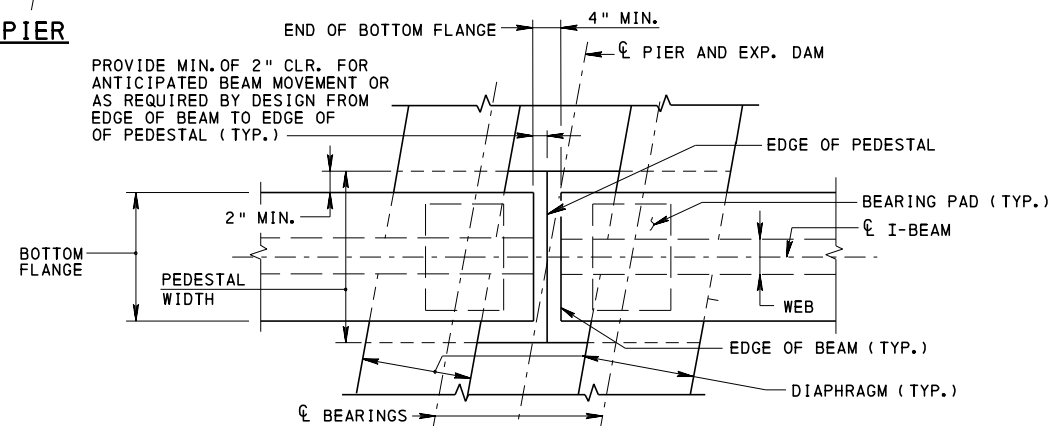
#### NOTE:

BEAM NOTCH NOT REQUIRED IF  
PAVING NOTCH IS OMITTED.



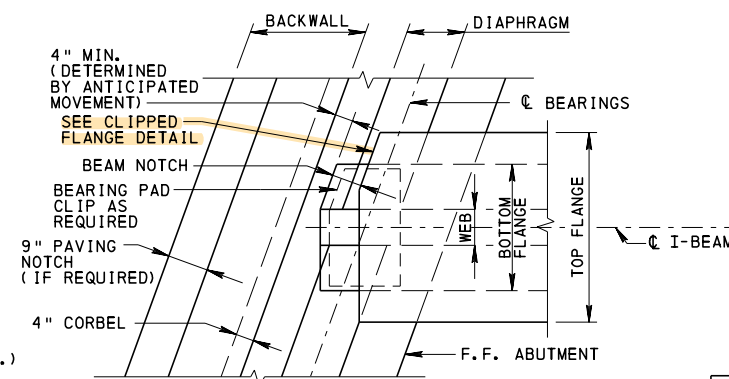
### DETAIL A - WITH PAVING NOTCH AND WITHOUT BACKWALL

(AASHTO TYPE I-BEAM SHOWN; OTHERS SIMILAR)



### DETAIL B

NOTE:  
TOP FLANGE NOT SHOWN.



### DETAIL C - WITH BACKWALL

#### NOTES:

- INTERMEDIATE DIAPHRAGMS (INT. OR EXT.) AND END DIAPHRAGMS WITH BACKWALLS AND WITHOUT BACKWALLS ARE IDENTICAL FOR SIMPLE AND CONTINUOUS BRIDGES. FOR DETAILS OF DIAPHRAGMS AT PIERS FOR CONTINUOUS BRIDGES, SEE BD-664M & BD-665M.
- FOR DIAPHRAGM REQUIREMENTS FOR SPREAD BOX AND I-BEAMS, SEE BD-651M.
- SHOW ALL APPLICABLE DETAILS ON THE DESIGN DRAWINGS.
- FOR ADDITIONAL CLIPPED FLANGE DETAILS, SEE BD-662M.

### SIMPLE SPAN DIAPHRAGM SCHEMATICS FIXED CONDITIONS

#### ABUTMENTS WITH BACKWALL

BAY (TYP.)  
TYP. FOR 4,8,12 BAY ETC. F P P F

TYP. FOR 5,7,9 BAY ETC. F P F P F

TYP. FOR 6,10,14 BAY ETC. F P F F P F

#### PIERS

TYP. FOR 4,8,12 BAY ETC. F P P F CL PIER

TYP. FOR 5,7,9 BAY ETC. F P F P F CL PIER

TYP. FOR 6,10,14 BAY ETC. F P F F P F CL PIER

#### SYMBOLS

F - DENOTES FULL DEPTH DIAPHRAGM  
P - DENOTES PARTIAL DEPTH DIAPHRAGM

#### NOTES:

- FOR BAY CONFIGURATION NOT SHOWN, USE A PATTERN SIMILAR TO THAT SHOWN ABOVE.
- ADDITIONAL FULL DEPTH DIAPHRAGMS MAY BE PROVIDED, IF REQUIRED, ONLY IF THEY ARE PLACED SYMMETRICALLY AT THE ABUTMENT OR PIER.

### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BRIDGE OFFICE

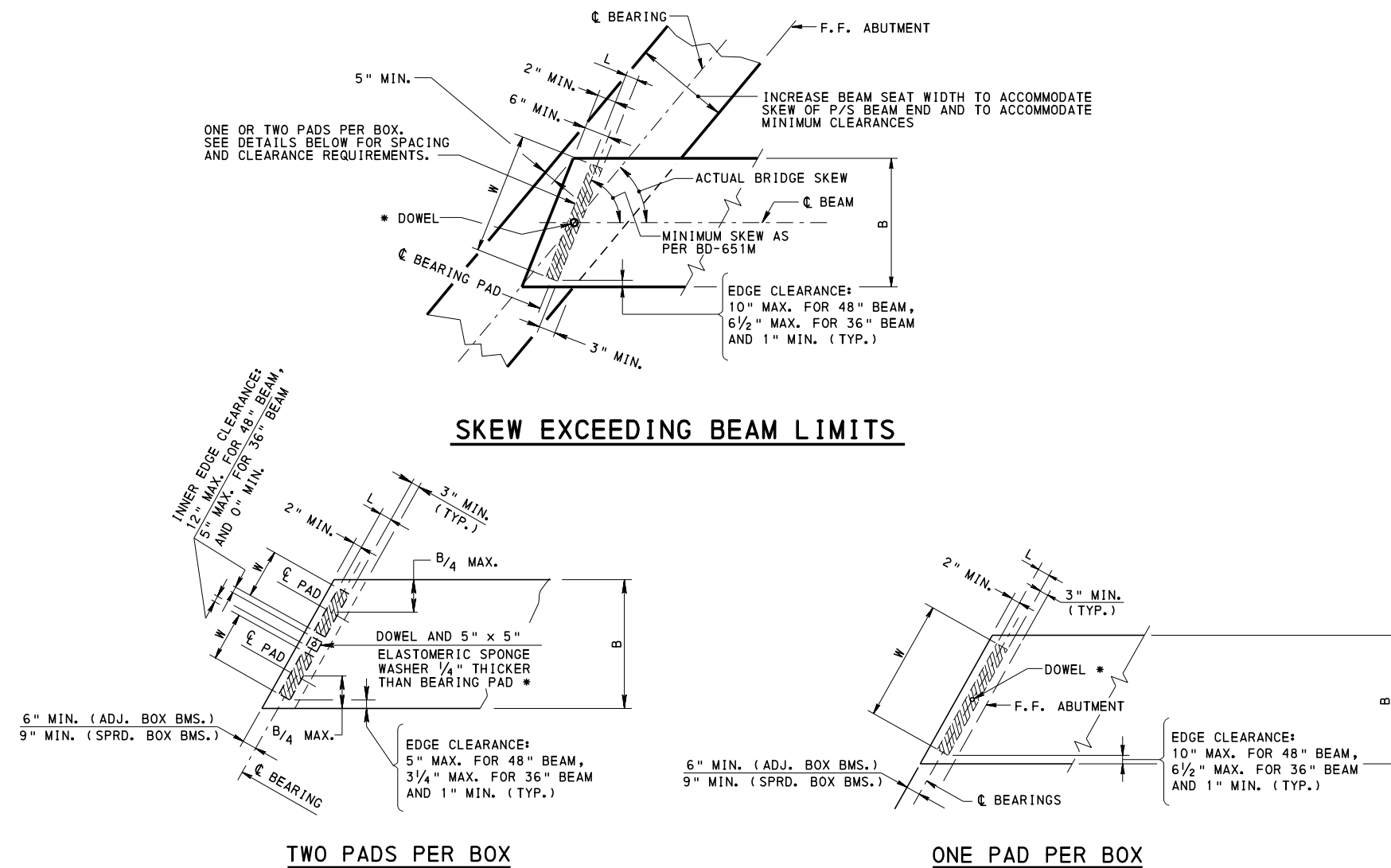
### STANDARD TYPICAL FRAMING PLANS AND DETAILS P/S CONCRETE I-BEAM AND SPREAD BOX BEAM BRIDGES

|                    |                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------|
| BD-651M            | REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS |
| BD-655M            | TYPICAL SUPERSTRUCTURE SECTIONS                                                            |
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS                                                              |
| BD-660M            | DECK SLAB AND STEEL REINFORCEMENT PLACEMENT                                                |
| BD-661M            | BOX BEAM REINFORCEMENT DETAILS                                                             |
| BD-662M            | I-BEAM AND PA-BULB-TEE BEAM REINFORCEMENT DETAILS                                          |
| BD-664M            | CONTINUITY FOR LIVE LOAD DETAILS I- BEAMS                                                  |
| BD-665M            | CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS                                                 |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS                                                |
| REFERENCE DRAWINGS |                                                                                            |

RECOMMENDED NOV. 23, 2022  
L. W. Gray  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 1 OF 2  
BD-653M



# NOTE:

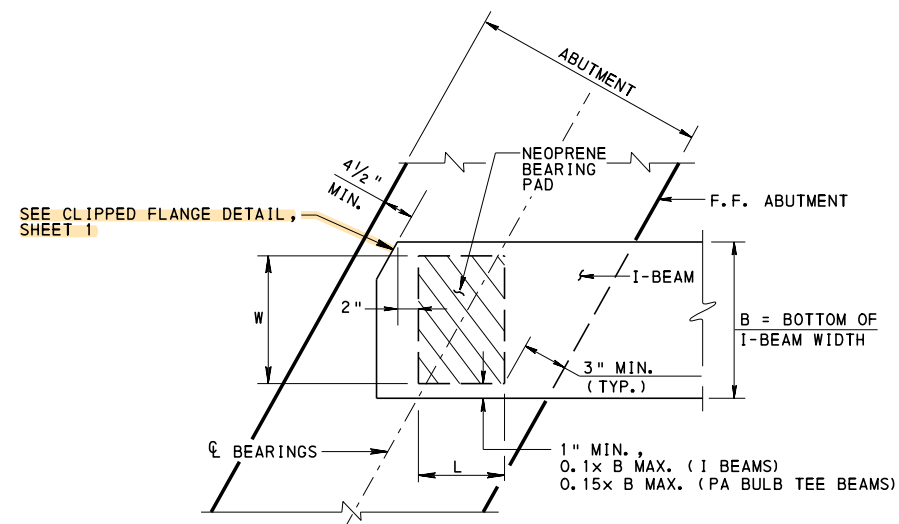
1. FOR WATERPROOFING AND EXPANSION DETAILS AT BEARING AREA, SEE BC-788M.

# LEGEND

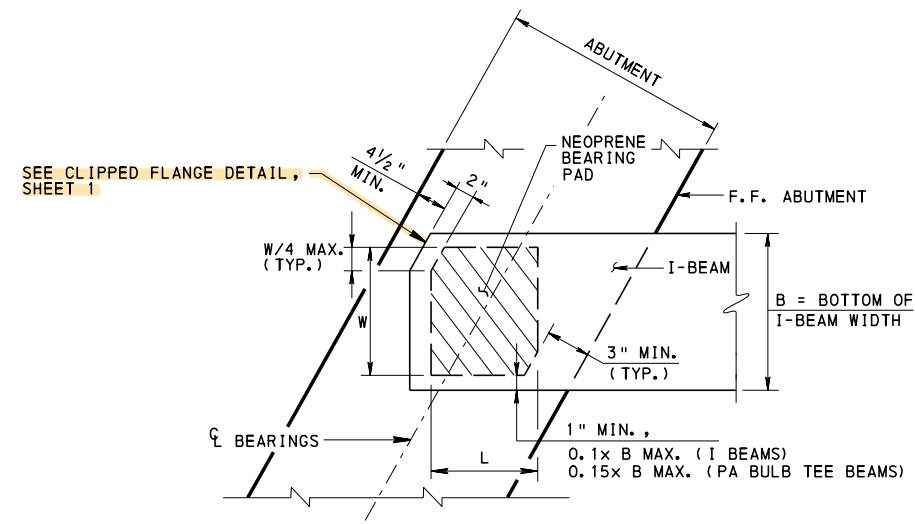
L = BEARING PAD LENGTH  
W = BEARING PAD WIDTH  
B = BEAM FLANGE WIDTH

\* IF REQUIRED BY BD-651M

## ELASTOMERIC BEARING PAD ARRANGEMENTS ( BOX BEAMS )



## ELASTOMERIC BEARING PAD ARRANGEMENTS ( I - BEAMS AND PA BULB TEE BEAMS )



## ALTERNATE BEARING PAD ARRANGEMENTS ( I - BEAMS AND PA BULB TEE BEAMS )

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
TYPICAL FRAMING  
PLANS AND DETAILS  
BEARING DETAILS FOR  
P/S CONCRETE BEAM BRIDGES

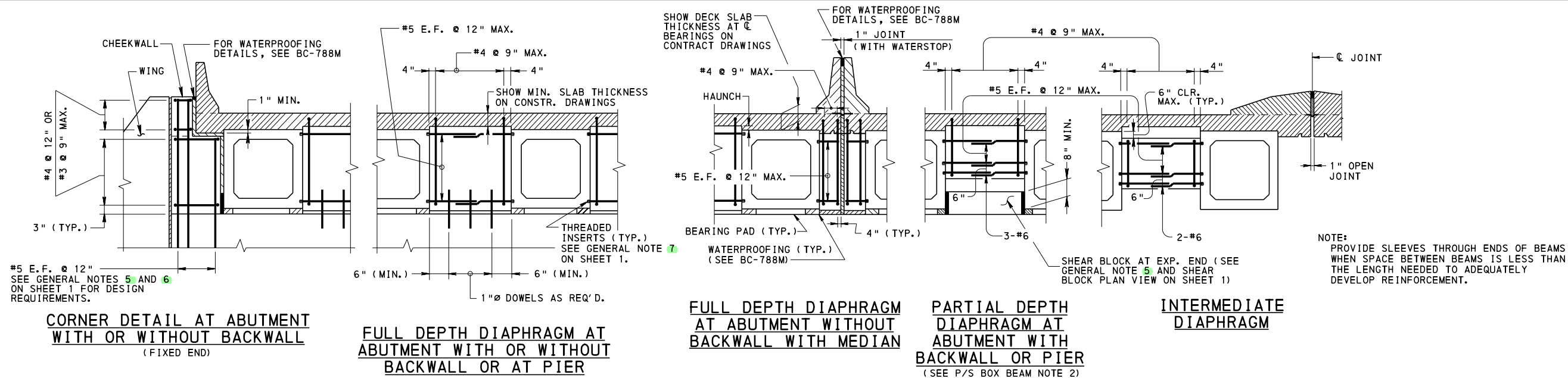
RECOMMENDED NOV. 23, 2022  
L. L. W. G.  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

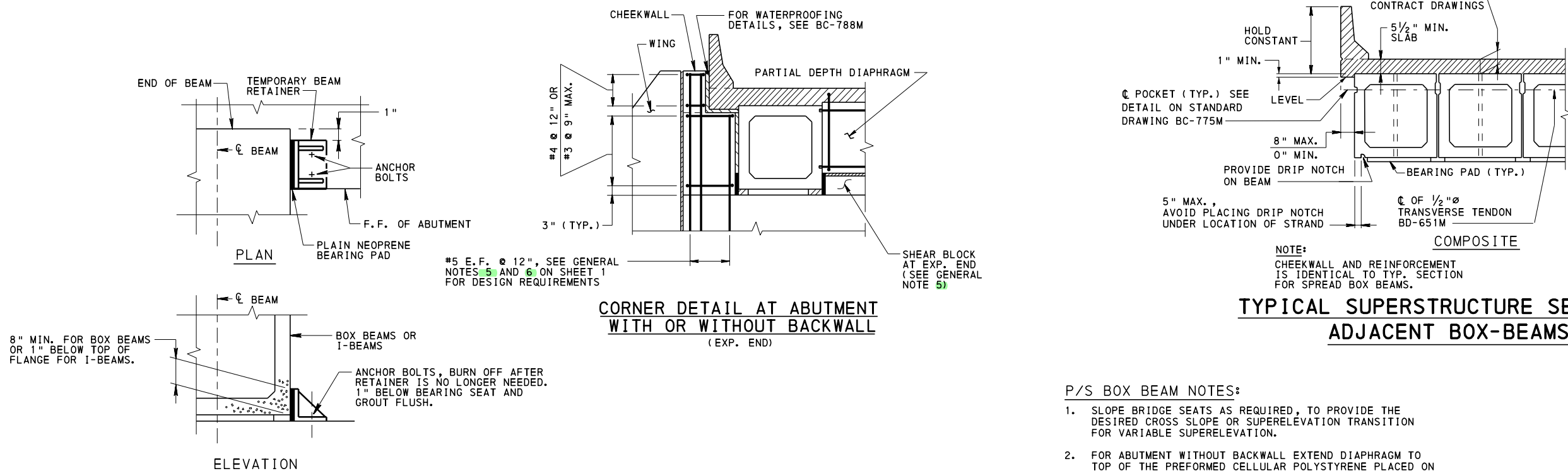
SHEET 2 OF 2  
BD-653M







### TYPICAL STRUCTURE SECTIONS - SPREAD BOX BEAMS



#### P/S BOX BEAM NOTES:

1. SLOPE BRIDGE SEATS AS REQUIRED, TO PROVIDE THE DESIRED CROSS SLOPE OR SUPERELEVATION TRANSITION FOR VARIABLE SUPERELEVATION.
2. FOR ABUTMENT WITHOUT BACKWALL EXTEND DIAPHRAGM TO TOP OF THE PREFORMED CELLULAR POLYSTYRENE PLACED ON TOP OF SHEAR BLOCK.

#### STAGED CONSTRUCTION TEMPORARY BEAM RETAINER

##### NOTES:

- STEEL MEMBERS, SIZES AND NUMBER OF ANCHOR BOLTS AS REQUIRED BY DESIGN.
- CONSTRUCT TEMPORARY RETAINER TO PROVIDE FULL BEARING ON SURFACES OF BEAM AND ABUTMENT.

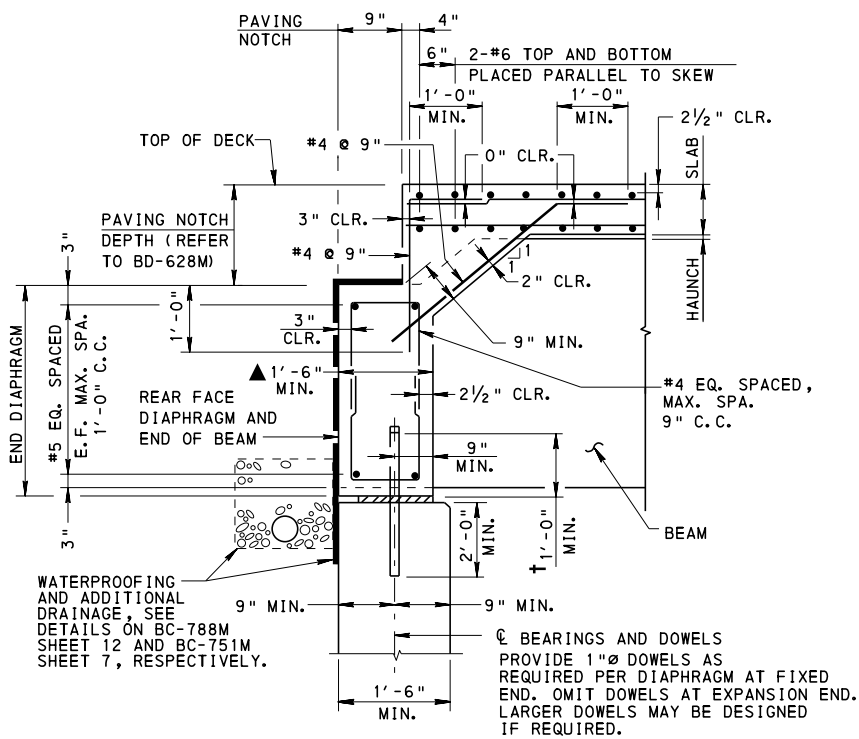
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
 BUREAU OF PROJECT DELIVERY

**STANDARD**  
**TYPICAL SUPERSTRUCTURE**  
**SECTIONS**  
**BOX BEAM BRIDGES**

RECOMMENDED AUG. 30, 2019  
 Louis J. Rizzo  
 ACTING CHIEF BRIDGE ENGINEER

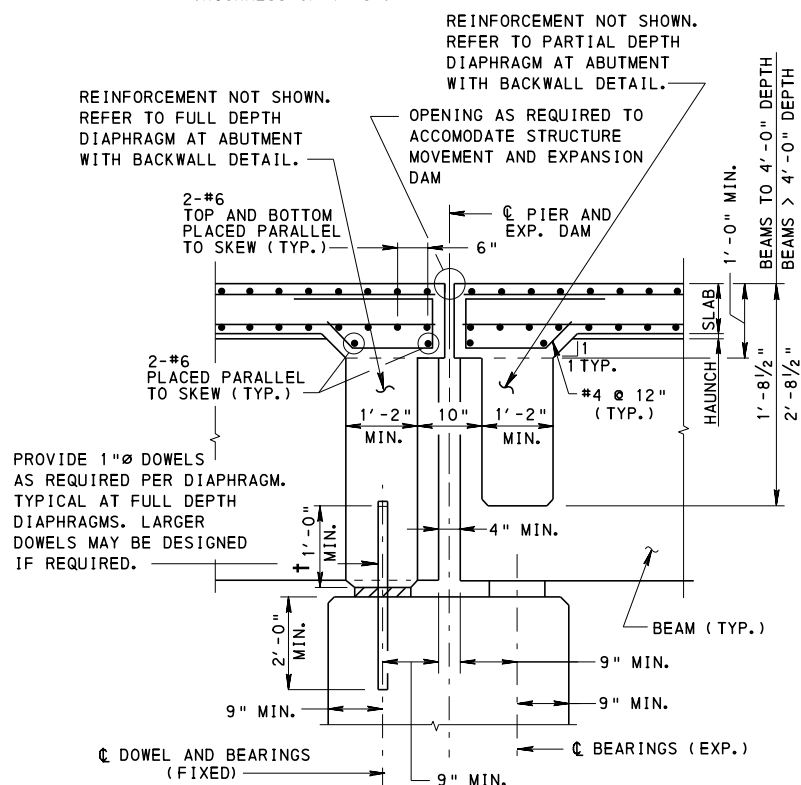
RECOMMENDED AUG. 30, 2019  
 M. J. B. B. B.  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 2  
 BD-655M



### FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL

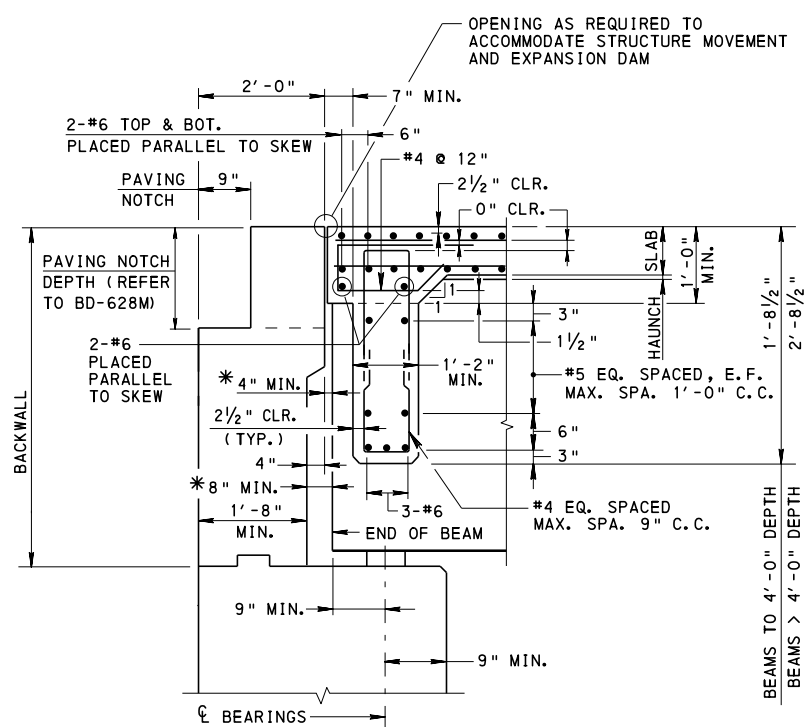
- FOR FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.
- ▲ BRADD DESIGNS PERMITTED TO USE END DIAPHRAGM MINIMUM THICKNESS OF 1'-3".



### FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER (FIXED AND EXP.)

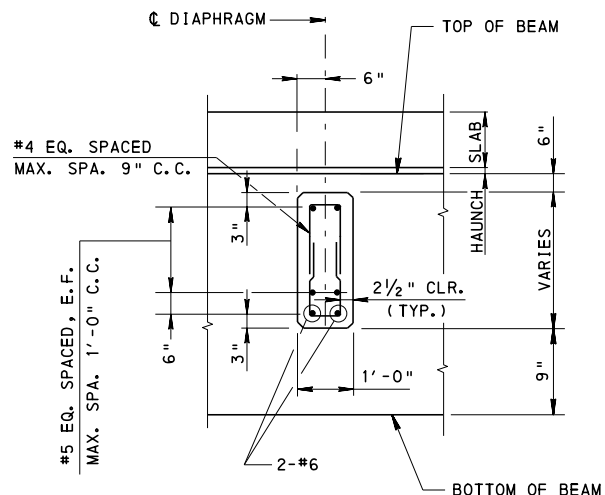
- FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-665M.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

## TYPICAL LONGITUDINAL SECTIONS FOR SPREAD BOX BEAMS

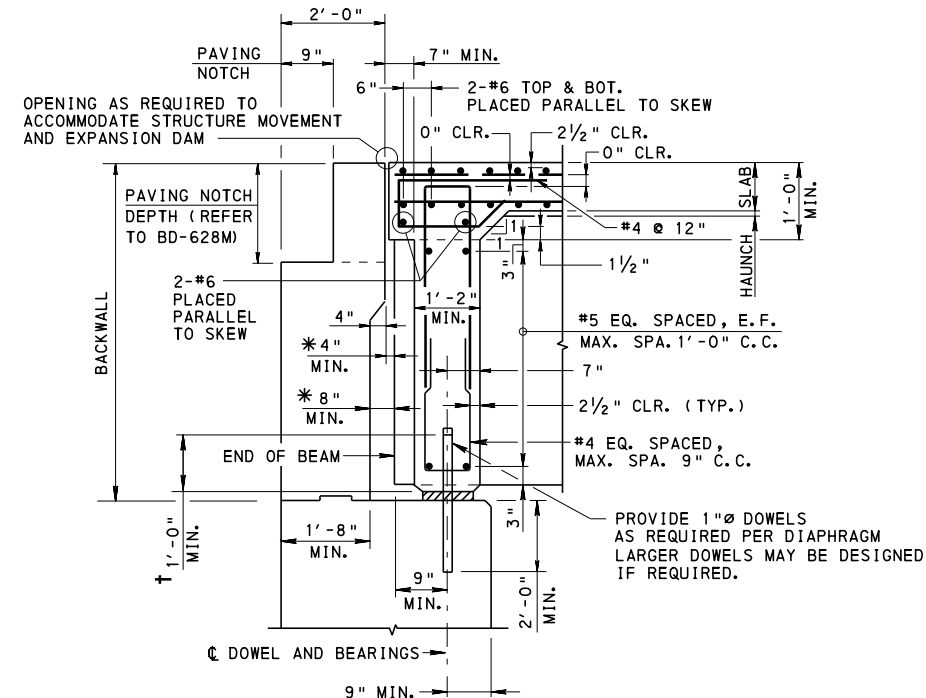


### PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED AND EXP.)

- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



### INTERMEDIATE DIAPHRAGM



### FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED)

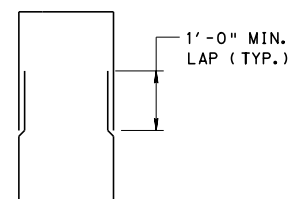
- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

#### GENERAL NOTES:

1. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. ALL DIMENSIONS SHOWN ARE NORMAL TO THE ABUTMENT OR PIER.
3. ALL SECTIONS WERE DRAWN LEVEL. THE EFFECTS OF THE SLOPE OF BEAMS MUST BE TAKEN INTO ACCOUNT.
4. FOR SIZE AND SPACING OF DECK SLAB REINFORCEMENT, SEE BD-601M.
5. ALL BACKWALLS ARE SHOWN CHAMFERED. FOR OPTIONAL TREATMENT, SEE BD-621M.
6. FOR DEPTH OF PAVING NOTCHES FOR VARIOUS DEPTH I-BEAMS AND BOX BEAMS, REFER TO BD-628M, BD-661M, BD-662M AND BC-775M.
7. FOR DOWEL DETAIL IN DIAPHRAGM, SEE BC-775M.
8. PAVING NOTCHES MAY BE OMITTED WHEN NO FUTURE CONCRETE APPROACH PAVEMENT IS CONTEMPLATED.
9. SHOW APPLICABLE DETAILS ON CONSTRUCTION DRAWINGS.
10. FOR LOCATION OF LONGITUDINAL DECK SLAB BARS WITH RESPECT TO EXPANSION DAM, SEE BC-762M AND BC-767M.

#### LEGEND:

- \* DETERMINED BY ANTICIPATED MOVEMENT
- † 6" FOR 17" DEEP BEAM & 10" FOR 21" DEEP BEAM



### TYPICAL DIAPHRAGM BAR

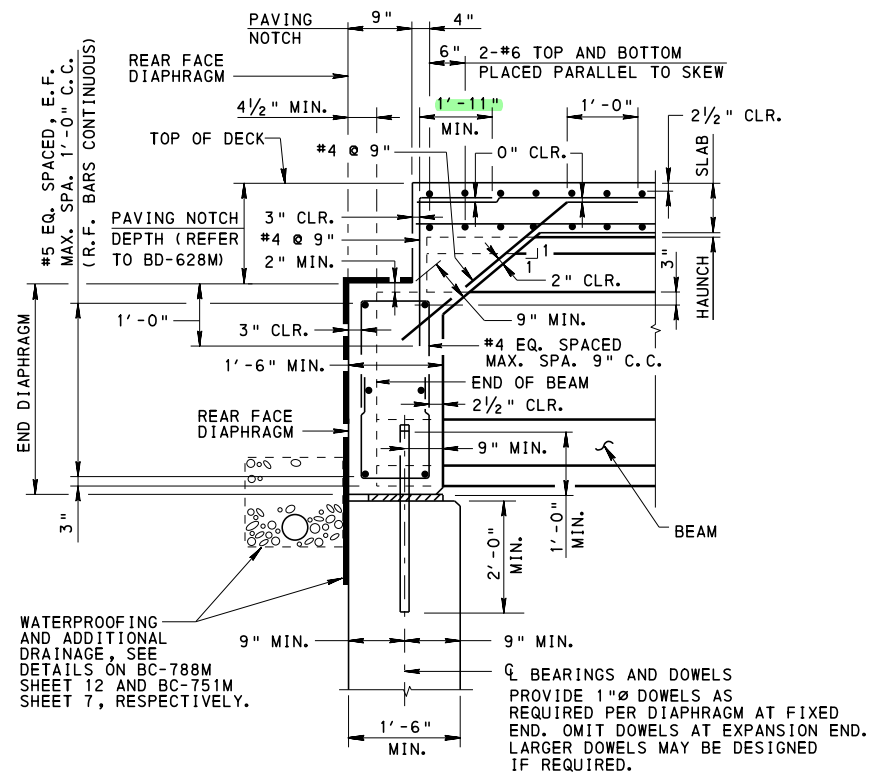
|         |                                                                                          |
|---------|------------------------------------------------------------------------------------------|
| BD-601M | CONCRETE DECK SLAB                                                                       |
| BD-621M | REINFORCED CONCRETE ABUTMENTS                                                            |
| BD-622M | R.C. ABUTMENTS WITH BACKWALL                                                             |
| BD-624M | R.C. ABUTMENTS WITHOUT BACKWALL                                                          |
| BD-628M | BRIDGE APPROACH SLABS                                                                    |
| BD-651M | REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS & BACKWALLS |
| BD-655M | TYPICAL SUPERSTRUCTURE SECTIONS                                                          |
| BD-660M | DECK SLAB & STEEL REINFORCEMENT PLACEMENT                                                |
| BD-661M | BOX BEAM REINFORCEMENT DETAILS                                                           |
| BD-662M | I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS                                        |
| BD-664M | CONTINUITY FOR LIVE LOAD DETAILS, I-BEAM AND BULB-TEE BEAM BRIDGES                       |
| BD-665M | CONTINUITY FOR LIVE LOAD DETAILS, BOX BEAMS                                              |
| BC-751M | BRIDGE DRAINAGE                                                                          |
| BC-762M | TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES                      |
| BC-766M | PREFORMED NEOPRENE COMPRESSION SEAL JOINT                                                |
| BC-767M | NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL I-BEAM BRIDGES                |
| BC-775M | MISCELLANEOUS PRESTRESS DETAILS                                                          |
| BC-788M | TYPICAL WATERPROOFING AND EXPANSION DETAILS                                              |
| RC-23M  | BRIDGE APPROACH SLABS                                                                    |

#### REFERENCE DRAWINGS

### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

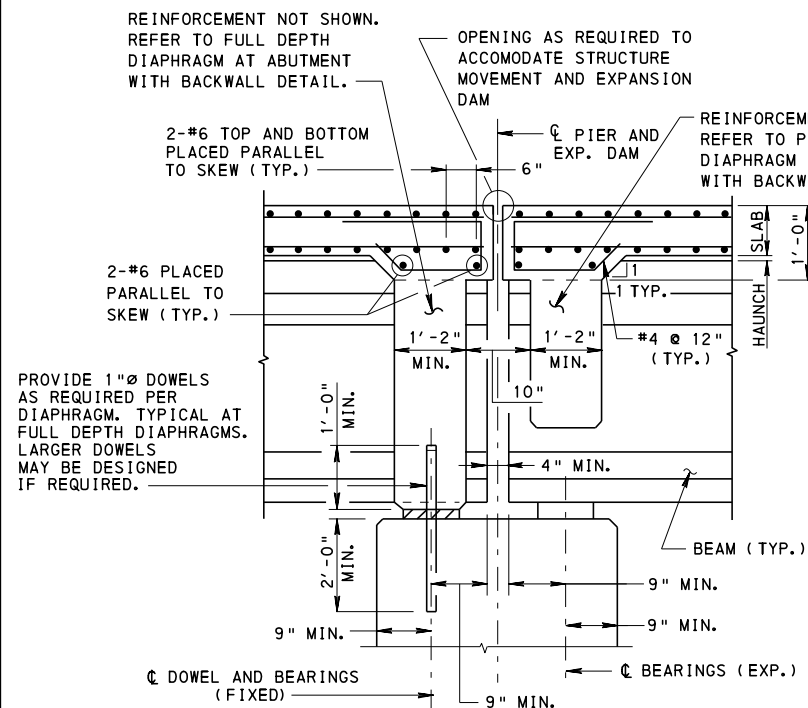
### STANDARD TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES

|                                                                                       |                                                                                              |                         |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------|
| RECOMMENDED<br>AUG. 30, 2019<br><i>John J. Ringer</i><br>ACTING CHIEF BRIDGE ENGINEER | RECOMMENDED<br>AUG. 30, 2019<br><i>Mark V. Bitter</i><br>ACT. DIR., BUR. OF PROJECT DELIVERY | SHEET 1 OF 7<br>BD-656M |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------|



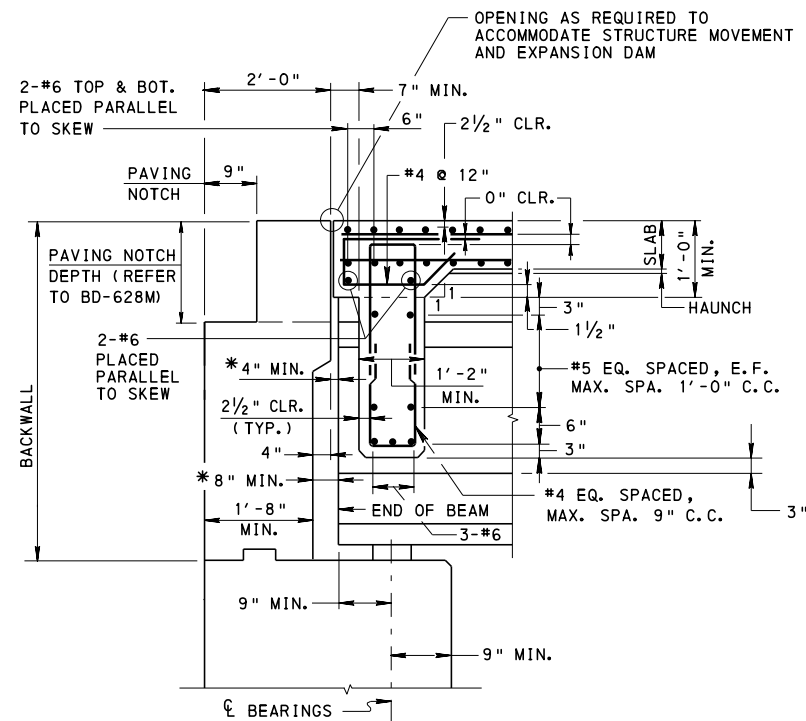
**FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL**

- FOR FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



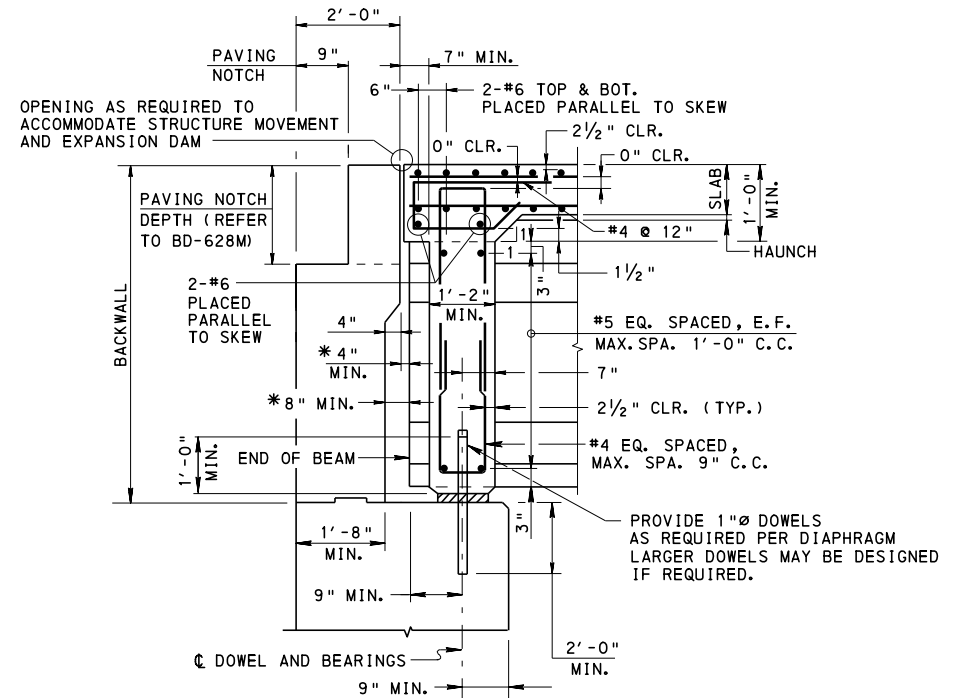
**FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER (FIXED AND EXP.)**

- FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-664M.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



**PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED AND EXP.)**

- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



**FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED)**

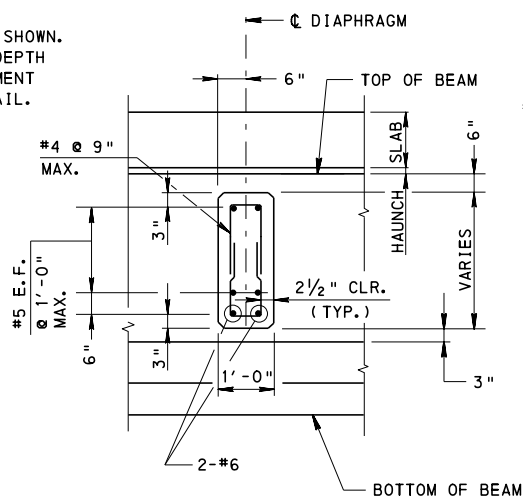
- SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.
- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

**LEGEND:**

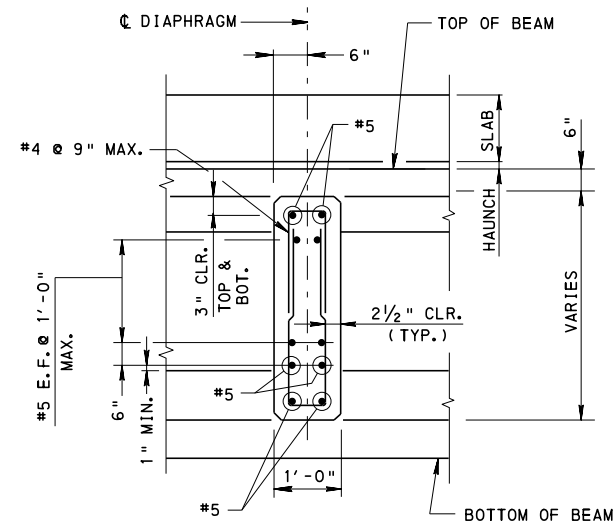
\* DETERMINED BY ANTICIPATED MOVEMENT

**NOTE:**

FOR TYPICAL DIAPHRAGM BAR DETAIL, SEE SHEET 1.



**TYPICAL**



**EXTERNAL BAYS**

FOR SPANS WITH VERTICAL CLEARANCE LESS THAN 16'-0" OVER VEHICULAR TRAFFIC.

**INTERMEDIATE DIAPHRAGM**

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
TYPICAL LONGITUDINAL SECTIONS  
I-BEAM AND BOX BEAM BRIDGES**

RECOMMENDED AUG. 30, 2019  
*John J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 7  
**BD-656M**

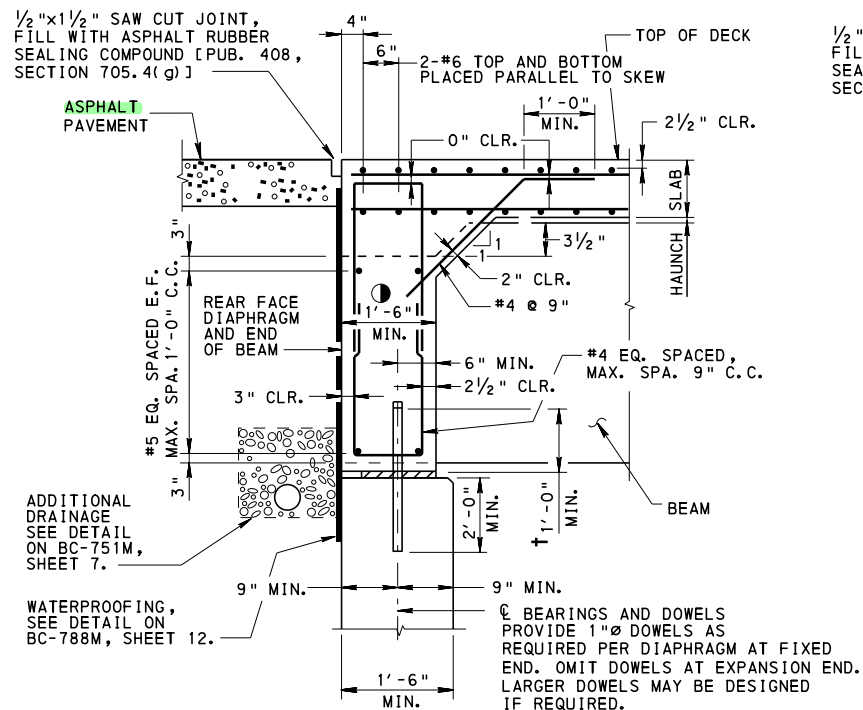
**TYPICAL LONGITUDINAL SECTIONS FOR I-BEAMS**

SEE SHEET 1 FOR NOTES







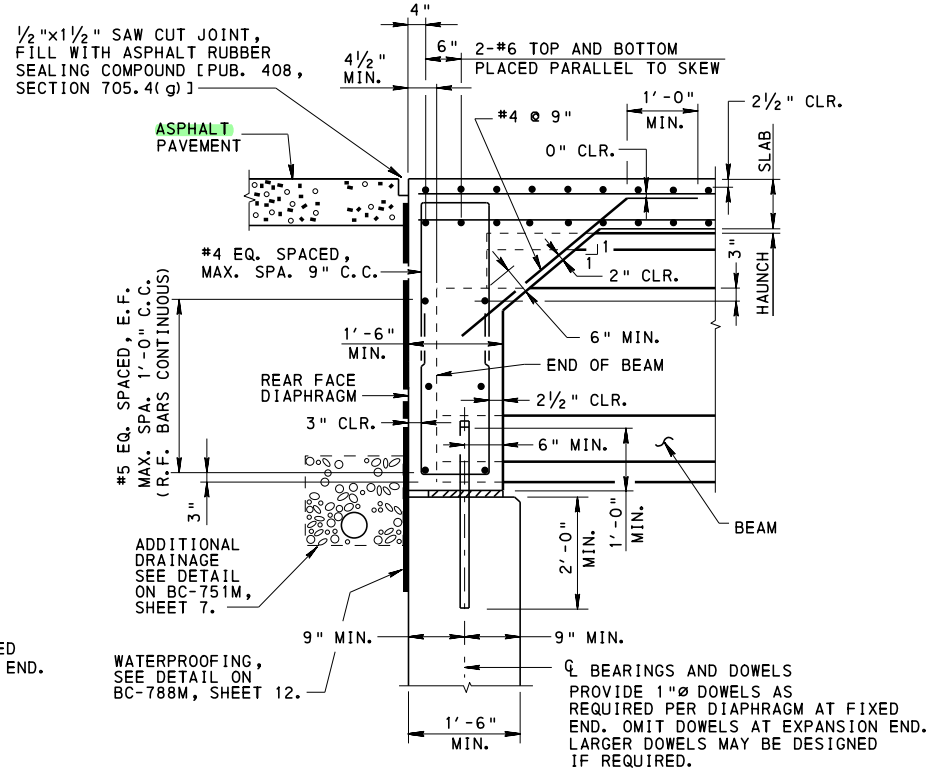


**FULL DEPTH DIAPHRAGM AT ABUTMENT  
WITHOUT BACKWALL**  
(WITHOUT PAVING NOTCH)

**TYPICAL LONGITUDINAL SECTION  
FOR SPREAD BOX BEAMS**

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

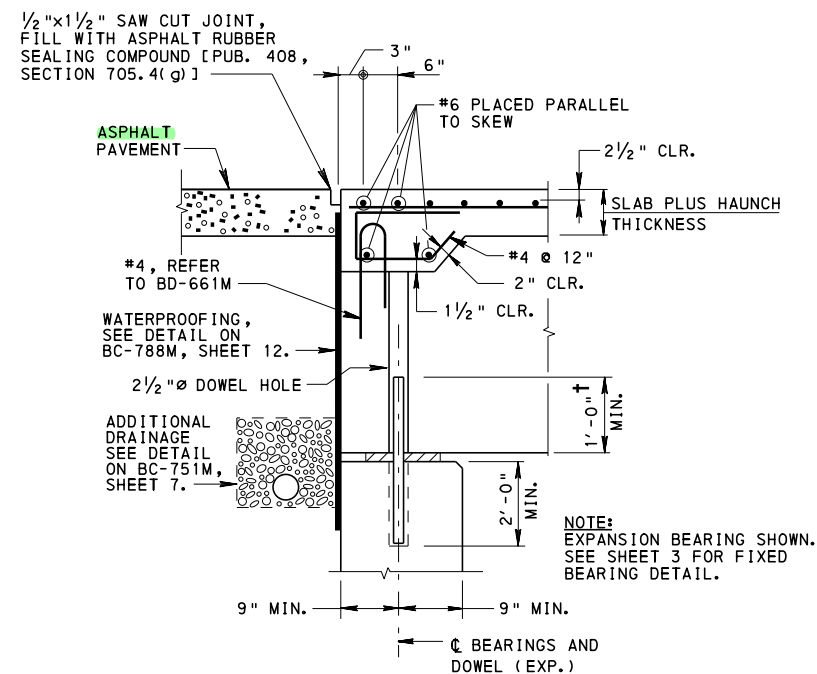
- BRADD DESIGNS PERMITTED TO USE END DIAPHRAGM MINIMUM THICKNESS OF 1'-3".



**FULL DEPTH DIAPHRAGM AT ABUTMENT  
WITHOUT BACKWALL**  
(WITHOUT PAVING NOTCH)

**TYPICAL LONGITUDINAL SECTION  
FOR I-BEAMS**

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



**ABUTMENT WITHOUT BACKWALL**  
(WITHOUT PAVING NOTCH)

**TYPICAL LONGITUDINAL SECTION  
FOR ADJACENT BOX BEAMS (COMPOSITE)**

**LEGEND:**

- † 6" FOR 17" DEEP BEAM & 10" FOR 21" DEEP BEAM

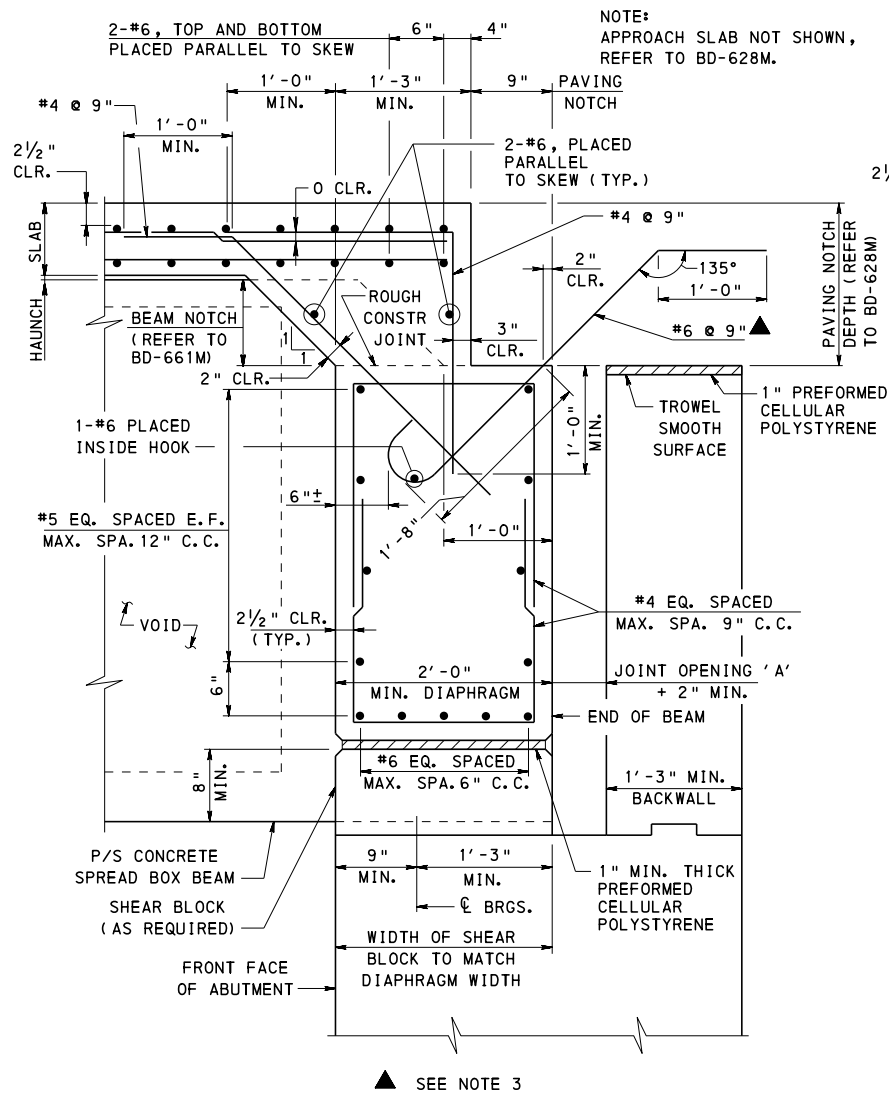
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
TYPICAL LONGITUDINAL SECTIONS  
I-BEAM AND BOX BEAM BRIDGES**

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

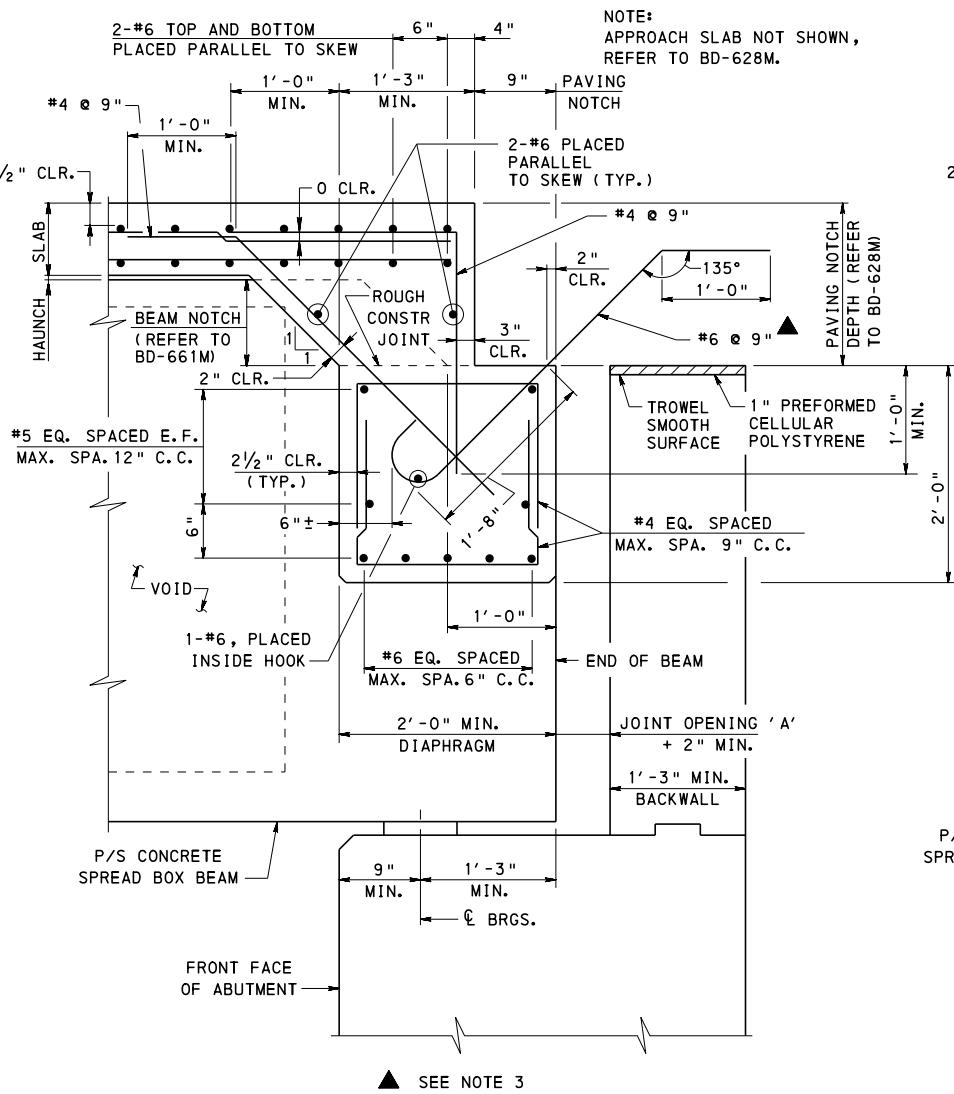
RECOMMENDED AUG. 30, 2019  
*Michael J. Bitter*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 7  
**BD-656M**



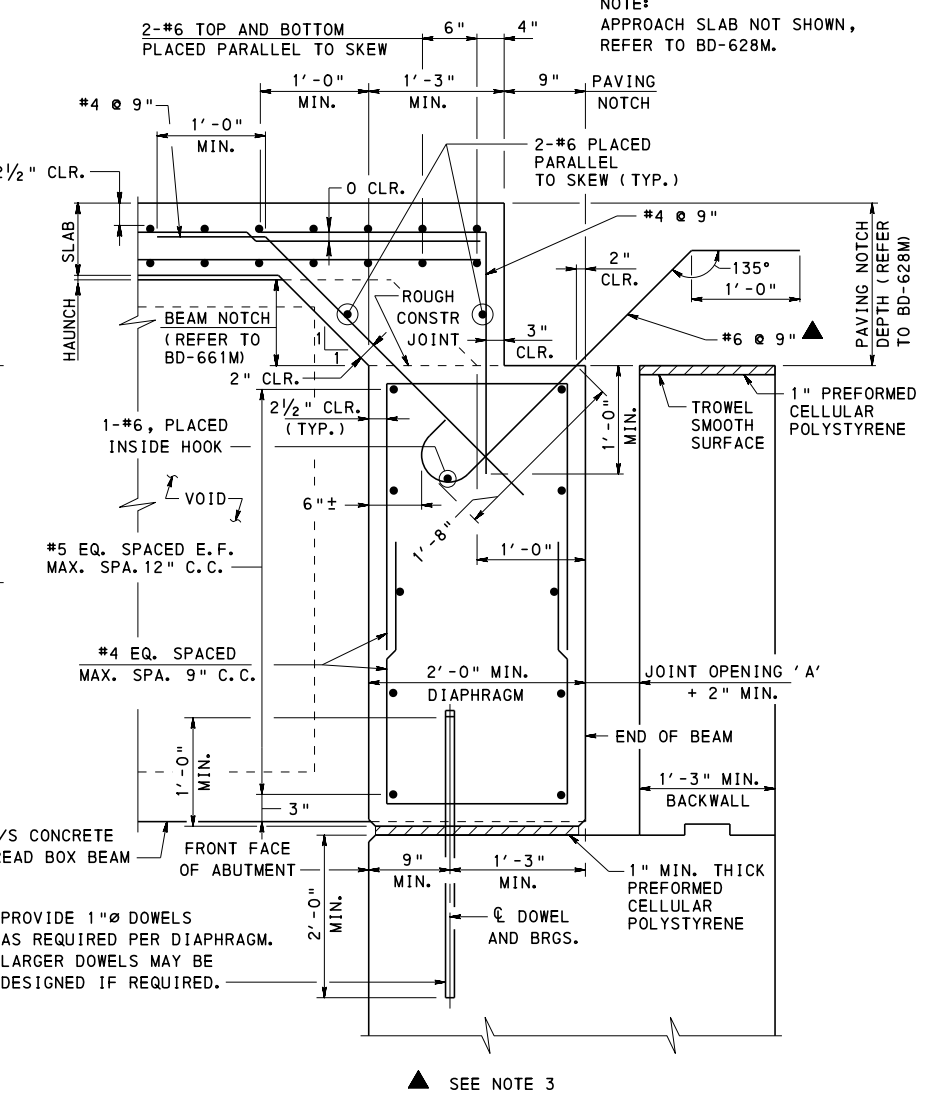
**PARTIAL DEPTH DIAPHRAGM AT ABUTMENT  
WITH BACKWALL AND SHEAR BLOCK (EXPANSION)**

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



**PARTIAL DEPTH DIAPHRAGM AT ABUTMENT  
WITH BACKWALL AND WITHOUT SHEAR BLOCK  
(FIXED AND EXPANSION)**

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



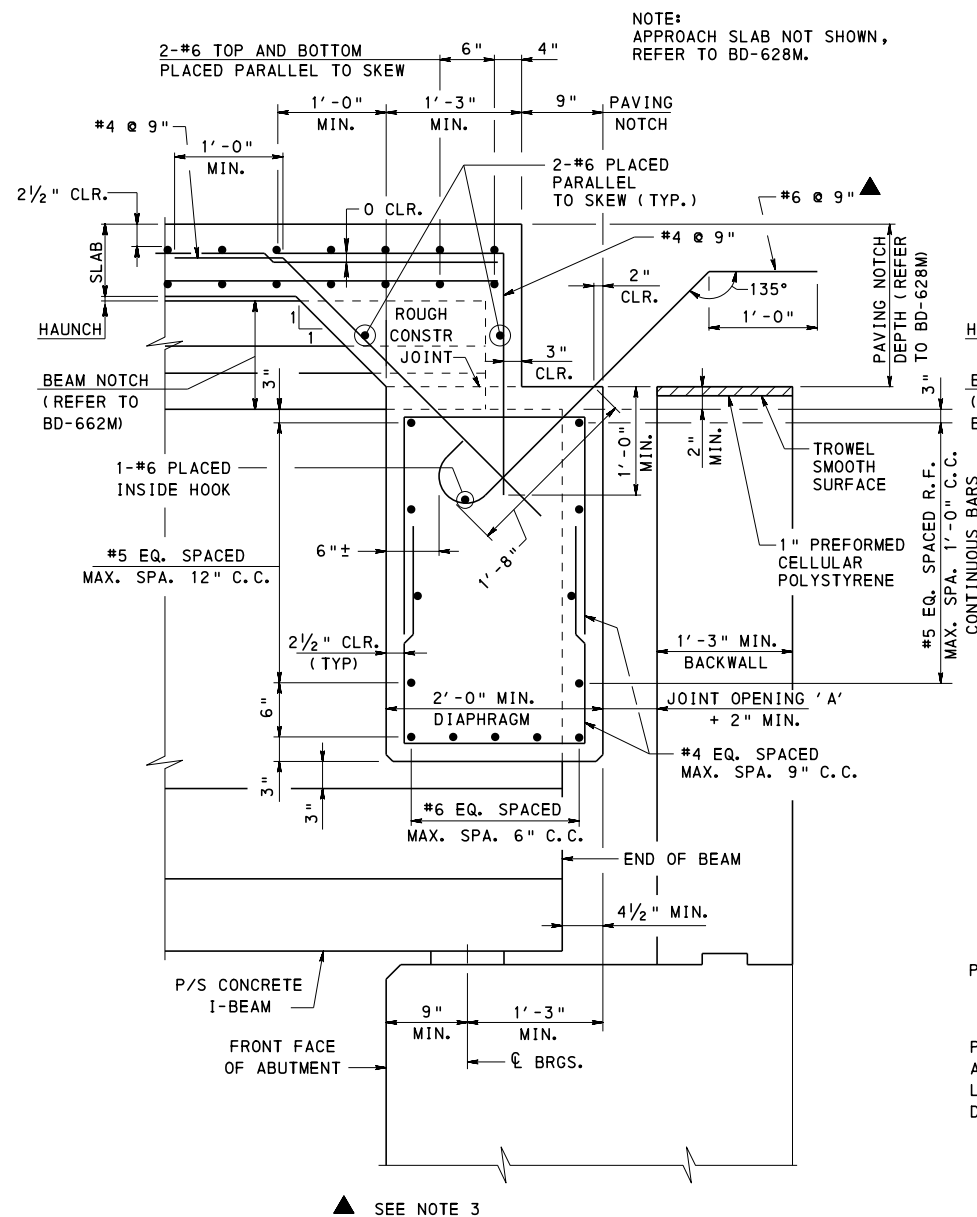
**FULL DEPTH DIAPHRAGM AT ABUTMENT  
WITH BACKWALL (FIXED)**

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

- NOTES**
- FOR GENERAL NOTES, SEE SHEET 1.
  - BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
  - PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHEET 24.

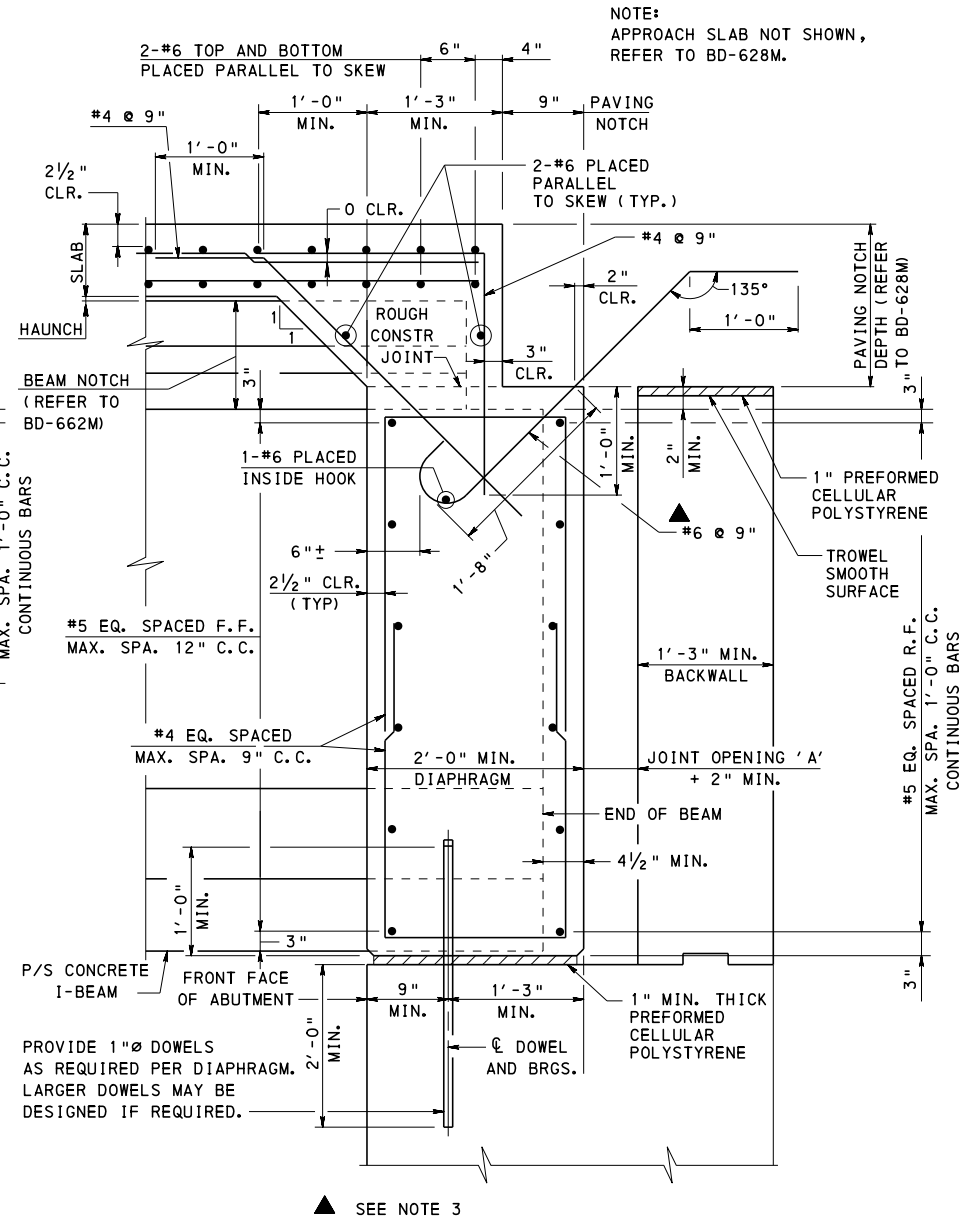
**TYPICAL LONGITUDINAL SECTIONS FOR SPREAD BOX BEAMS  
WITH TYPE 3 APPROACH SLABS**

(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)



**PARTIAL DEPTH DIAPHRAGM AT ABUTMENT  
WITH BACKWALL (FIXED AND EXPANSION)**

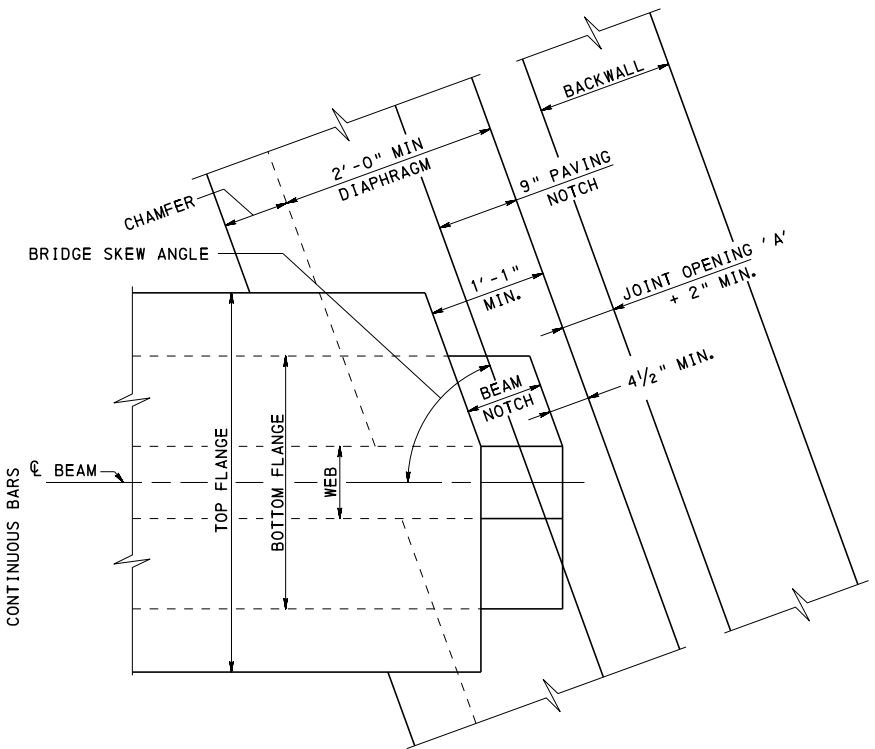
FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



**FULL DEPTH DIAPHRAGM AT ABUTMENT  
WITH BACKWALL (FIXED)**

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

**TYPICAL LONGITUDINAL SECTIONS FOR I-BEAMS  
WITH TYPE 3 APPROACH SLABS**  
(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)



**PLAN - SKEWED STRUCTURES**  
(AASHTO TYPE I-BEAM SHOWN; OTHERS SIMILAR)

**NOTES**

1. FOR GENERAL NOTES, SEE SHEET 1.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHEET 24.

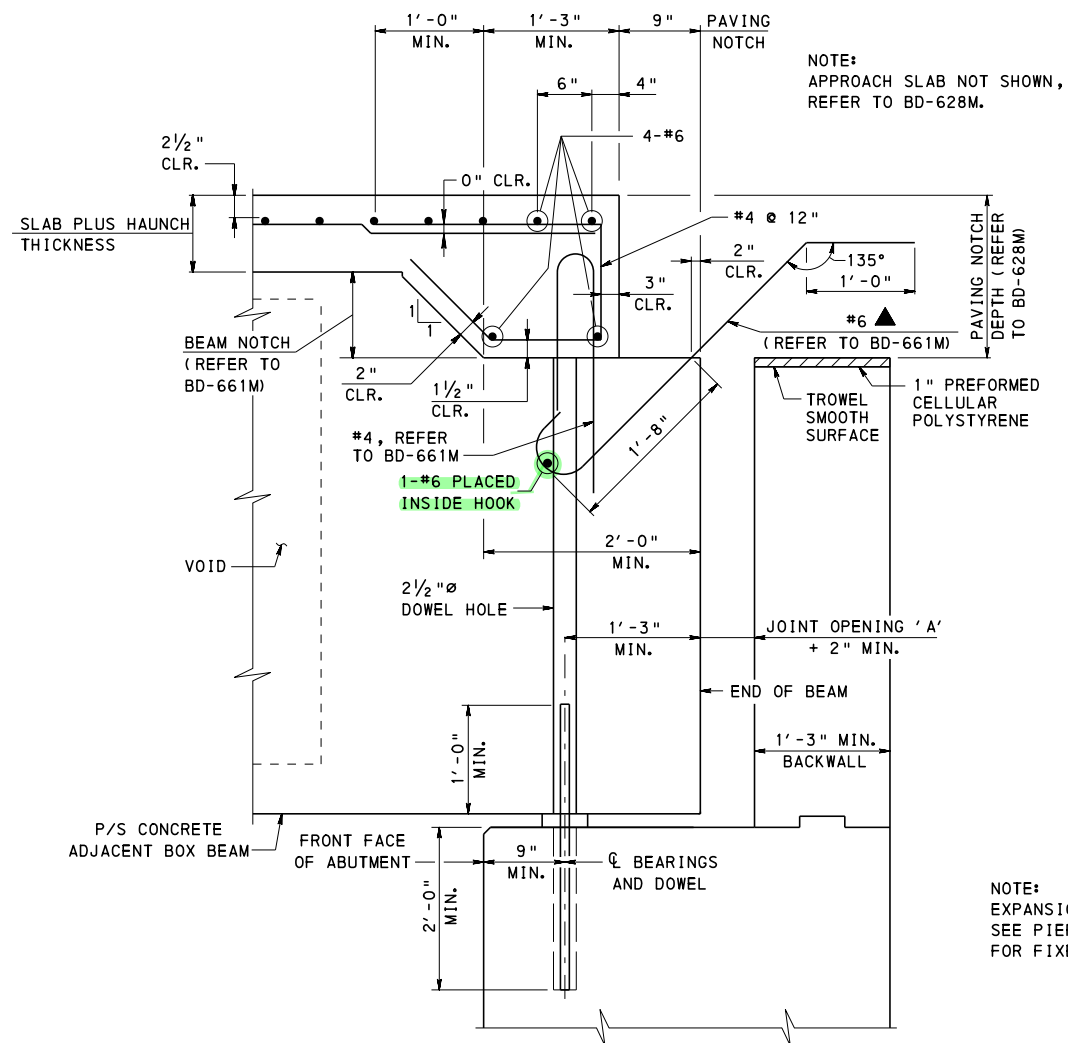
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
TYPICAL LONGITUDINAL SECTIONS  
I-BEAM AND BOX BEAM BRIDGES**

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Biele*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 7  
**BD-656M**

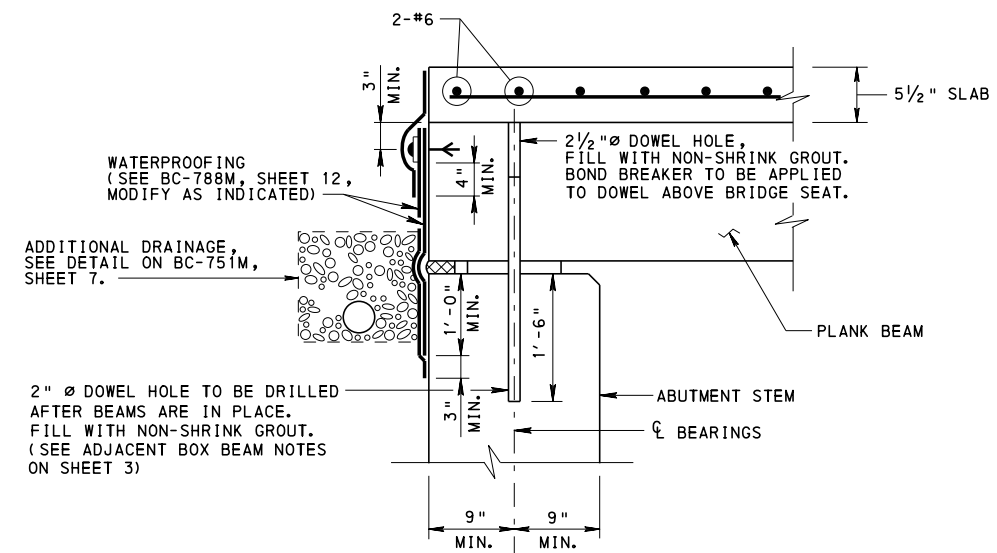


▲ SEE NOTE 3

### ABUTMENT WITH BACKWALL

## TYPICAL LONGITUDINAL SECTION FOR ADJACENT BOX BEAMS WITH TYPE 3 APPROACH SLABS

(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)



## TYPICAL LONGITUDINAL SECTION FOR PLANK BEAMS

### NOTES

1. FOR GENERAL NOTES, SEE SHEET 1.
2. BURN OFF, TO TOP OF BEAM, REINFORCEMENT AND/OR LIFTING DEVICES PROTRUDING INTO APPROACH SLAB.
3. PLACED PARALLEL TO BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHT. 24.

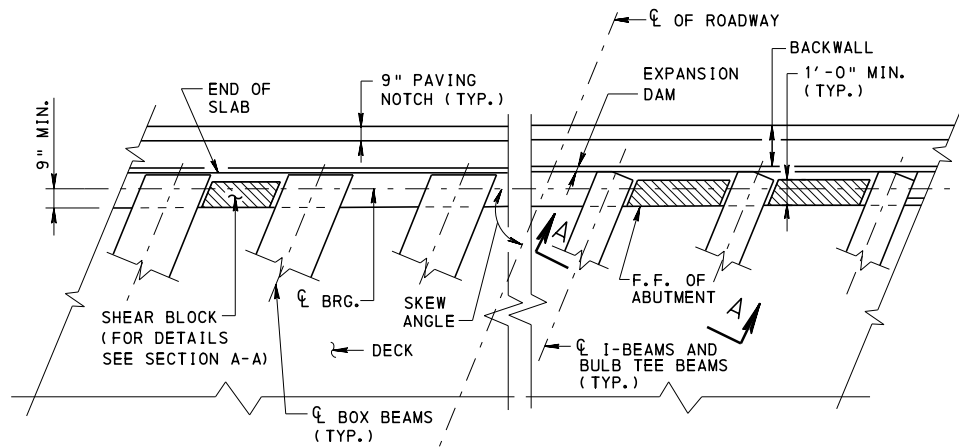
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
TYPICAL LONGITUDINAL SECTIONS  
I-BEAM, BOX BEAM AND  
PLANK BEAM BRIDGES

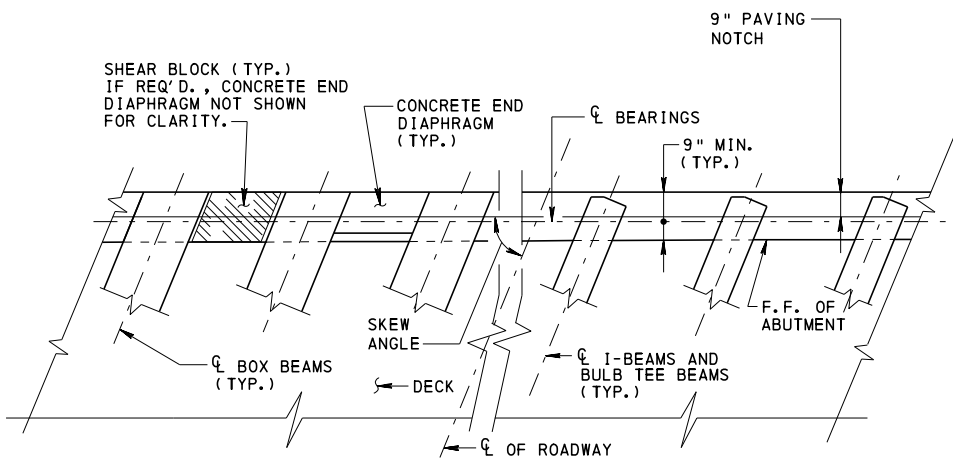
RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael V. Bittler*  
ACT. DIR., BUR. OF PROJECT DELIVERY

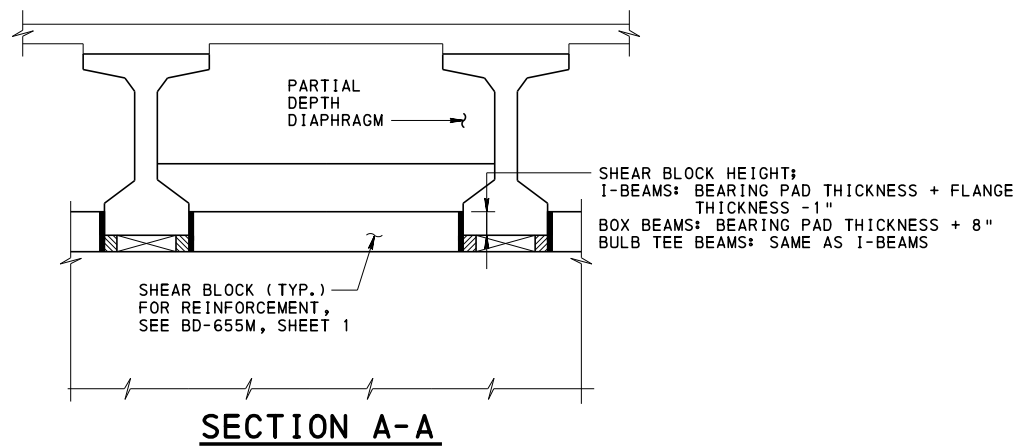
SHEET 7 OF 7  
BD-656M



**SPREAD BOX BEAMS** **I-BEAMS**  
**ABUTMENT PLAN - WITH BACKWALL (SKEWED)**  
 NOTE: END DIAPHRAGMS NOT SHOWN FOR CLARITY

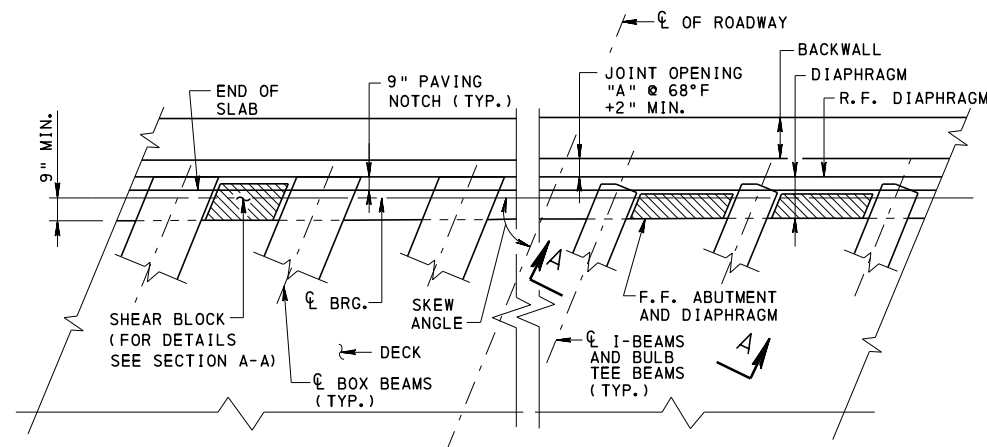


**SPREAD BOX BEAMS** **I-BEAMS**  
**ABUTMENT PLAN - WITHOUT BACKWALL (SKEWED)**



**SECTION A-A NOTE:**  
 1. SECTION FOR SPREAD BOX BEAM AND FOR BULB TEE BEAM IS SIMILAR TO THE SECTION FOR I-BEAM AS SHOWN ABOVE.

- GENERAL NOTES:**
- PAVING NOTCHES MAY BE OMITTED WHEN NO FUTURE CONCRETE APPROACH IS CONTEMPLATED.
  - FOR DOWEL, SHEAR BLOCK AND BACKWALL REQUIREMENTS, SEE BD-651M.
  - EXPANSION CONDITIONS AT ABUTMENTS WITH OR WITHOUT BACKWALL REQUIRE AS A MINIMUM SHEAR BLOCKS BETWEEN THE FASCIA AND FIRST INTERIOR BEAM FOR I-BEAM, BULB TEE BEAM AND BOX BEAM BRIDGES. FIXED CONDITIONS REQUIRE FULL AND PARTIAL DEPTH DIAPHRAGMS. FOR REQUIREMENTS, SEE BD-651M.
  - SKEWED CONDITION IS SHOWN. FOR 90° SKEWS, END OF BEAMS ARE CUT PERPENDICULAR TO CL OF BEAMS
  - DETAILS AND SHEAR BLOCK LOCATIONS ARE TYPICAL FOR SIMPLE OR CONTINUOUS SPANS. SEE BD-655M FOR ADDITIONAL DETAILS.
  - FOR EXPANSION CONDITIONS AT ABUTMENTS WITH OR WITHOUT BACKWALL, PROVIDE ADDITIONAL SHEAR BLOCK IN A MIN. OF 50% OF THE TOTAL NO. OF BAYS AT THE ACUTE ANGLE SIDE OF THE DECK FOR SKEWS 75° AND LESS (TYP. FOR I-BEAM, BULB TEE BEAM AND SPREAD BOX BEAM BRIDGES).
  - REFER TO BD-653M AND BD-656M FOR I-BEAM AND BULB TEE BEAM CLIPPING DETAILS.

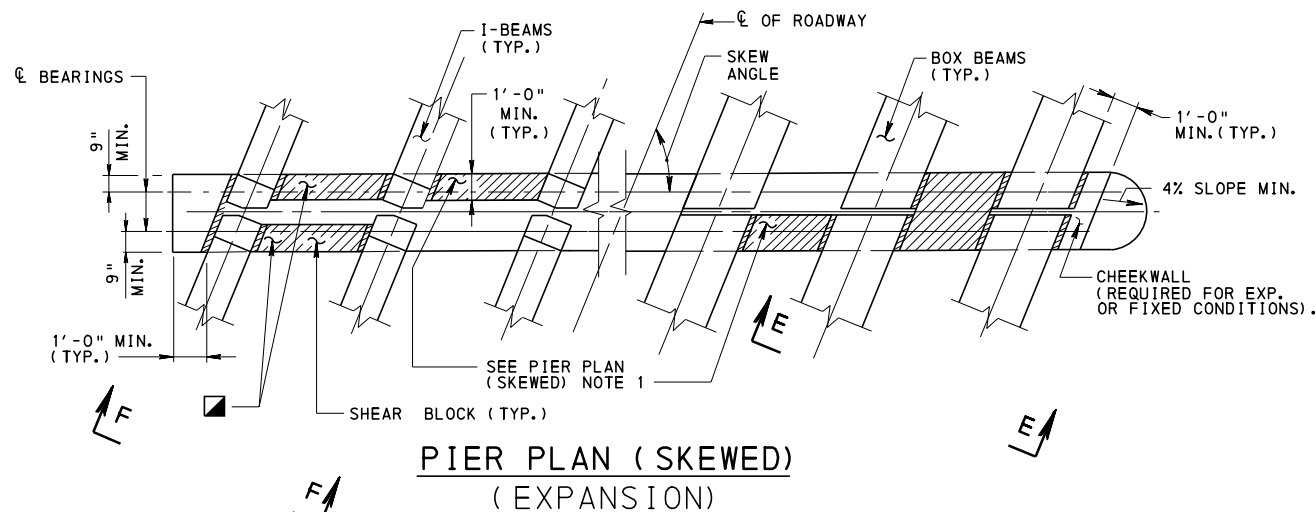


**SPREAD BOX BEAMS** **I-BEAMS**  
**ABUTMENT PLAN - WITH BACKWALL (SKEWED)**  
**FOR TYPE 3 AND 4 APPROACH SLABS**

|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| BD-621M            | REINFORCED CONCRETE ABUTMENTS                                                             |
| BD-622M            | R. C. ABUTMENTS WITH BACKWALL                                                             |
| BD-624M            | R. C. ABUTMENTS WITHOUT BACKWALL                                                          |
| BD-628M            | BRIDGE APPROACH SLABS                                                                     |
| BD-651M            | REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS |
| BD-653M            | TYPICAL FRAMING PLANS AND DETAILS                                                         |
| BD-655M            | TYPICAL SUPERSTRUCTURE SECTIONS                                                           |
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS                                                             |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS                                               |
| RC-23M             | BRIDGE APPROACH SLABS                                                                     |
| REFERENCE DRAWINGS |                                                                                           |

| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BUREAU OF PROJECT DELIVERY |                                                                                    |                         |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------|
| STANDARD<br>I-BEAM AND BOX BEAM BRIDGES<br>WITH BACKWALL AND WITHOUT BACKWALL              |                                                                                    |                         |
| RECOMMENDED APR. 29, 2016<br>Thomas P. Maciore<br>CHIEF BRIDGE ENGINEER                    | RECOMMENDED APR. 29, 2016<br>Brenda Thompson<br>DIRECTOR, BUR. OF PROJECT DELIVERY | SHEET 1 OF 1<br>BD-657M |

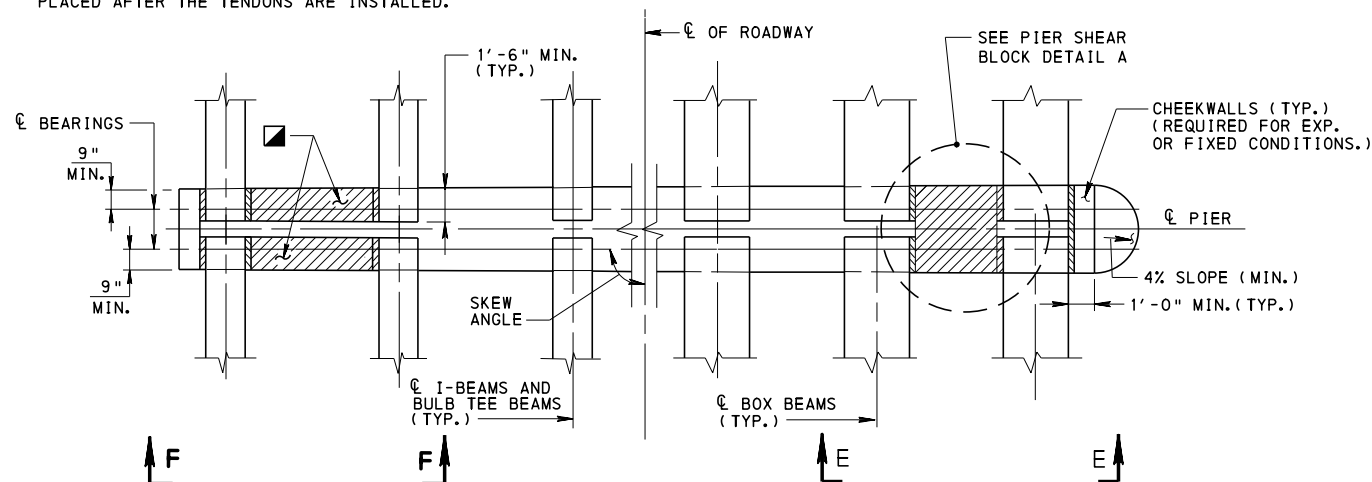




#### PIER PLAN (SKEWED) NOTES:

1. PROVIDE THIS ADDITIONAL SHEAR BLOCK AT THE ACUTE ANGLE SIDE OF THE DECK FOR SKEW 75° AND LESS (TYP. FOR I-BEAM, BULB TEE BEAM AND SPREAD BOX BEAM BRIDGES).
2. ADJACENT BOX BEAM BRIDGES ARE SIMILAR EXCEPT THAT THE CHEEKWALL AT THE ACUTE SIDE OF THE DECK OR AT EITHER SIDE OF A 90° BRIDGE MUST BE PLACED BEFORE THE BEAMS ARE SET. (EXP. END ONLY). THE OPPOSING CHEEKWALL IS TO BE PLACED AFTER THE TENDONS ARE INSTALLED.

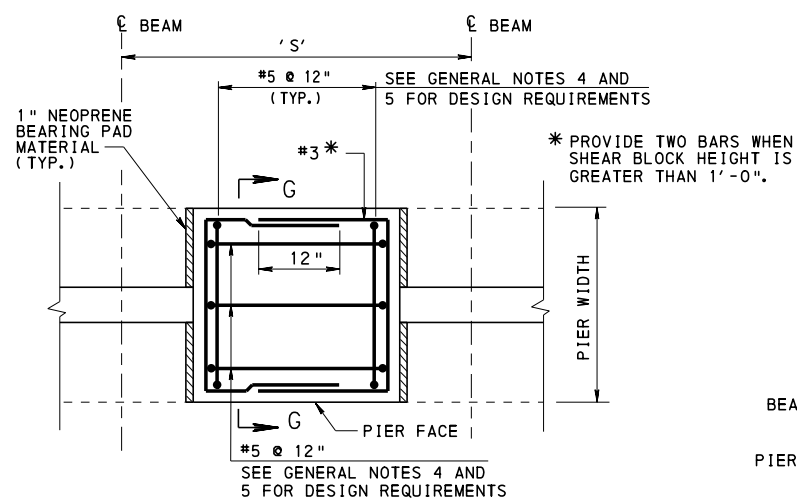
■ TWO SEPARATE SHEAR BLOCKS SHOWN FOR I-BEAMS AND BULB TEE BEAMS. ONE SINGLE SHEAR BLOCK, EXTENDING THE FULL WIDTH OF THE PIER, IS PERMITTED.



#### PIER PLAN (90°) (EXPANSION)

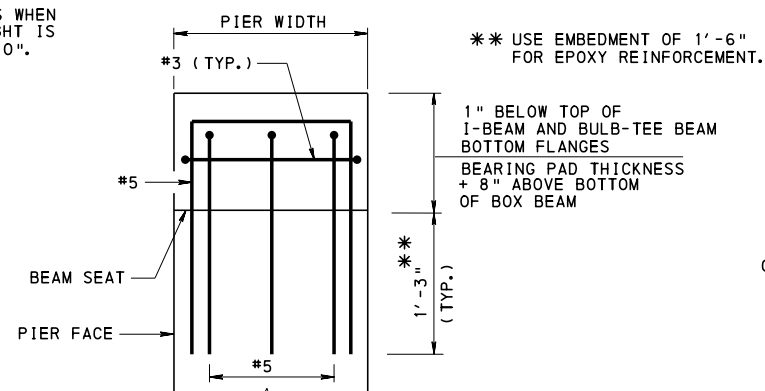
#### PIER PLAN (90°) NOTE:

- ADJACENT BOX BEAM BRIDGES ARE SIMILAR.

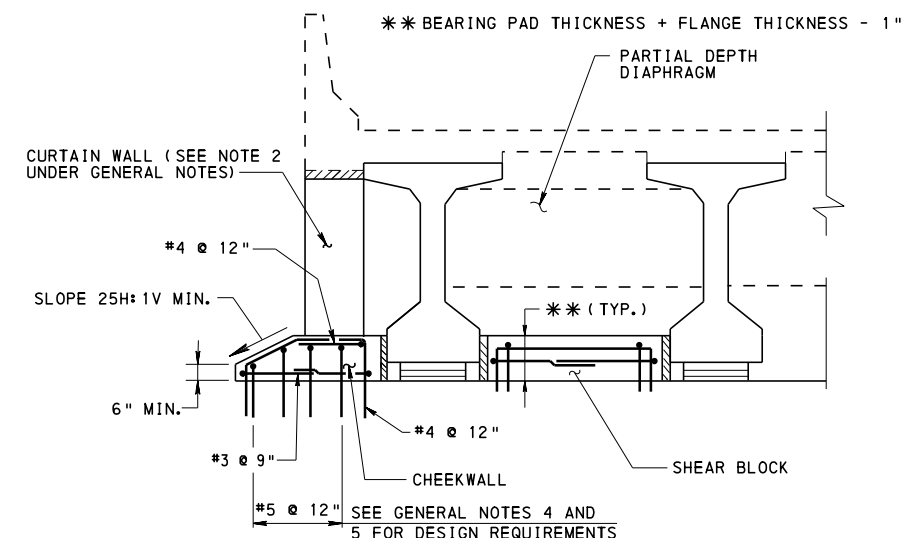


#### PIER SHEAR BLOCK DETAIL A PLAN VIEW

ALL SPANS OF EQUAL 'S' DIMENSION

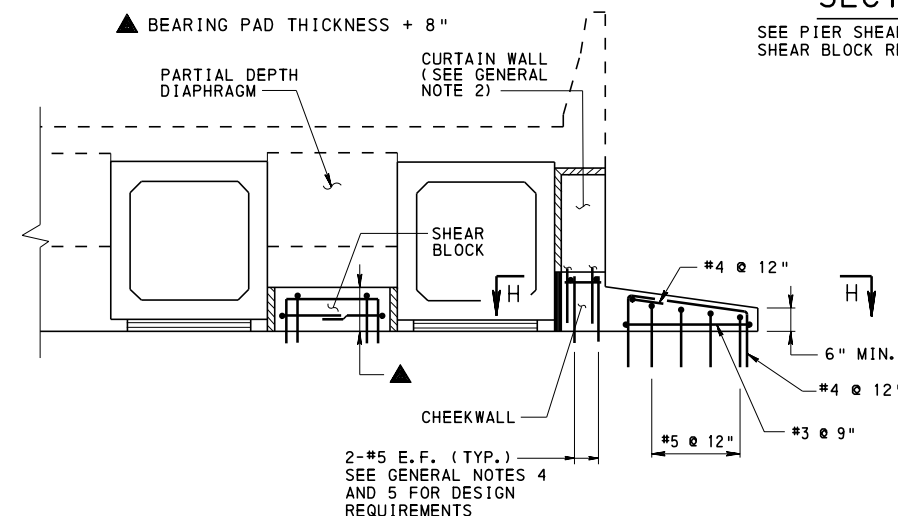


#### SECTION G-G



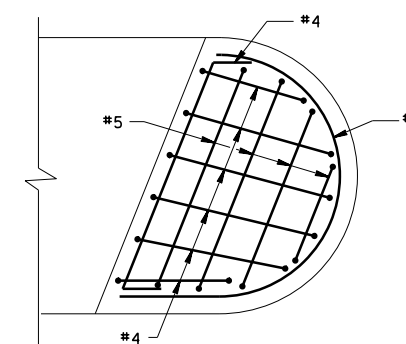
#### SECTION F-F

SEE PIER SHEAR BLOCK DETAIL A FOR SHEAR BLOCK REINFORCEMENT



#### SECTION E-E

SEE PIER SHEAR BLOCK DETAIL A FOR SHEAR BLOCK REINFORCEMENT



#### SECTION H-H

CHEEKWALL REINFORCEMENT NOT SHOWN FOR CLARITY

#### GENERAL NOTES:

1. ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706.
2. EXTEND CURTAIN WALL, WHEN REQUIRED FOR AESTHETICS, A MAXIMUM OF 1" FROM BOTTOM OF SLAB.
3. FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
4. DESIGN THE CHEEKWALL AND SHEAR BLOCKS TO RESIST THE LATERAL FORCES AT THE EXPANSION END OF THE BRIDGE. REINFORCEMENTS SHOWN ARE MINIMUMS.
5. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #6 REINFORCEMENT BAR MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

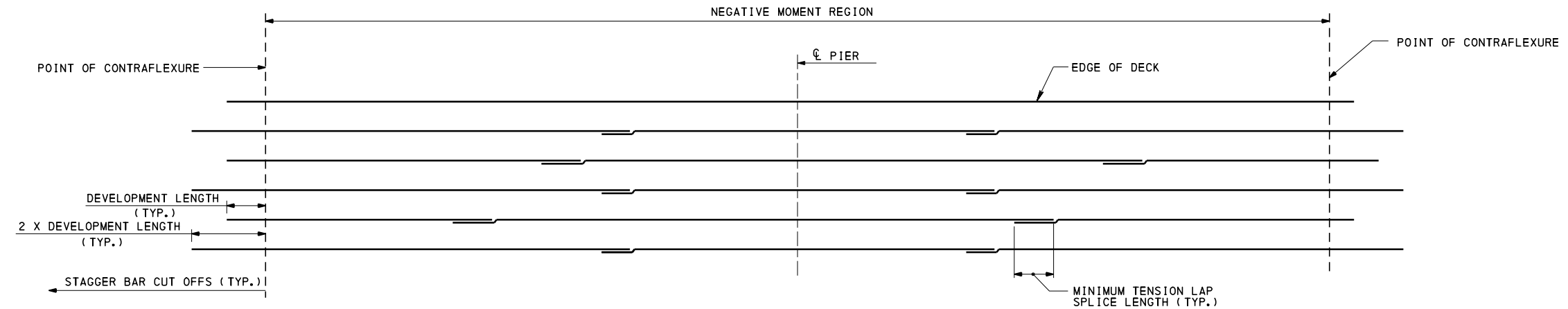
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
SHEAR BLOCK DETAILS AT PIER  
PRESTRESSED CONCRETE  
I-BEAM, BULB-TEE BEAM AND  
BOX BEAM BRIDGES

BC-788M TYPICAL WATERPROOFING AND EXPANSION DETAILS  
REFERENCE DRAWINGS

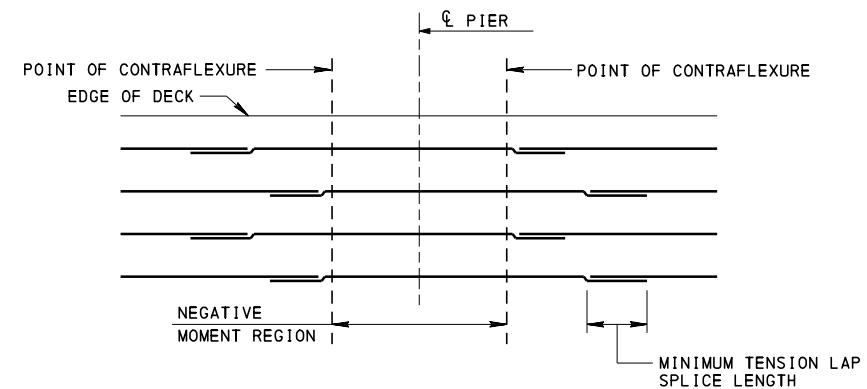
RECOMMENDED APR. 29, 2016  
THOMAS P. MACIORE  
CHIEF BRIDGE ENGINEER  
RECOMMENDED APR. 29, 2016  
BRIAN D. STROTHMAN  
DIRECTOR, BUR. OF PROJECT DELIVERY  
SHEET 1 OF 1  
BD-658M





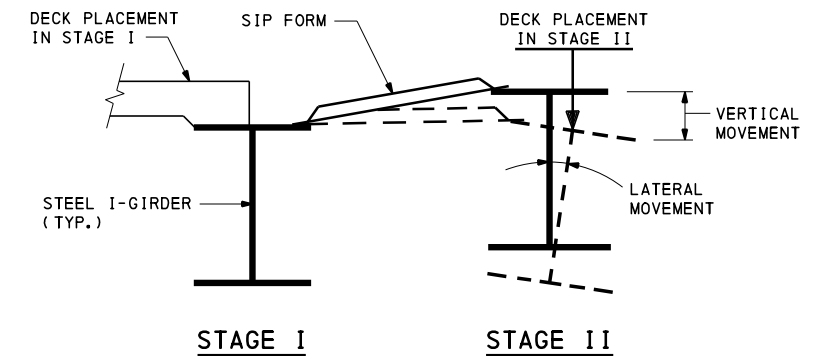
### LONGITUDINAL REINFORCEMENT STAGGER DETAIL IN NEGATIVE MOMENT REGION

- NOTES:**
1. DETAIL SHOWN REPRESENTS A LARGE NEGATIVE MOMENT REGION. IF THE NEGATIVE MOMENT REGION IS SMALL ENOUGH, STAGGER LONGITUDINAL REINFORCEMENT OUTSIDE THE NEGATIVE MOMENT REGION.
  2. USE MAXIMUM REINFORCEMENT BAR LENGTH UP TO 60' TO MINIMIZE SPLICES AND TO KEEP SPLICES AS FAR FROM THE PIER AS PRACTICAL.
  3. LOCATE SPLICES AS FAR AWAY FROM CENTERLINE OF PIER AS POSSIBLE.



### LONGITUDINAL REINFORCEMENT STAGGER DETAIL IN NEGATIVE MOMENT REGION

ONLY FOR SPANS < 100'.



### DECK PLACEMENT FOR STEEL GIRDER DURING PHASED/STAGED CONSTRUCTION

**NOTE:** DESIGNER SHALL INVESTIGATE AND ADDRESS THE VERTICAL AND POTENTIAL LATERAL MOVEMENTS DURING PHASED/STAGED CONSTRUCTION. VERTICAL DEFLECTION AND LATERAL MOVEMENT, IF ANY, AT EACH STAGE SHALL BE SHOWN ON THE PLANS.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BRIDGE OFFICE**

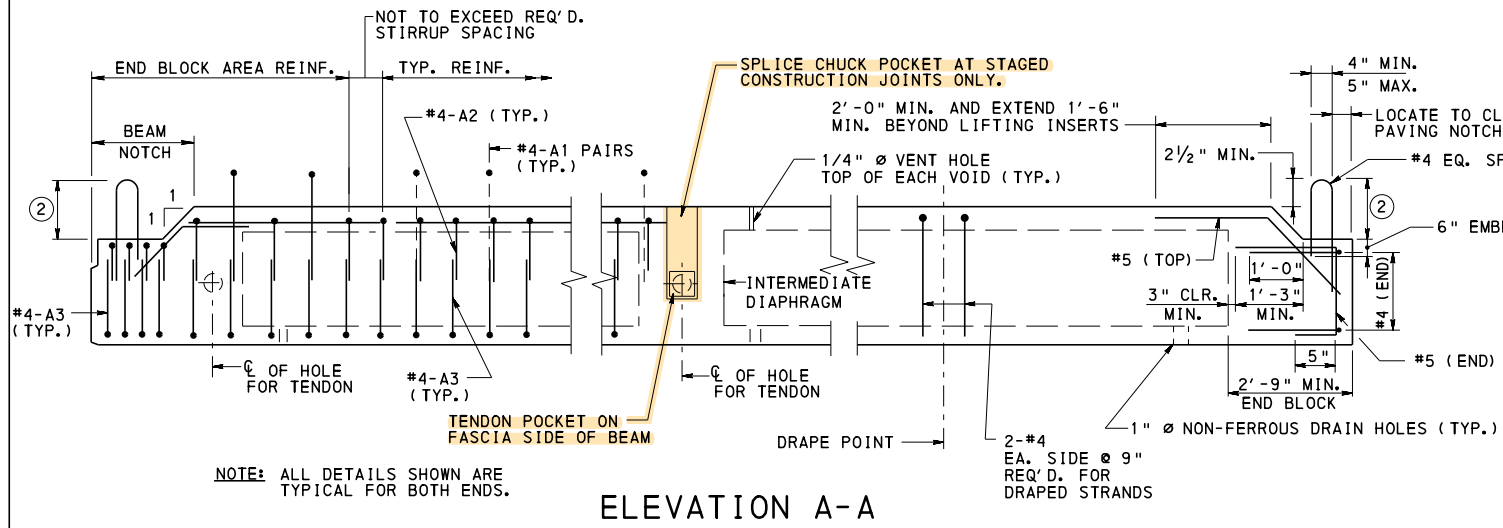
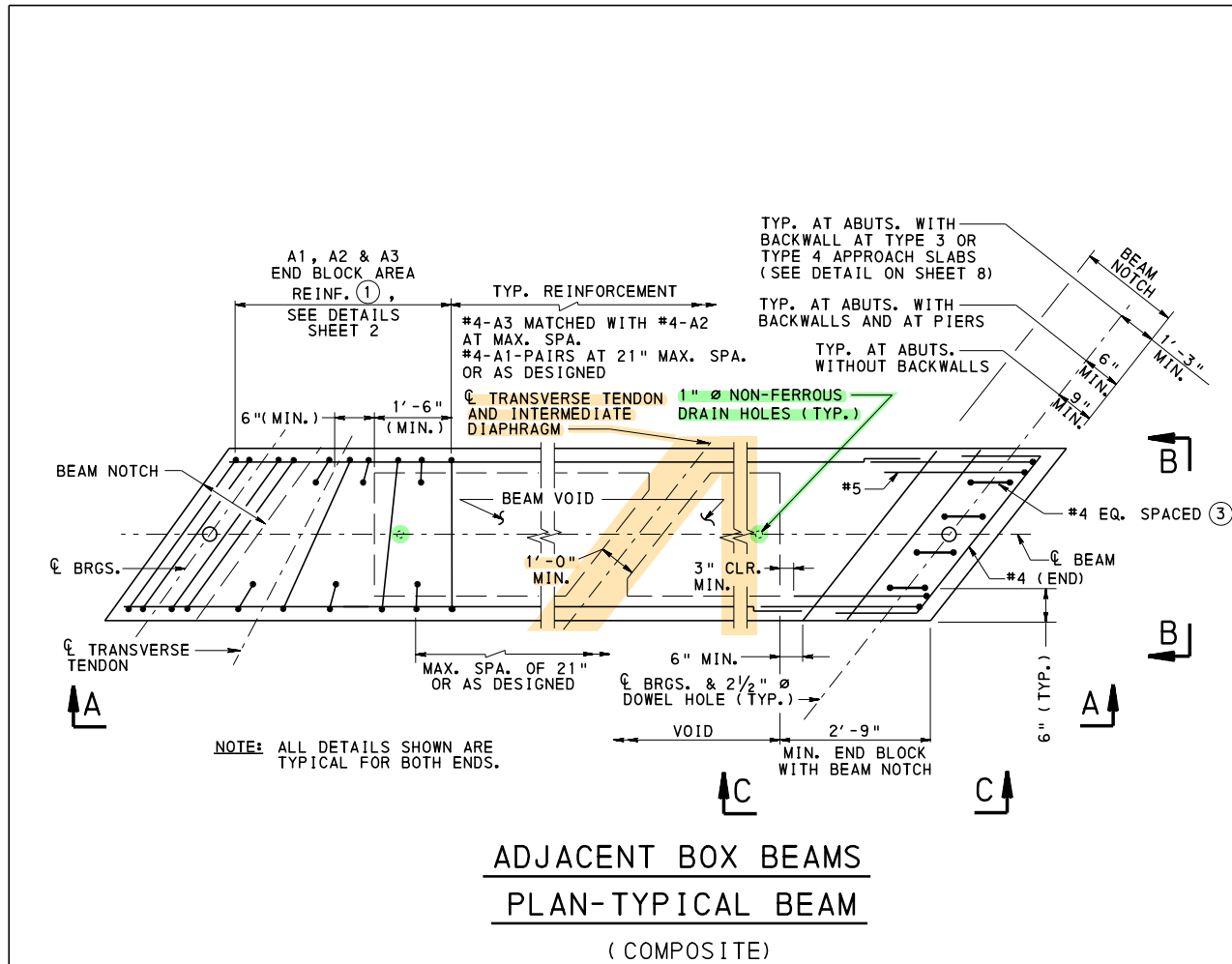
**STANDARD**  
**DECK SLAB, FORMS AND STEEL**  
**REINFORCEMENT PLACEMENT**  
**PRESTRESSED CONCRETE AND STEEL**  
**I-BEAM AND BOX BEAM BRIDGES**

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

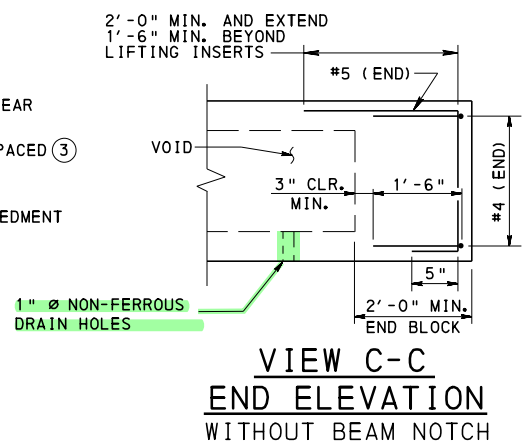
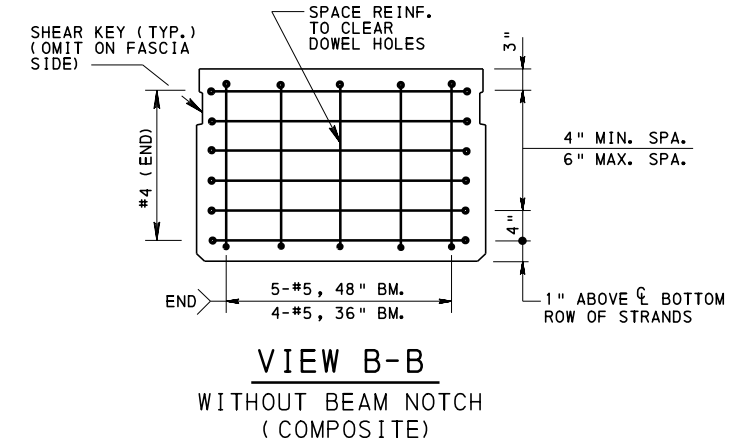
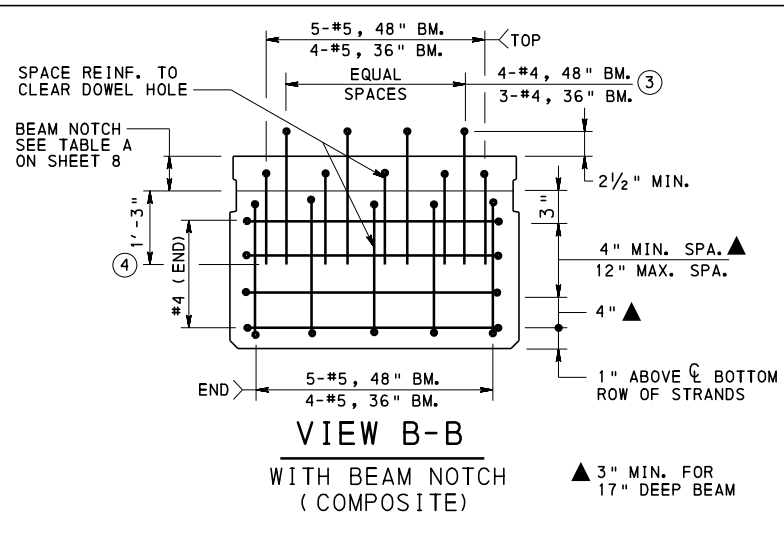
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*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 2 OF 2  
BD-660M

- CHANGE 2
- CHANGE 3
- CHANGE 5



- LEGEND:**
- ① A1 MATCHED WITH A3 IS CONSIDERED A STIRRUP ONLY IN THE END BLOCK AREA. A2 MATCHED WITH A3 IS CONSIDERED A STIRRUP ALONG THE ENTIRE LENGTH OF THE BEAM. A1 IS SPACED AT 21" OR AS DESIGNED INDEPENDENTLY OF A2 AND A3 OUTSIDE THE END BLOCK AREA.
- ② TO BE DETAILED ON THE SHOP DRAWINGS.
- ③ BARS MAY BE ROTATED PARALLEL TO BEAM END ALONG CENTERLINE OF BEARINGS.
- ④ #4 BARS TO TERMINATE 1/4" ABOVE THE TOP OF THE BOTTOM SLAB OR 1'-3" BELOW BEAM NOTCH, WHICHEVER IS LESS. #5 (TOP) BARS TO TERMINATE TO PROVIDE 2" MIN. COVER TO BEAM REAR FACE OR 1'-3" BELOW BEAM NOTCH, WHICHEVER IS LESS.



- GENERAL NOTES:**
- DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL, PART 4, D5.4.3.6P.
  - EPOXY COAT ALL REBARS FOR A DISTANCE OF 9'-0" FROM BEAM ENDS ADJACENT TO DECK JOINTS.
  - EPOXY COAT ALL REINFORCEMENT WHICH PROTRUDES INTO BRIDGE DECK FROM TOP OF BEAMS.
  - SHOW DESIGN LENGTH AND CASTING LENGTH ON SHOP DRAWINGS.
  - SHOW PLAN, ELEVATION, SECTIONS AND ALL REINFORCEMENT DETAILS ON SHOP DRAWINGS.
  - SHOW ANY MODIFICATIONS TO REINFORCEMENT SPLICE AND BENDING DETAILS ON SHOP DRAWINGS.
  - CALCULATE BEARING SEAT ELEVATION, DAPPING DIMENSIONS, SLOPE AND HAUNCH DEPTH USING THE FINAL NET CAMBER - "C".
  - SHOW THE FOLLOWING DATA ON THE SHOP DRAWINGS:  
1) THE SIZE AND LOCATION OF THE TEMPORARY STORAGE SUPPORTS.  
2) THE TYPE AND LOCATION OF THE BRACING AND TEMPORARY SUPPORTS USED FOR THE TRANSPORTATION AND ERECTION OF THE BEAMS.
  - END ZONE REINFORCEMENT MAY BE INCREASED BY FABRICATOR TO REFLECT FABRICATOR'S EXPERIENCE AND/OR TO CONTROL CRACKING. WIRE MESH OF EQUIVALENT AREA IS PERMISSIBLE FOR CRACK CONTROL REINFORCEMENT.
  - FABRICATOR TO CHECK STABILITY FOR HANDLING AND TRANSPORTING OF THE MEMBERS.
  - END REINFORCEMENT SPACING MAY BE REDUCED AS REQUIRED TO SATISFY SHEAR REINF. REQUIREMENTS, BUT DO NOT REDUCE THE MINIMUM AREA TO BE REINFORCED.
  - MINIMUM COVER ON REINFORCEMENT BARS:  
TOP SLAB - 1"  
INSIDE VOID - 1"  
ELSEWHERE - 2" UNLESS OTHERWISE NOTED
  - THE VERTICAL MILD-STEEL REINFORCEMENT (BARS A1, A2, AND A3) SHOWN ARE MINIMUMS. THE DESIGN MAY REQUIRE ADDITIONAL VERTICAL MILD-STEEL REINFORCEMENT.
  - INTERFACE SHEAR REINFORCEMENT SHOWN ARE #4 BARS, A1, WITH 21" MAXIMUM SPACING. FOR #5 BARS, THE MAXIMUM SPACING IS 21".
  - FOR BEAM CAMBER DIAGRAM, SEE BD-662M.

|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| BD-601M            | CONCRETE DECK SLAB                                                                        |
| BD-628M            | BRIDGE APPROACH SLABS                                                                     |
| BD-651M            | REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS |
| BD-652M            | P/S BEAM SIZES AND SECTION PROPERTIES                                                     |
| BD-653M            | TYPICAL FRAMING PLANS AND DETAILS                                                         |
| BD-655M            | TYPICAL SUPERSTRUCTURE SECTIONS                                                           |
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS                                                             |
| BD-657M            | I-BEAM AND BOX BEAM BRIDGES                                                               |
| BD-662M            | I-BEAM REINFORCEMENT DETAILS                                                              |
| BD-665M            | CONTINUITY FOR LIVE LOAD DETAILS - BOX BEAM BRIDGES                                       |
| BC-701M            | PROTECTIVE FENCE                                                                          |
| BC-711M            | ALUMINUM PROTECTIVE BARRIER                                                               |
| BC-716M            | ALUMINUM PEDESTRIAN RAILING                                                               |
| BC-720M            | ALUMINUM OR STEEL BRIDGE HAND RAILING                                                     |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                                                     |
| BC-755M            | BEARINGS                                                                                  |
| BC-775M            | MISCELLANEOUS PRESTRESS DETAILS                                                           |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS                                               |
| REFERENCE DRAWINGS |                                                                                           |

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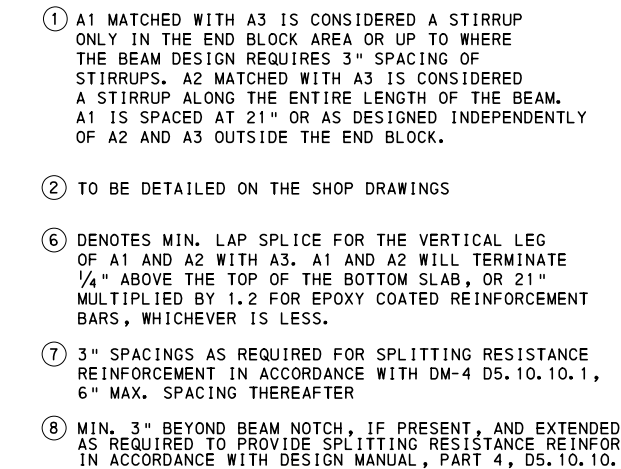
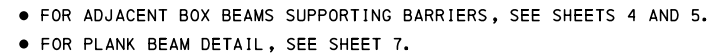
STANDARD  
BOX BEAM REINFORCEMENT DETAILS  
ADJACENT BOX BEAM

RECOMMENDED NOV. 23, 2022  
L. D. W. G.  
CHIEF BRIDGE ENGINEER

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Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

SHEET 1 OF 8  
BD-661M

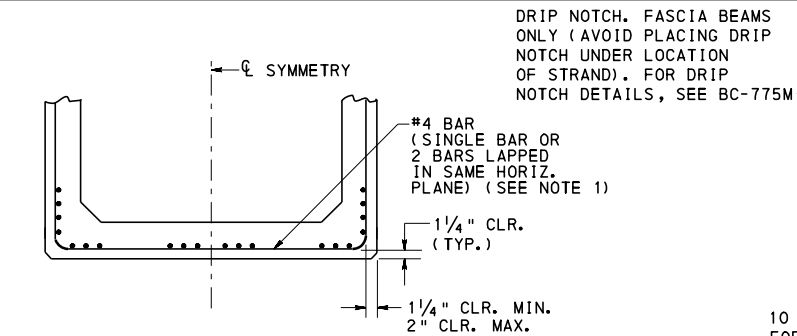
1. FOR ALTERNATE END BLOCK REINFORCEMENT DETAIL, SEE SHEET 6.
2. #4 BARS, A1, WITH 21" MAXIMUM SPACING ARE SHOWN AS INTERFACE SHEAR REINFORCEMENT. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #5 WITH A 21" MAXIMUM SPACING BARS MAY BE USED INDICATING THE APPROPRIATE MINIMUM LAP SPLICE LENGTH.
3. OMIT SHEAR KEY ON THE FASCIA SIDE OF BEAMS.
4. FOR TYPICAL CORNER BLOCKOUT DETAIL, SEE BC-775M.
5. IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN IN THE END BLOCK REINFORCEMENT DETAIL TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DESIGN MANUAL, PART 4, D5.10.10.1, ALTERNATE A1 AND A2 WITH A3 TO THE END OF THE 3" STIRRUP SPACING.



# STANDARD BOX BEAM REINFORCEMENT DETAILS ADJACENT BOX BEAM

|                                                                                                                                                    |                                                                                                                                                             |                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| RECOMMENDED <u>NOV. 23, 2022</u><br><br>CHIEF BRIDGE ENGINEER | RECOMMENDED <u>NOV. 23, 2022</u><br><br>CHIEF ENGINEER, HIGHWAY ADMIN. | SHEET 2 OF 8<br><br>BD-661M |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|

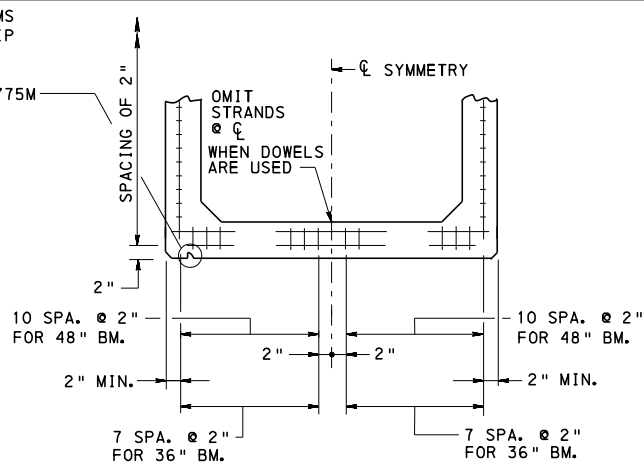




TYPICAL  
STRAND CONFINEMENT  
ALL BEAMS

STRAND CONFINEMENT NOTES:

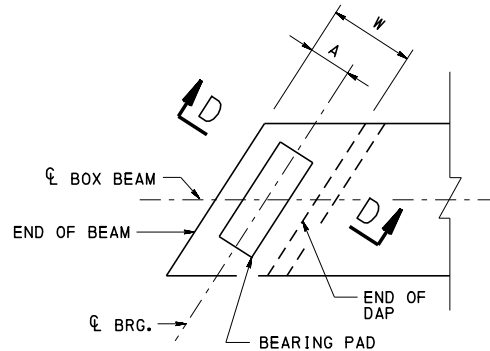
1. FOR LIMITS OF STRAND CONFINEMENT REINFORCEMENT, REFER TO DESIGN MANUAL, PART 4, **D5.9.4.4.2.**



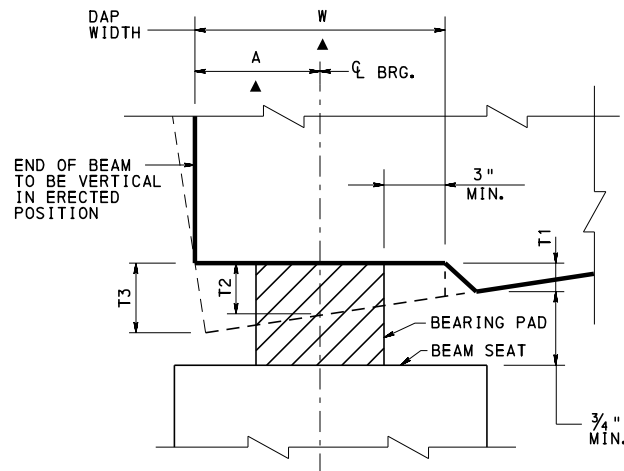
TYPICAL  
STRAND PATTERN  
ALL BEAMS

STRAND PATTERN NOTES:

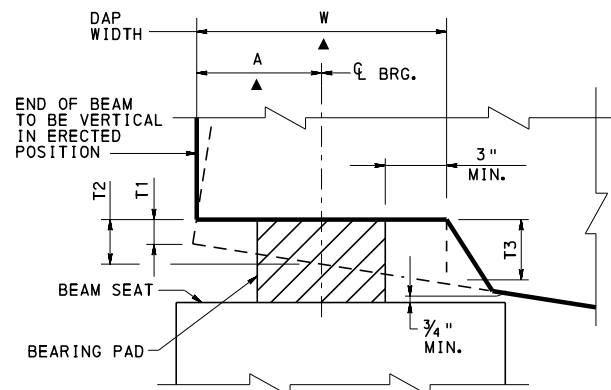
1. DO NOT PLACE MORE THAN ONE COLUMN OF PRESTRESSING STRANDS IN THE WEBS.
2. DO NOT PLACE PRESTRESSING STRANDS AT CORNER LOCATION IN BOTTOM ROW.
3. DO NOT PLACE PRESTRESSING STRANDS AT LOCATIONS THAT CONFLICT WITH TRANSVERSE TENDON POCKET.
4. IF SPLICE CHUCK POCKET IS REQUIRED FOR STAGING, PLACE NO STRANDS ABOVE THE TRANSVERSE TENDON POCKET.



PLAN



SECTION D-D AT  
LOW END OF BEAM



SECTION D-D AT  
HIGH END OF BEAM

BEAM DAP DETAILS

▲ - MEASURED NORMAL TO CL BEARINGS

BEAM DAP NOTES:

1. T1 IS DAP THICKNESS AT END OF BEAM FOR HIGHER END OF BEAM AND DAP THICKNESS AT BEGINNING OF DAP FOR LOWER END OF BEAM. T1 MINIMUM IS 1/4".
2. T2 IS DAP THICKNESS AT CENTERLINE OF BEARING.
3. T3 IS DEFINED AS THE DAP THICKNESS BASED ON THE SLOPE OF THE BEAM DUE TO THE GRADE AND CAMBER.
4. BEAM SEAT AND BOTTOM OF BEAM BEARING AREA REQUIREMENTS AS PER DESIGN MANUAL, PART 4, SECTION 14.7.6.3.9dP.
5. MAXIMUM GRADE FOR USE OF DAPPING IS BASED ON LIMITING THE MAXIMUM DAP THICKNESS TO 1 1/2" AND MAINTAINING 1" MINIMUM CONCRETE COVER ON CONFINEMENT REINFORCEMENT IN THE PROPOSED BEAM DAPPING AREA.
6. FOR BEAM DAPPING, A MINIMUM CLEARANCE OF 3/4" MUST BE PROVIDED BETWEEN THE BOTTOM OF THE BEAM (WITHOUT CONSIDERATION OF THE DAP) AND THE TOP OF BEAM SEAT TO ENSURE INSPECTABILITY OF BEARING PAD.
7. PARTIAL-WIDTH BEAM DAPS ARE NOT PERMITTED.
8. THE MAXIMUM DAP THICKNESS IS 1 1/2".
9. ENSURE THAT ALL CONCRETE COVER REQUIREMENTS ON STEEL CONFINEMENT REINFORCEMENT AND PRESTRESSING STRANDS ARE SATISFIED WHEN USING BEAM DAPS TO MODIFY THE BOTTOM OF BEAM AREA.
10. WHEN BEAM DAPS ARE USED AND THE BEAM (AND BEARING PAD) IS ON THE SKEW, THE BEAM SEAT MUST SLOPE TO ENSURE EVEN BEARING PRESSURE ON THE PADS.

| MAXIMUM<br>REQUIRED<br>DAP DEPTH<br>(T3) | DISTANCE<br>TO FIRST ROW<br>OF STRANDS<br>(IN.) | BOTTOM<br>FLANGE THICKNESS<br>(BOX BEAMS)<br>(IN.) |
|------------------------------------------|-------------------------------------------------|----------------------------------------------------|
| 1/4 < (T3) ≤ 3/4                         | 2 1/2                                           | 6                                                  |
| 3/4 < (T3) ≤ 1 1/4                       | 3                                               | 6 1/2                                              |
| 1 1/4 < (T3) ≤ 1 1/2                     | 3 1/4                                           | 7                                                  |
| 1 1/2 < (T3) *                           | 2                                               | 5 1/2 *                                            |

\* USE BEVELED SOLE PLATE, SEE BC-755M.

BOX BEAM DAP DESIGN PARAMETERS

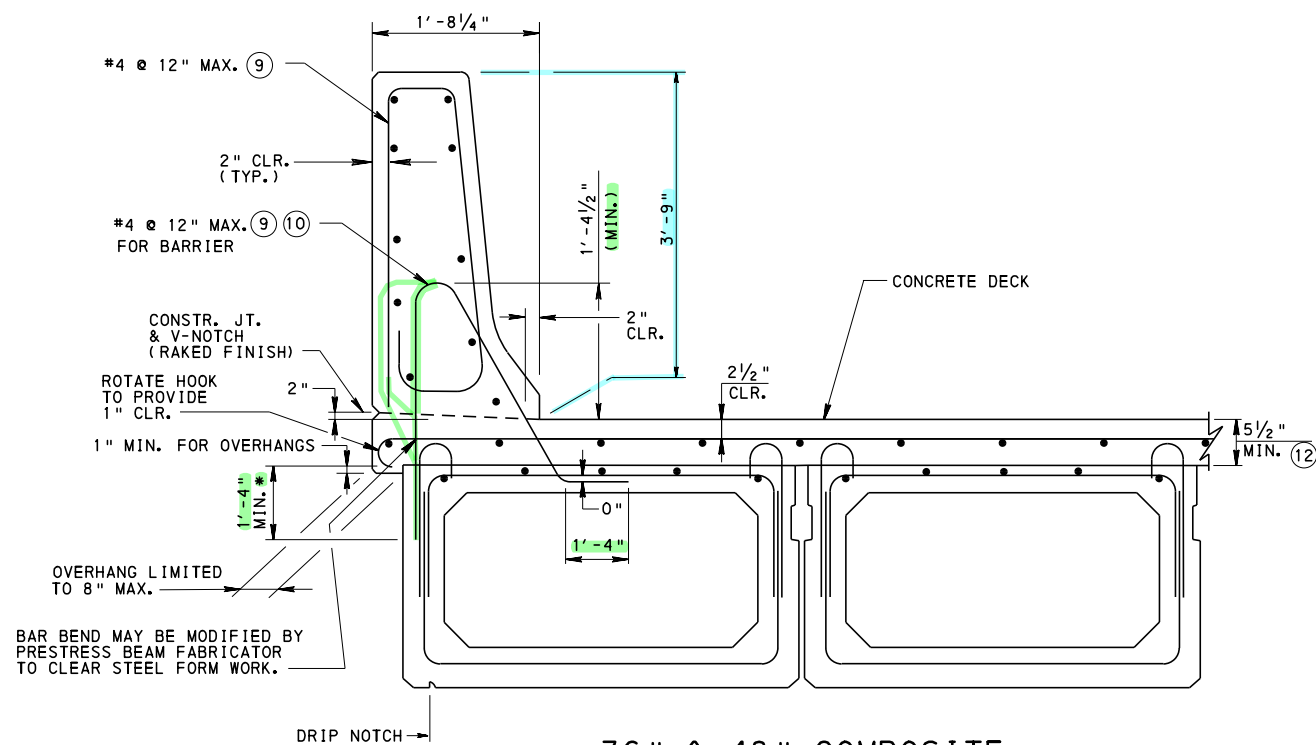
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BRIDGE OFFICE

STANDARD  
BOX BEAM REINFORCEMENT DETAILS  
STRAND PATTERN AND BEAM DAP

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SHEET 3 OF 8  
BD-661M



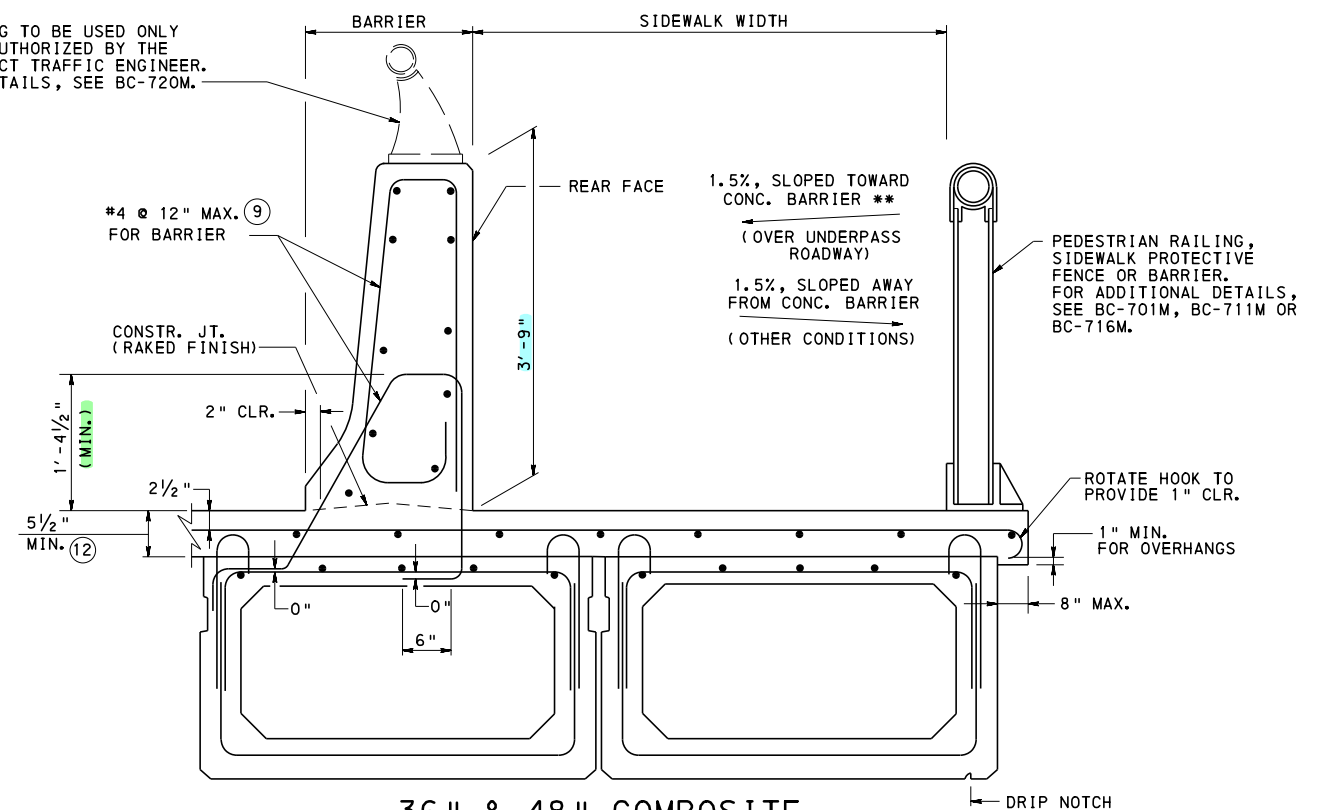
### 36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING F-SHAPE BARRIER

#### NOTES:

- 45" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 42" F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.

\* OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM

RAILING TO BE USED ONLY WHEN AUTHORIZED BY THE DISTRICT TRAFFIC ENGINEER. FOR DETAILS, SEE BC-720M.



### 36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK

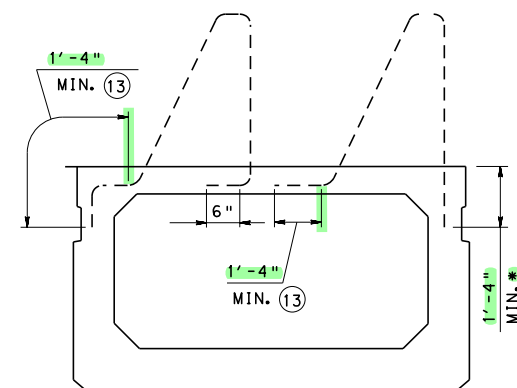
#### NOTES:

- 45" F-SHAPE CONCRETE BARRIER SHOWN, 32" AND 42" F-SHAPE CONCRETE BARRIER AND PLANK BEAM IS SIMILAR.

\*\* DRAIN RUNOFF THROUGH CONC. BARRIER WITH CURB DRAIN. SET SIDEWALK ELEVATION AT REAR FACE OF BARRIER 1" ABOVE GUTTERLINE ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR TRANSVERSE DECK REINFORCEMENT BARS.

#### NOTES

- FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BRIDGE BARRIERS NOT SHOWN, SEE BD-601M.
- FOR WATERPROOFING DETAIL AT SHEAR KEY, SEE BC-788M.



### REINFORCEMENT DETAIL FOR BARRIERS WITH TYPICAL SIDEWALK

\* OR 1/4" ABOVE BOTTOM SLAB THICKNESS OF BEAM

#### LEGEND

- WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE, REDUCE SPACING OF REINFORCING BARS TO HALF THE SPACING SHOWN. FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS SHOWN ON BD-622M AND BD-624M.
- BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.
- USE ONLY WHEN ROADWAY AND SIDEWALK WIDTHS PERMIT THE HORIZONTAL LEGS OF THE BARRIER BAR TO BE EMBEDDED ENTIRELY WITHIN ONE BEAM. ROADWAY/SIDEWALK WIDTHS MAY NEED ADJUSTED TO ACCOMMODATE THIS CONDITION.
- INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD PER DESIGN MANUAL, PART 4, DC5.12.3.3.8.
- MAINTAIN MIN. EMBEDMENT LENGTH OF 1'-4" FROM TOP OF BEAM TO END OF REINFORCEMENT (MEASURED ALONG OUTSIDE EDGE OF THE REINFORCEMENT).
- IF THE 32" F-SHAPE CONCRETE BARRIER IS USED, THE COMBINED HEIGHT OF THE BARRIER AND RAILING MUST BE 3'-6" MINIMUM.

#### REINFORCEMENT BAR NOTES

- REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

#### ADJACENT BOX BEAM SUPPORTING BARRIER/SIDEWALK NOTES:

- FOR BEAM DIMENSIONS AND BEAM REINFORCEMENT, SEE SHEET 2.
- REINFORCEMENT BARS PROTRUDING FROM THE BOX BEAM TO THE BARRIER MUST RESIDE IN ONE BEAM.

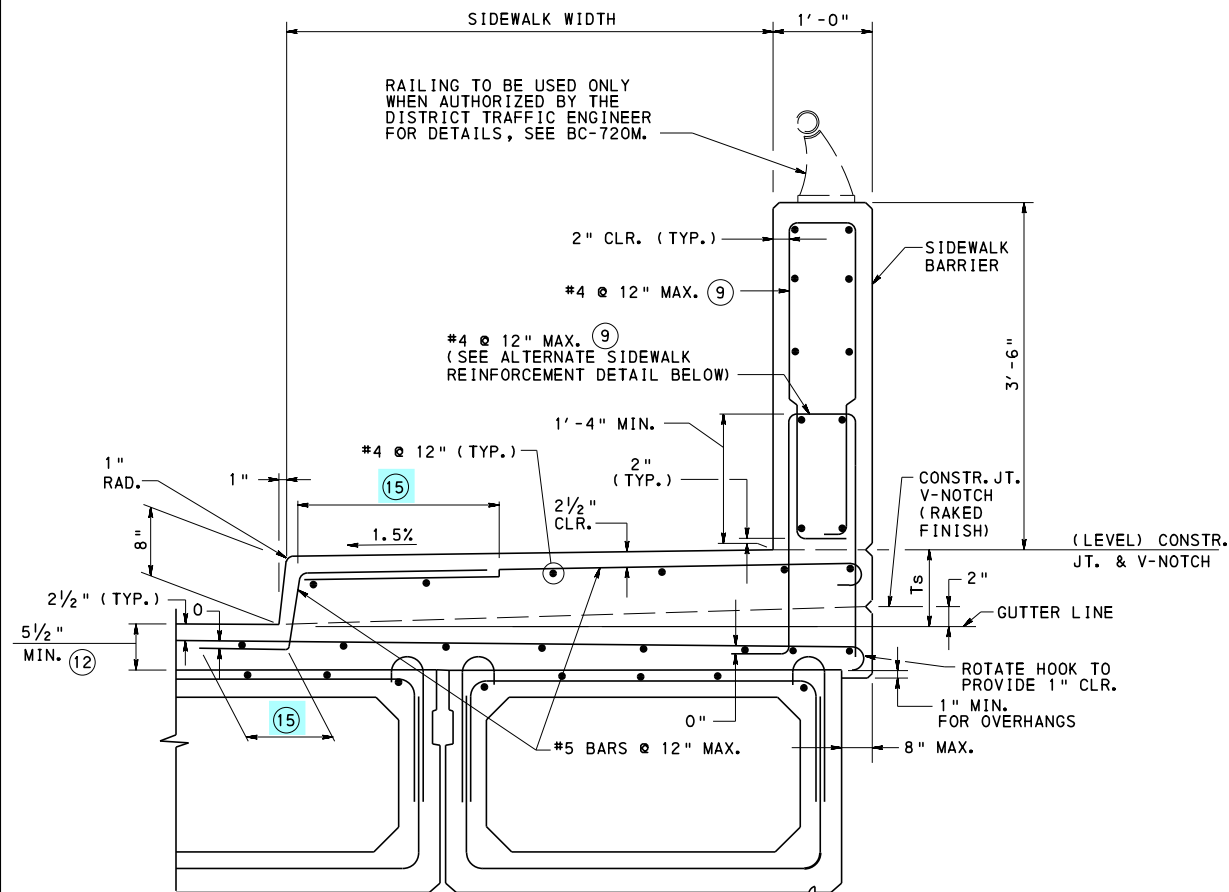
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STANDARD  
BOX BEAM REINFORCEMENT DETAILS  
ADJACENT BOX BEAM

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CHIEF BRIDGE ENGINEER

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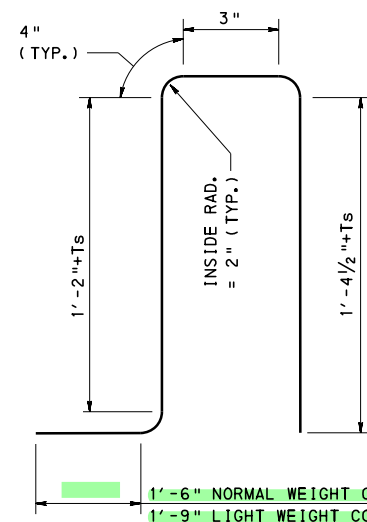
SHEET 4 OF 8  
BD-661M



36" & 48" COMPOSITE  
ADJACENT BOX BEAMS  
SUPPORTING ALTERNATE SIDEWALK  
WITH 42" VERTICAL WALL CONCRETE BARRIER

ADJACENT BOX BEAM SUPPORTING  
BARRIER/SIDEWALK NOTES:

1. FOR BEAM DIMENSIONS AND BEAM REINFORCEMENT, SEE SHEET 2.
2. FOR REINFORCEMENT BAR DETAILS OF THE SIDEWALK BARRIER, SEE BD-601M.



ALTERNATE SIDEWALK  
REINFORCEMENT DETAIL

REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

LEGEND

- 9 WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE, REDUCE SPACING OF REINFORCING BARS TO HALF THE SPACING SHOWN. FOR END OF BARRIER TRANSITIONING TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.
- 12 INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD PER DESIGN MANUAL, PART 4, DC5.12.3.3.8.
- 15 FOR DIMENSION, SEE BD-601M, SHEET 4.

NOTES

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BRIDGE BARRIERS NOT SHOWN, SEE BD-601M.

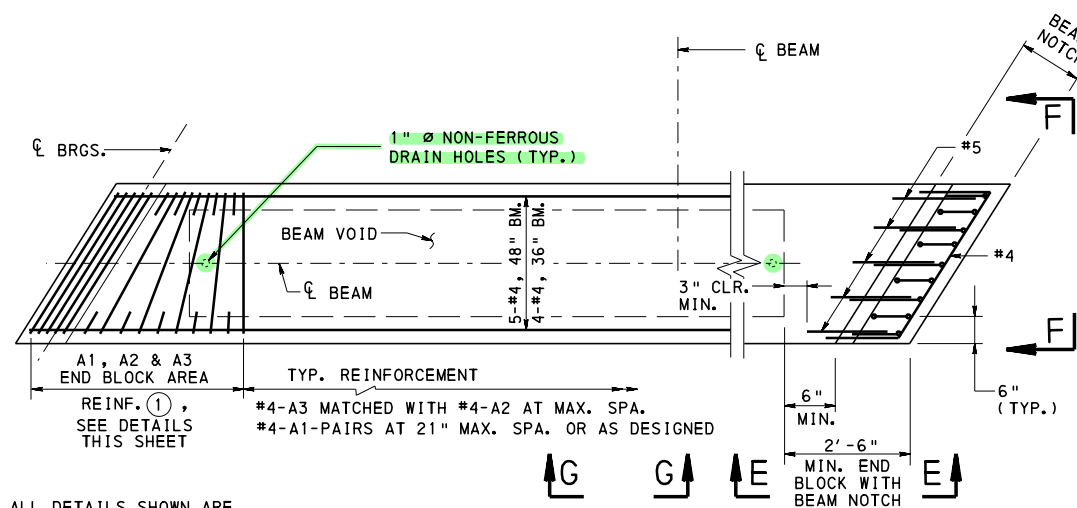
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STANDARD  
BOX BEAM REINFORCEMENT DETAILS  
ADJACENT BOX BEAM

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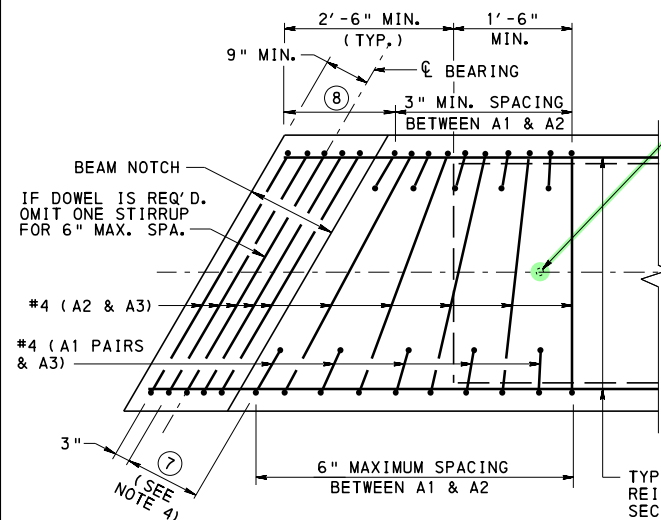
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SHEET 5 OF 8  
BD-661M

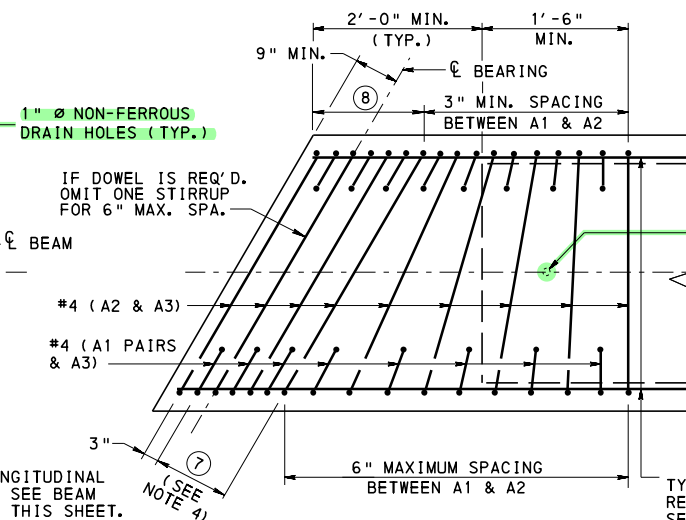


NOTE: ALL DETAILS SHOWN ARE TYPICAL FOR BOTH ENDS.

PLAN - SPREAD BOX BEAM  
BEAM REINFORCEMENT

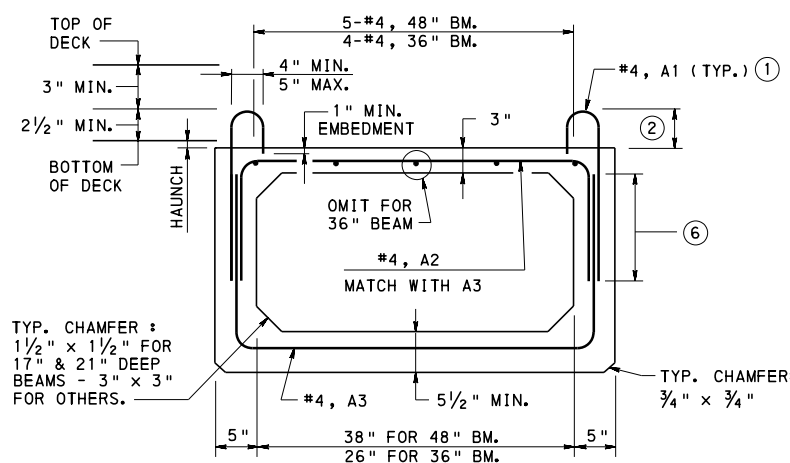


SPREAD BOX BEAM  
WITH BEAM NOTCH

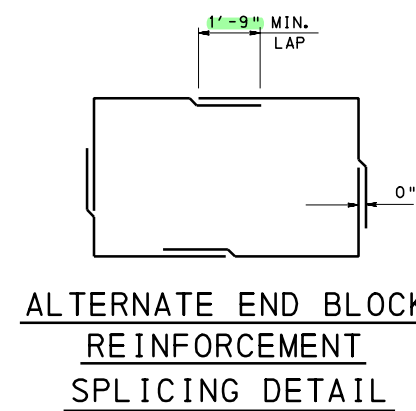


SPREAD BOX BEAM  
WITHOUT BEAM NOTCH

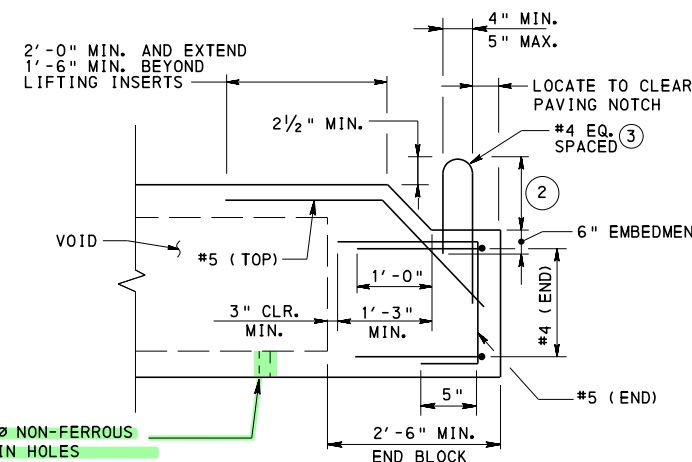
END BLOCK REINFORCEMENT



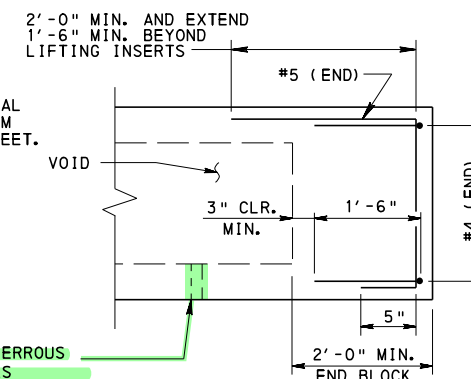
SPREAD BOX BEAM SECTION



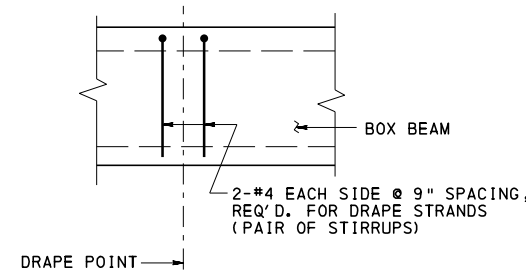
ALTERNATE END BLOCK  
REINFORCEMENT  
SPlicing DETAIL



VIEW E-E  
END ELEVATION  
WITH BEAM NOTCH



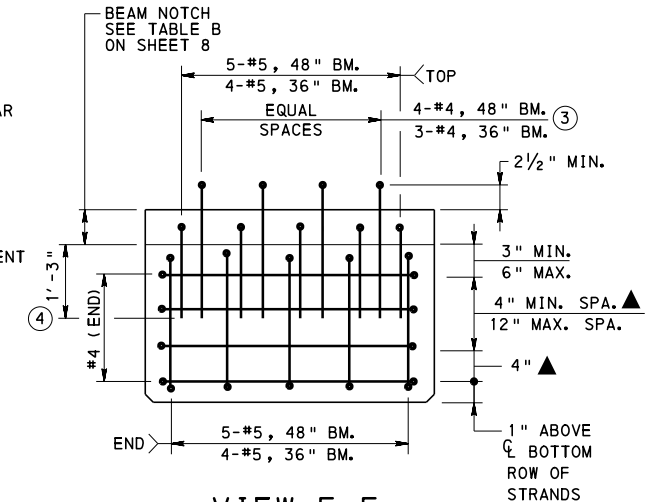
VIEW E-E  
END ELEVATION  
WITHOUT BEAM NOTCH



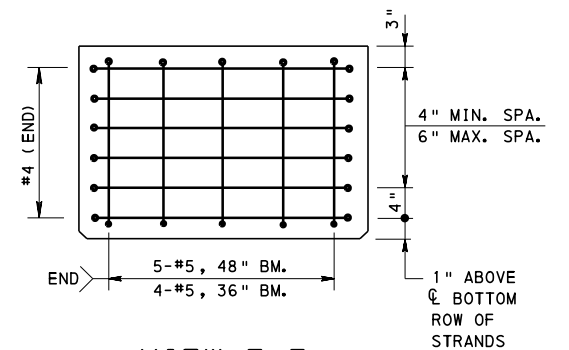
BEAM ELEVATION  
SECTION G-G

SPREAD BOX BEAM NOTES:

- SEE THIS SHEET FOR ALTERNATE END BLOCK REINFORCEMENT DETAIL.
- #4 BARS, A1, WITH 21" MAXIMUM SPACING ARE SHOWN AS INTERFACE SHEAR REINFORCEMENT. IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #5 WITH A 21" MAXIMUM SPACING BARS MAY BE USED INDICATING THE APPROPRIATE MINIMUM LAP SPLICE LENGTH.
- FOR TYPICAL CORNER BLOCKOUT DETAIL, SEE BC-775M.
- IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN IN THE END BLOCK REINFORCEMENT DETAIL TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DESIGN MANUAL, PART 4, D5.10.10.1, ALTERNATE A1 AND A2 WITH A3 TO THE END OF THE 3" STIRRUP SPACING.
- FOR LEGEND NOTES ①, ②, ③, ④, ⑥, ⑦ AND ⑧ SEE LEGEND ON SHEETS 1 AND 2.



VIEW F-F  
WITH BEAM NOTCH



VIEW F-F  
WITHOUT BEAM NOTCH

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DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
BOX BEAM REINFORCEMENT DETAILS  
SPREAD BOX BEAM

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SHEET 6 OF 8  
BD-661M



PLAN - 12" DEEP PLANK BEAM



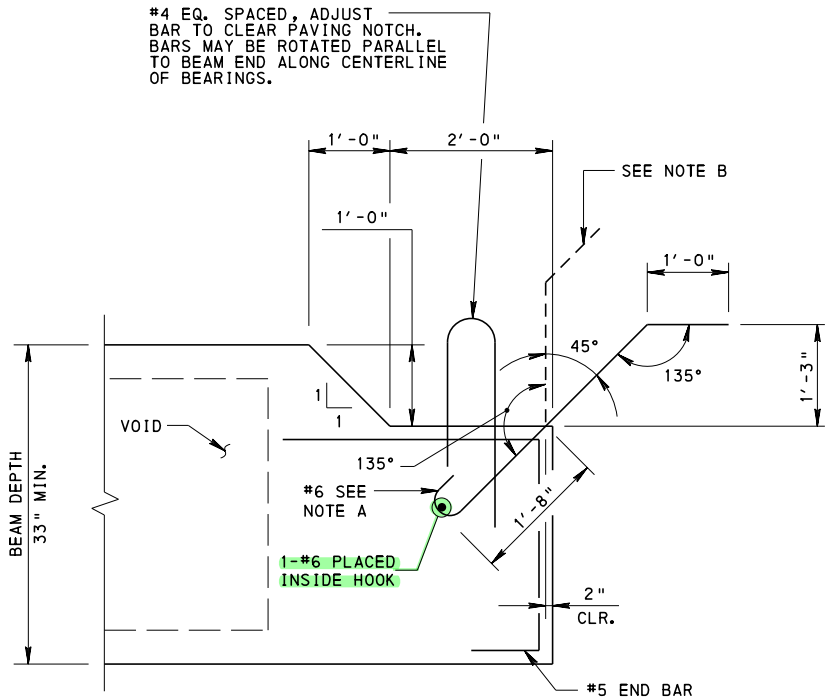
1. IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DM-4 D5.10.10.1, CONTINUE THE 3" STIRRUP SPACING.



| TABLE A<br>BEAM NOTCH DEPTHS FOR COMPOSITE ADJACENT BOX BEAMS |          |                                       |                   |
|---------------------------------------------------------------|----------|---------------------------------------|-------------------|
| APPROACH<br>SLAB TYPE<br>(SEE NOTE 1)                         | BACKWALL | BEAM NOTCH DEPTH                      | REMARKS           |
| 1                                                             | YES      | 4½" FOR 17" BEAM DEPTHS               |                   |
|                                                               |          | 6" FOR BEAM DEPTHS > 17"              |                   |
| 1                                                             | NO       | 4½" FOR 17" BEAM DEPTHS               | SEE NOTE 2        |
|                                                               |          | 6" FOR 21" AND 24" BEAM DEPTHS        |                   |
|                                                               |          | 10" FOR BEAM DEPTHS 27" AND GREATER   |                   |
| 2                                                             | YES      | 4½" FOR 17" BEAM DEPTHS               |                   |
|                                                               |          | 6" FOR BEAM DEPTHS > 17"              |                   |
| 2                                                             | NO       | 4½" FOR 17" BEAM DEPTHS               | SEE NOTE 3        |
|                                                               |          | 6" FOR 21", 24" AND 27" BEAM DEPTHS   |                   |
|                                                               |          | 1'-3" FOR BEAM DEPTHS 30" AND GREATER |                   |
| 3                                                             | YES      | 1'-0" FOR BEAM DEPTHS 33" AND GREATER | SEE NOTES 4 AND 5 |
| 4                                                             | YES      | 1'-0" FOR BEAM DEPTHS 33" AND GREATER | SEE NOTES 4 AND 5 |
| 5                                                             | N/A      | N/A                                   |                   |
| RC-23M                                                        | N/A      | 4½" FOR 17" BEAM DEPTHS               | SEE NOTE 6        |
|                                                               |          | 6" FOR BEAM DEPTHS > 17"              |                   |
| NO APPROACH<br>SLAB                                           | N/A      | 4½" FOR 17" BEAM DEPTHS               | SEE NOTES 7 AND 8 |
|                                                               |          | 6" FOR BEAM DEPTHS > 17"              |                   |

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17", 21" AND 24" DEEP BEAMS.
3. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17", 21", 24" AND 27" DEEP BEAMS.
4. BACKWALL PLACED UNDER APPROACH SLAB.
5. TYPE 3 AND 4 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 33".  
USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
6. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
7. OMIT BEAM NOTCH FOR PLANK BEAMS AND PIER ENDS FOR BEAMS MADE CONTINUOUS.
8. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
9. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.



ADJACENT BOX BEAM WITH TYPE 3 OR 4 APPROACH SLAB  
(ADDITIONAL REINFORCEMENT BAR)

| TABLE B<br>BEAM NOTCH DEPTHS FOR SPREAD BOX BEAMS |          |                                                                        |                   |
|---------------------------------------------------|----------|------------------------------------------------------------------------|-------------------|
| APPROACH<br>SLAB TYPE<br>(SEE NOTE 1)             | BACKWALL | BEAM NOTCH DEPTH                                                       | REMARKS           |
| 1                                                 | YES      | 3½"                                                                    | SEE NOTE 2        |
| 1                                                 | NO       | 3½" FOR 17" AND 21" BEAM DEPTHS<br>7½" FOR BEAM DEPTHS 24" AND GREATER |                   |
| 2                                                 | YES      | 3½"                                                                    |                   |
| 2                                                 | NO       | 3½" FOR 17", 21", 24" AND 27" BEAM DEPTHS                              | SEE NOTE 3        |
|                                                   |          | 1'-0½" FOR BEAM DEPTHS 30" AND GREATER                                 |                   |
| 3                                                 | YES      | 9½" FOR BEAM DEPTHS 39" AND GREATER                                    | SEE NOTES 4 AND 5 |
| 4                                                 | YES      | 9½" FOR BEAM DEPTHS 39" AND GREATER                                    | SEE NOTES 4 AND 5 |
| 5                                                 | N/A      | N/A                                                                    |                   |
| RC-23M                                            | N/A      | 3½"                                                                    | SEE NOTE 6        |
| NO APPROACH<br>SLAB                               | N/A      | 3½"                                                                    | SEE NOTES 7 AND 8 |

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17" AND 21" DEEP BEAMS.
3. SUPPORT APPROACH SLAB ON ABUTMENT FOR 17", 21", 24" AND 27" DEEP BEAMS.
4. BACKWALL PLACED UNDER APPROACH SLAB.
5. TYPE 3 AND 4 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 39".  
USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
6. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
7. OMIT BEAM NOTCH FOR PLANK BEAMS AND PIER ENDS FOR BEAMS MADE CONTINUOUS.
8. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
9. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

NOTE A:

PROVIDE 5 BARS FOR 48" WIDE BEAMS.  
PROVIDE 4 BARS FOR 36" WIDE BEAMS.  
MATCH WITH #5 END BAR.

NOTE B:

LOCATION OF BAR FOR BEAM CASTING. AFTER  
BEAM IS CAST, BEND BAR AS REQUIRED TO SHAPE  
SHOWN. FOR ALTERNATE REBAR DETAILS, SEE  
BD-628M, SHEET 24.

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BRIDGE OFFICE

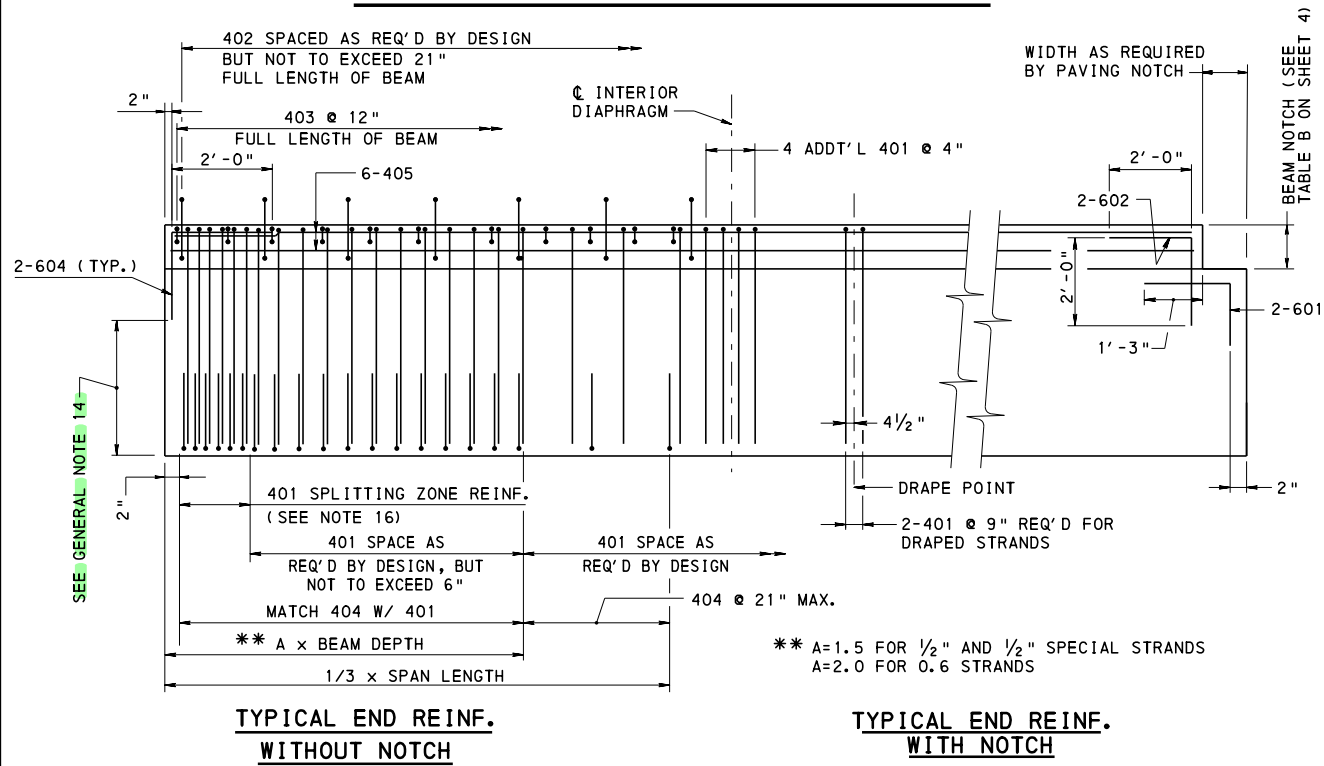
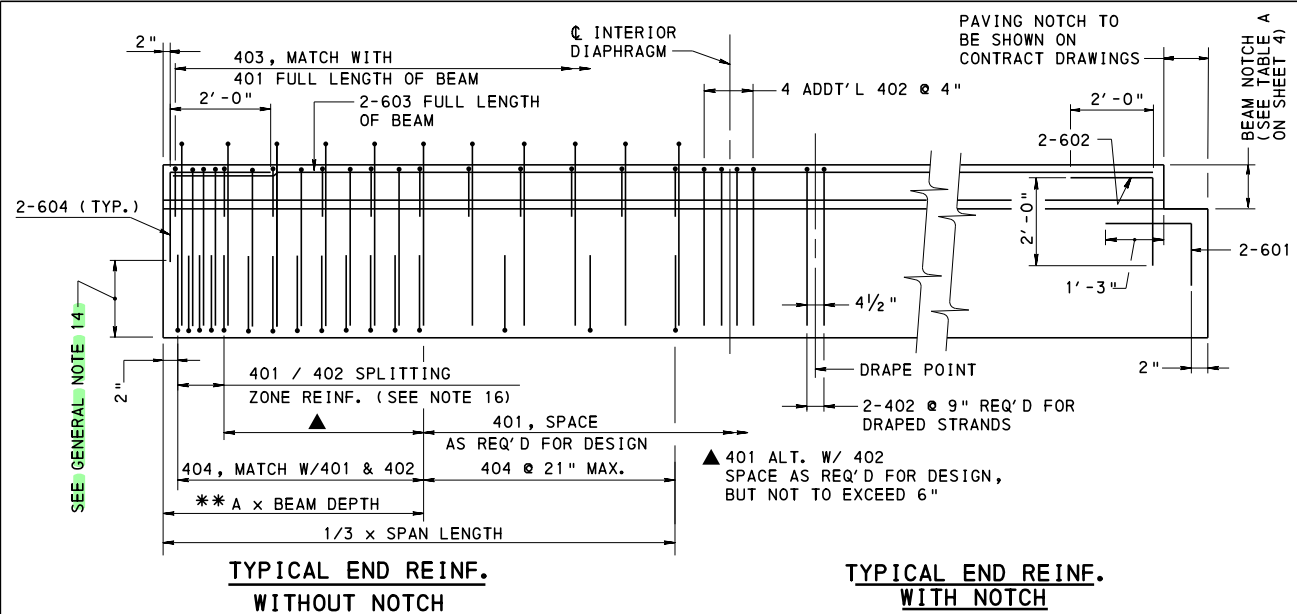
STANDARD  
BOX BEAM REINFORCEMENT DETAILS  
BEAM NOTCH TABLES

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION

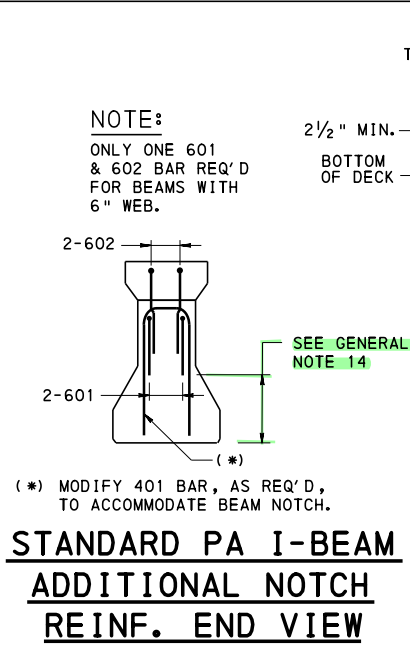
SHEET 8 OF 8  
BD-661M

CHANGE 2

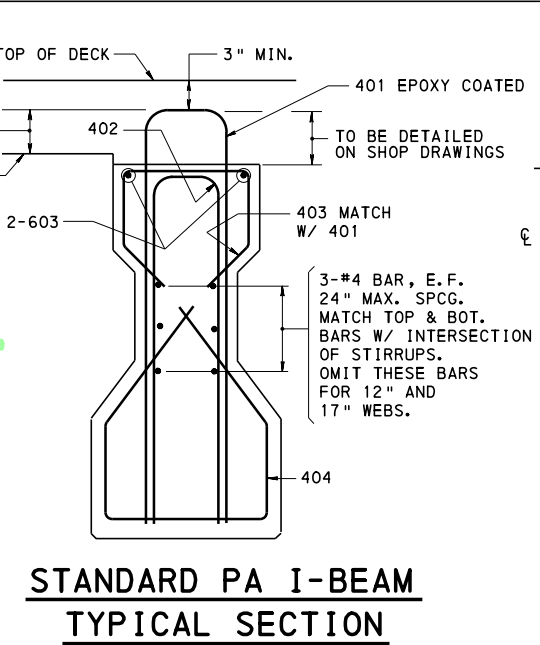
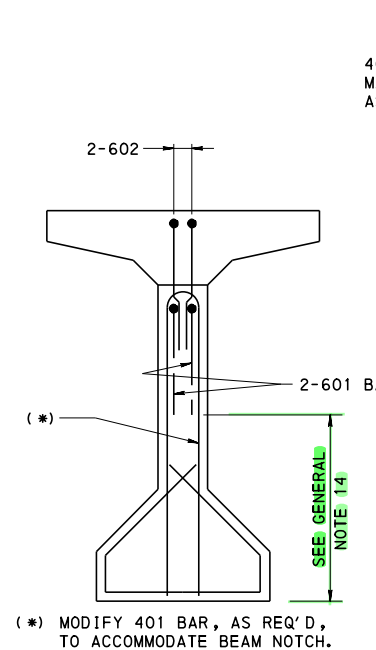


**GENERAL NOTES:**

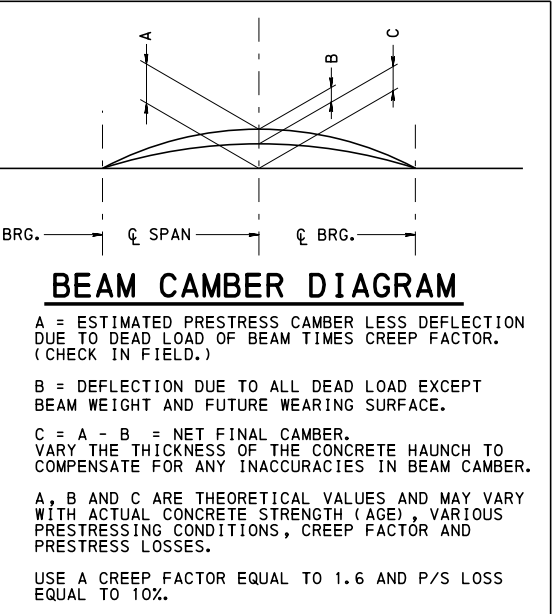
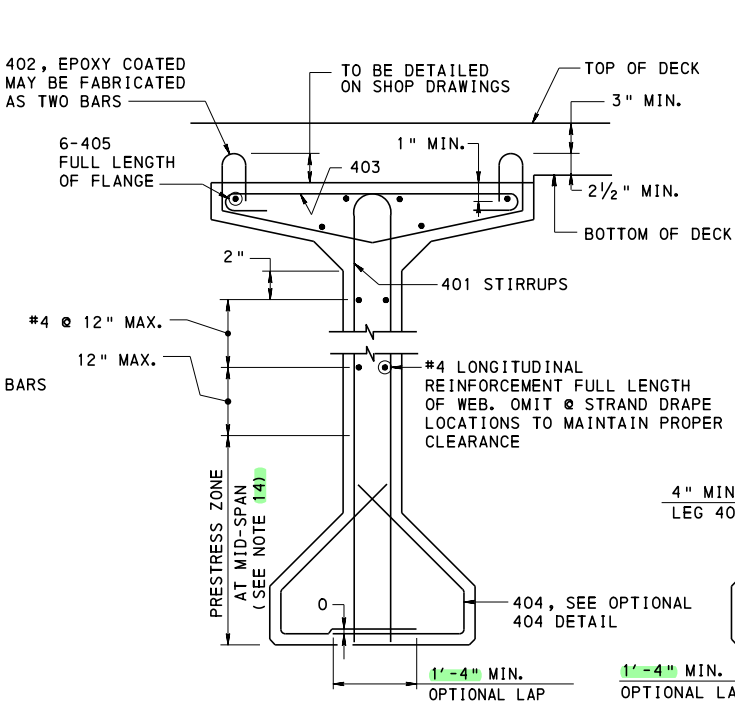
1. PROVIDE MATERIAL AND WORK QUALITY IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
2. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, D5.4.3.6P.
3. EPOXY COAT ALL REBARS FOR A DISTANCE OF 9'-0" FROM BEAM ENDS ADJACENT TO DECK JOINTS.
4. EPOXY COAT ALL REINFORCEMENT WHICH PROTRUDES INTO BRIDGE DECK FROM TOP OF BEAMS.
5. SHOW DESIGN LENGTH AND CASTING LENGTH ON SHOP DRAWINGS.
6. SHOW PLAN, ELEVATION, SECTIONS AND ALL REINFORCEMENT DETAILS ON SHOP DRAWINGS.
7. SHOW ANY MODIFICATIONS TO REINFORCEMENT SPLICE AND BENDING DETAILS ON SHOP DRAWINGS.
8. CALCULATE BEARING SEAT ELEVATION, SLOPE AND HAUNCH DEPTH USING THE NET FINAL CAMBER - "C".
9. SHOW THE FOLLOWING DATA ON THE SHOP DRAWINGS:
  - 1) THE SIZE AND LOCATION OF THE TEMPORARY STORAGE SUPPORTS.
  - 2) THE TYPE AND LOCATION OF THE BRACING AND TEMPORARY SUPPORTS USED FOR THE TRANSPORTATION AND ERECTION OF THE BEAMS.
10. END ZONE REINFORCEMENT MAY BE INCREASED BY FABRICATOR TO REFLECT FABRICATOR'S EXPERIENCE AND/OR TO CONTROL CRACKING.
11. FABRICATOR TO CHECK STABILITY FOR HANDLING AND TRANSPORTING OF THE MEMBERS.
12. TEMPERATURE REINFORCEMENT IN WEB MAY BE OMITTED, BUT ONLY IN THE AREA WHERE IT INTERFERS WITH DRAPED PRESTRESSING STRANDS.
13. MIN. COVER : STIRRUPS - 1" MIN. ALL OTHERS - 1 1/2" MIN.
14. PRESTRESS ZONE IS DEFINED AS THE DISTANCE FROM THE BOTTOM OF BEAM TO THE TOP ROW OF STRANDS.
15. #5 SIZE BARS MAY BE USED FOR SHEAR STIRRUPS IF THE REQUIRED SPACING FOR #4 BARS IS LESS THAN 3".
16. TO SATISFY THE AREA REQUIREMENTS IN AASHTO LRFD ARTICLE 5.9.4.4.1, USE 3" SPACING FOR 401 AS LONG AS REQUIRED BY DESIGN.
17. BEAM FABRICATORS ARE REQUIRED TO SHOW SUPPLEMENTAL WEB REINFORCEMENT ON SHOP DRAWINGS AT THE ENDS OF 96" DEEP I-BEAMS ADJACENT TO CONTINUITY DIAPHRAGMS.
18. FOR PA BULB-TEE BEAM DETAILS, SEE SHEET 2.



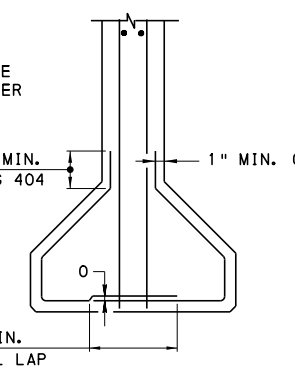
**AASHTO I-BEAM ADDITIONAL NOTCH REINF. END VIEW**



**AASHTO I-BEAM TYPICAL SECTION**



**OPTIONAL 404 DETAIL**



|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| BD-601M            | CONCRETE DECK SLAB                                                                        |
| BD-628M            | BRIDGE APPROACH SLABS                                                                     |
| BD-651M            | REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCK, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS |
| BD-652M            | P/S BEAM SIZES AND SECTION PROPERTIES                                                     |
| BD-653M            | TYPICAL FRAMING PLANS AND DETAILS                                                         |
| BD-655M            | TYPICAL SUPERSTRUCTURE SECTIONS                                                           |
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS                                                             |
| BD-657M            | I-BEAM AND BOX BEAM BRIDGES                                                               |
| BD-664M            | CONTINUITY FOR LIVE LOAD DETAILS - I-BEAM AND PA BULB-TEE BEAM BRIDGES                    |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                                                     |
| BC-755M            | BEARINGS                                                                                  |
| REFERENCE DRAWINGS |                                                                                           |

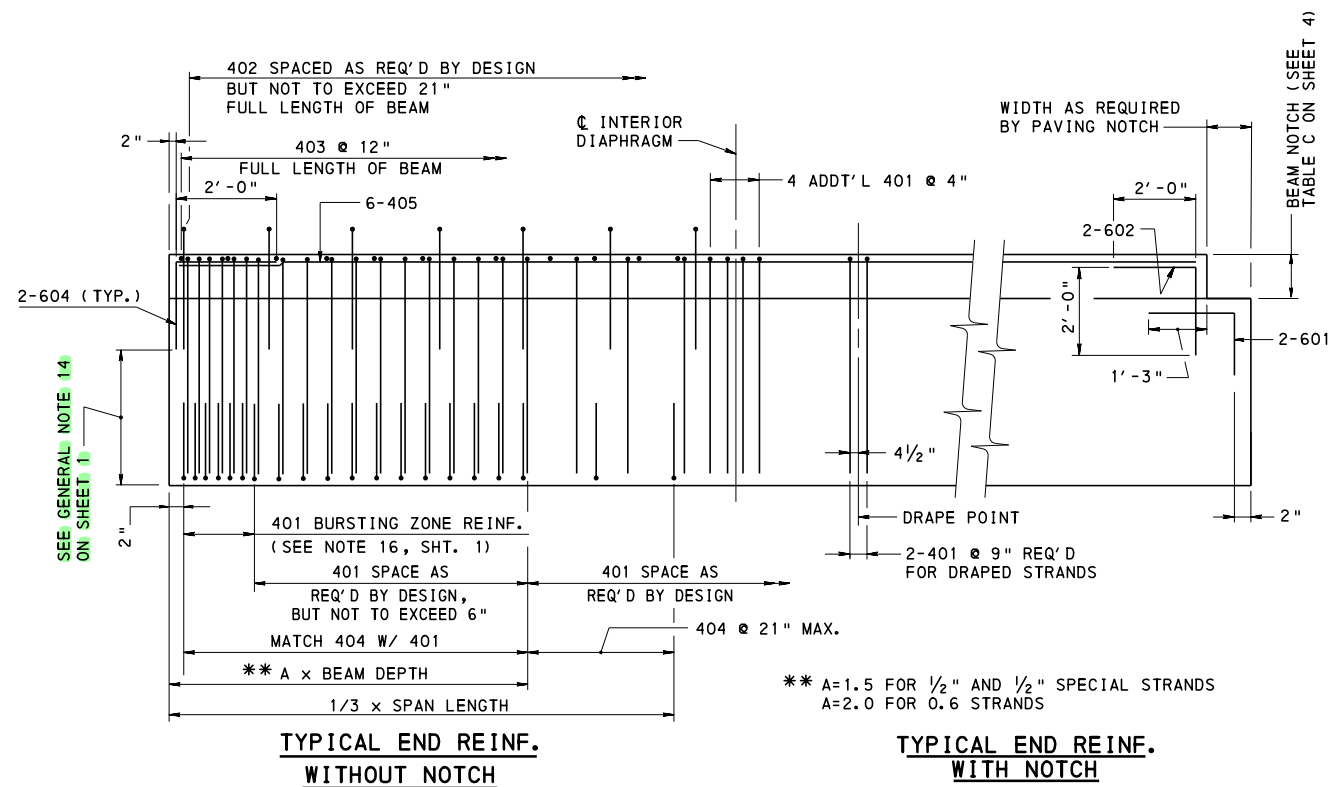
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**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

**STANDARD**  
**I-BEAM & PA BULB-TEE BEAM**  
**REINFORCEMENT DETAILS**

RECOMMENDED AUG. 30, 2019  
*John J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Mark V. Bitt*  
ACT. DIR., BUR. OF PROJECT DELIVERY

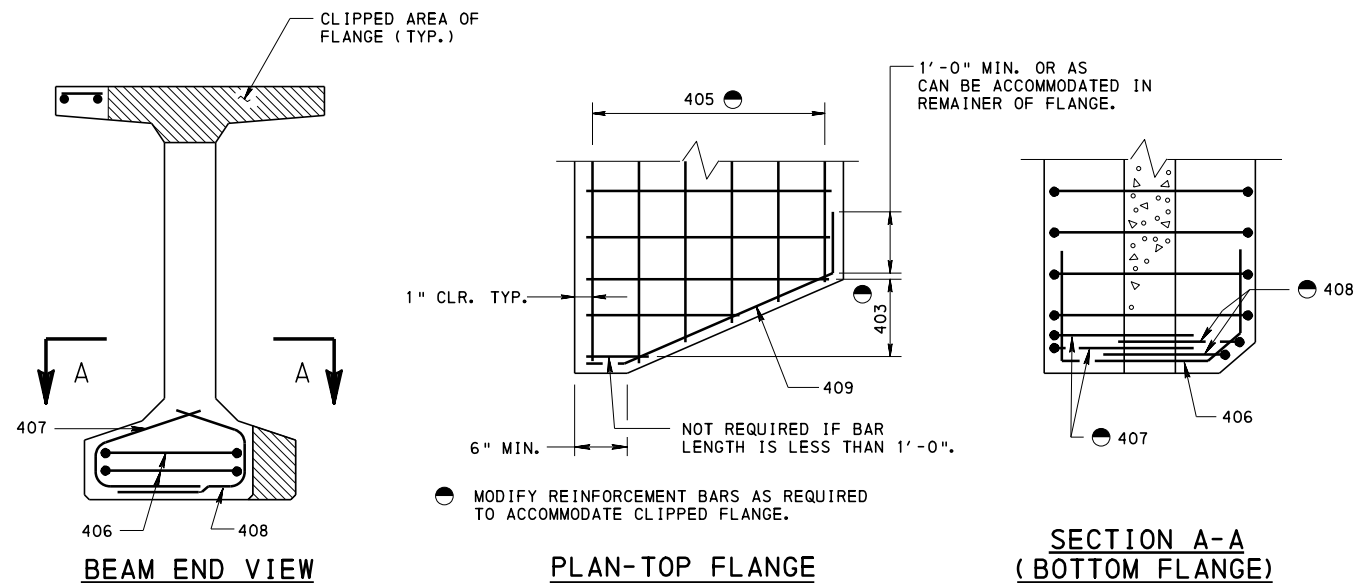
SHEET 1 OF 4  
**BD-662M**



**PA BULB-TEE BEAM - ELEVATION**

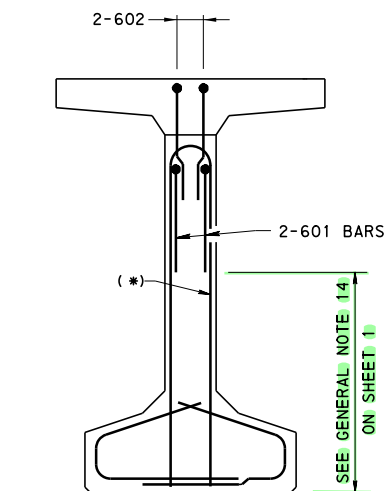
**NOTES:**

1. FOR GENERAL NOTES AND TYPICAL CAMBER DIAGRAM SEE SHEET 1.
2. FOR AASHTO AND PA I-BEAM DETAILS, SEE SHEET 1.
3. BEAM ENDS ARE PERMITTED TO BE CLIPPED TO AVOID INTERFERENCE WITH ANOTHER BEAM OR BACKWALL. CLIP MUST NOT EXTEND INTO THE WEB UNLESS THE REQUIRED BEAM NOTCH EXTENDS TO THE WEB.

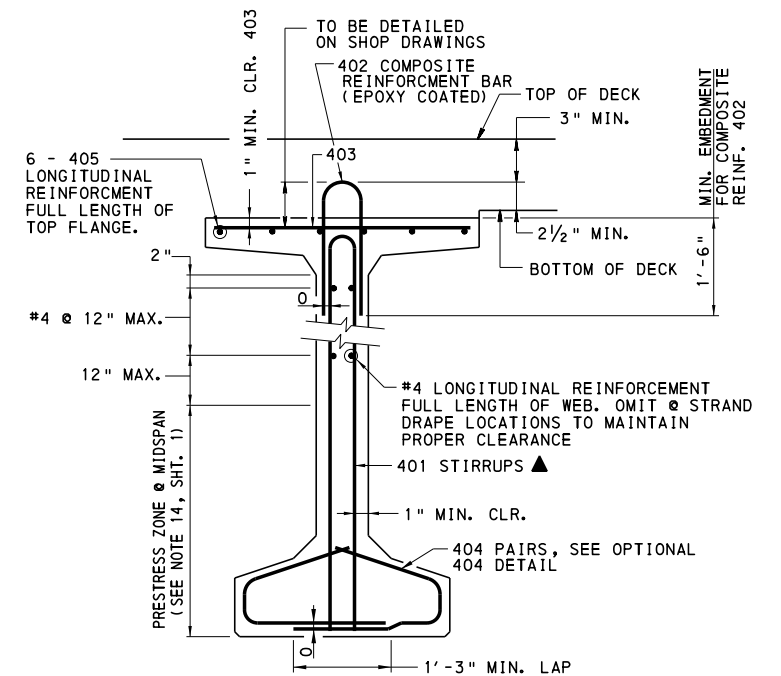


**TYPICAL CLIPPED FLANGE REINFORCEMENT DETAILS**

BULB TEE SHOWN, SIMILAR FOR AASHTO AND PA I-BEAMS.

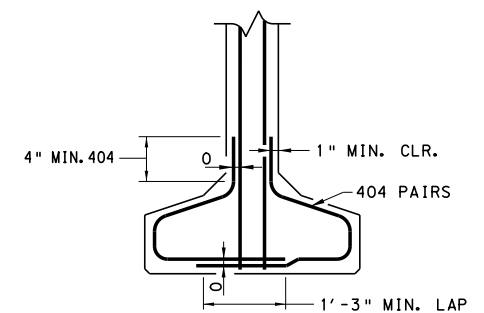


**PA BULB-TEE  
ADDITIONAL NOTCH  
REINF. END VIEW**



**PA BULB-TEE (8" WEB)  
TYPICAL SECTION**

- ▲ 401 MAY BE UTILIZED BY FABRICATOR TO REPLACE 402 COMPOSITE REINFORCEMENT. ALL 401 REINFORCEMENT BARS PROJECTING INTO THE DECK SLAB MUST BE EPOXY COATED FOR ENTIRE LENGTH.



**OPTIONAL 404 DETAIL**

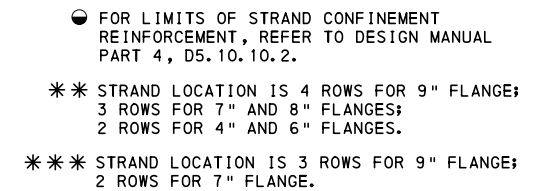
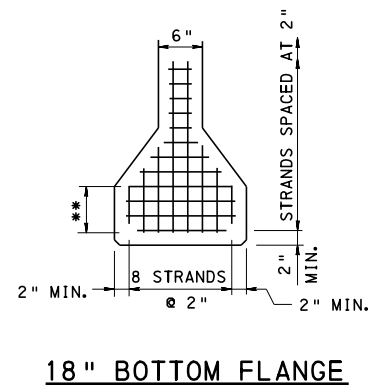
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**STANDARD  
I-BEAM & PA BULB-TEE BEAM  
REINFORCEMENT DETAILS**

RECOMMENDED AUG. 30, 2019  
*John J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

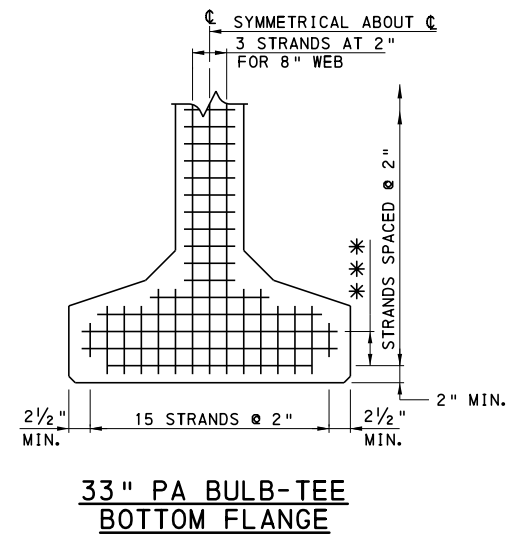
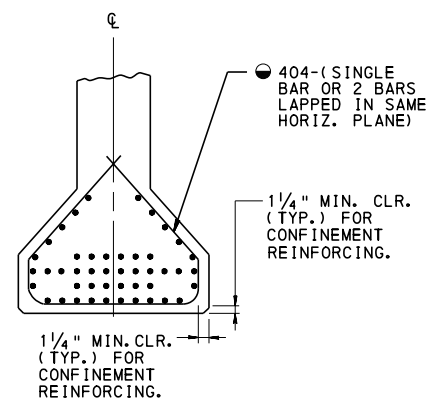
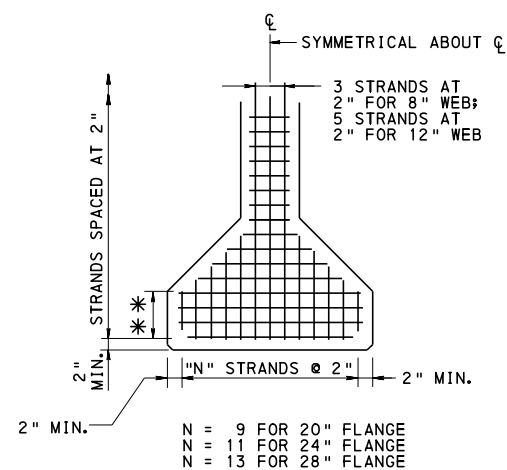
RECOMMENDED AUG. 30, 2019  
*Mark V. Biter*  
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SHEET 2 OF 4  
BD-662M



BEAM DAP NOTES:

1. T1 IS DAP THICKNESS AT END OF BEAM FOR HIGHER END OF BEAM AND DAP THICKNESS AT BEGINNING OF DAP FOR LOWER END OF BEAM. T1 MINIMUM IS  $\frac{1}{4}$ ".
2. T2 IS DAP THICKNESS AT CENTERLINE OF BEARING.
3. T3 IS DEFINED AS THE DAP THICKNESS BASED ON THE SLOPE OF THE BEAM DUE TO THE GRADE AND CAMBER.
4. INCREASE IN DISTANCE TO FIRST ROW OF STRANDS COULD RESULT IN STRAND PATTERNS DIFFERENT FROM WHAT IS SHOWN.
5. BEAM SEAT AND BOTTOM OF BEAM BEARING AREA REQUIREMENTS AS PER DESIGN MANUAL PART 4, SECTION 14.7.5.3.8DP
6. MAXIMUM GRADE FOR USE OF DAPPING IS BASED ON LIMITING THE MAXIMUM DAP THICKNESS TO  $1\frac{1}{2}$ " AND MAINTAINING 1" MINIMUM CONCRETE COVER ON CONFINEMENT REINFORCEMENT IN THE PROPOSED BEAM DAPPING AREA.
7. FOR BEAM DAPPING, A MINIMUM CLEARANCE OF  $\frac{3}{4}$ " MUST BE PROVIDED BETWEEN THE BOTTOM OF THE BEAM (WITHOUT CONSIDERATION OF THE DAP ) AND THE TOP OF BEAM SEAT TO ENSURE INSPECTABILITY OF BEARING PAD.
8. PARTIAL-WIDTH BEAM DAPS ARE NOT PERMITTED.
9. THE MAXIMUM DAP THICKNESS IS  $1\frac{1}{2}$ ".
10. ENSURE THAT ALL CONCRETE COVER REQUIREMENTS ON STEEL CONFINEMENT REINFORCEMENT AND PRESTRESSING STRANDS ARE SATISFIED WHEN USING BEAM DAPS TO MODIFY THE BOTTOM OF BEAM AREA.



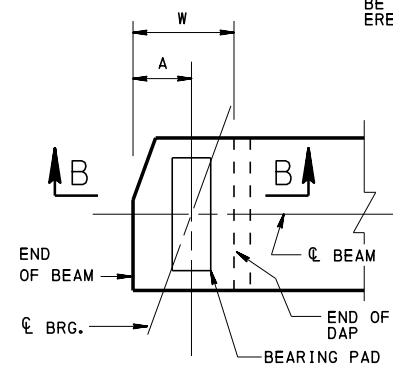
### TYPICAL STRAND LOCATIONS

NOTE: DO NOT PLACE PRESTRESSING STRANDS  
AT CORNER LOCATION IN BOTTOM ROW.

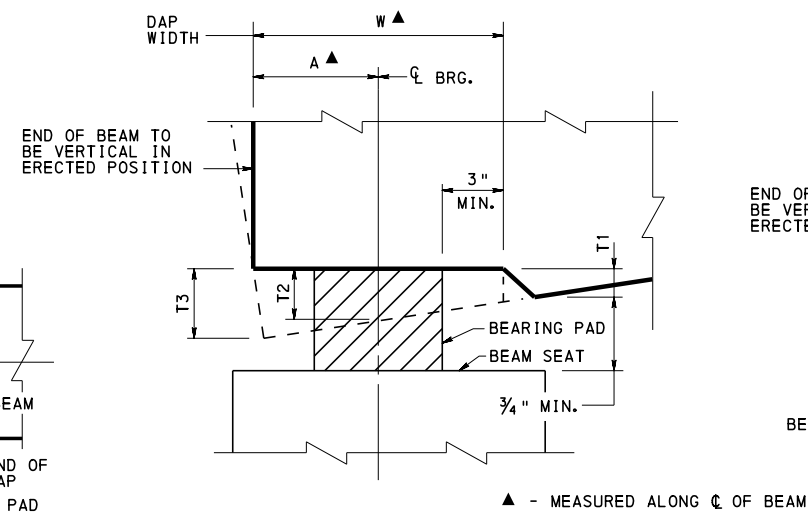
| MAXIMUM<br>REQUIRED<br>DAP DEPTH<br>( T3 )<br>( IN. ) | DISTANCE<br>TO FIRST ROW<br>OF STRANDS<br>( IN. ) |
|-------------------------------------------------------|---------------------------------------------------|
| $\frac{1}{4} < (T3) \leq \frac{3}{4}$                 | 2½                                                |
| $\frac{3}{4} < (T3) \leq 1\frac{1}{4}$                | 3                                                 |
| $1\frac{1}{4} < (T3) \leq 1\frac{1}{2}$               | 3¾                                                |
| $1\frac{1}{2} < (T3) *$                               | 2                                                 |

\* USE BEVELED SOLE PLATE,  
SEE BC-755M.

### I-BEAM AND PA BULB-TEE BEAM DAP DESIGN PARAMETERS

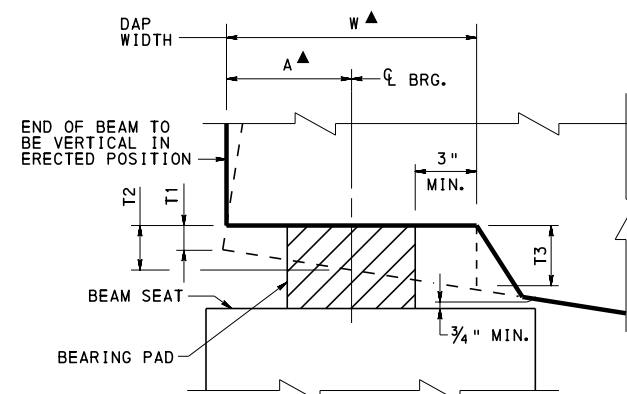


## PLAN



SECTION B-B AT  
LOW END OF BEAM

## BEAM DAP DETAILS



SECTION B-B AT  
HIGH END OF BEAM

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

# STANDARD I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS

RECOMMENDED AUG. 30, 2019  
*Joris J. Runyon*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Melvin D. Butler*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 4

BD-662M

| TABLE A<br>BEAM NOTCH DEPTHS FOR PA I-BEAMS |          |                                                                     |                   |
|---------------------------------------------|----------|---------------------------------------------------------------------|-------------------|
| APPROACH<br>SLAB TYPE<br>(SEE NOTE 1)       | BACKWALL | BEAM NOTCH DEPTH<br>(SEE NOTE 2)                                    | REMARKS           |
| 1                                           | YES      | T2 + B3                                                             |                   |
| 1                                           | NO       | T2 + B3 IF GREATER THAN 9½"                                         |                   |
|                                             |          | 9½" IF T2 + B3 IS LESS THAN 9½"<br>(NOTCH TO EXTEND INTO WEB)       |                   |
| 2                                           | YES      | T2 + B3                                                             |                   |
| 2                                           | NO       | T2 + B3 IF GREATER THAN 1'-2½"                                      |                   |
|                                             |          | 1'-2½" IF T2 + B3 IS LESS THAN 1'-2½"<br>(NOTCH TO EXTEND INTO WEB) |                   |
| 3                                           | YES      | T2 + B3 IF GREATER THAN 11½"                                        | SEE NOTES 3 AND 4 |
|                                             |          | 11½" IF T2 + B3 IS LESS THAN 11½"<br>(NOTCH TO EXTEND INTO WEB)     |                   |
| 4                                           | YES      | T2 + B3 IF GREATER THAN 11½"                                        | SEE NOTES 3 AND 4 |
|                                             |          | 11½" IF T2 + B3 IS LESS THAN 11½"<br>(NOTCH TO EXTEND INTO WEB)     |                   |
| 5                                           | N/A      | N/A                                                                 |                   |
| RC-23M                                      | N/A      | T2 + B3                                                             | SEE NOTE 5        |
| NO APPROACH<br>SLAB                         | N/A      | T2 + B3                                                             | SEE NOTES 6 AND 7 |

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. REFER TO BD-652M FOR DIMENSIONS T2 AND B3.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. TYPE 3 AND 4 APPROACH SLABS ARE ONLY PERMITTED FOR BEAM DEPTHS 26/54, 24/60, 26/60, 24/63 AND 26/63. IF BEAM DEPTH IS NOT INDICATED USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
5. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
6. OMIT BEAM NOTCH AT PIER ENDS FOR BEAMS MADE CONTINUOUS.
7. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
8. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

| TABLE C<br>BEAM NOTCH DEPTHS FOR PA BULB-TEE BEAMS |          |                                   |                   |
|----------------------------------------------------|----------|-----------------------------------|-------------------|
| APPROACH<br>SLAB TYPE<br>(SEE NOTE 1)              | BACKWALL | BEAM NOTCH DEPTH<br>(SEE NOTE 2)  | REMARKS           |
| 1                                                  | YES      | T2 + D1 + B3                      |                   |
| 1                                                  | NO       | 9½" (NOTCH TO EXTEND INTO WEB)    |                   |
| 2                                                  | YES      | T2 + D1 + B3                      |                   |
| 2                                                  | NO       | 1'-2½" (NOTCH TO EXTEND INTO WEB) |                   |
| 3                                                  | YES      | 11½" (NOTCH TO EXTEND INTO WEB)   | SEE NOTES 3 AND 4 |
| 4                                                  | YES      | 11½" (NOTCH TO EXTEND INTO WEB)   | SEE NOTES 3 AND 4 |
| 5                                                  | N/A      | N/A                               |                   |
| RC-23M                                             | N/A      | T2 + D1 + B3                      | SEE NOTE 5        |
| NO APPROACH<br>SLAB                                | N/A      | T2 + D1 + B3                      | SEE NOTES 6 AND 7 |

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. REFER TO BD-652M FOR DIMENSIONS T2, D1 AND B3.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. TYPE 3 AND 4 APPROACH SLABS ARE NOT PERMITTED FOR BEAM DEPTHS LESS THAN 47.25" USE TYPE 1 OR 2 APPROACH SLAB WITH BACKWALL.
5. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
6. OMIT BEAM NOTCH AT PIER ENDS FOR BEAMS MADE CONTINUOUS.
7. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
8. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

| TABLE B<br>BEAM NOTCH DEPTHS FOR AASHTO I-BEAMS |          |                                   |                   |
|-------------------------------------------------|----------|-----------------------------------|-------------------|
| APPROACH<br>SLAB TYPE<br>(SEE NOTE 1)           | BACKWALL | BEAM NOTCH DEPTH<br>(SEE NOTE 2)  | REMARKS           |
| 1                                               | YES      | T2 + D1 + B3                      |                   |
| 1                                               | NO       | T2 + D1 + B3                      |                   |
| 2                                               | YES      | T2 + D1 + B3                      |                   |
| 2                                               | NO       | 1'-2½" (NOTCH TO EXTEND INTO WEB) |                   |
| 3                                               | YES      | T2 + D1 + B3                      | SEE NOTE 3        |
| 4                                               | YES      | T2 + D1 + B3                      | SEE NOTE 3        |
| 5                                               | N/A      | N/A                               |                   |
| RC-23M                                          | N/A      | T2 + D1 + B3                      | SEE NOTE 4        |
| NO APPROACH<br>SLAB                             | N/A      | T2 + D1 + B3                      | SEE NOTES 5 AND 6 |

BEAM NOTCH NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. REFER TO BD-652M FOR DIMENSIONS T2, D1 AND B3.
3. BACKWALL PLACED UNDER APPROACH SLAB.
4. PROVIDE APPROACH SLAB IN ACCORDANCE WITH RC-23M FOR BRADD BRIDGES.
5. OMIT BEAM NOTCH AT PIER ENDS FOR BEAMS MADE CONTINUOUS.
6. BEAM NOTCH MAY BE OMITTED WHEN PAVING NOTCH IS NOT REQUIRED.
7. ADJUST BEAM NOTCHES AS REQUIRED TO ACCOMMODATE EXPANSION DAMS.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
I-BEAM & PA BULB-TEE BEAM  
REINFORCEMENT DETAILS

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bittner*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 4  
BD-662M



CHANGE 4

NOTES:

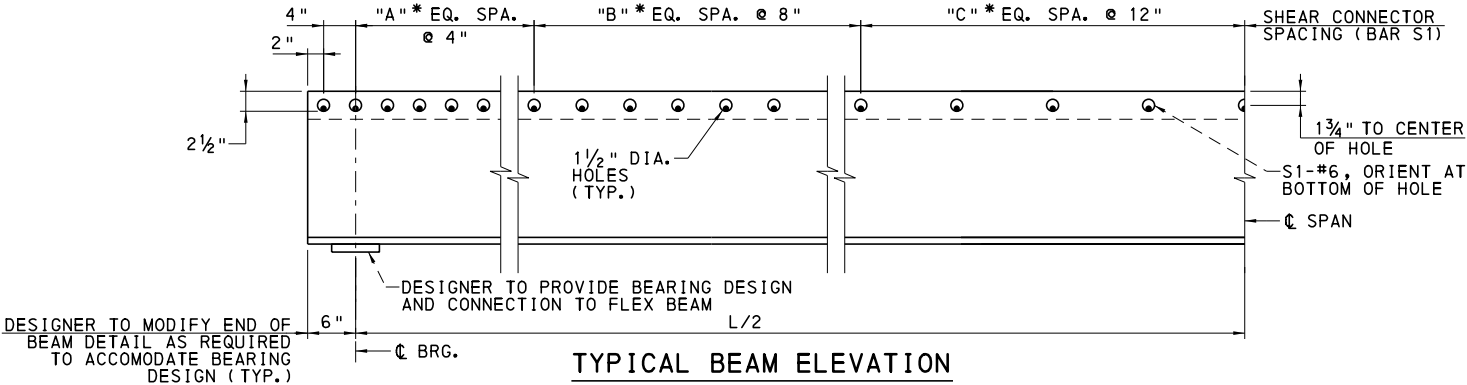
1. DESIGN SPECIFICATIONS:  
-AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND COMMENTARY 7TH EDITION  
-PENNDOT DESIGN MANUAL, PART 4 (DM-4) APRIL 29, 2015.  
-AASHTO/AWS D1.5M/D1.5: 2008-BRIDGE WELDING CODE.
2. MATERIAL STRENGTH:  
-REINFORCEMENT STEEL: GRADE 60, EPOXY COATED  
-STRUCTURAL STEEL: ASTM A709 GRADE 50  
-CONCRETE  $f'c = 4$  KSI (CLASS AAAP CONCRETE)  
FOR DECK SLABS AND CONCRETE END  
DIAPHRAGMS AND  $f'c = 3.5$  KSI  
(CLASS AA CONCRETE) FOR BARRIERS  
-MODULAR RATIO ( $E_s/E_c$ )  $N = 8$   
-ALL BOLTS TO BE ASTM F3125 GRADE A325, HAVING AN UNTHREADED  
SHANK OF SUFFICIENT LENGTH TO NOT ALLOW ANY THREADS TO EXIST  
IN THE PLANE BETWEEN THE CONNECTED PARTS (SHEAR PLANE)
3. LIVE LOAD:  
-AS PER DESIGN MANUAL PART 4.
4. DESIGN LOAD:  
-NORMAL WEIGHT CONCRETE = 150 LB./FT<sup>3</sup>  
-F-SHAPE BARRIER, MODIFIED = 700 LB./FT.  
-FUTURE WEARING SURFACE = 30 LB./FT<sup>2</sup>  
-MAXIMUM OVERLAY/WEARING SURFACE  
PLACED AT TIME OF INITIAL  
CONSTRUCTION. = 23 LB./FT<sup>2</sup>  
-DECK SLAB AND BARRIER LOADS ARE ASSUMED TO BE  
PLACED USING SHORED CONSTRUCTION.
5. DESIGN CONTROLS:  
-CONCRETE COVER: DECK TOTAL TOP COVER = 2"  
DECK BOTTOM COVER = 1"  
BARRIER = 2"  
-MIN. CLEAR DISTANCE BETWEEN REINFORCEMENT MATS = 2"  
-BAR SIZE: MAXIMUM BAR SIZE: #6  
MINIMUM BAR SIZE: #4  
S1 AND S2, BARS: #6  
S3 AND S4 BARS: #4  
-BAR SPACINGS: MAXIMUM SPACING = 12" SLAB  
= 12" BARRIER  
-PLACE A 1¼" LATEX MODIFIED CONCRETE OR POLYESTER  
POLYMER CONCRETE (PPC) WEARING SURFACE ON THE 7½"  
PRECAST DECK PRIOR TO OPENING BRIDGE TO TRAFFIC.  
AN EPOXY OVERLAY, IF EQUIVALENT IN WEIGHT, IS ALSO  
ALLOWED AS AN ALTERNATIVE.
6. USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT IN ACCORDANCE WITH  
PUBLICATION 408, SECTION 709.
7. REINFORCEMENT IN SOME SECTIONS NOT SHOWN FOR CLARITY.
8. DYNAMIC LOAD ALLOWANCE FOR DECK SLAB DESIGN (IM) = 50%  
DYNAMIC LOAD ALLOWANCE STEEL BEAM DESIGN (IM) = 33%
9. DRAWINGS ARE NOT TO SCALE.
10. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68°F.
11. ALL DIMENSIONS SHOWN ARE HORIZONTAL, UNLESS OTHERWISE NOTED.
12. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS SEE BC-788M.
13. SUBMIT SHOP DRAWINGS FOR FLEX BEAM PANELS AND ASSOCIATED COMPONENTS.
14. NO-LOAD CAMBER TOLERANCE AT MIDSPAN SHALL BE 0 IN. TO +0.5 IN. NO-LOAD CAMBER  
OF GIRDERS SHALL MEET THE REQUIREMENTS SPECIFIED IN THE DESIGN DRAWINGS.  
CAMBER PRIOR TO WELDING AND PRIMING.
15. HOLES SHALL BE DRILLED. PUNCHING MAY BE ALLOWED BUT WILL BE  
SUBJECT TO APPROVAL. IF PUNCHING IS USED, CUT HOLES CLEAN WITHOUT  
TORN OR RAGGED EDGES.
16. LIFTING DEVICES SHALL BE DESIGNED BY THE CONTRACTOR AND SUBMITTED AS PART OF  
THE SHOP DRAWING SUBMISSION.
17. DO NOT MAKE WELDS BY MANUAL SHIELDED METAL ARC PROCESS FOR PRIMARY GIRDER  
WELDS, SUCH AS FLANGE-TO-WEB WELDS OR FOR SHOP SPLICES OF WEBS AND FLANGES.
18. PAINT STRUCTURAL STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 1060.
19. CASTING OF THE DECK SHALL BE FULLY SUPPORTED.
20. STEEL T REQUIRES MIDSPAN SUPPORT TO NO LOAD CONDITION DURING CASTING.
21. INTERFACE OF PRECAST PANELS ALONG THE TRANSVERSE AND LONGINTUDINAL  
JOINTS SHALL BE BLAST CLEANED TO CREATE AN EXPOSED AGGREGATE FINISH.
22. PRE-WET PRECAST INTERFACE OF JOINT WITH WATER TO CREATE A SATURATED  
SURFACE CONDITION.
23. PLACE THE FOLLOWING NOTE ON THE CONTRACT DRAWINGS - "THE STEEL  
SUPERSTRUCTURE SHALL BE DETAILED AND FABRICATED FOR TOTAL DEAD  
LOAD FIT (TDLF). GIRDER WEBS SHALL BE PLUMB UNDER THE FULL DEAD  
LOAD EXISTING AT THE END OF CONSTRUCTION."
24. PROVIDE CHARPY V-NOTCH (CVN) TESTING FOR ZONE 2 FOR WEB AND  
FLANGE PLATES PER PUB. 408, SECTION 1105.02(d) 5.
25. FILLET WELD SIZES ARE GOVERNED BY MATERIAL THICKNESS IN  
ACCORDANCE WITH AASHTO/AWS EXCEPT AS NOTED.
26. SLIGHTLY STAGGER LONGITUDINAL REBARS IN THE BRIDGE DECK SUCH THAT  
NO REBAR IN THE TOP MAT IS DIRECTLY ABOVE A REBAR IN THE BOTTOM MAT.

LEGEND:

- DIA. - DIAMETER
- Ø - DIAMETER
- U.H.P.C. - ULTRA-HIGH PERFORMANCE CONCRETE
- EQ. - EQUAL
- SPA. - SPACING

DESIGN NOTES:

1. IF NEEDED DETAILS ARE NOT FOUND IN THIS STANDARD, A SPECIAL SUBMISSION REQUESTING  
APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.
2. THE INFORMATION SHOWN IN THIS STANDARD IS PROVIDED FOR USE IN THE DEVELOPMENT OF THE  
CONTRACT DOCUMENTS. THE DESIGNER IS RESPONSIBLE FOR THE PRESENTATION OF ALL DESIGN INFORMATION.
3. USE THIS STANDARD FOR FLEXBEAM STRUCTURES SUBJECT TO LIMITATIONS AS SHOWN. USE THIS  
STANDARD AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS.
4. THE DESIGNER MUST PROVIDE THE INFORMATION OBTAINED FROM THE DESIGN TABLES AND DETAILS ON THE CONTRACT DRAWINGS.
5. DESIGN COMPUTATIONS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE  
DESIGN TABLES CONTAINED IN THIS STANDARD. DO NOT VIOLATE CRITERIA USED FOR THE DEVELOPMENT OF THESE DESIGN TABLES.
6. DESIGN TABLES INCLUDED IN THIS STANDARD ARE BASED ON THE DESIGN CRITERIA SHOWN ON THIS SHEET.
7. THE SPAN RANGE INCLUDED IN THIS STANDARD IS AS FOLLOWS:  
BD-663M: FLEXBEAM STRUCTURES FROM 30' TO 70'
8. THE DESIGN TABLES INCLUDE ACCEPTABLE MEMBER AND MODULE SIZES AND SPACINGS FOR VARIOUS STRUCTURE WIDTHS.
9. CAMBERS ARE GIVEN ASSUMING PRECAST BARRIERS ARE USED AND ARE PLACED USING SHORED CONSTRUCTION. IF CAST-IN-PLACE BARRIERS  
ARE USED, THE DESIGNER IS TO MODIFY DEAD LOAD CAMBERS ACCORDINGLY.
10. FLEX BEAMS ARE DESIGNED TO SATISFY LIVE LOAD DEFLECTION REQUIREMENT:  
 $\Delta_{MAX} \leq L/800$
11. BEARINGS ARE TO BE DESIGNED BY THE ENGINEER AND ARE NOT INCLUDED AS PART OF THIS STANDARD.
12. SUBSTRUCTURE UNITS ARE TO BE DESIGNED BY THE ENGINEER AND ARE NOT INCLUDED AS PART OF THIS STANDARD.
13. THIS STANDARD APPLIES TO STRAIGHT BRIDGES WITH A SKEW OF 90 DEGREES.
14. DETAIL ALL BARS ON THE CONTRACT DRAWINGS.
15. FOR STANDARD DOUBLE MODULE DESIGN, SEE SHEET NO. 2.
16. STEEL END DIAPHRAGM DESIGN AVAILABLE. FOR STEEL END DIAPHRAGM DETAILS, SEE SHEET NO. 4.
17. CONCRETE END DIAPHRAGM DESIGN AVAILABLE. FOR CONCRETE DIAPHRAGM DETAILS, SEE SHEET NO. 5.
18. FOR BEAM AND SHEAR CONNECTOR DESIGN TABLES, SEE SHEET NO. 3.
19. FOR CAMBER DESIGN TABLES, SEE SHEET NO. 6.
20. ULTRA HIGH PERFORMANCE CONCRETE STRENGTH VARIES WITH TIME, DESIGNER SHOULD CHECK WITH  
MANUFACTURER TO DETERMINE APPROPRIATE MATERIAL FOR PROJECT SCHEDULE.
21. MASH COMPLIANT F-SHAPED BARRIER SHOWN. OTHER MASH COMPLIANT BARRIERS MAY BE SUBSTITUTED  
AT THE DISCRETION OF THE DISTRICT BRIDGE ENGINEER.
22. LATEX MODIFIED CONCRETE, PPC OVERLAY, OR EPOXY OVERLAY ARE ALL ACCEPTABLE AS A FINAL  
RIDING SURFACE AT THE DISCRETION OF THE DISTRICT BRIDGE ENGINEER.
23. IN ORDER TO MAKE MINOR CHANGES TO THE CROSS SLOPE, THE THICKNESS OF THE OVERLAY CAN BE VARIED WITHIN THE FOLLOWING PARAMETERS:  
-MINIMUM OVERLAY THICKNESS OF 1¼"  
-MAXIMUM OVERLAY THICKNESS OF 4" AND AVERAGE OVERLAY THICKNESS OF 2" OR LESS.
24. LIVE LOAD DISTRIBUTION FACTOR FOR FLEXURE IS 0.30. LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR IS FROM  
AASHTO 8TH EDITION/DM-4 2019. FOR STEEL TEE SPACINGS OR SPANS OUTSIDE THE RANGES SHOWN IN THESE  
STANDARDS, DISTRIBUTION FACTORS SHALL BE DETERMINED BY THE ENGINEER.



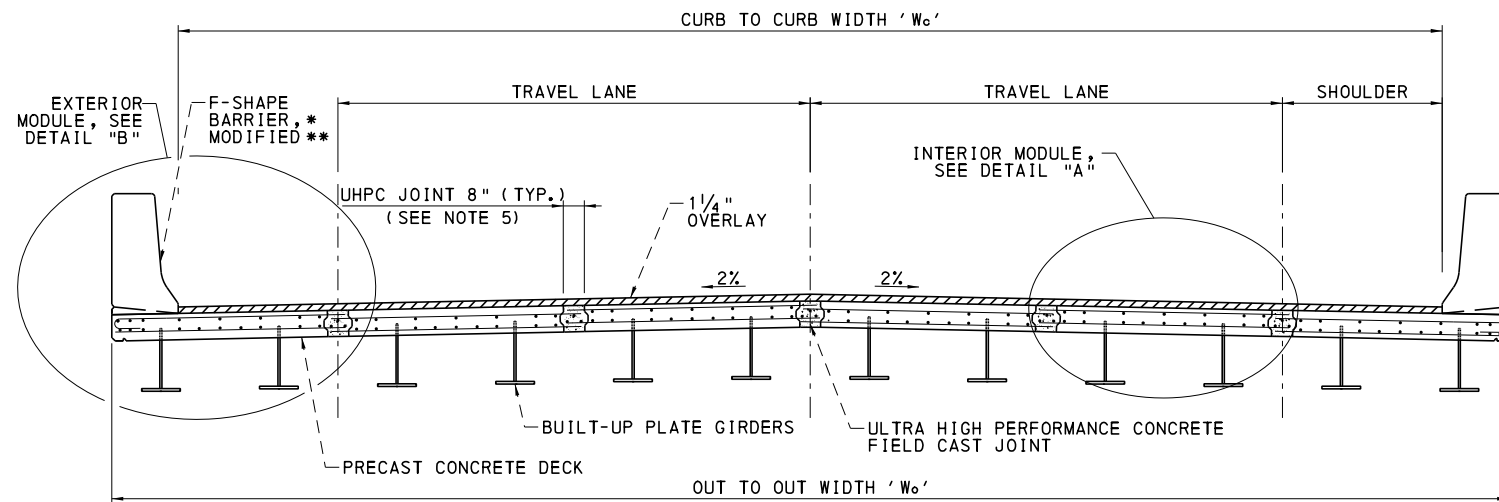
\* FOR NUMBER OF SPACES, "A", "B", AND "C",  
SEE DESIGN TABLES ON SHEET NO. '3.

|                    |                                                    |
|--------------------|----------------------------------------------------|
| BD-601M            | CONCRETE DECK SLAB                                 |
| BD-660M            | DECK SLAB, FORMS AND STEEL REINFORCEMENT PLACEMENT |
| BC-752M            | CONCRETE DECK SLAB DETAILS                         |
| BC-754M            | STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES  |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS        |
| REFERENCE DRAWINGS |                                                    |

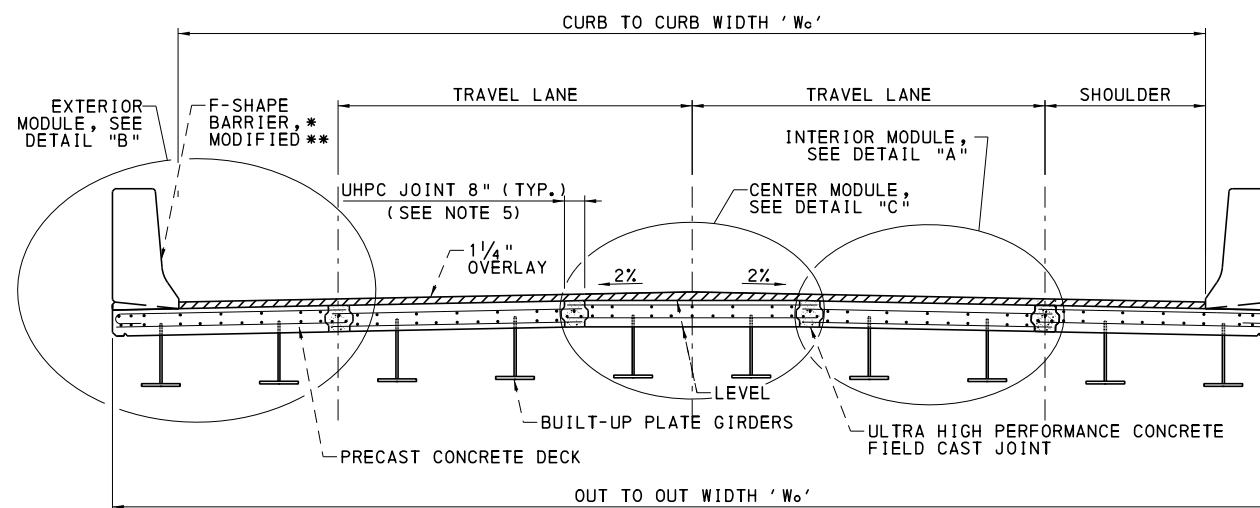
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CONCRETE DECK SLAB DESIGN &  
DETAILS FOR FLEX BEAM BRIDGES  
GENERAL NOTES

|                                                                               |                                                                                            |                         |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------|
| RECOMMENDED JUNE 1, 2021<br><i>Thomas P. Macione</i><br>CHIEF BRIDGE ENGINEER | RECOMMENDED JUNE 1, 2021<br><i>Bruce B. Thompson</i><br>DIRECTOR, BUR. OF PROJECT DELIVERY | SHEET 1 OF 6<br>BD-663M |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------|



TYPICAL DECK SECTION - DOUBLE MODULE (EVEN NUMBER OF MODULES)



TYPICAL DECK SECTION - DOUBLE MODULE (ODD NUMBER OF MODULES)

LEGEND:

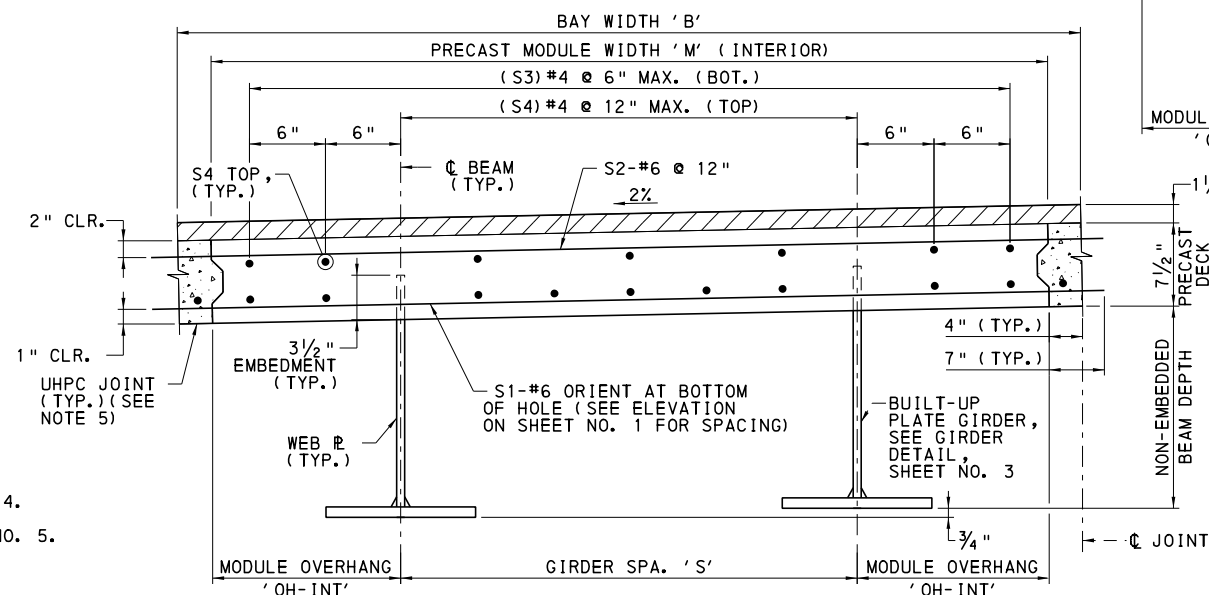
- ULTRA HIGH PERFORMANCE CONCRETE
- WEARING SURFACE/OVERLAY

\* 45" F-SHAPED BARRIER, MODIFIED SHOWN. OTHER MASH COMPLIANT BARRIERS PERMITTED AS PER THE DISTRICT BRIDGE ENGINEER.

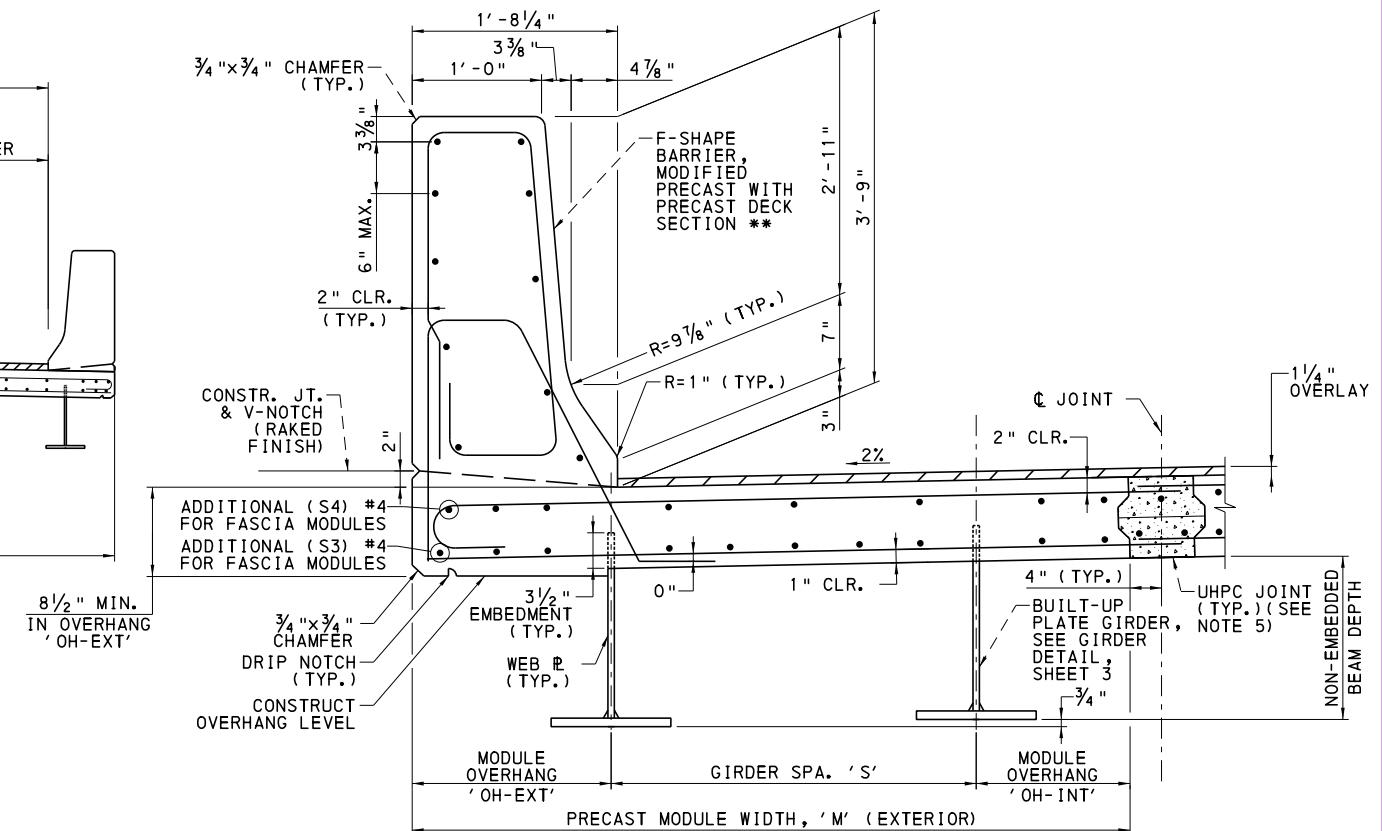
\*\* REFER TO BD-601M FOR REINFORCEMENT.

NOTES:

1. FOR DESIGN TABLES, SEE SHEET NO. 3.
2. FOR STEEL END DIAPHRAGM DETAILS, SEE SHEET NO. 4.
3. FOR CONCRETE END DIAPHRAGM DETAILS, SEE SHEET NO. 5.
4. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
5. SEE LONGITUDINAL JOINT AND CLOSURE POUR DETAIL, SHEET NO. 3.

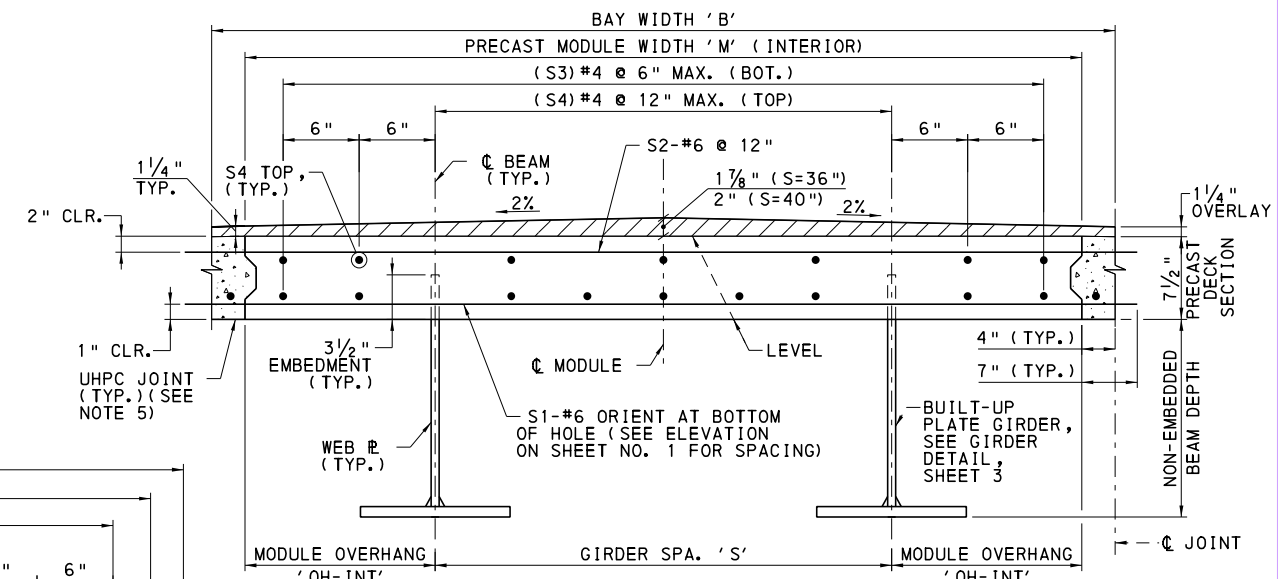


DETAIL A



DETAIL B

(UNLESS OTHERWISE NOTED, SEE DETAIL A, THIS SHEET FOR DECK REINFORCEMENT)



DETAIL C

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CONCRETE DECK SLAB DESIGN &  
DETAILS FOR FLEX BEAM BRIDGES  
TYPICAL SECTIONS

RECOMMENDED JUNE 1, 2021  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

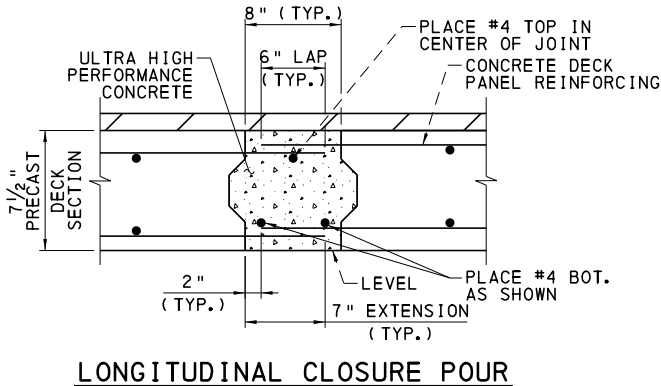
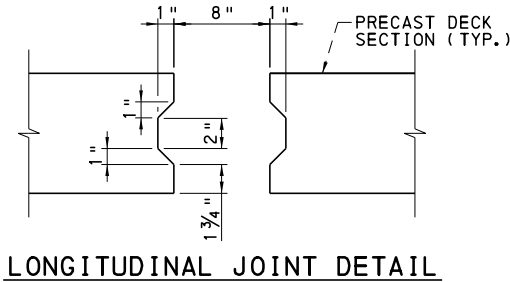
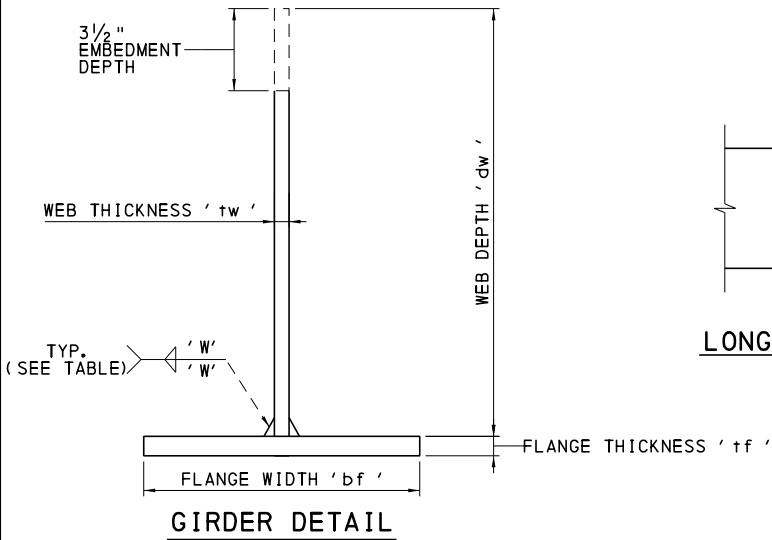
RECOMMENDED JUNE 1, 2021  
Brenda Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 2 OF 6  
BD-663M

- NOTES:
- FOR STEEL END DIAPHRAGM DETAILS, SEE SHEET NO. 4.
  - FOR CONCRETE END DIAPHRAGM DETAILS, SEE SHEET NO. 5.
  - FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
  - FOR TYPICAL SECTIONS, SEE SHEET NO. 2.
  - FOR CAMBER TABLES, SEE SHEET NO. 6.

| SPAN LENGTH, 'L'<br>(C/C BRGS., FT.) | DESIGN ROADWAY<br>WIDTH, 'W'<br>(FT) | GIRDER<br>SPACING, 'S'<br>(IN) | BAY WIDTH,<br>'B'<br>(IN) | PRECAST MODULE WIDTH                     |                                          | NUMBER OF<br>MODULES | OUT TO OUT<br>WIDTH, 'Wo'<br>(FT) | ACTUAL<br>CURB TO CURB<br>WIDTH, 'Wc'<br>(FT) | OVERHANG WIDTH                           |                                           | STEEL PLATE GIRDER      |                     |                     |                         |                                  | SHEAR CONNECTOR SPACING<br>INFORMATION |                    |                     |
|--------------------------------------|--------------------------------------|--------------------------------|---------------------------|------------------------------------------|------------------------------------------|----------------------|-----------------------------------|-----------------------------------------------|------------------------------------------|-------------------------------------------|-------------------------|---------------------|---------------------|-------------------------|----------------------------------|----------------------------------------|--------------------|---------------------|
|                                      |                                      |                                |                           | INTERIOR<br>MODULE<br>WIDTH, 'M'<br>(IN) | EXTERIOR<br>MODULE<br>WIDTH, 'M'<br>(IN) |                      |                                   |                                               | INTERIOR<br>OVERHANG<br>'OH-INT'<br>(IN) | EXTERIOR<br>OVERHANG,<br>'OH-EXT'<br>(IN) | BOTTOM FLANGE           |                     | WEB                 |                         | STIFFENER<br>DEPTH,<br>'ds' (IN) | SHEAR CONNECTOR SPACING<br>INFORMATION |                    |                     |
|                                      |                                      |                                |                           |                                          |                                          |                      |                                   |                                               |                                          |                                           | THICKNESS,<br>'tf' (IN) | WIDTH,<br>'bf' (IN) | DEPTH,<br>'dw' (IN) | THICKNESS,<br>'tw' (IN) |                                  | 'A' SPACES<br>@ 4"                     | 'B' SPACES<br>@ 8" | 'C' SPACES<br>@ 12" |
| 30                                   | 24                                   | 36                             | 72                        | 64                                       | 68                                       | 5                    | 30.00                             | 26.63                                         | 14                                       | 18                                        | 0.500                   | 12                  | 17.500              | 0.375                   | 13.40                            | 25                                     | 7                  | 2                   |
|                                      | 28                                   | 40                             | 80                        | 72                                       | 76                                       | 5                    | 33.33                             | 29.96                                         | 16                                       | 20                                        | 0.500                   | 12                  | 17.500              | 0.375                   | 13.40                            | 26                                     | 8                  | 1                   |
|                                      | 32                                   | 36                             | 72                        | 64                                       | 68                                       | 6                    | 36.00                             | 32.63                                         | 14                                       | 18                                        | 0.500                   | 12                  | 17.500              | 0.375                   | 13.40                            | 25                                     | 7                  | 2                   |
|                                      | 36                                   | 40                             | 80                        | 72                                       | 76                                       | 6                    | 40.00                             | 36.63                                         | 16                                       | 20                                        | 0.500                   | 12                  | 17.500              | 0.375                   | 13.40                            | 26                                     | 8                  | 1                   |
|                                      | 40                                   | 40                             | 80                        | 72                                       | 76                                       | 7                    | 46.67                             | 43.29                                         | 16                                       | 20                                        | 0.500                   | 12                  | 17.500              | 0.375                   | 13.40                            | 26                                     | 8                  | 1                   |
| 40                                   | 24                                   | 36                             | 72                        | 64                                       | 68                                       | 5                    | 30.00                             | 26.63                                         | 14                                       | 18                                        | 0.500                   | 12                  | 20.500              | 0.375                   | 16.40                            | 30                                     | 12                 | 2                   |
|                                      | 28                                   | 40                             | 80                        | 72                                       | 76                                       | 5                    | 33.33                             | 29.96                                         | 16                                       | 20                                        | 0.750                   | 12                  | 20.250              | 0.375                   | 16.15                            | 31                                     | 10                 | 3                   |
|                                      | 32                                   | 36                             | 72                        | 64                                       | 68                                       | 6                    | 36.00                             | 32.63                                         | 14                                       | 18                                        | 0.500                   | 12                  | 20.500              | 0.375                   | 16.40                            | 30                                     | 12                 | 2                   |
|                                      | 36                                   | 40                             | 80                        | 72                                       | 76                                       | 6                    | 40.00                             | 36.63                                         | 16                                       | 20                                        | 0.750                   | 12                  | 20.250              | 0.375                   | 16.15                            | 31                                     | 10                 | 3                   |
|                                      | 40                                   | 40                             | 80                        | 72                                       | 76                                       | 7                    | 46.67                             | 43.29                                         | 16                                       | 20                                        | 0.750                   | 12                  | 20.250              | 0.375                   | 16.15                            | 31                                     | 10                 | 3                   |
| 50                                   | 24                                   | 36                             | 72                        | 64                                       | 68                                       | 5                    | 30.00                             | 26.63                                         | 14                                       | 18                                        | 0.625                   | 12                  | 24.375              | 0.500                   | 20.28                            | 30                                     | 12                 | 7                   |
|                                      | 28                                   | 40                             | 80                        | 72                                       | 76                                       | 5                    | 33.33                             | 29.96                                         | 16                                       | 20                                        | 1.000                   | 12                  | 24.000              | 0.500                   | 19.90                            | 31                                     | 13                 | 6                   |
|                                      | 32                                   | 36                             | 72                        | 64                                       | 68                                       | 6                    | 36.00                             | 32.63                                         | 14                                       | 18                                        | 0.625                   | 12                  | 24.375              | 0.500                   | 20.28                            | 30                                     | 12                 | 7                   |
|                                      | 36                                   | 40                             | 80                        | 72                                       | 76                                       | 6                    | 40.00                             | 36.63                                         | 16                                       | 20                                        | 1.000                   | 12                  | 24.000              | 0.500                   | 19.90                            | 31                                     | 13                 | 6                   |
|                                      | 40                                   | 40                             | 80                        | 72                                       | 76                                       | 7                    | 46.67                             | 43.29                                         | 16                                       | 20                                        | 1.000                   | 12                  | 24.000              | 0.500                   | 19.90                            | 31                                     | 13                 | 6                   |
| 60                                   | 24                                   | 36                             | 72                        | 64                                       | 68                                       | 5                    | 30.00                             | 26.63                                         | 14                                       | 18                                        | 0.750                   | 12                  | 30.250              | 0.625                   | 26.15                            | 30                                     | 15                 | 10                  |
|                                      | 28                                   | 40                             | 80                        | 72                                       | 76                                       | 5                    | 33.33                             | 29.96                                         | 16                                       | 20                                        | 0.875                   | 12                  | 30.125              | 0.625                   | 26.03                            | 33                                     | 18                 | 7                   |
|                                      | 32                                   | 36                             | 72                        | 64                                       | 68                                       | 6                    | 36.00                             | 32.63                                         | 14                                       | 18                                        | 0.750                   | 12                  | 30.250              | 0.625                   | 26.15                            | 30                                     | 15                 | 10                  |
|                                      | 36                                   | 40                             | 80                        | 72                                       | 76                                       | 6                    | 40.00                             | 36.63                                         | 16                                       | 20                                        | 0.875                   | 12                  | 30.125              | 0.625                   | 26.03                            | 33                                     | 18                 | 7                   |
|                                      | 40                                   | 40                             | 80                        | 72                                       | 76                                       | 7                    | 46.67                             | 43.29                                         | 16                                       | 20                                        | 0.875                   | 12                  | 30.125              | 0.625                   | 26.03                            | 33                                     | 18                 | 7                   |
| 70                                   | 24                                   | 36                             | 72                        | 64                                       | 68                                       | 5                    | 30.00                             | 26.63                                         | 14                                       | 18                                        | 0.750                   | 12                  | 33.250              | 0.625                   | 29.15                            | 38                                     | 17                 | 11                  |
|                                      | 28                                   | 40                             | 80                        | 72                                       | 76                                       | 5                    | 33.33                             | 29.96                                         | 16                                       | 20                                        | 1.125                   | 12                  | 32.875              | 0.625                   | 28.78                            | 39                                     | 15                 | 12                  |
|                                      | 32                                   | 36                             | 72                        | 64                                       | 68                                       | 6                    | 36.00                             | 32.63                                         | 14                                       | 18                                        | 0.750                   | 12                  | 33.250              | 0.625                   | 29.15                            | 38                                     | 17                 | 11                  |
|                                      | 36                                   | 40                             | 80                        | 72                                       | 76                                       | 6                    | 40.00                             | 36.63                                         | 16                                       | 20                                        | 1.125                   | 12                  | 32.875              | 0.625                   | 28.78                            | 39                                     | 15                 | 12                  |
|                                      | 40                                   | 40                             | 80                        | 72                                       | 76                                       | 7                    | 46.67                             | 43.29                                         | 16                                       | 20                                        | 1.125                   | 12                  | 32.875              | 0.625                   | 28.78                            | 39                                     | 15                 | 12                  |

| BASE METAL OF THICKER<br>PART JOINED (T) (IN.) | 'W', MIN. SIZE OF<br>FILLET WELD (IN.) |
|------------------------------------------------|----------------------------------------|
| $T \leq \frac{3}{4}$                           | $\frac{1}{4}$                          |
| $\frac{3}{4} < T$                              | $\frac{5}{16}$                         |



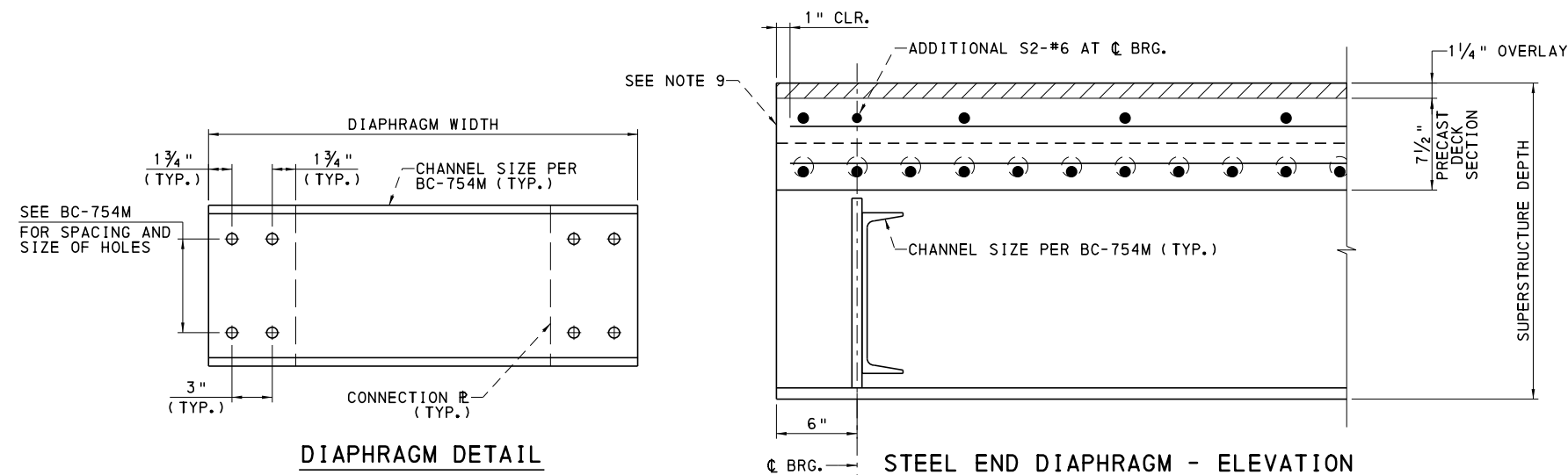
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CONCRETE DECK SLAB DESIGN &  
DETAILS FOR FLEX BEAM BRIDGES  
DESIGN TABLES

RECOMMENDED JUNE 1, 2021  
*Thomas P. Macione*  
CHIEF BRIDGE ENGINEER

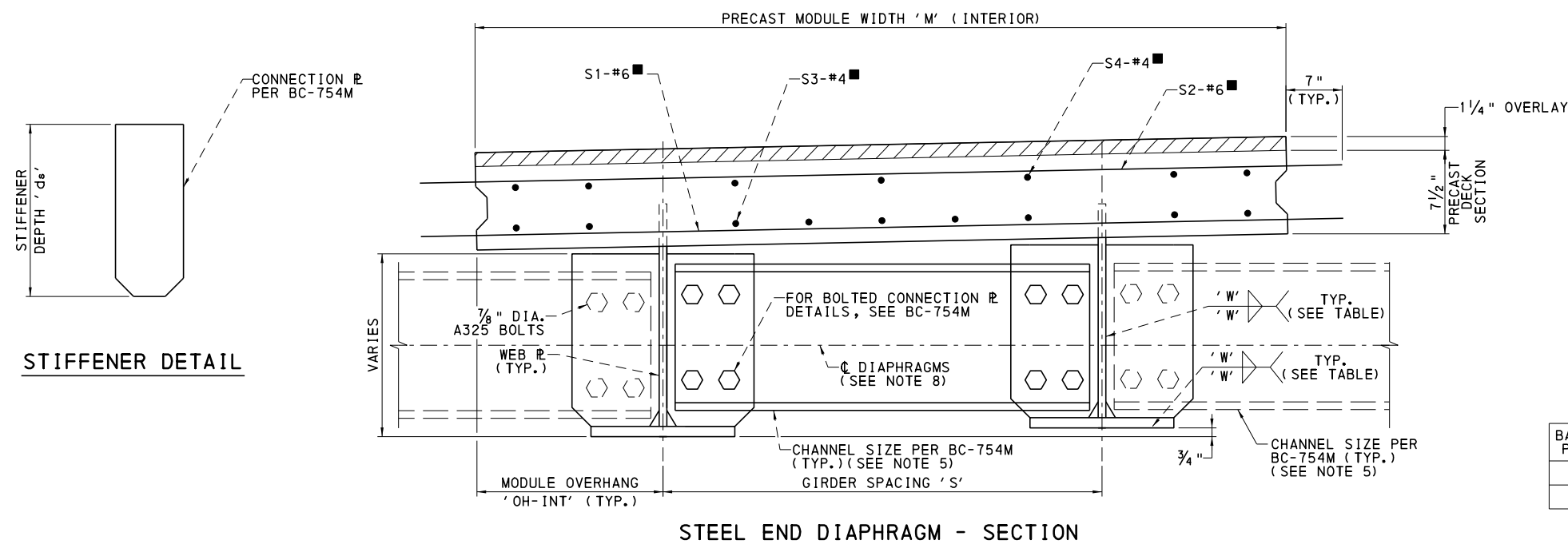
RECOMMENDED JUNE 1, 2021  
*Bruce B. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 3 OF 6  
BD-663M



# NOTES:

1. FOR TYPICAL SECTIONS, SEE SHEET NO. 2.
2. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
3. FOR DESIGN TABLES, SEE SHEET NO. 3.
4. FOR CAMBER TABLES, SEE SHEET NO. 6.
5. DIAPHRAGMS TO BE PLACED AND CONNECTED TO STIFFENERS PRIOR TO PLACEMENT OF PRECAST MODULES. DESIGNER TO CONFIRM DIAPHRAGM DEPTH IS SUITABLE FOR CONSTRUCTABILITY AND MAINTENANCE PURPOSES FOR EACH INDIVIDUAL DESIGN APPLICATION.
6. DIAPHRAGMS BETWEEN PRECAST MODULES TO BE PLACED AND CONNECTED TO STIFFENERS IN THE FIELD AFTER PLACEMENT OF PRECAST MODULES.
7. FOR CONCRETE END DIAPHRAGMS, SEE SHEET NO. 5.
8. PLACE STEEL END DIAPHRAGMS CENTERED VERTICALLY ABOUT THE C OF THE STIFFENERS.
9. WHEN A NEOPRENE STRIP SEAL IS TO BE USED, ADJUST AND COORDINATE LOCATION OF LAST TWO TRANSVERSE BARS BEYOND C BRG. TO ALLOW PLACEMENT OF STEEL EXTRUSION.



| BASE METAL OF THICKER PART JOINED (T) (IN.) | 'W', MIN. SIZE OF FILLET WELD (IN.) |
|---------------------------------------------|-------------------------------------|
| T ≤ 3/4                                     | 1/4                                 |
| 3/4 < T                                     | 5/16                                |

## LEGEND:

- FOR SPACING AND LOCATION DETAILS, SEE SHEET NO. 2.
- ▨ WEARING SURFACE/OVERLAY

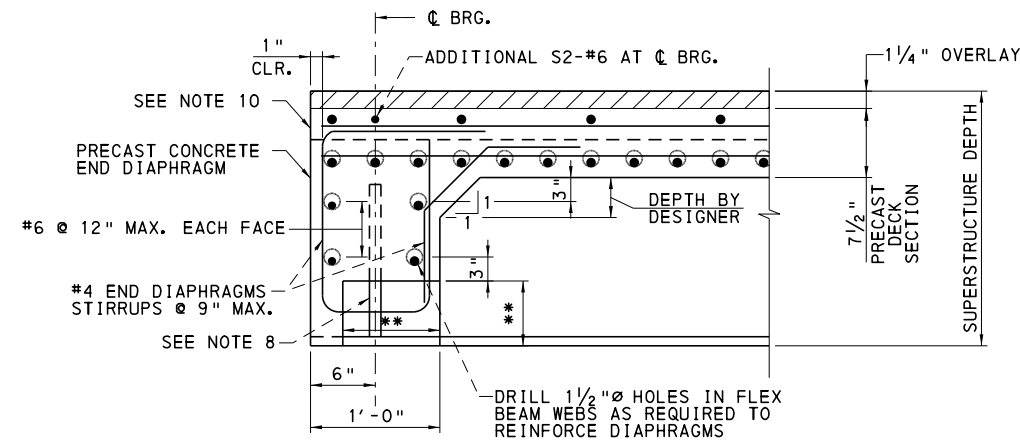
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

## STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR FLEX BEAM BRIDGES STEEL END DIAPHRAGMS

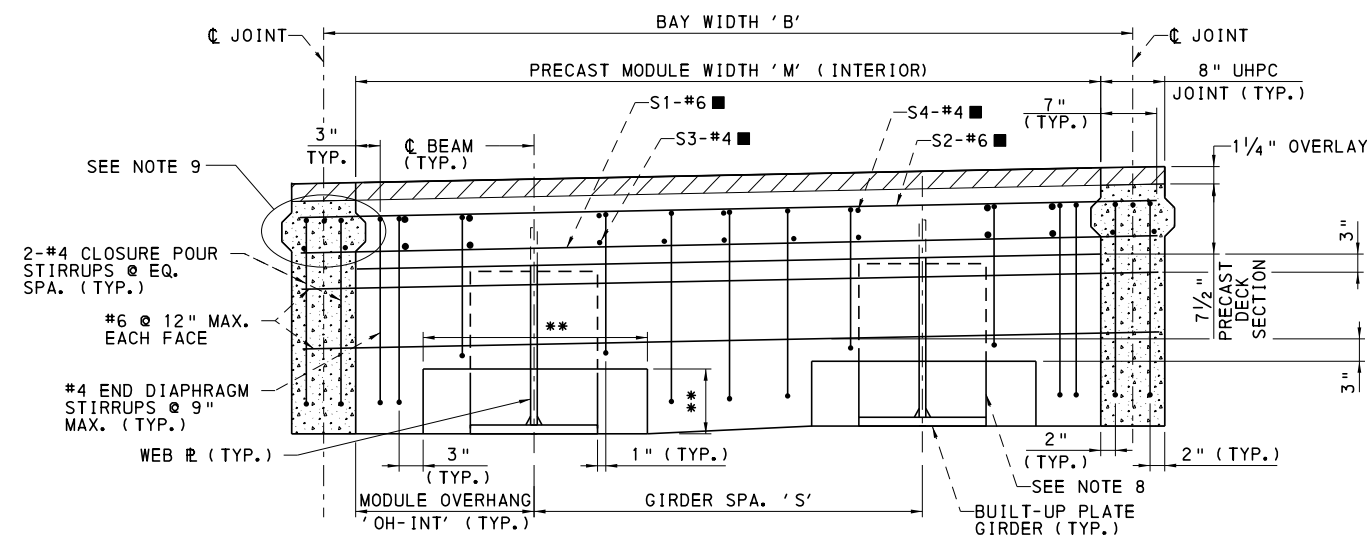
RECOMMENDED JUNE 1, 2021  
*Thomas P. Maciara*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUNE 1, 2021  
*Bruce S. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 4 OF 6  
BD-663M



CONCRETE END DIAPHRAGM - ELEVATION



CONCRETE END DIAPHRAGM - SECTION

NOTES:

1. BLOCKOUT SIZE TO BE DETERMINED BY THE ENGINEER.
2. FOR TYPICAL SECTIONS, SEE SHEET NO. 2.
3. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
4. FOR DESIGN TABLES, SEE SHEET NO. 3.
5. FOR CAMBER TABLES, SHEET NO. 6.
6. CONCRETE END DIAPHRAGMS TO BE PRECAST WITH THE MODULES. ULTRA HIGH PERFORMANCE CONCRETE LONGITUDINAL JOINT TO BE CAST IN THE FIELD AFTER PLACEMENT OF PRECAST MODULES.
7. FOR STEEL END DIAPHRAGMS, SEE SHEET NO. 4.
8. FOR STIFFENER DETAIL, SEE SHEET NO. 4.
9. FOR REINFORCEMENT OF LONGITUDINAL DECK CLOSURE POUR, SEE SHEET NO. 3.
10. WHEN A NEOPRENE STRIP SEAL IS TO BE USED, ADJUST AND COORDINATE LOCATION OF LAST TWO TRANSVERSE BARS BEYOND CL BRG. TO ALLOW PLACEMENT OF STEEL EXTRUSION.

LEGEND:

- FOR SPACING AND LOCATION DETAILS, SEE SHEET NO. 2.
- \*\* FORMED BLOCKOUT FOR BEARING (SEE NOTE 1) (TYP.)
- ULTRA HIGH PERFORMANCE CONCRETE
- WEARING SURFACE/OVERLAY

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
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STANDARD  
CONCRETE DECK SLAB DESIGN &  
DETAILS FOR FLEX BEAM BRIDGES  
CONCRETE END DIAPHRAGMS

RECOMMENDED JUNE 1, 2021  
Thomas P. Macione  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUNE 1, 2021  
Brenda Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 5 OF 6  
BD-663M



| CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 30' SPAN |          |    |      |      |      |      |     |     |     |     |     |      |     |     |     |     |      |      |      |      |     |    |
|-------------------------------------------------------------------------|----------|----|------|------|------|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|------|------|------|-----|----|
| DEFLECTION / CAMBER                                                     | LOCATION |    |      |      |      |      |     |     |     |     |     |      |     |     |     |     |      |      |      |      |     |    |
|                                                                         | 0        |    | 0.1  |      | 0.2  |      | 0.3 |     | 0.4 |     | 0.5 |      | 0.6 |     | 0.7 |     | 0.8  |      | 0.9  |      | 1.0 |    |
| GIRDER SPACING 'S' (IN.)                                                | 36       | 40 | 36   | 40   | 36   | 40   | 36  | 40  | 36  | 40  | 36  | 40   | 36  | 40  | 36  | 40  | 36   | 40   | 36   | 40   | 36  | 40 |
| DEAD LOAD DEFLECTIONS (TYPE 1)                                          | 0        | 0  | 1/16 | 1/16 | 1/16 | 1/16 | 1/8 | 1/8 | 1/8 | 1/8 | 1/8 | 3/16 | 1/8 | 1/8 | 1/8 | 1/8 | 1/16 | 1/16 | 1/16 | 1/16 | 0   | 0  |
| DEAD LOAD DEFLECTIONS (TYPE 2)                                          | 0        | 0  | 1/16 | 1/16 | 1/16 | 1/16 | 1/8 | 1/8 | 1/8 | 1/8 | 1/8 | 1/8  | 1/8 | 1/8 | 1/8 | 1/8 | 1/16 | 1/16 | 1/16 | 1/16 | 0   | 0  |
| VERTICAL PROFILE CAMBER (NOTE A)                                        |          |    |      |      |      |      |     |     |     |     |     |      |     |     |     |     |      |      |      |      |     |    |
| TOTAL CAMBER (NOTE B)                                                   |          |    |      |      |      |      |     |     |     |     |     |      |     |     |     |     |      |      |      |      |     |    |

| CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 40' SPAN |          |    |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |     |    |
|-------------------------------------------------------------------------|----------|----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|------|-----|----|
| DEFLECTION / CAMBER                                                     | LOCATION |    |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |     |    |
|                                                                         | 0        |    | 0.1 |      | 0.2  |      | 0.3  |      | 0.4  |      | 0.5  |      | 0.6  |      | 0.7  |      | 0.8  |      | 0.9 |      | 1.0 |    |
| GIRDER SPACING 'S' (IN.)                                                | 36       | 40 | 36  | 40   | 36   | 40   | 36   | 40   | 36   | 40   | 36   | 40   | 36   | 40   | 36   | 40   | 36   | 40   | 36  | 40   | 36  | 40 |
| DEAD LOAD DEFLECTIONS (TYPE 1)                                          | 0        | 0  | 1/8 | 1/8  | 3/16 | 3/16 | 5/16 | 1/4  | 5/16 | 5/16 | 3/8  | 5/16 | 5/16 | 5/16 | 5/16 | 1/4  | 3/16 | 3/16 | 1/8 | 1/8  | 0   | 0  |
| DEAD LOAD DEFLECTIONS (TYPE 2)                                          | 0        | 0  | 1/8 | 1/16 | 3/16 | 3/16 | 1/4  | 3/16 | 5/16 | 1/4  | 5/16 | 1/4  | 5/16 | 1/4  | 1/4  | 3/16 | 3/16 | 3/16 | 1/8 | 1/16 | 0   | 0  |
| VERTICAL PROFILE CAMBER (NOTE A)                                        |          |    |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |     |    |
| TOTAL CAMBER (NOTE B)                                                   |          |    |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |     |    |

| CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 50' SPAN |          |    |      |     |      |      |      |      |      |      |      |     |      |      |      |      |      |      |      |     |     |    |
|-------------------------------------------------------------------------|----------|----|------|-----|------|------|------|------|------|------|------|-----|------|------|------|------|------|------|------|-----|-----|----|
| DEFLECTION / CAMBER                                                     | LOCATION |    |      |     |      |      |      |      |      |      |      |     |      |      |      |      |      |      |      |     |     |    |
|                                                                         | 0        |    | 0.1  |     | 0.2  |      | 0.3  |      | 0.4  |      | 0.5  |     | 0.6  |      | 0.7  |      | 0.8  |      | 0.9  |     | 1.0 |    |
| GIRDER SPACING 'S' (IN.)                                                | 36       | 40 | 36   | 40  | 36   | 40   | 36   | 40   | 36   | 40   | 36   | 40  | 36   | 40   | 36   | 40   | 36   | 40   | 36   | 40  | 36  | 40 |
| DEAD LOAD DEFLECTIONS (TYPE 1)                                          | 0        | 0  | 3/16 | 1/8 | 5/16 | 5/16 | 7/16 | 3/8  | 1/2  | 7/16 | 9/16 | 1/2 | 1/2  | 7/16 | 7/16 | 3/8  | 5/16 | 5/16 | 3/16 | 1/8 | 0   | 0  |
| DEAD LOAD DEFLECTIONS (TYPE 2)                                          | 0        | 0  | 1/8  | 1/8 | 5/16 | 1/4  | 3/8  | 5/16 | 7/16 | 3/8  | 1/2  | 3/8 | 7/16 | 3/8  | 3/8  | 5/16 | 5/16 | 1/4  | 1/8  | 1/8 | 0   | 0  |
| VERTICAL PROFILE CAMBER (NOTE A)                                        |          |    |      |     |      |      |      |      |      |      |      |     |      |      |      |      |      |      |      |     |     |    |
| TOTAL CAMBER (NOTE B)                                                   |          |    |      |     |      |      |      |      |      |      |      |     |      |      |      |      |      |      |      |     |     |    |

| CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 60' SPAN |          |    |      |      |      |      |      |      |     |     |       |       |     |     |      |      |      |      |      |      |     |    |
|-------------------------------------------------------------------------|----------|----|------|------|------|------|------|------|-----|-----|-------|-------|-----|-----|------|------|------|------|------|------|-----|----|
| DEFLECTION / CAMBER                                                     | LOCATION |    |      |      |      |      |      |      |     |     |       |       |     |     |      |      |      |      |      |      |     |    |
|                                                                         | 0        |    | 0.1  |      | 0.2  |      | 0.3  |      | 0.4 |     | 0.5   |       | 0.6 |     | 0.7  |      | 0.8  |      | 0.9  |      | 1.0 |    |
| GIRDER SPACING 'S' (IN.)                                                | 36       | 40 | 36   | 40   | 36   | 40   | 36   | 40   | 36  | 40  | 36    | 40    | 36  | 40  | 36   | 40   | 36   | 40   | 36   | 40   | 36  | 40 |
| DEAD LOAD DEFLECTIONS (TYPE 1)                                          | 0        | 0  | 3/16 | 3/16 | 3/8  | 3/8  | 9/16 | 9/16 | 5/8 | 5/8 | 11/16 | 11/16 | 5/8 | 5/8 | 9/16 | 9/16 | 3/8  | 3/8  | 3/16 | 3/16 | 0   | 0  |
| DEAD LOAD DEFLECTIONS (TYPE 2)                                          | 0        | 0  | 3/16 | 3/16 | 5/16 | 5/16 | 7/16 | 7/16 | 1/2 | 1/2 | 9/16  | 1/2   | 1/2 | 1/2 | 7/16 | 7/16 | 5/16 | 5/16 | 3/16 | 3/16 | 0   | 0  |
| VERTICAL PROFILE CAMBER (NOTE A)                                        |          |    |      |      |      |      |      |      |     |     |       |       |     |     |      |      |      |      |      |      |     |    |
| TOTAL CAMBER (NOTE B)                                                   |          |    |      |      |      |      |      |      |     |     |       |       |     |     |      |      |      |      |      |      |     |    |

| CAMBER AND THEORETICAL DEAD LOAD DEFLECTIONS, INCHES - FOR L = 70' SPAN |          |    |      |      |     |      |       |      |       |       |       |       |       |       |       |      |     |      |      |      |     |    |
|-------------------------------------------------------------------------|----------|----|------|------|-----|------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|-----|------|------|------|-----|----|
| DEFLECTION / CAMBER                                                     | LOCATION |    |      |      |     |      |       |      |       |       |       |       |       |       |       |      |     |      |      |      |     |    |
|                                                                         | 0        |    | 0.1  |      | 0.2 |      | 0.3   |      | 0.4   |       | 0.5   |       | 0.6   |       | 0.7   |      | 0.8 |      | 0.9  |      | 1.0 |    |
| GIRDER SPACING 'S' (IN.)                                                | 36       | 40 | 36   | 40   | 36  | 40   | 36    | 40   | 36    | 40    | 36    | 40    | 36    | 40    | 36    | 40   | 36  | 40   | 36   | 40   | 36  | 40 |
| DEAD LOAD DEFLECTIONS (TYPE 1)                                          | 0        | 0  | 5/16 | 5/16 | 5/8 | 9/16 | 13/16 | 3/4  | 15/16 | 7/8   | 1     | 15/16 | 15/16 | 7/8   | 13/16 | 3/4  | 5/8 | 9/16 | 5/16 | 5/16 | 0   | 0  |
| DEAD LOAD DEFLECTIONS (TYPE 2)                                          | 0        | 0  | 1/4  | 1/4  | 1/2 | 7/16 | 11/16 | 9/16 | 13/16 | 11/16 | 13/16 | 11/16 | 13/16 | 11/16 | 11/16 | 9/16 | 1/2 | 7/16 | 1/4  | 1/4  | 0   | 0  |
| VERTICAL PROFILE CAMBER (NOTE A)                                        |          |    |      |      |     |      |       |      |       |       |       |       |       |       |       |      |     |      |      |      |     |    |
| TOTAL CAMBER (NOTE B)                                                   |          |    |      |      |     |      |       |      |       |       |       |       |       |       |       |      |     |      |      |      |     |    |

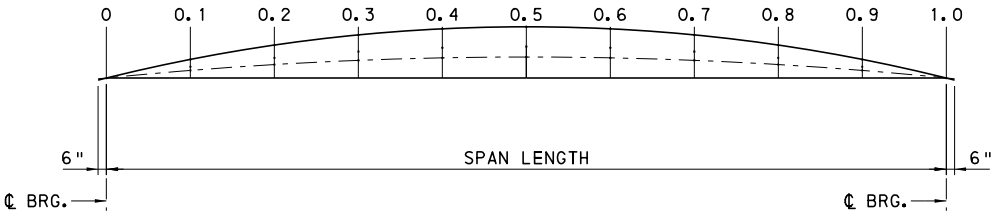
CAMBER DEFLECTION NOTES:

TYPE 1 = THEORETICAL DEAD LOAD DEFLECTION CALCULATED USING THE LONG TERM MOMENT OF INERTIA DUE TO SELF-WT OF STEEL BEAM, (INCLUDING DIAPHRAGMS), AND THE TRIBUTARY WIDTH OF THE DECK (ASSUMING SHORED CONSTRUCTION). ALSO INCLUDES DEAD LOAD DEFLECTION USING THE LONG TERM MOMENT OF INERTIA DUE TO SELF-WT OF 1/4" WEARING SURFACE/OVERLAY PLACED AT TIME OF CONSTRUCTION.

TYPE 2 = THEORETICAL DEAD LOAD DEFLECTION CALCULATED USING THE LONG TERM MOMENT OF INERTIA DUE TO SELF-WT OF BARRIER (ASSUMING SHORED CONSTRUCTION). NOTE THAT TYPE 2 DEAD LOAD DEFLECTIONS ARE ONLY APPLICABLE TO THE OUTERMOST FLEX BEAM UNITS (FASCIA GIRDER AND FIRST INTERIOR GIRDER).

NOTE A: AS REQUIRED BY DESIGN, TO BE PROVIDED BY FINAL DESIGN ENGINEER.

NOTE B: TOTAL CAMBER TO INCLUDE CAMBER REQUIRED FOR DEAD LOAD DEFLECTIONS TYPE 1 AND TYPE 2, AND FOR VERTICAL PROFILE, AS REQUIRED BY DESIGN.



NO-LOAD CAMBER TOLERANCE = 0 TO +0.5 IN. AT MIDSPAN. POSITIVE CAMBER IS UPWARD.

———— INITIAL CAMBER - THE INITIAL, NO LOAD CAMBER.

----- LONG-TERM CAMBER - THE ACTUAL PROFILE OF THE COMPOSITE SPAN UNDER DEAD LOAD OF STEEL WT AND CONCRETE DECK USING THE LONG TERM MOMENT OF INERTIA.

NOTES:

1. FOR GENERAL AND DESIGN NOTES, SEE SHEET NO. 1.
2. FOR DESIGN TABLES, SEE SHEET NO. 3.
3. DEAD LOAD OF STEEL T COMPONENTS AND CONCRETE SLAB IS CARRIED ON A COMPOSITE SECTION.

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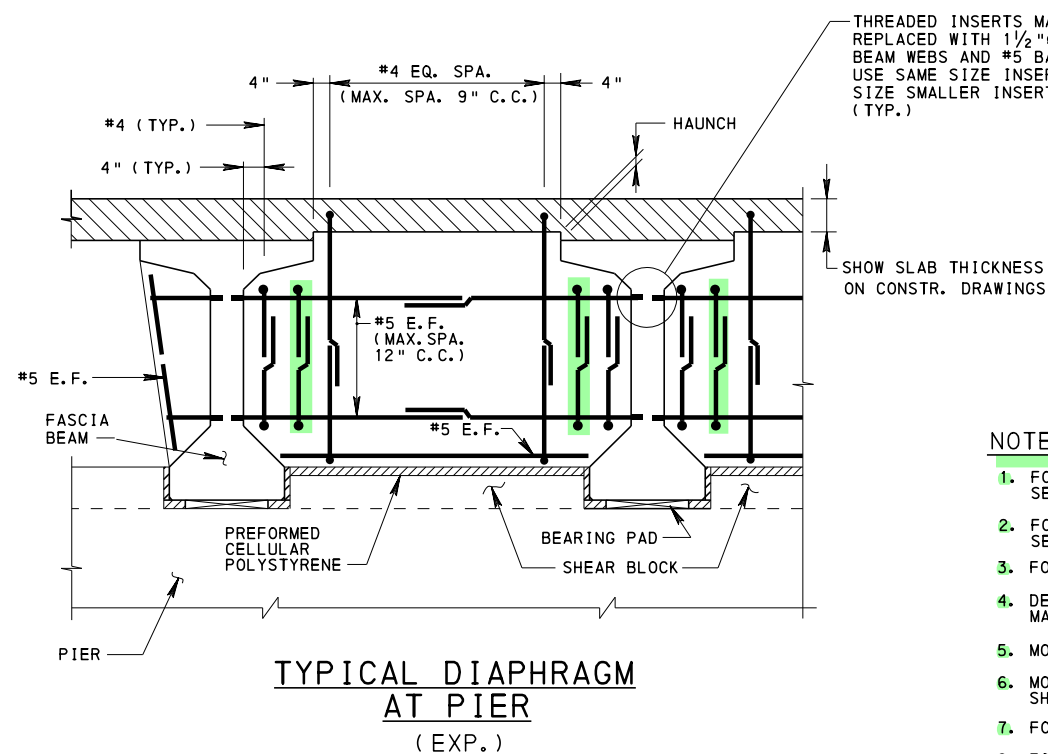
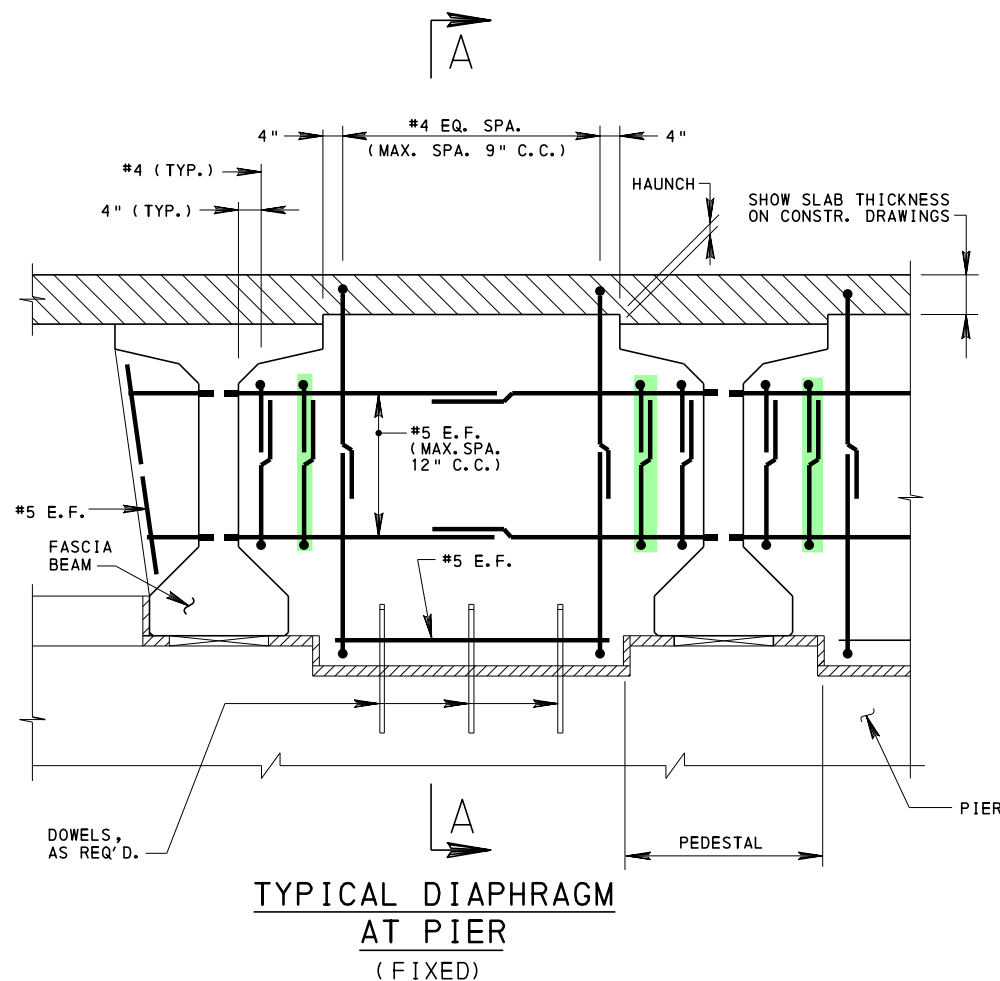
STANDARD  
CONCRETE DECK SLAB DESIGN &  
DETAILS FOR FLEX BEAM BRIDGES  
BEAM CAMBER

RECOMMENDED JUNE 1, 2021  
*Thomas P. Macione*  
CHIEF BRIDGE ENGINEER

RECOMMENDED JUNE 1, 2021  
*Bruce B. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 6 OF 6

BD-663M



#### NOTES:

- FOR LOCATION OF DOWELS, SHEAR BLOCKS OR CURTAIN WALLS, SEE BD-658M.
- FOR SLAB REINFORCEMENT AND PLACEMENT OF DIAPHRAGM CONCRETE, SEE BD-660M.
- FOR BEAM REINFORCEMENT, SEE BD-662M.
- DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, DESIGN SPECIFICATIONS, D5.4.3.6P.
- MODIFY DETAILS AS REQUIRED FOR BRIDGES ON SKEWS.
- MODIFY DOWELS AS REQUIRED TO RESIST HORIZONTAL FORCES. DOWELS SHOWN ARE THE MINIMUM REQUIRED.
- FOR DOWEL DETAIL, SEE BC-775M.
- FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
- PROVIDE MINIMUM CLEAR DISTANCE (W) BETWEEN THE ENDS OF BEAMS AS FOLLOWS:

#### WITH POSITIVE MOMENT REINFORCEMENT

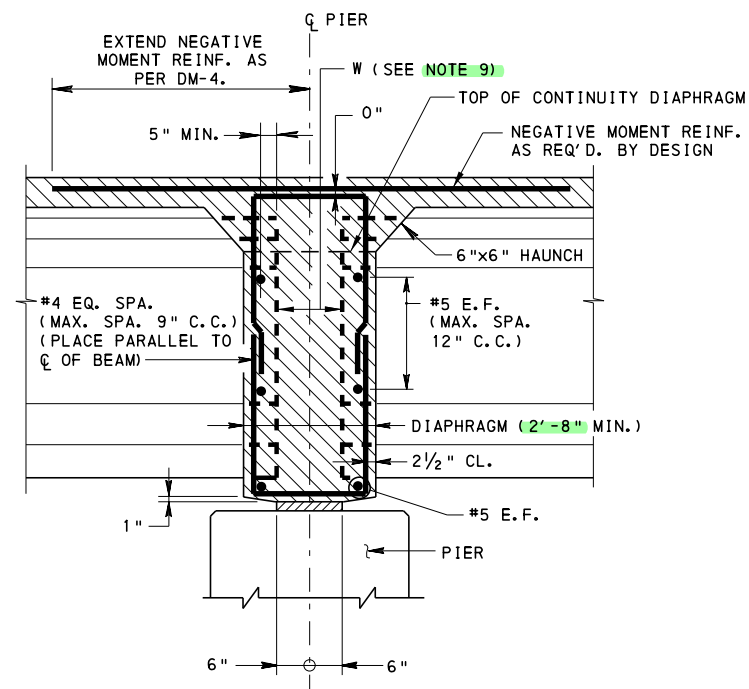
SINGLE LAYER OF POSITIVE MOMENT REINFORCEMENT:  
 10" WIDTH FOR #4 AND #5  
 12" WIDTH FOR #6 AND #7  
 14" WIDTH FOR #8

TWO LAYERS OF POSITIVE MOMENT REINFORCEMENT:  
 12" WIDTH FOR #4 AND #5  
 14" WIDTH FOR #6 AND #7  
 16" WIDTH FOR #8

#### WITHOUT POSITIVE MOMENT REINFORCEMENT

4"

- POSITIVE MOMENT REINFORCEMENT BARS MUST BE THE SAME SIZE WITHIN A BEAM.
- WHEN KINKED BEAMS ARE USED, DESIGN THE BRIDGE AS SIMPLE SPAN MADE CONTINUOUS WITHOUT THE NEED FOR POSITIVE MOMENT REINFORCEMENT. FULL CONTINUITY WITH POSITIVE MOMENT REINFORCEMENT WILL BE PERMITTED ONLY WITH THE CHIEF BRIDGE ENGINEER'S APPROVAL. FOR ALTERNATE DESIGNS AND DESIGN-BUILD PROJECTS, KINKING THE GIRDERS WITH FULL CONTINUITY MAY ONLY BE PROPOSED IF SPECIFICALLY PERMITTED IN THE CONTRACT SPECIAL PROVISIONS.
- HORIZONTAL OFFSETS OF OPPOSING GIRDERS ARE NOT PERMITTED.



**TYPICAL LONGITUDINAL SECTION AT PIER**  
 (FIXED CONDITION SHOWN)  
 (EXPANSION CONDITION SIMILAR)

|         |                                                           |
|---------|-----------------------------------------------------------|
| BD-656M | TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES |
| BD-658M | SHEAR BLOCK DETAILS AT PIER                               |
| BD-660M | DECK SLAB AND STEEL REINFORCEMENT PLACEMENT               |
| BD-662M | I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS           |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                     |
| BC-775M | MISCELLANEOUS PRESTRESS DETAILS                           |
| BC-788M | TYPICAL WATERPROOFING AND EXPANSION DETAILS               |

#### REFERENCE DRAWINGS

**COMMONWEALTH OF PENNSYLVANIA  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF PROJECT DELIVERY**

**STANDARD  
 CONTINUITY FOR LIVE LOAD DETAILS  
 I-BEAM & PA BULB-TEE  
 BEAM BRIDGES**

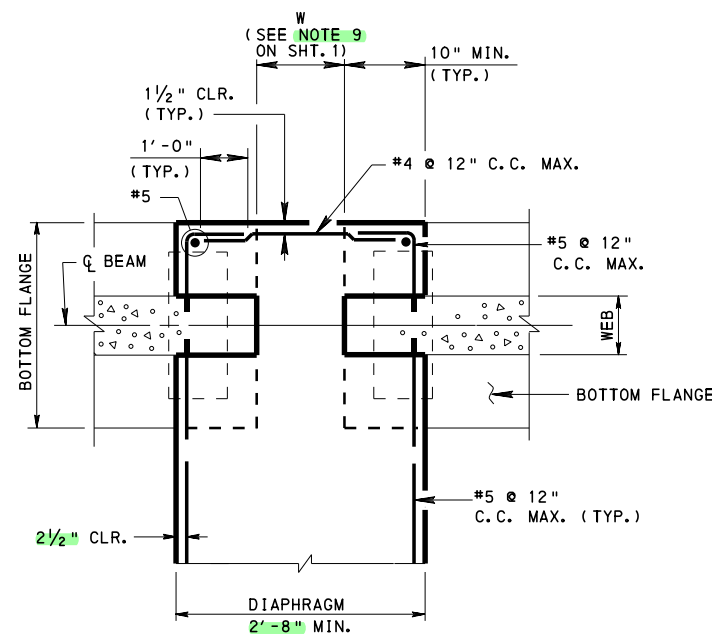
RECOMMENDED AUG. 30, 2019  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 4

**BD-664M**

**CHANGE 2**

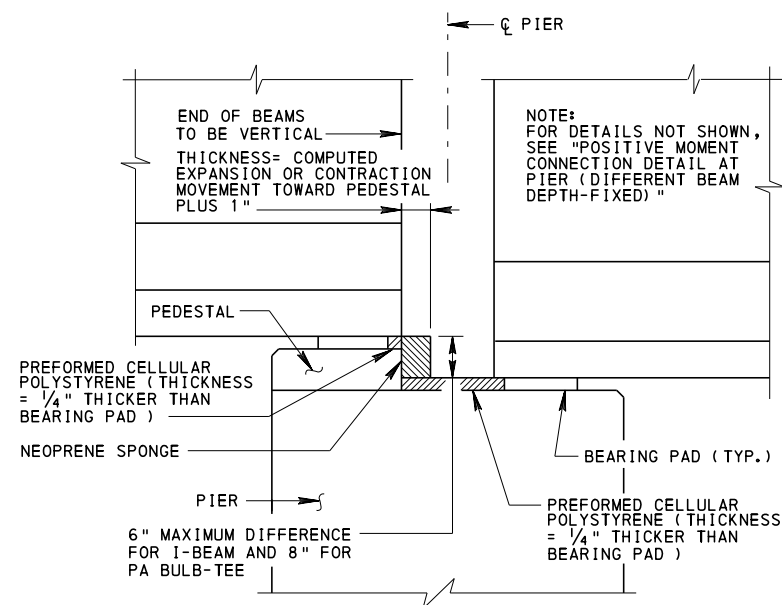


PLAN

TOP FLANGE OF BEAM NOT SHOWN FOR CLARITY

### TYPICAL DIAPHRAGM DETAIL FASCIA BEAM

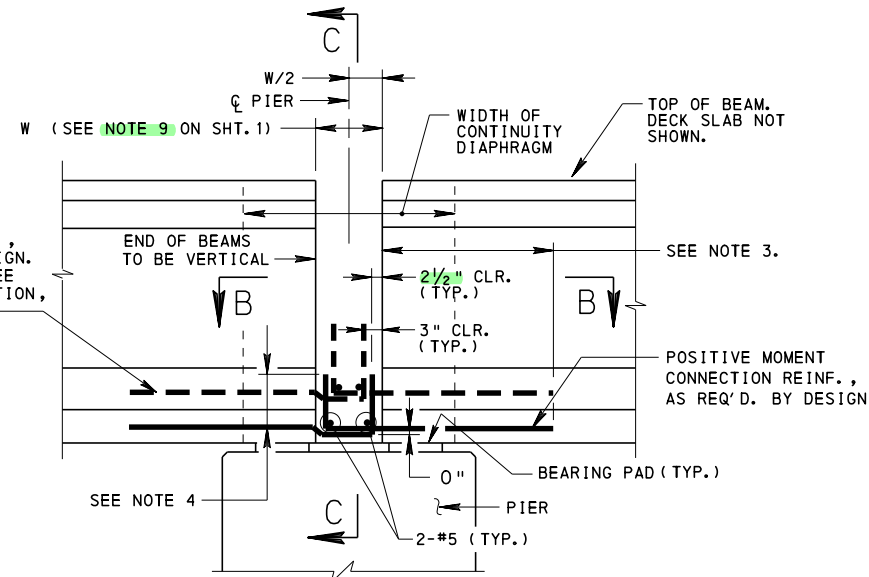
(FASCIA DIAPHRAGM TO BE NORMAL TO  
BEAMS FOR SKEWED BRIDGES)



### POSITIVE MOMENT CONNECTION DETAIL AT PIER

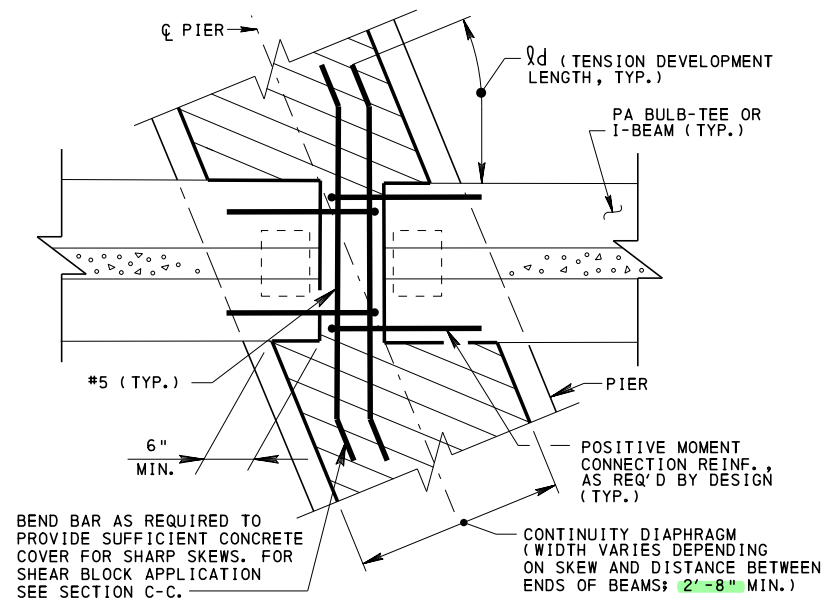
(DIFFERENT BEAM DEPTH-EXPANSION)

SECOND LAYER OF  
POSITIVE MOMENT  
CONNECTION REINF.,  
AS REQ'D. BY DESIGN.  
(FOR LOCATION, SEE  
TYPICAL BEAM SECTION,  
SHEET 3)



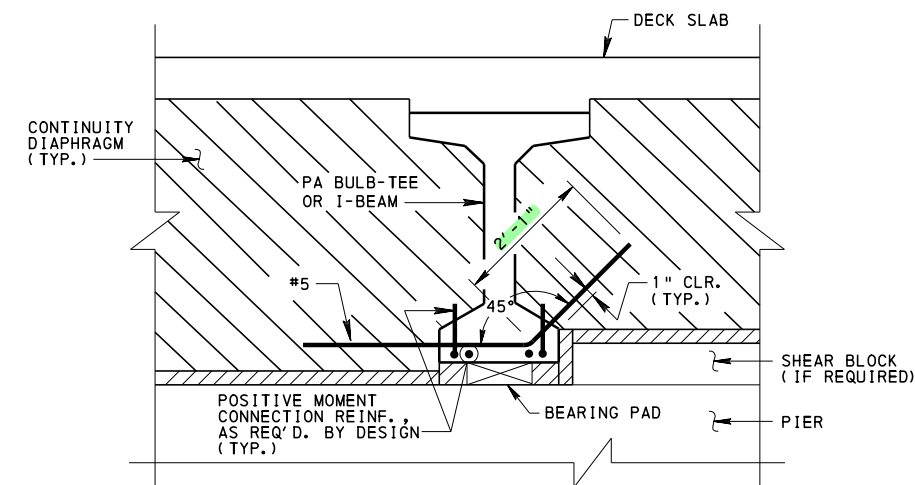
### POSITIVE MOMENT CONNECTION DETAIL AT PIER

(SAME BEAM DEPTH)



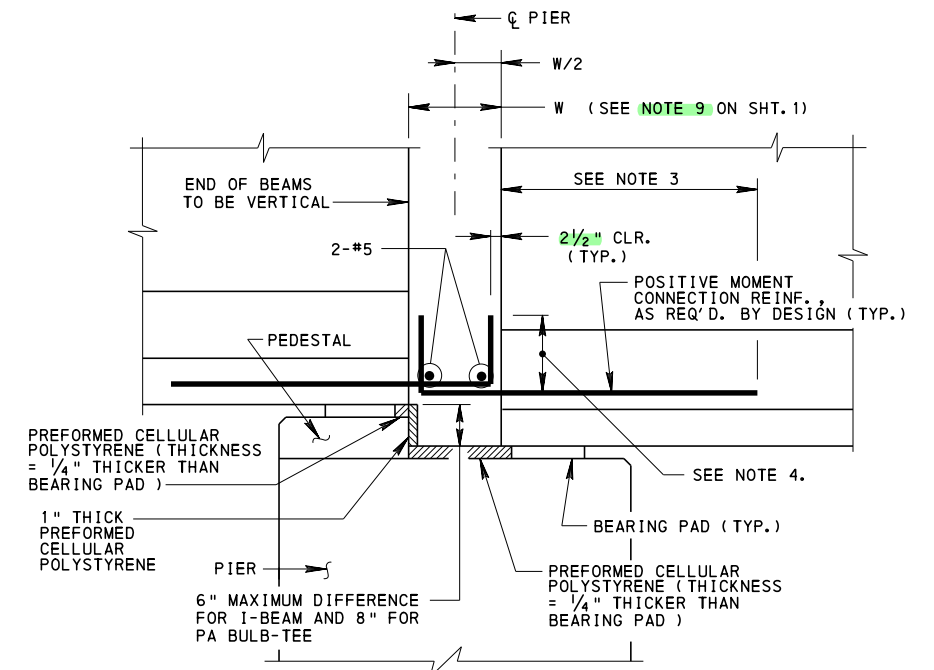
### SECTION B-B

(SKEWED)



### SECTION C-C

(SHOWN WITH SHEAR BLOCK)



### POSITIVE MOMENT CONNECTION DETAIL AT PIER

(DIFFERENT BEAM DEPTH-FIXED)

#### POSITIVE MOMENT CONNECTION NOTES:

1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM.
2. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #8. LARGER SIZE MAY BE USED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
3. EMBED POSITIVE MOMENT REINFORCEMENT BARS INTO THE PRESTRESSED BEAM A MINIMUM OF TWO TIMES THE TRANSFER LENGTH OF THE PRESTRESSING STRANDS PLUS THE TENSION DEVELOPMENT LENGTH OF THE POSITIVE MOMENT REINFORCEMENT BAR. EXTEND EVERY OTHER BAR AN ADDITIONAL 9" TO PROVIDE A STAGGERED CUTOFF CONDITION.
4. PROVIDE VERTICAL LEG AS FOLLOWS:  
#4 AND #5 BAR: 1'-2"  
#6 BAR: 1'-5"  
#7 BAR: 1'-9"  
#8 BAR: 1'-11"  
A 180° HOOK MAY BE USED IN THE FLANGE AREA OF THE BEAM WHEN THE VERTICAL LEG OF A 90° HOOK WOULD PROTRUDE THROUGH THE BEAM FORMS.
5. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM.
6. FOR OPTIONAL POSITIVE MOMENT CONNECTION DETAILS AND NOTES, SEE SHT. 4.

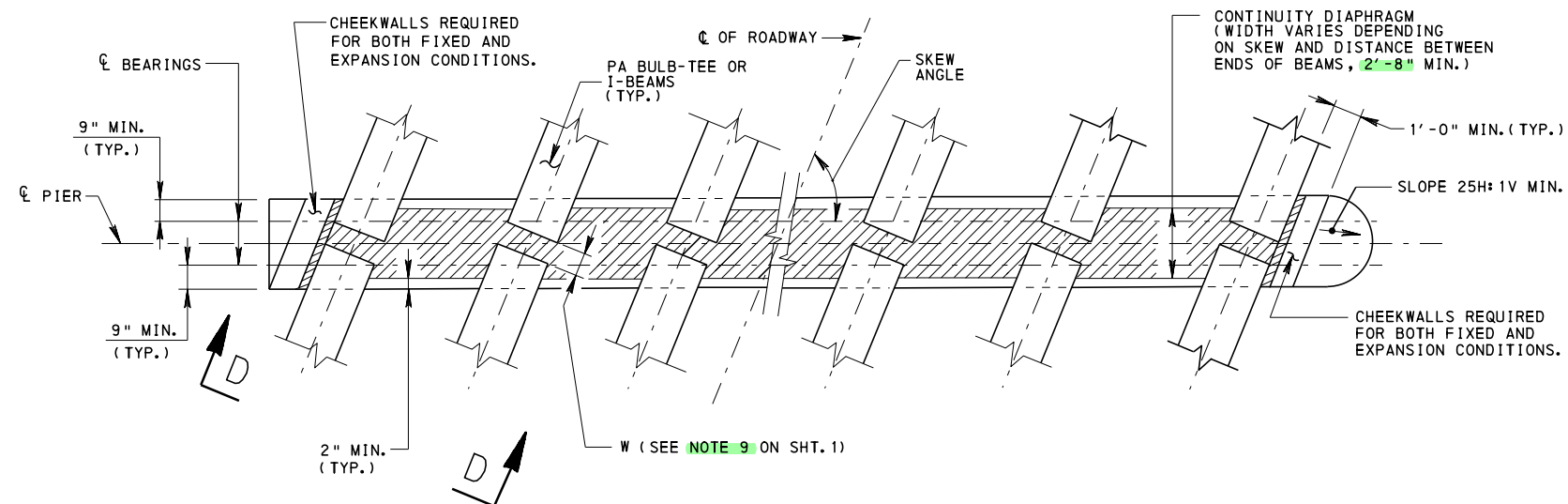
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
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### STANDARD CONTINUITY FOR LIVE LOAD DETAILS I-BEAM & PA BULB-TEE BEAM BRIDGES

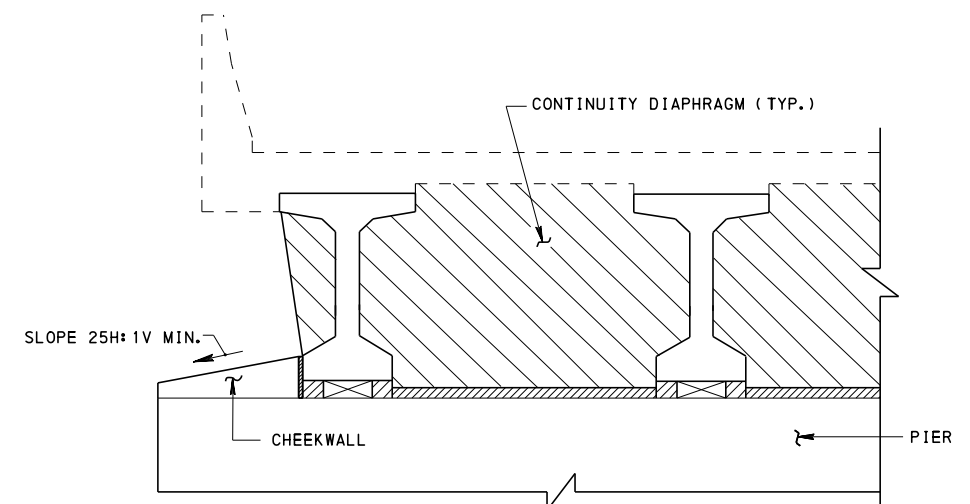
RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

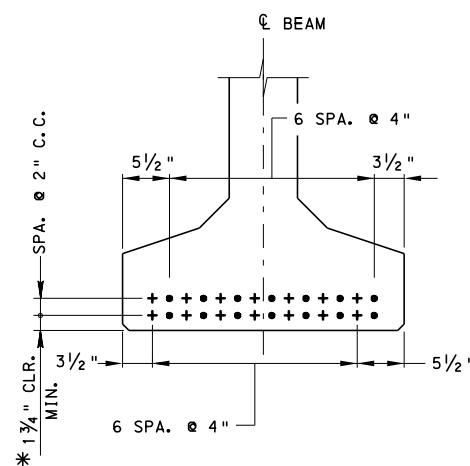
SHEET 2 OF 4  
BD-664M



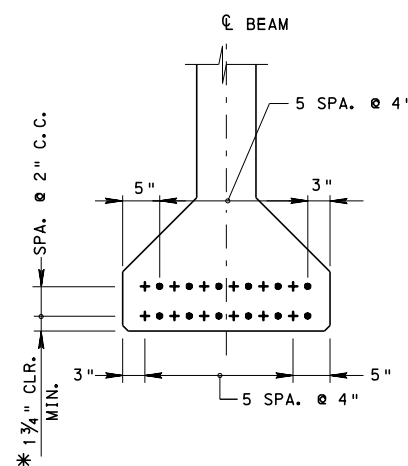
PIER PLAN - (SKEWED)



SECTION D-D



TYPICAL PA BULB-TEE SECTION  
POSITIVE MOMENT REINF. LOCATIONS



TYPICAL I-BEAM SECTION  
POSITIVE MOMENT REINF. LOCATIONS

TYPICAL BEAM SECTION NOTES:

- + DENOTES LOCATION OF POSITIVE MOMENT REINF. AT ONE END OF BEAM.
- DENOTES LOCATION OF POSITIVE MOMENT REINF. AT END OF OPPOSING BEAM.
- \* ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS OR BAR SIZE OF POSITIVE REINFORCEMENT.
- 1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
- 2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE REINFORCEMENT, IF DESIGN IS PROVIDED.
- 3. FOR OPTIONAL POSITIVE MOMENT REINF. LOCATIONS, SEE SHT. 4.

NOTE:

1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.

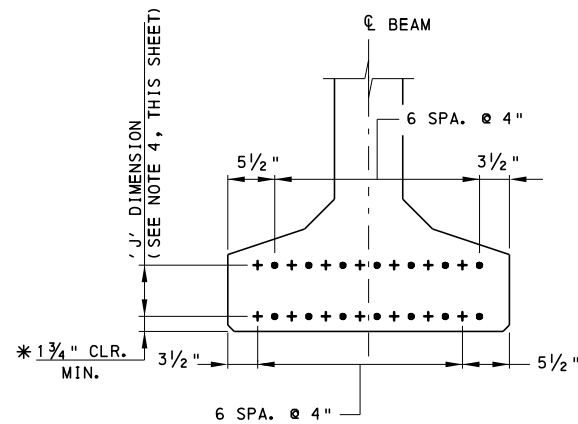
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CONTINUITY FOR LIVE LOAD DETAILS  
I-BEAM & PA BULB-TEE  
BEAM BRIDGES

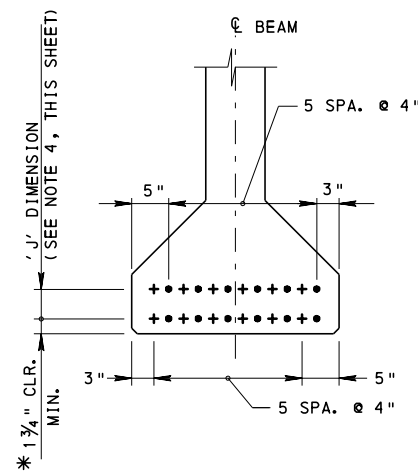
RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bito*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 4  
BD-664M



TYPICAL PA BULB-TEE SECTION  
OPTIONAL POSITIVE MOMENT REINF. LOCATIONS▲



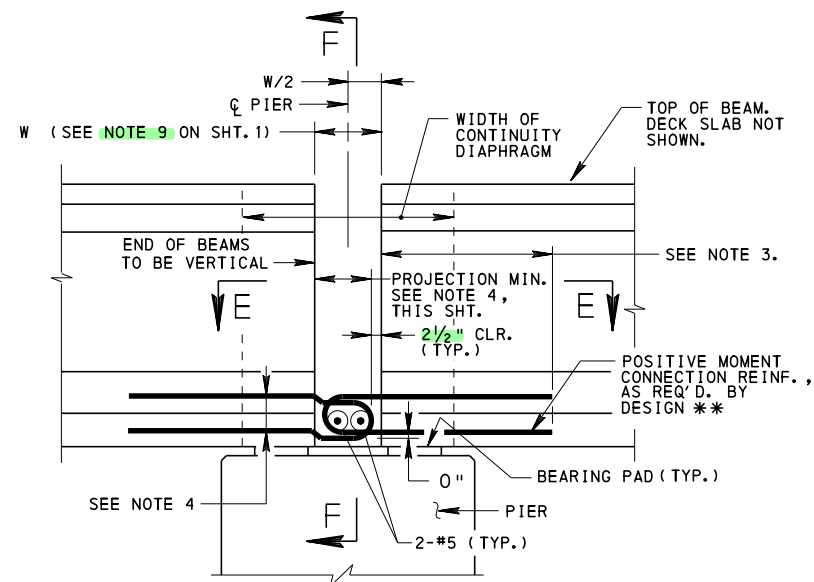
TYPICAL I-BEAM SECTION  
OPTIONAL POSITIVE MOMENT REINF. LOCATIONS▲

#### TYPICAL BEAM SECTION NOTES:

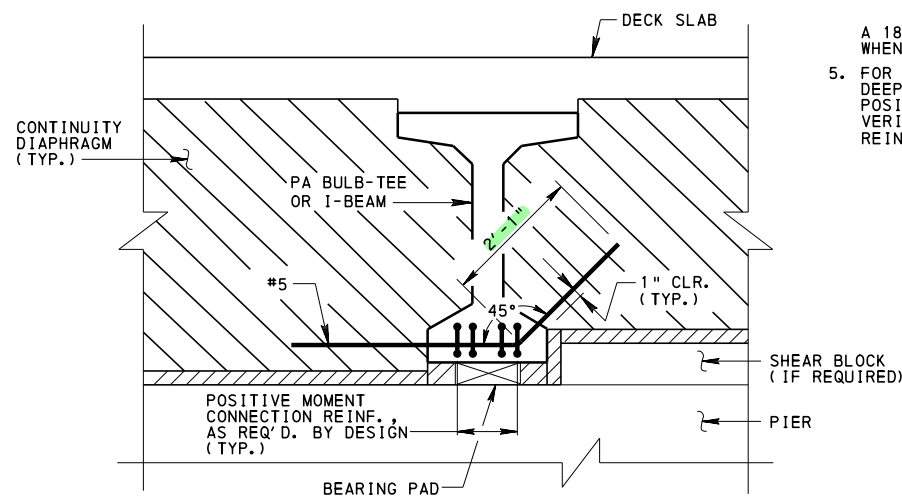
- + DENOTES LOCATION OF POSITIVE MOMENT REINF. AT ONE END OF BEAM.
- DENOTES LOCATION OF POSITIVE MOMENT REINF. AT END OF OPPOSING BEAM.
- ▲ LOCATIONS ARE LIMITED BY BOTTOM FLANGE CONFIGURATION AND 'J' DIMENSION FOR POSITIVE MOMENT REINFORCEMENT (SEE NOTE 4, THIS SHEET)
- \* ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS OR BAR SIZE OF POSITIVE REINFORCEMENT.
- 1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
- 2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE REINFORCEMENT, IF DESIGN IS PROVIDED.

#### NOTE:

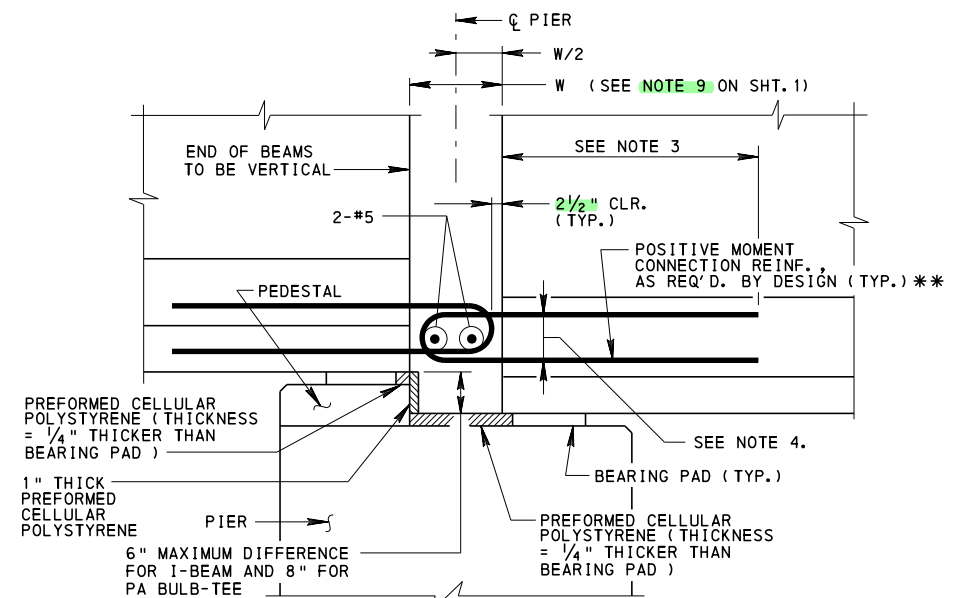
1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.



OPTIONAL POSITIVE MOMENT CONNECTION  
DETAIL AT PIER  
(SAME BEAM DEPTH)



SECTION F-F  
(SHOWN WITH SHEAR BLOCK)

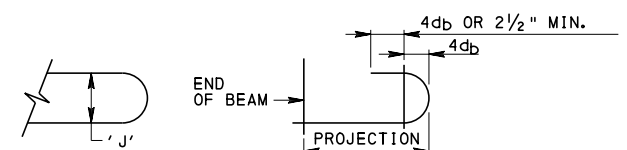


OPTIONAL POSITIVE MOMENT CONNECTION  
DETAIL AT PIER  
(DIFFERENT BEAM DEPTH-FIXED)

#### OPTIONAL POSITIVE MOMENT CONNECTION NOTES:

- \*\* THE CALCULATED AREA OF POSITIVE MOMENT REINFORCEMENT PROVIDED TO BE BASED ON ONE LEG OF REINFORCEMENT. IF BOTH LEGS OF THE REQUIRED REINFORCEMENT WILL FALL ABOVE THE BOTTOM FLANGE AND OUTSIDE THE BEAMS WEB, THIS DETAIL MAY NOT BE USED.
- 1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM. ONLY ONE LAYER OF HAIRPIN REINFORCEMENT IS PERMITTED.
- 2. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #8. LARGER SIZE MAY BE USED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
- 3. EMBED POSITIVE MOMENT REINFORCEMENT BARS INTO THE PRESTRESSED BEAM A MINIMUM OF TWO TIMES THE TRANSFER LENGTH OF THE PRESTRESSING STRANDS PLUS THE TENSION DEVELOPMENT LENGTH (ld) OF THE POSITIVE MOMENT REINFORCEMENT BAR. EXTEND EVERY OTHER BAR AN ADDITIONAL 9" TO PROVIDE A STAGGERED CUTOFF CONDITION.
- 4. PROVIDE 'J' DIMENSION, PROJECTION, AND TENSION DEVELOPMENT LENGTH (ld) FOR POSITIVE MOMENT REINFORCEMENT AS FOLLOWS:

|         | 'J' | PROJECTION | TENSION DEVELOPMENT (ld)<br>(SEE NOTE 3) |
|---------|-----|------------|------------------------------------------|
| #4 BAR: | 4"  | 8"         | 12"                                      |
| #5 BAR: | 5"  | 8"         | 15"                                      |
| #6 BAR: | 6"  | 10"        | 18"                                      |
| #7 BAR: | 7"  | 10"        | 21"                                      |
| #8 BAR: | 8"  | 12"        | 24"                                      |

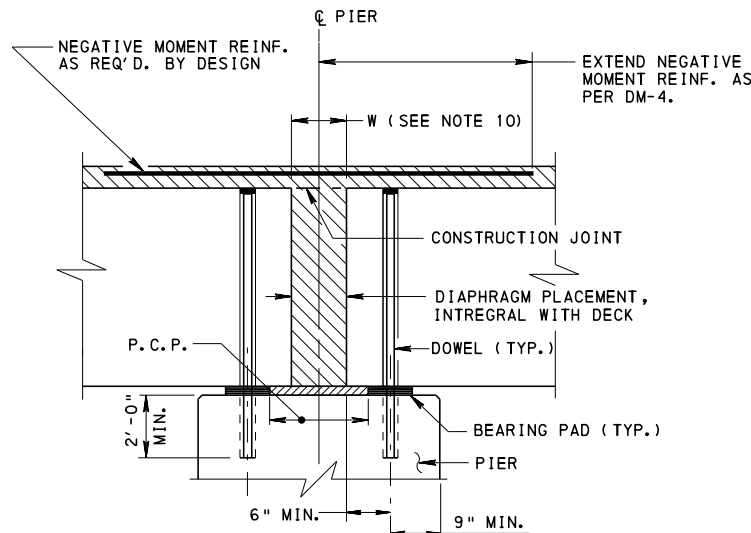


- A 180° HOOK MAY BE USED IN THE FLANGE AREA OF THE BEAM WHEN THE HAIRPIN BAR WOULD PROTRUDE THROUGH THE BEAM FORMS.
- 5. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM. DESIGNER MUST VERIFY CONSTRUCTIBILITY FOR THE NUMBER AND SIZE OF POSITIVE MOMENT REINFORCEMENT BARS USED.

### COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

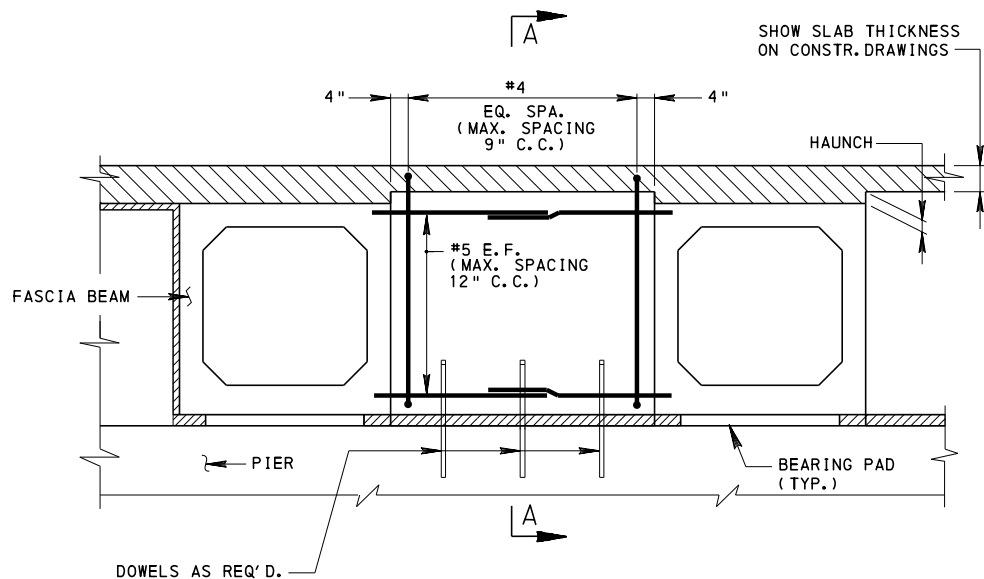
### STANDARD CONTINUITY FOR LIVE LOAD DETAILS I-BEAM & PA BULB-TEE BEAM BRIDGES



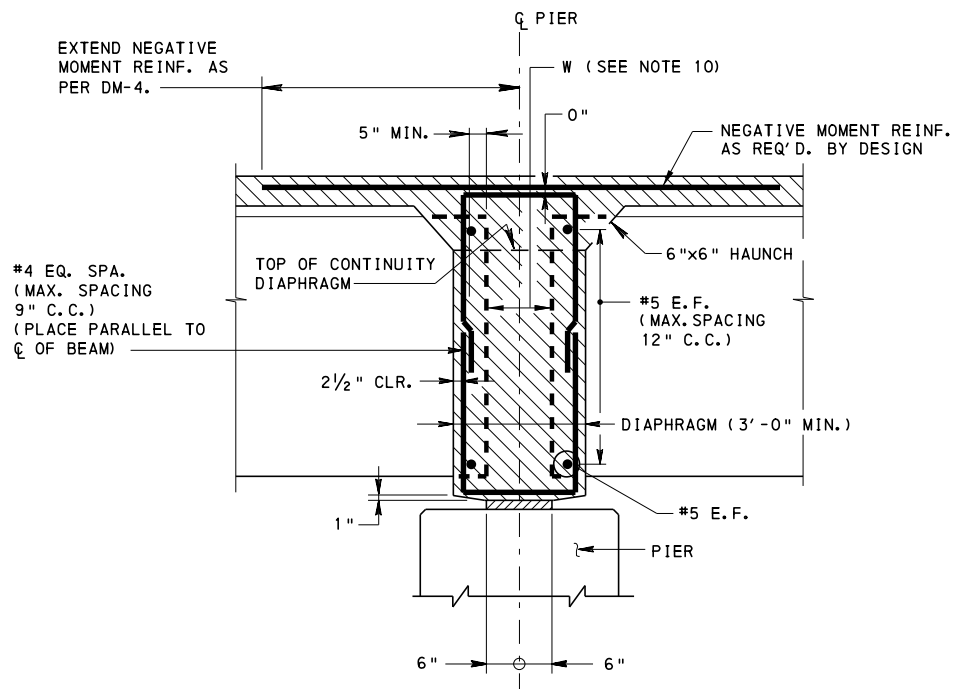


**TYPICAL LONGITUDINAL SECTION  
ADJACENT BOX BEAMS AT PIER  
(FIXED)**

**NOTE:**  
DRILL 2" DIA. HOLE IN PIER AFTER SHEAR KEY  
GROUT REPLACEMENT, PLACE 1 1/4" DIA. DOWEL BARS, AND FILL  
HOLE WITH NON-SHRINK GROUT. USE PREFORMED HOLES FOR PIER  
BENTS OR HAMMERHEAD PIERS. SEE BC-775M FOR ADDITIONAL DETAILS.

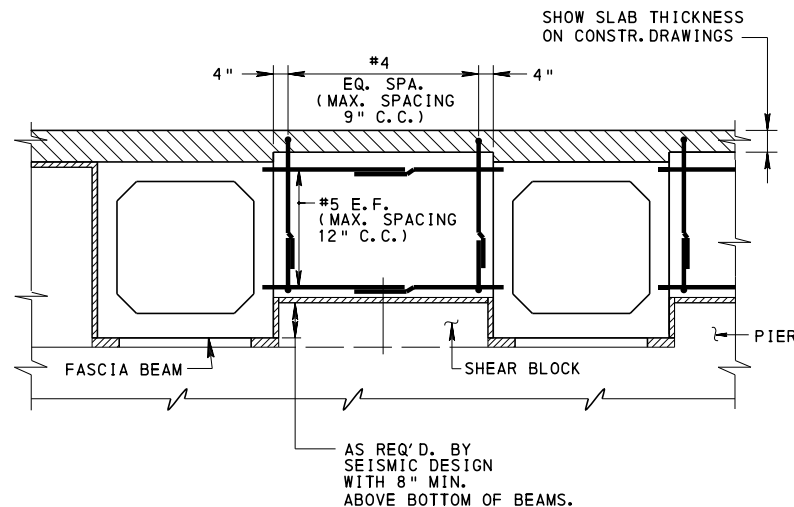


**TYPICAL DIAPHRAGM  
SPREAD BOX BEAMS AT PIER  
(FIXED)**



**SECTION A-A  
(DOWELS NOT SHOWN)**

**TYPICAL LONGITUDINAL SECTION  
SPREAD BOX BEAMS AT PIER  
(FIXED CONDITION SHOWN)  
(EXPANSION CONDITION SIMILAR)**



**TYPICAL DIAPHRAGM  
SPREAD BOX BEAMS AT PIER  
(EXPANSION)**

**NOTES:**

1. ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A615/A615M, A996/A996M OR A706/A706M.
2. FOR LOCATION OF DOWELS, SHEAR BLOCKS OR CURTAIN WALLS, SEE BD-658M.
3. FOR SLAB REINFORCEMENT AND PLACEMENT OF DIAPHRAGM CONCRETE, SEE BD-660M.
4. FOR BEAM REINFORCEMENT, SEE BD-661M.
5. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, D5.4.3.6P.
6. MODIFY DETAILS AS REQUIRED FOR BRIDGES ON SKEWS.
7. MODIFY DOWELS AS REQUIRED TO RESIST HORIZONTAL FORCES. DOWELS SHOWN ARE THE MINIMUM REQUIRED.
8. FOR DOWEL DETAIL, SEE BC-775M.
9. FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
10. PROVIDE MINIMUM CLEAR DISTANCE (W) BETWEEN THE ENDS OF BEAMS AS FOLLOWS:

**WITH POSITIVE MOMENT REINFORCEMENT**

SINGLE LAYER OF POSITIVE MOMENT REINFORCEMENT:

- 10" WIDTH FOR #4 AND #5
- 12" WIDTH FOR #6 AND #7
- 14" WIDTH FOR #8

TWO LAYERS OF POSITIVE MOMENT REINFORCEMENT:

- 12" WIDTH FOR #4 AND #5
- 14" WIDTH FOR #6 AND #7
- 16" WIDTH FOR #8

**WITHOUT POSITIVE MOMENT REINFORCEMENT**

4"

11. POSITIVE MOMENT REINFORCEMENT BARS MUST BE THE SAME SIZE WITHIN A BEAM.
12. WHEN KINKED BEAMS ARE USED, DESIGN THE BRIDGE AS SIMPLE SPAN MADE CONTINUOUS WITHOUT THE NEED FOR POSITIVE MOMENT REINFORCEMENT. FULL CONTINUITY WITH POSITIVE MOMENT REINFORCEMENT WILL BE PERMITTED ONLY WITH THE CHIEF BRIDGE ENGINEER'S APPROVAL. FOR ALTERNATE DESIGNS AND DESIGN-BUILD PROJECTS, KINKING THE GIRDERS WITH FULL CONTINUITY MAY ONLY BE PROPOSED IF SPECIFICALLY PERMITTED IN THE CONTRACT SPECIAL PROVISIONS.
13. HORIZONTAL OFFSETS OF OPPOSING GIRDERS ARE NOT PERMITTED.

**ABBREVIATIONS:**

P.C.P. - PREFORMED CELLULAR POLYSTYRENE

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
CONTINUITY FOR LIVE LOAD DETAILS  
BOX BEAM BRIDGES**

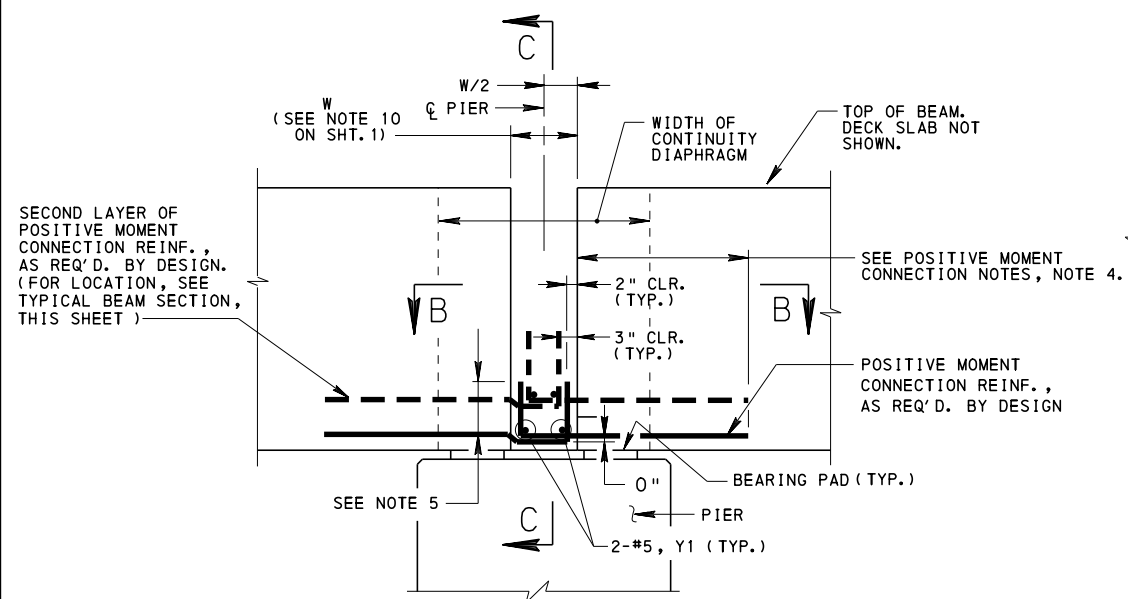
RECOMMENDED APR. 29, 2016  
*Thomas P. Maciore*  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
*Brian S. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

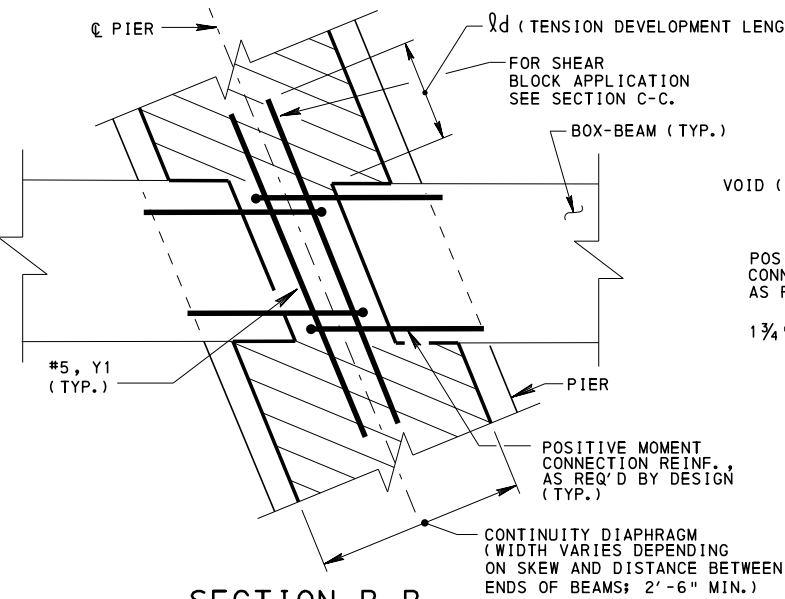
SHEET 1 OF 3

**BD-665M**

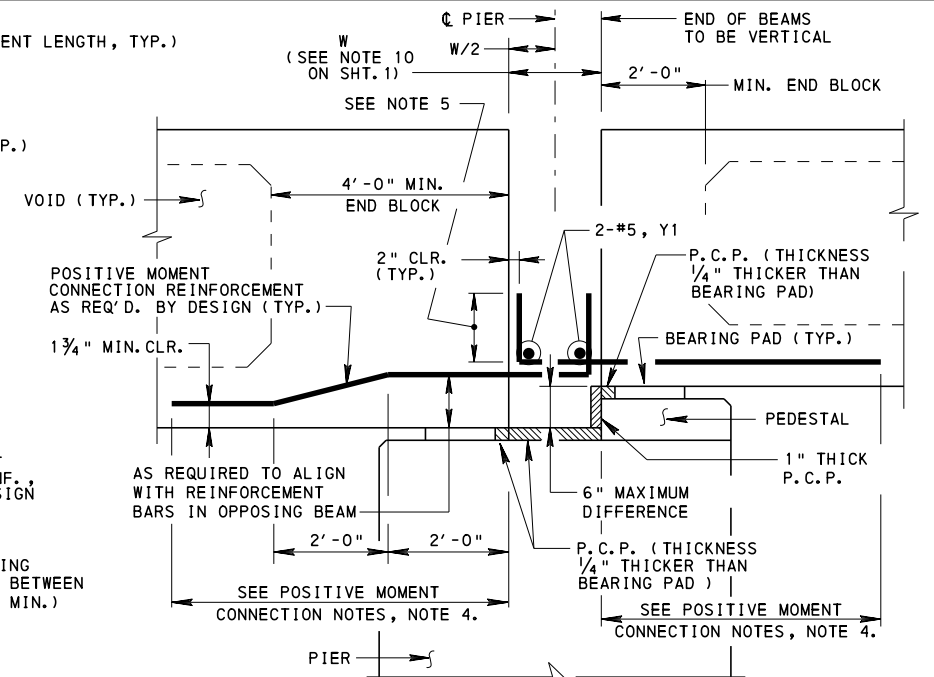
|                    |                                                             |
|--------------------|-------------------------------------------------------------|
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS I-BEAMS AND BOX BEAM SECTIONS |
| BD-658M            | SHEAR BLOCK DETAILS AT PIER                                 |
| BD-660M            | DECK SLAB AND STEEL REINFORCEMENT PLACEMENT                 |
| BD-661M            | BOX BEAM REINFORCEMENT DETAILS                              |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                       |
| BC-775M            | MISCELLANEOUS PRESTRESS DETAILS                             |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS                 |
| REFERENCE DRAWINGS |                                                             |



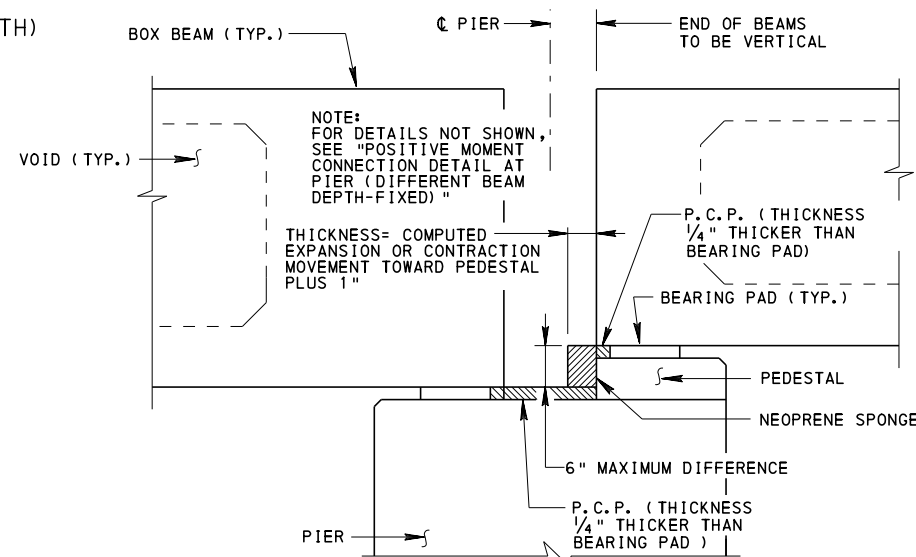
**POSITIVE MOMENT CONNECTION DETAIL  
AT PIER**  
(SAME BEAM DEPTH)



**SECTION B-B**  
(SKEWED)



**POSITIVE MOMENT CONNECTION DETAIL  
AT PIER**  
(DIFFERENT BEAM DEPTH-FIXED)



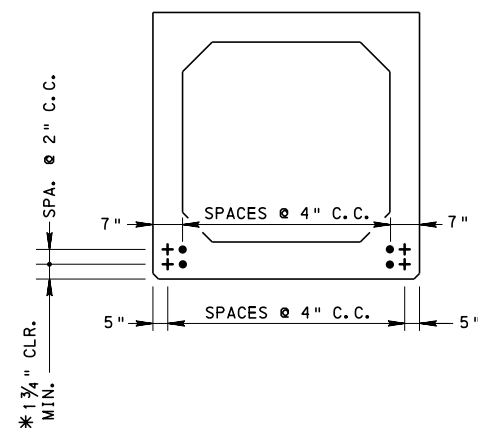
**POSITIVE MOMENT CONNECTION DETAIL  
AT PIER**  
(DIFFERENT BEAM DEPTH-EXPANSION)

**POSITIVE MOMENT CONNECTION NOTES:**

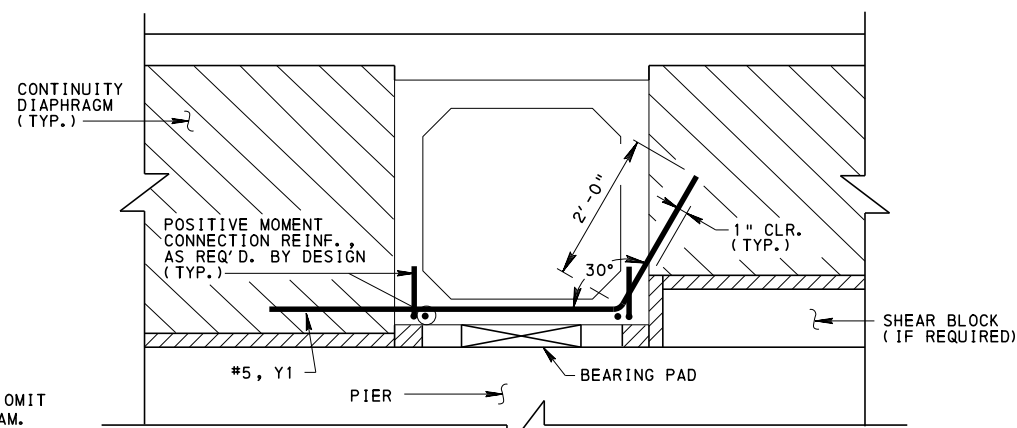
1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM.
2. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM.
3. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #8. LARGER SIZE MAY BE USED WITH APPROVAL OF THE CHIEF BRIDGE ENGINEER.
4. EMBED POSITIVE MOMENT REINFORCEMENT BARS INTO THE PRESTRESSED BEAM A MINIMUM OF TWO TIMES THE TRANSFER LENGTH OF THE PRESTRESSING STRANDS PLUS THE TENSION DEVELOPMENT LENGTH OF THE POSITIVE MOMENT REINFORCEMENT BAR. EXTEND EVERY OTHER BAR AN ADDITIONAL 9" TO PROVIDE A STAGGERED CUTOFF CONDITION.
5. PROVIDE VERTICAL LEG AS FOLLOWS:
  - #4 AND #5 BAR: 1'-2"
  - #6 BAR: 1'-5"
  - #7 BAR: 1'-9"
  - #8 BAR: 1'-11"

**TYPICAL BEAM SECTION NOTES:**

- + DENOTES LOCATION OF POSITIVE MOMENT REINF. AT ONE END OF BEAM.
  - DENOTES LOCATION OF POSITIVE MOMENT REINF. AT END OF OPPOSING BEAM.
  - \* ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS.
1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
  2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE MOMENT REINFORCEMENT IF DESIGN IS PROVIDED.
  3. IF DOWEL IS USED FOR ADJACENT BOX BEAMS, OMIT POSITIVE MOMENT REINFORCEMENT AT CL OF BEAM.



**TYPICAL BEAM SECTION**  
**POSITIVE MOMENT REINF. LOCATIONS**



**SECTION C-C**

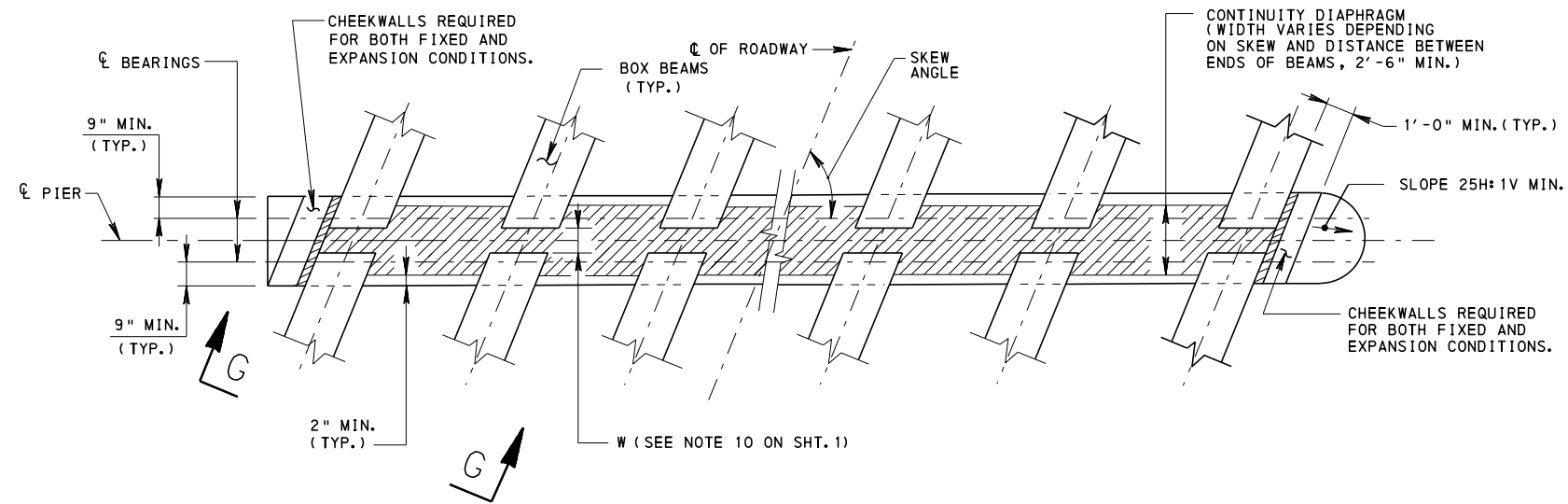
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

**STANDARD**  
**CONTINUITY FOR LIVE LOAD DETAILS**  
**BOX BEAM BRIDGES**

RECOMMENDED APR. 29, 2016  
*Thomas P. Maciore*  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
*Brian S. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

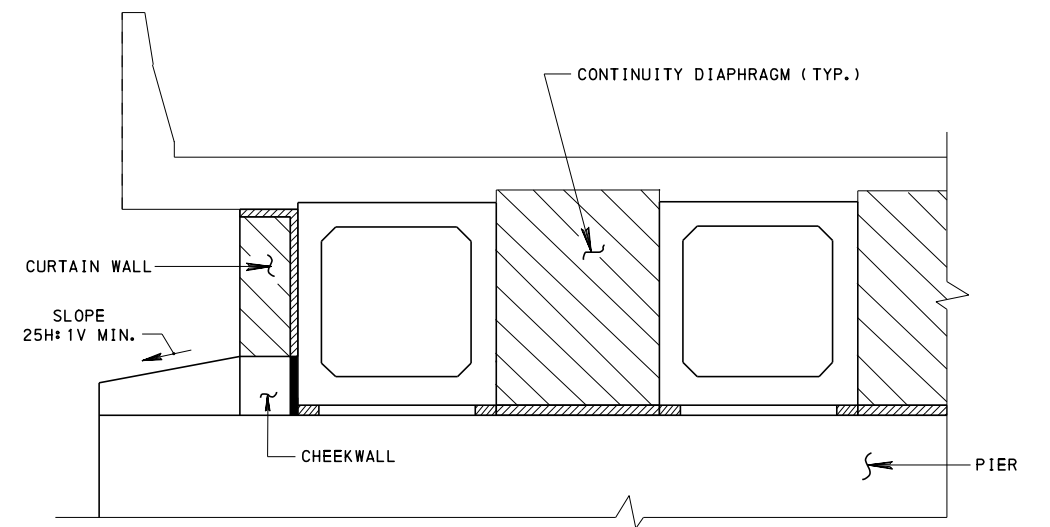
SHEET 2 OF 3  
**BD-665M**



PIER PLAN - (SKEWED)

NOTE:

ADJACENT BOX BEAM BRIDGES ARE SIMILAR. PLACE CHEEKWALLS ON ONE SIDE OF BRIDGE BEFORE THE BEAMS ARE SET. PLACE CHEEKWALLS ON OTHER SIDE OF BRIDGE AFTER THE POST-TENSIONING TENDONS ARE INSTALLED.



SECTION G-G

NOTE:

1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
CONTINUITY FOR LIVE LOAD DETAILS  
BOX BEAM BRIDGES

RECOMMENDED APR. 29, 2016  
*Thomas P. Maciore*  
CHIEF BRIDGE ENGINEER

RECOMMENDED APR. 29, 2016  
*Brian S. Thompson*  
DIRECTOR, BUR. OF PROJECT DELIVERY

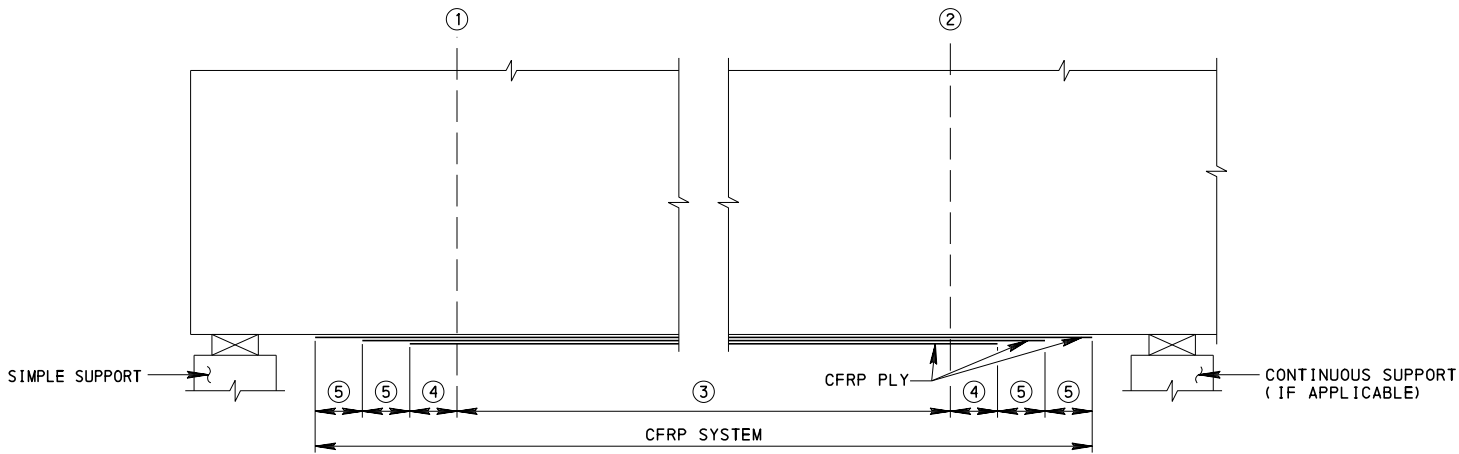
SHEET 3 OF 3  
BD-665M

DESIGN NOTES:

1. THE PROJECT DESIGNER WILL DETERMINE IF A CARBON FIBER REINFORCEMENT POLYMER (CFRP) SYSTEM IS A SUITABLE STRENGTHENING REPAIR TECHNIQUE FOR THE SPECIFIC PROJECT. PERFORM A CONDITION ASSESSMENT OF THE EXISTING BRIDGE THAT INCLUDES ESTABLISHING ITS LOAD-CARRYING CAPACITY, IDENTIFYING DEFICIENCIES AND THEIR CAUSES, AND DETERMINING THE CONDITION AND STRENGTH OF THE CONCRETE SUBSTRATE.
2. THE PROJECT DESIGNER WILL PROVIDE CONCEPTUAL DESIGN CALCULATIONS, CONTRACT DRAWINGS AND PERFORMANCE SPECIFICATIONS THAT ARE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA. THE PROJECT DESIGNER MUST PROVIDE CALCULATIONS THAT SUMMARIZE THE ASSUMPTIONS AND PARAMETERS USED FOR THE CONCEPTUAL DESIGN OF THE CFRP SYSTEM. THE FINAL DESIGN OF THE CFRP SYSTEM WILL BE PREPARED BY THE CONTRACTOR'S PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA.
3. DESIGN THE STRENGTHENING REPAIR IN ACCORDANCE WITH AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF BONDED FRP SYSTEMS FOR REPAIR AND STRENGTHENING OF CONCRETE BRIDGE ELEMENTS, 1ST EDITION.
4. REFER TO NCHRP REPORT 609 RECOMMENDED CONSTRUCTION SPECIFICATIONS AND PROCESS CONTROL MANUAL FOR REPAIR AND RETROFIT OF CONCRETE STRUCTURES USING BONDED FRP COMPOSITES FOR PREPARING THE CONTRACT DRAWINGS AND PERFORMANCE SPECIFICATIONS.
5. REFER TO ACI 440.2R-17 GUIDE FOR THE DESIGN AND CONSTRUCTION OF EXTERNALLY BONDED FRP SYSTEMS FOR STRENGTHENING CONCRETE STRUCTURES FOR ADDITIONAL GUIDANCE IN PREPARING THE DESIGN, CONTRACT DRAWINGS, AND PERFORMANCE SPECIFICATIONS.
6. TO PREVENT SUDDEN FAILURE OF THE BEAM IN CASE THE CFRP SYSTEM IS DAMAGED. LIMIT THE STRENGTHENING OBTAINED BY THE CFRP SYSTEM SO THAT THE LOSS OF THE CFRP REINFORCEMENT WILL NOT CAUSE MEMBER FAILURE UNDER SUSTAINED SERVICE LOADS.
7. ANALYSIS MUST BE PERFORMED ON THE MEMBER STRENGTHENED BY THE CFRP SYSTEM TO CHECK THAT UNDER OVERLOAD CONDITIONS THE STRENGTHENED MEMBER WILL FAIL IN A FLEXURE MODE RATHER THAN A SHEAR MODE.
8. INCLUDE GENERAL NOTES ON THE CONTRACT DRAWINGS THAT LIST DESIGN LOADS AND ALLOWABLE STRAINS IN THE CFRP SYSTEM USED IN THE CONCEPTUAL DESIGN.
9. DESCRIBE THE MATERIAL PROPERTIES OF THE CFRP LAMINATES AND CONCRETE SUBSTRATE USED IN THE CONCEPTUAL DESIGN. THE EXISTING CONCRETE SUBSTRATE MUST POSSESS THE NECESSARY STRENGTH TO DEVELOP THE DESIGN STRESSES OF THE CFRP SYSTEM THROUGH BOND.
10. CONSIDER BEAM REPLACEMENT WHEN 25% OF THE STRANDS IN A BEAM NO LONGER CONTRIBUTE TO ITS CAPACITY. LIKewise, CONSIDER BEAM REPLACEMENT IF EXCESSIVE FLEXURE CRACKS ARE PRESENT INDICATING SUBSTANTIAL LOSS OF PRESTRESS.

GENERAL NOTES:

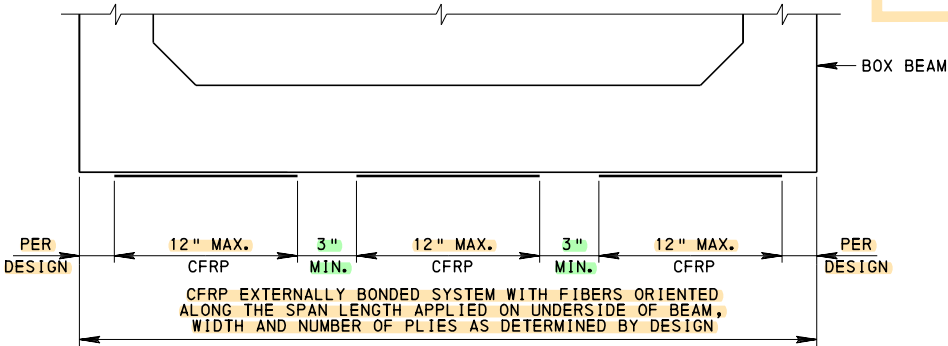
1. USE AN EXTERNALLY BONDED CFRP SYSTEM TO STRENGTHEN EXISTING STRUCTURE COMPONENTS.
2. CONSTRUCT CONCRETE REPAIRS IN ACCORDANCE WITH BC-783M PRIOR TO INSTALLING THE CFRP SYSTEM. IF REPAIR OF BEAM DETERIORATION IS NEEDED, CONFIRM THAT THE SPECIFIED BEAM DETERIORATION REPAIR MATERIAL IS COMPATIBLE WITH THE CFRP SYSTEM.
3. USE A BOND-CRITICAL CFRP SYSTEM. DO NOT USE MECHANICAL ANCHORAGES.
4. THE APPLICATION OF THE CFRP SYSTEM WILL NOT STOP THE ONGOING CORROSION OF EXISTING REINFORCEMENT STEEL. IF STEEL CORROSION IS EVIDENT OR IS DEGRADING THE CONCRETE SUBSTRATE, PLACEMENT OF CFRP REINFORCEMENT IS NOT RECOMMENDED WITHOUT ARRESTING THE ONGOING CORROSION AND REPAIRING ANY DEGRADATION TO THE SUBSTRATE.
5. IDENTIFY THE CAUSE(S) OF THE BEAM DETERIORATION AND TAKE CORRECTIVE ACTION TO EXTEND THE DESIGN LIFE OF THE STRENGTHENING. FOR EXAMPLE, LEAKING EXPANSION JOINTS SHOULD BE REPAIRED.
6. ONLY SPECIFY WELL-DOCUMENTED CFRP SYSTEMS THAT HAVE SUFFICIENT TEST DATA TO DEMONSTRATE ADEQUATE PERFORMANCE OF THE ENTIRE SYSTEM IN SIMILAR APPLICATIONS, INCLUDING METHODS OF INSTALLATION.
7. INDICATE THE LOCATION OF THE CFRP SYSTEM RELATIVE TO THE EXISTING STRUCTURE.
8. PROVIDE THE CONCEPTUAL DIMENSIONS AND ORIENTATION OF EACH PLY OR LAMINATE, THE NUMBER OF PLYS, AND THE SEQUENCE OF INSTALLATION.
9. PROVIDE THE LOCATIONS OF SPLICES AND LAP LENGTHS.
10. SPECIFY THE CONCRETE SURFACE PREPARATION REQUIREMENTS, INCLUDING CORNER PREPARATION AND MAXIMUM IRREGULARITIES LIMITATIONS.
11. SPECIFY PULL-OFF TESTS OF INSTALLED CFRP.
12. PROVIDE AN ULTRAVIOLET LIGHT PROTECTION COATING SYSTEM OF SIMILAR COLOR AS THE SURROUNDING EXISTING CONCRETE. THE COATING MUST BE A NON-VAPOR-BARRIER, FLEXIBLE, WATERPROOFING, AND COMPATIBLE WITH THE CFRP SYSTEM.
13. FILL ANY SURFACE VOID IN THE EXISTING CONCRETE WITH A DIAMETER LARGER THAN 1/2" OR A DEPTH GREATER THAN 1/8".
14. REPAIR CRACKS WITH A WIDTH OF 1/8" OR GREATER IN EXISTING CONCRETE PRIOR TO CONSTRUCTING THE CFRP STRENGTHENING. SPECIFY EPOXY INJECTION CRACK REPAIR IN ACCORDANCE WITH PUBLICATION 408, SECTION 1091.
15. FILL ANY SURFACE OUT-OF FLATNESS DEPRESSION DEEPER THAN 1/8 IN. OVER A LENGTH OF 12 IN.
16. THE MAXIMUM SURFACE ROUGHNESS OF THE CONCRETE SHALL NOT EXCEED CSP-3 AS DEFINED BY ICRI/ACI (1999).
17. PROVIDE SPACES BETWEEN CFRP SHEAR REINFORCEMENT U-WRAP STRIPS TO ALLOW FOR MOISTURE EVAPORATION AND INSPECTION OF THE CFRP SYSTEM AND BEAM.
18. USE U-WRAPS WITH NO MECHANICAL ANCHORAGE FOR CFRP SHEAR CAPACITY STRENGTHENING SYSTEMS.
19. IF THE DECK IS NOT TO BE REMOVED AS PART OF THE PROJECT, THEN USE A THREE-SIDED U-WRAP FOR SHEAR STRENGTHENING. IF THE DECK IS TO BE REMOVED, THEN COMPLETELY WRAP THE BEAM SECTION.
20. DO NOT USE THE CFRP SYSTEM AS COMPRESSION REINFORCEMENT.
21. THE CFRP SYSTEM CAN ALSO BE APPLIED TO REINFORCED CONCRETE T-BEAM BRIDGES. THE CAUSE OF THE BEAM DETERIORATION AND THE REPAIR OF SUBSTRATE CONCRETE AND REINFORCEMENT BARS MUST BE ADDRESSED PRIOR TO APPLYING THE CFRP SYSTEM.



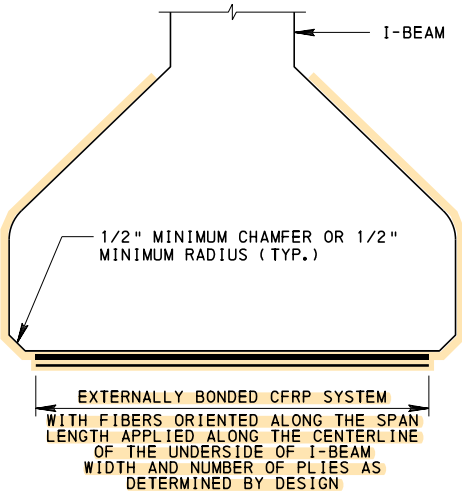
ELEVATION - TYPICAL FLEXURE STRENGTHENING  
OF CONCRETE BEAM

LEGEND:

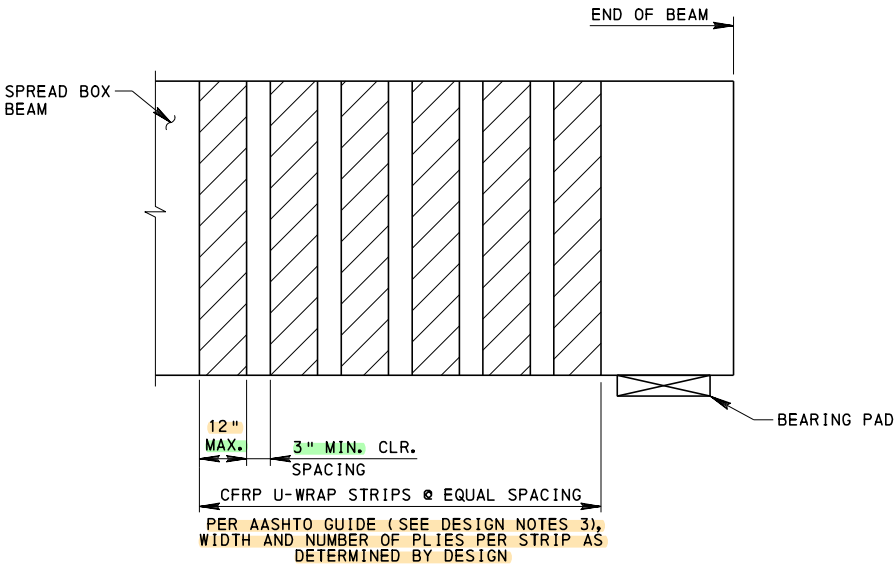
- ① LOCATION TOWARD THE NEAREST SIMPLE SUPPORT, AT WHICH THE FACTORED MOMENT FALLS BELOW THE CRACKING MOMENT OF THE STRENGTHENED BEAM ( $M_u \leq M_{cr}$ ).
- ② LOCATION TOWARD THE NEAREST CONTINUOUS SUPPORT, AT WHICH THE FACTORED MOMENT IS AT AN INFLECTION POINT ( $M_u = 0$ ).
- ③ CFRP BONDED LENGTH BETWEEN LOCATION ① AND ② BUT NO LESS THAN STRENGTHENING LENGTH AS DETERMINED BY DESIGN.
- ④ DEVELOPMENT LENGTH PER AASHTO GUIDE (SEE DESIGN NOTE 3), 12 IN. MIN.
- ⑤ 6 IN. MIN.



SECTION - FLEXURE STRENGTHENING  
OF BOX BEAM



SECTION - FLEXURE STRENGTHENING  
OF I-BEAM



ELEVATION - SHEAR STRENGTHENING  
OF SPREAD BOX BEAM

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

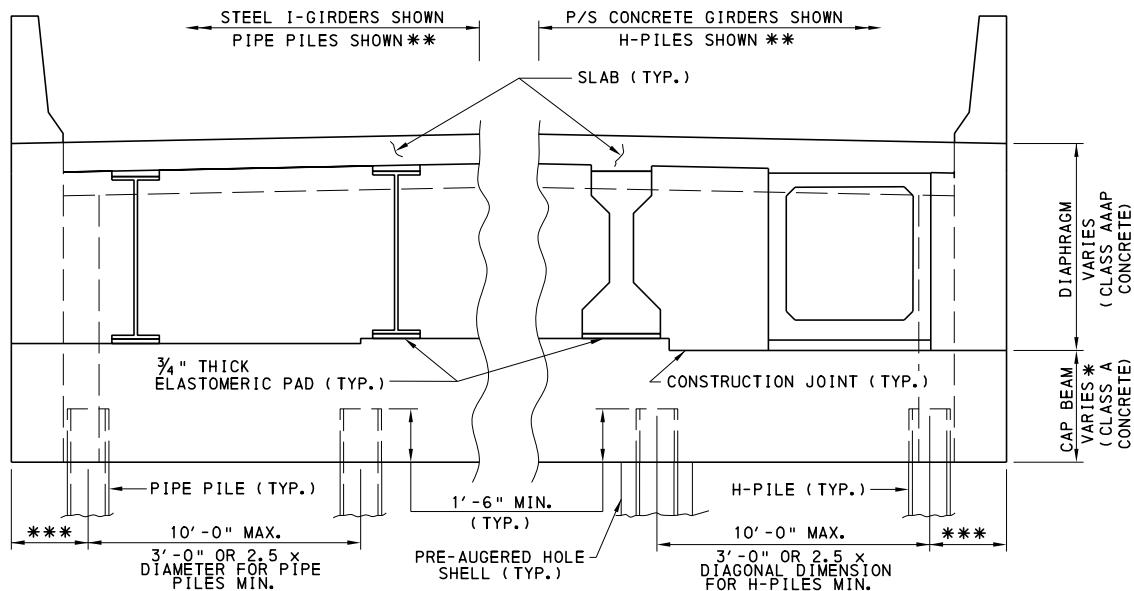
STANDARD  
CFRP STRENGTHENING  
PRESTRESSED CONCRETE BEAMS

RECOMMENDED NOV. 23, 2022  
L. E. Gray  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
L. E. Gray  
CHIEF ENGINEER, HIGHWAY ADMIN.

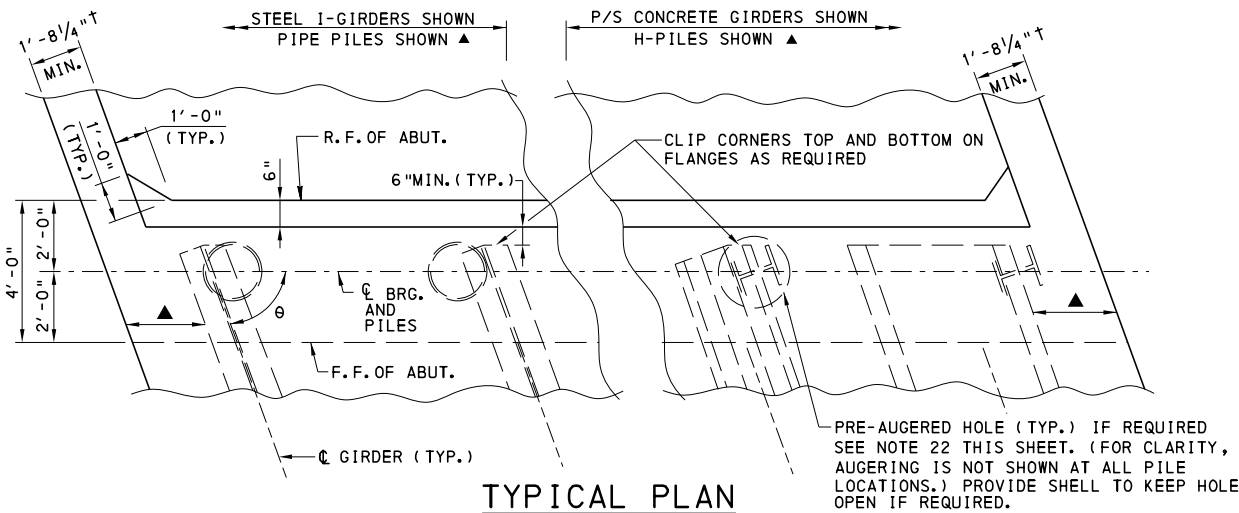
SHEET 1 OF 1  
BD-666M

- CHANGE 2
- CHANGE 3
- CHANGE 5



TYPICAL ELEVATION

- \* DEPTH OF ABUTMENT BELOW CONSTRUCTION JOINT IS 3'-3" AT SHALLOWEST POINT (SEE DESIGN MANUAL, PART 4, AP.G.1.4.1). THE MAXIMUM DIFFERENCE BETWEEN THE MINIMUM AND MAXIMUM CAP DEPTH WILL NOT EXCEED 1'-0" FOR SKEW < 80° OR 1'-6" FOR SKEW ≥ 80°.
- \*\* BOTH H-PILES AND PIPE PILES MAY BE USED WITH STEEL OR CONCRETE GIRDERS. GALVANIZE TOP 15'-0" LENGTH OF THE PILES OR ENTIRE PILES LENGTH.
- \*\*\* THE MAXIMUM EDGE DISTANCE BETWEEN THE CENTERLINE OF THE PILE AND THE END OF THE ABUTMENT, MEASURED ALONG THE SKEW, SHALL BE THE LARGER OF:
  - 2'-6" AND  $\frac{(W+dpile/2)}{\sin(\theta)}$  (ROUNDED UP TO THE NEXT 3" INCREMENT)
  - WHERE: W: WIDTH OF WINGWALL AT REAR FACE OF INTEGRAL ABUTMENT, NEGLECTING THE 1' HAUNCH (ft.)
  - dpile: OUTSIDE DIAMETER FOR PIPE PILES OR PILE DEPTH FOR H-PILES (ft.)
- THE MINIMUM EDGE DISTANCE BETWEEN THE CENTERLINE OF THE PILE AND THE END OF THE ABUTMENT, MEASURED ALONG THE SKEW, SHALL BE THE LARGER OF:
  - 1'-6"
  - THE DISTANCE REQUIRED TO PROVIDE 3" CLEARANCE FROM THE PILES TO THE HORIZONTAL REINFORCEMENT EXTENDING FROM THE WINGWALL.



TYPICAL PLAN

- † WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE SELECTED.
- ▲ EXTERIOR BEAMS TO BE LOCATED TO PROVIDE 3" CLEAR TO THE HORIZONTAL REINFORCEMENT EXTENDING FROM THE WINGWALLS.

DETACHED WINGWALL NOTES

- DETERMINE THE MOVEMENT REQUIREMENTS AND THE OPENING OF THE EXPANSION DAM FOR THE EXPANSION JOINT BETWEEN THE ABUTMENT AND DETACHED WINGWALLS, AT THE TIME OF CONSTRUCTION, IN ACCORDANCE WITH DESIGN MANUAL, PART 4 AP.G.1.6.
- BOND THE PREFORMED NEOPRENE COMPRESSION SEAL BETWEEN THE ABUTMENT AND THE DETACHED WINGWALL EXPANSION JOINTS (SEE SECTION M-M ON SHEET 6) TO BOTH THE ABUTMENT AND THE DETACHED WINGWALL.
- BOND THE CLOSED CELL NEOPRENE SPONGE IN THE DETACHED WINGWALL EXPANSION JOINTS (SEE SECTION M-M ON SHEET 6) TO THE WINGWALL. RECESS THE NEOPRENE SPONGE 1/2" INTO THE WINGWALL.
- THE WATERPROOFING MEMBRANE ACROSS THE EXPANSION JOINT BETWEEN THE INTEGRAL ABUTMENT AND DETACHED WINGWALLS WILL BE IN ACCORDANCE WITH PUBLICATION 408, SECTION 680. THE MEMBRANE SHALL SPAN THE WIDTH OF THE RECESS IN THE ABUTMENT AND IN THE DETACHED WALL, AND SHALL HAVE 8" BONDED ON EACH SIDE. THE LENGTH OF THE MEMBRANE SHALL BE 6" LONGER THAN THE SPANNED LENGTH (I.E. 6" SLACK) AT THE TIME OF INSTALLATION. SEE DETAIL P ON SHEET 7.
- PAINT THE CONTACT SURFACE BETWEEN THE APPROACH SLAB AND WINGWALL WITH AN APPROVED BOND BREAKER AND SEAL WITH AN APPROVED SEALER.

GENERAL NOTES

- ALL DIMENSIONS GIVEN IN U.S. CUSTOMARY UNITS.
- DESIGN SPECIFICATIONS
  - AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
  - PENNDOT DESIGN MANUAL PART 4, VOLUME 1, PART B: DESIGN SPECIFICATIONS AND VOLUME 2, APPENDIX G
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PUBLICATION 408 AND CONTRACT SPECIAL PROVISIONS.
- MATERIAL STRENGTH
  - REINFORCEMENT STEEL  $f_y = 60$  KSI
  - CONCRETE  $f'_c = 4000$  PSI (CLASS AAAP CONCRETE) FOR DECK SLABS, APPROACH SLABS, AND END DIAPHRAGMS AND WINGWALLS ABOVE CONSTRUCTION JOINT, MODULAR RATIO ( $E_s/E_c$ )  $n = 8$ .
  - $f'_c = 3500$  PSI (CLASS AA CONCRETE) FOR BARRIERS, MODULAR RATIO ( $E_s/E_c$ )  $n = 8$ .
  - $f'_c = 3000$  PSI (CLASS A CONCRETE) FOR CAP BEAM AND WINGWALLS BELOW CONSTRUCTION JOINT, MODULAR RATIO ( $E_s/E_c$ )  $n = 9$ .
- DEAD LOAD
  - DENSITY OF NORMAL WEIGHT CONCRETE = 150 PCF
  - FUTURE WEARING SURFACE = 30 PSF
- LIVE LOAD
  - LIVE LOAD IS CALCULATED ASSUMING ALL POTENTIAL LANES ARE LOADED. USE A MULTIPLE PRESENCE FACTOR OF 1.0 FOR DESIGN OF THE INTEGRAL ABUTMENT CAP AND SUPPORTING PILES.
  - THE LIVE LOAD IS ASSUMED TO BE EVENLY DISTRIBUTED TO ALL PILES.
- DYNAMIC LOAD ALLOWANCE (1M) = 33% IS APPLIED TO LIVE LOADS ON THE ABUTMENTS AND THE PILES ACCORDING TO ARTICLES A3.6.2.1 AND D3.6.2.1.
- DESIGN CONTROLS
  - CONCRETE COVER: INTEGRAL ABUTMENT (I.E., CAP BEAM AND END DIAPHRAGM) AND WINGWALLS = 3"
  - DETAIL MINIMUM EMBEDMENT AND SPLICE LENGTHS IN ACCORDANCE WITH STANDARD DRAWING BC-736M.
  - BAR SIZE: MAXIMUM BAR SIZE #11 MINIMUM BAR SIZE #4
- FOR DESIGN CONTROLS OF DECK AND BARRIERS, SEE BD-601M.
- USE ONLY ONE ROW OF VERTICAL PILES PER ABUTMENT. PILES MAY BE H-PILES OR PIPE PILES. FOR H-PILES, ORIENT THE WEB PERPENDICULAR TO THE LONGITUDINAL AXIS OF THE GIRDER OF THE END SPAN. TAPERED PILES MAY BE USED PROVIDED THE TAPER POINT IS BELOW THE POINT OF CONTRAFLEXURE.
- ALL REINFORCING BARS ARE TO BE EPOXY COATED.
- USE ONLY NORMAL WEIGHT CONCRETE FOR WINGWALLS AND ABUTMENTS.
- DETAIL ALL BARS ON THE CONTRACT DRAWINGS.
- PROVIDE A TROWEL SMOOTH SURFACE OF THE CONSTRUCTION JOINT DIRECTLY UNDER THE GIRDERS AND THE AREA EXTENDING 2" OUTSIDE OF THAT AREA. ON ALL OTHER CONSTRUCTION JOINTS, PROVIDE A RAKED SURFACE.
- PROVIDE 3/4" THICK, 50 DUROMETER NEOPRENE PADS UNDER ALL GIRDERS. ALL PADS WILL BE 12" ALONG THE LENGTH OF THE BEAM AND MATCH THE WIDTH OF THE BEAM MINUS ANY CHAMFERS. BLOCK THE AREAS UNDER THE GIRDERS NOT IN CONTACT WITH THE BEARING PADS USING 1" THICK BACKER RODS.
- TAKE LIMITS OF FILL BEHIND THE ABUTMENT AND THE WINGWALLS AS SHOWN ON RC-12M.
- FOR DETAILS OF INSERTS IN PRECAST CONCRETE BEAMS, SEE BD-655M IN ADDITION TO SHEETS 2, 4 AND 9 OF THIS STANDARD.
- FOR DETAILS OF APPROACH SLABS FOR INTEGRAL ABUTMENT BRIDGES, SEE BD-628M.
- PLACE ALL GIRDERS, INCLUDING BOX BEAMS, WITH THEIR WEBS VERTICAL. STEP TOP OF CAP BEAM TO PROVIDE THE CORRECT BEAM SEAT ELEVATION. CHANGE HAUNCH THICKNESS ACROSS THE WIDTH OF THE GIRDERS TO PROVIDE THE CORRECT ROADWAY CROSS-SLOPE AND SUPERELEVATION. SLOPE BEAM SEAT IN THE LONGITUDINAL DIRECTION TO MATCH BOTTOM OF BEAM. FOR ADJACENT BOX BEAMS, ENSURE SHEAR KEYS AND TENDONS ALIGN ACROSS BEAM SEAT STEPS.
- THE BOTTOM OF THE ABUTMENT MAY BE HORIZONTAL. HOWEVER, THE VARIATION IN THE PILE CAP DEPTH FROM ONE END OF THE ABUTMENT TO THE OTHER DUE TO SUPERELEVATION IS LIMITED TO 1'-6" [1'-0" FOR SKEWS LESS THAN 80 DEGREES]. FOR SUPERELEVATIONS THAT WOULD RESULT IN GREATER VARIATIONS, THE BOTTOM OF THE ABUTMENT MUST BE PARALLEL TO THE SLOPE OF THE ROADWAY. FOR THE REINFORCEMENT SHOWN, THE PILE CAP IS TO BE A MINIMUM 3'-3" THICK, WITH A MAXIMUM DEPTH OF 4'-3" FOR SKEWS LESS THAN 80 DEGREES, AND A MAXIMUM DEPTH OF 4'-9" FOR SKEWS GREATER THAN OR EQUAL TO 80 DEGREES. PILE CAP DEPTHS GREATER THAN 4'-3" FOR SKEWS LESS THAN 80 DEGREES AND PILE CAP DEPTHS GREATER THAN 4'-9" FOR SKEWS GREATER THAN OR EQUAL TO 80 DEGREES MUST BE APPROVED BY CHIEF BRIDGE ENGINEER.
- INTEGRAL ABUTMENTS AT OPPOSITE ENDS OF A BRIDGE SHALL BE THE SAME DEPTH EXCEPT FOR VARIATIONS DUE TO DIFFERENCES IN ROADWAY CROSS SLOPE OR SUPERELEVATION. THE BEAM SEAT MUST BE PARALLEL TO THE ROADWAY GRADE, IN THE LONGITUDINAL DIRECTION.
- DETERMINE THE MINIMUM DIAMETER OF THE PRE-AUGERED HOLES IN ACCORDANCE WITH DESIGN MANUAL, PART 4 AP.G.1.4.2.1.
- BEAM DEPTH IS RESTRICTED TO A 6'-0" MAXIMUM DEPTH WHEN USED FOR INTEGRAL ABUTMENT UNLESS APPROVED BY CHIEF BRIDGE ENGINEER.
- DETAILS FOR BEAMS LESS THAN 1'-5" ARE NOT INCLUDED IN THIS STANDARD.
- SKEW LIMITATION FOR INTEGRAL ABUTMENTS PER SECTION 1.2.2 OF DESIGN MANUAL, PART 4 APPENDIX "G".
- FLARED WINGWALLS ARE NOT TO BE USED WITH INTEGRAL ABUTMENTS. REFERENCE APPENDIX "G" OF DESIGN MANUAL PART 4 SECTION 1.4.4.
- BOTH THE TYPICAL AND ALTERNATE SIDEWALK DETAILS MAY BE USED ON INTEGRAL ABUTMENT BRIDGES. IF USED, THOSE DETAILS MUST BE CARRIED THROUGH THE APPROACH SLAB.
- THE SLRFD SOFTWARE REQUIRES BEARING STIFFENERS AT THE CENTERLINE OF BEARING AND ALSO CONSIDERS THE GIRDERS TO BE Laterally BRACED AT THE CENTERLINE OF BEARING. THE DESIGNER IS RESPONSIBLE FOR DETAILING THE BEARING STIFFENERS. THE LATERAL BRACING (END DIAPHRAGM) IS TO BE OMITTED AND THE FOLLOWING NOTE ADDED TO THE CONSTRUCTION DRAWINGS:
  - THE CONTRACTOR IS RESPONSIBLE FOR TEMPORARY BRACING OF THE GIRDERS. PLACE THE #8 REINFORCEMENT BARS THROUGH THE BEAMS AND THE CAP FORMWORK PRIOR TO PLACING ANY DECK CONCRETE.
- SUPERSTRUCTURE MUST BE ERECTED AND CONNECTED TO THE INTEGRAL ABUTMENTS PRIOR TO PLACING BACKFILL BEHIND THE ABUTMENTS.
- ADD THE FOLLOWING NOTE TO THE CONSTRUCTION DRAWINGS:
  - DURING REDECKING, CONCRETE END DIAPHRAGMS MUST BE REMOVED COMPLETELY PRIOR TO DECK REMOVAL TO AVOID SUBJECTING THE GIRDERS TO STRUCTURE AND PAVEMENT TEMPERATURE FORCES AND EARTH PRESSURE.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
INTEGRAL ABUTMENT  
LAYOUT AND GENERAL NOTES

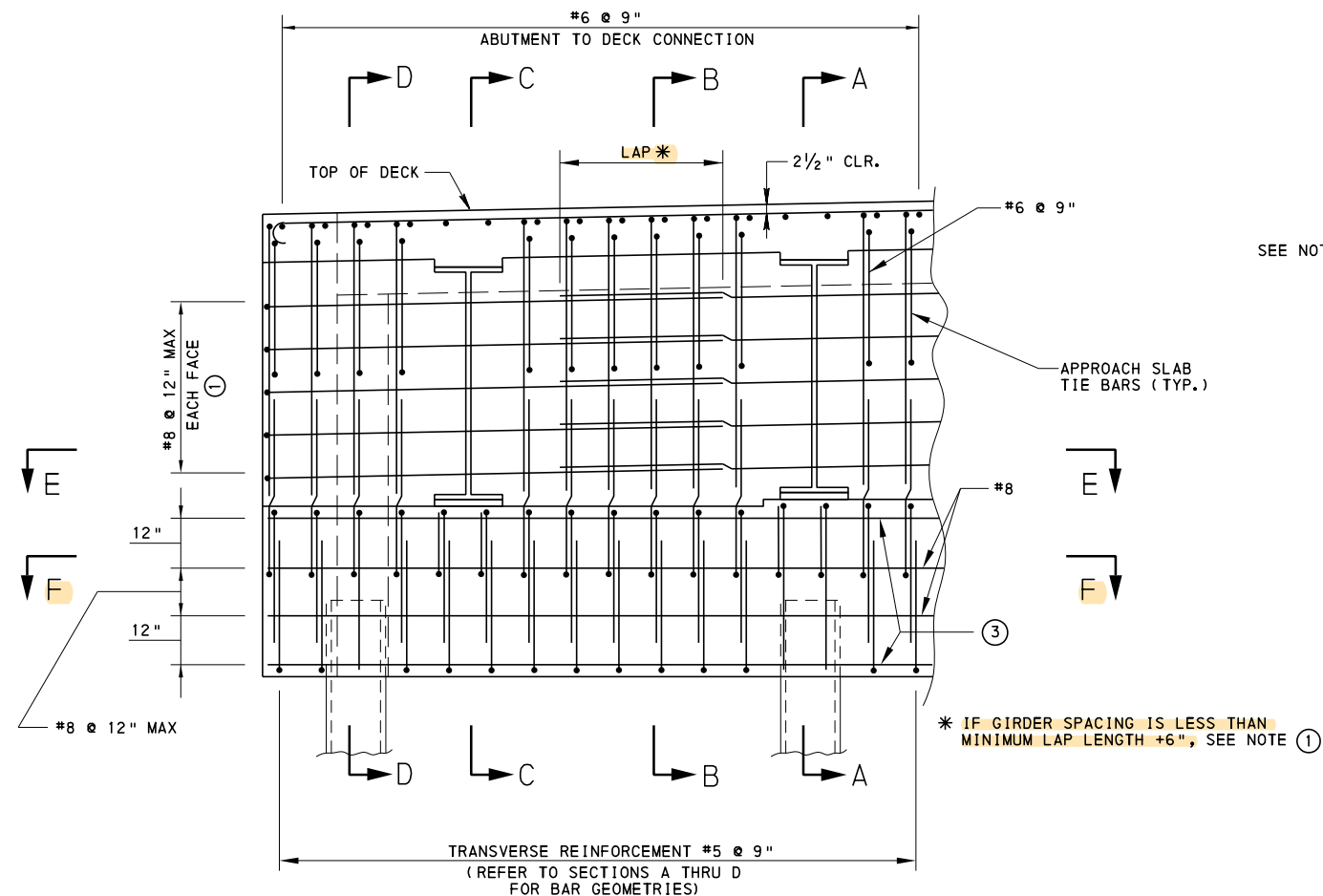
|                    |                                                                           |
|--------------------|---------------------------------------------------------------------------|
| BD-601M            | CONCRETE DECK SLAB                                                        |
| BD-622M            | R.C. ABUTMENTS WITH BACKWALL                                              |
| BD-624M            | R.C. ABUTMENTS WITHOUT BACKWALL                                           |
| BD-628M            | BRIDGE APPROACH SLABS                                                     |
| BD-655M            | TYPICAL SUPERSTRUCTURE SECTIONS                                           |
| BD-656M            | TYPICAL LONGITUDINAL SECTIONS                                             |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                                     |
| BC-751M            | BRIDGE DRAINAGE                                                           |
| BC-754M            | STEEL DIAPHRAGMS FOR STEEL BEAM/GIRDER STRUCTURES (STRAIGHT GIRDERS ONLY) |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS                               |
| RC-12M             | BACKFILL AT STRUCTURES                                                    |
| RC-50M             | GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS                                  |
| REFERENCE DRAWINGS |                                                                           |

RECOMMENDED NOV. 23, 2022  
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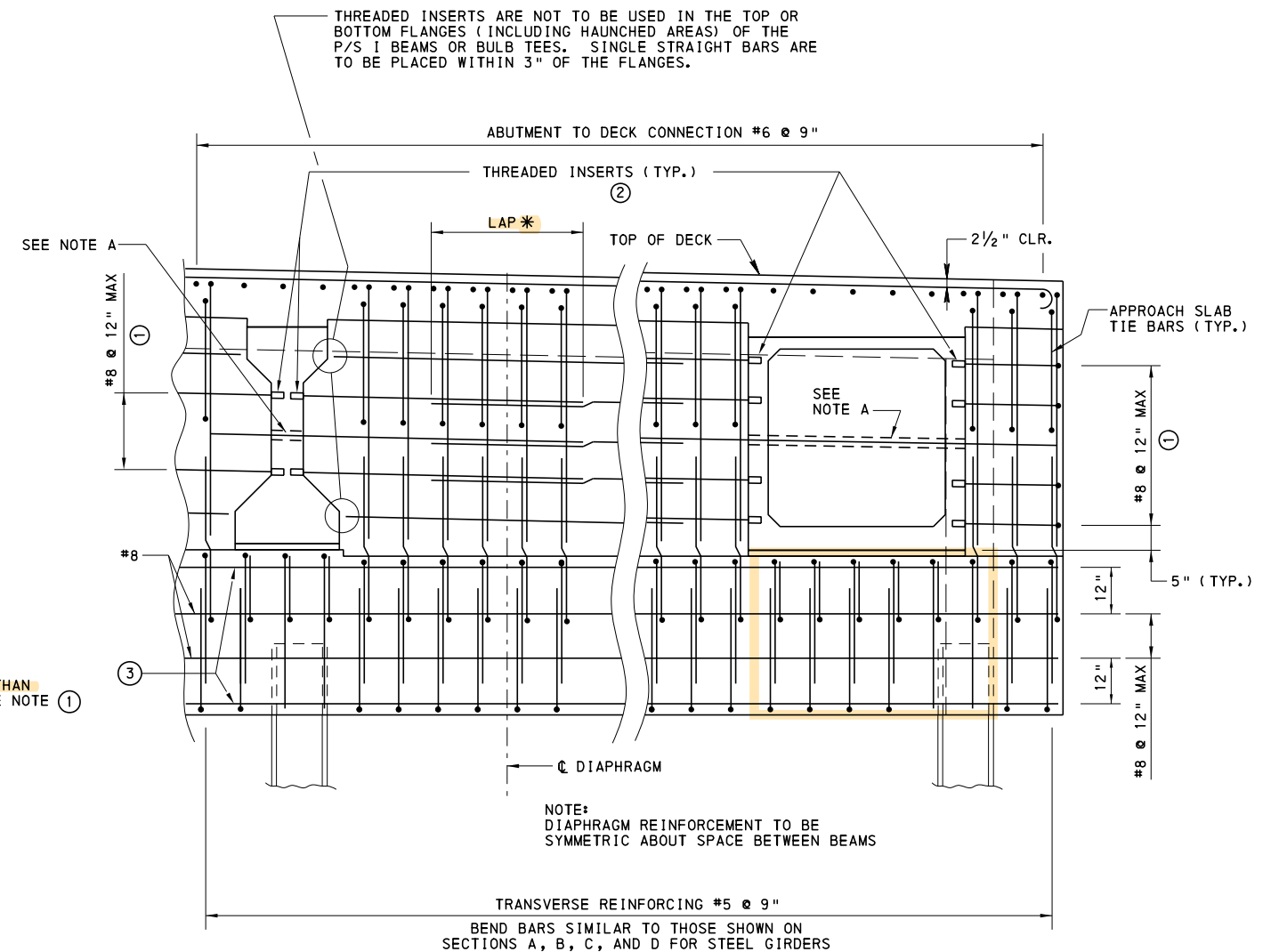
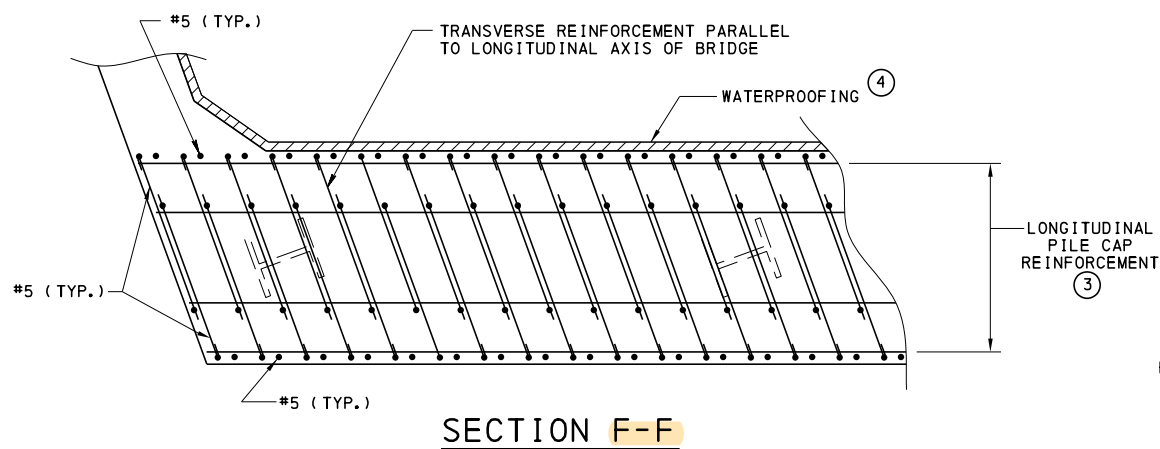
SHEET 1 OF 10  
BD-667M





### PARTIAL SECTION THRU ABUTMENT STEEL GIRDERS

NOTE: FOR SECTION A-A, SEE SHEET 3.  
FOR SECTION B-B, SEE SHEET 3.  
FOR SECTION C-C, SEE SHEET 3.  
FOR SECTION D-D, SEE SHEET 3.  
FOR SECTION E-E, SEE SHEET 5.  
DECK REINFORCEMENT NOT SHOWN FOR CLARITY



### PARTIAL SECTION THRU ABUTMENT CONCRETE GIRDERS

NOTE: DECK REINFORCEMENT NOT SHOWN FOR CLARITY

#### NOTE A:

AS AN ALTERNATE TO THREADED INSERTS AND BAR LAPS, SLEEVES MAY BE PROVIDED IN P/S BEAMS.

### LEGEND:

- ① LENGTH OF BARS BETWEEN GIRDERS:
  - FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO 3" THREADING + 1/2 GIRDER CLEAR SPACING + 1/2 LAP SPLICE LENGTH. IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING THE BARS SHOULD EXTEND TO WITHIN 3" OF THE ADJACENT BEAMS.
  - BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG AND INCLUDE 3" THREADED.
  - FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO THE CLEAR SPACING + LAP LENGTH. IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING EXTEND BARS TO WITHIN 3" OF THE ADJACENT BEAMS ON EACH SIDE.
  - BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG.
- ② FOR INSERT DETAILS, SEE BD-655M AND BD-656M FULL DEPTH DIAPHRAGM WITHOUT BACKWALL AND INTEGRAL ABUTMENT DETAILS. FOR INSERT LOCATIONS, SEE SHEET 9.
- ③ FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DESIGN MANUAL, PART 4, AP. G 1.4.3
- ④ REFER TO WATERPROOFING DETAIL ON SHEET 5 FOR ADDITIONAL INFORMATION.

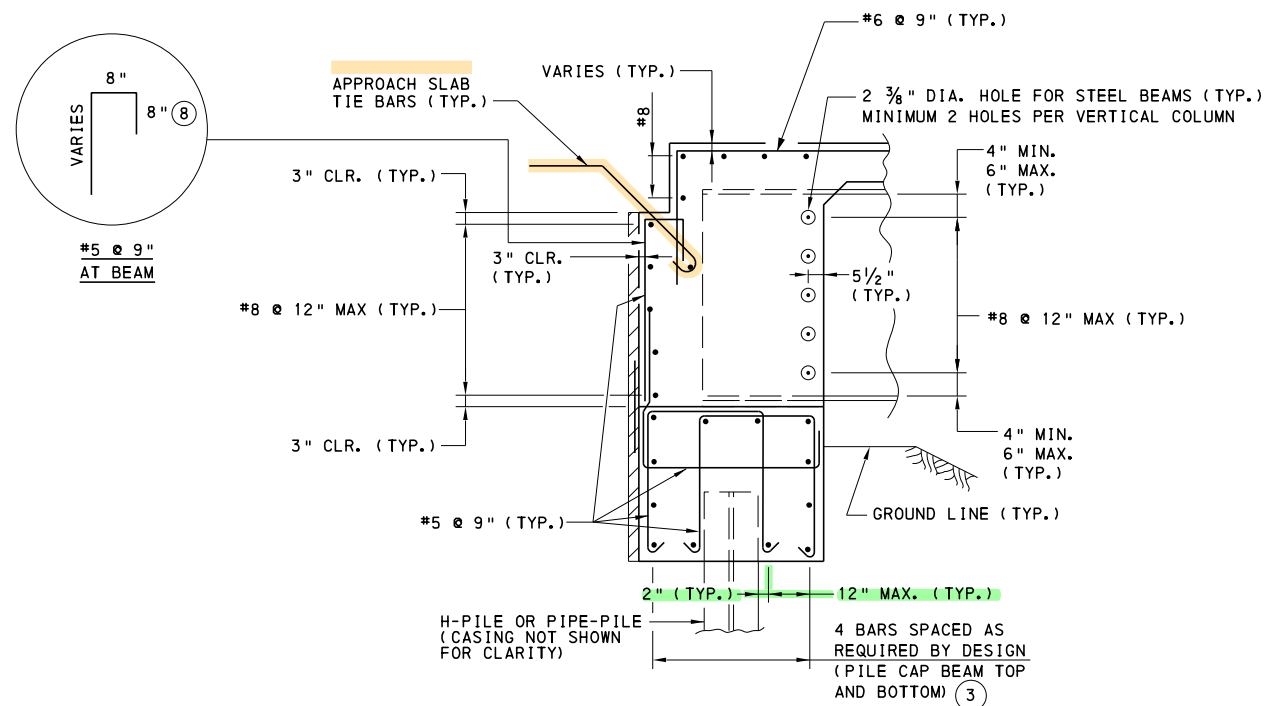
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
INTEGRAL ABUTMENT  
TYPICAL SECTIONS

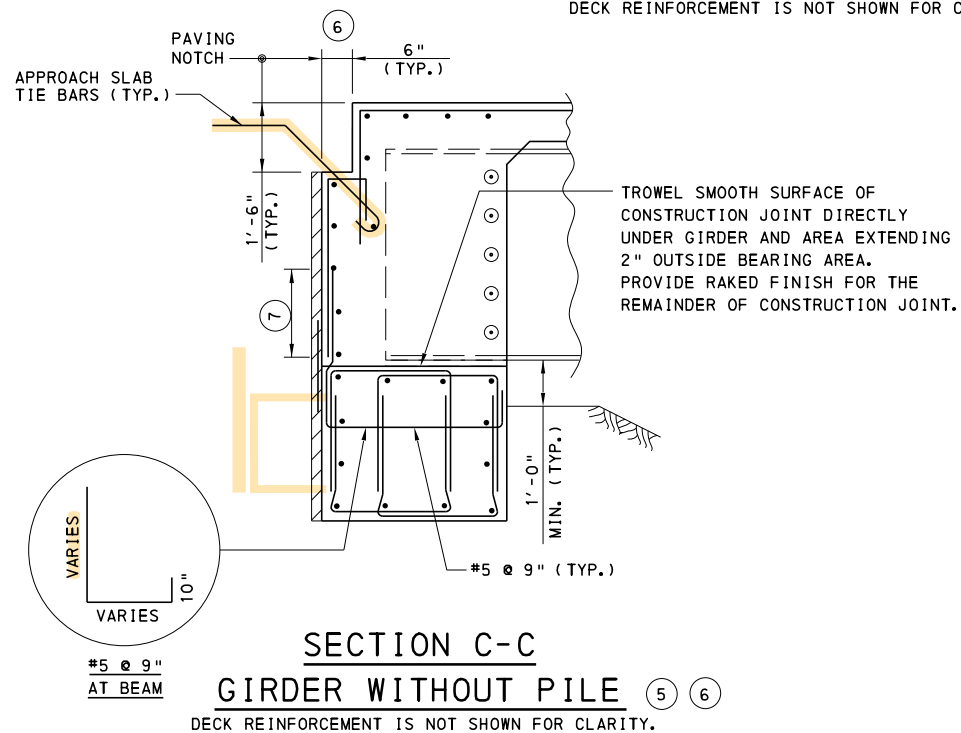
RECOMMENDED NOV. 23, 2022  
L. W. G.  
CHIEF BRIDGE ENGINEER

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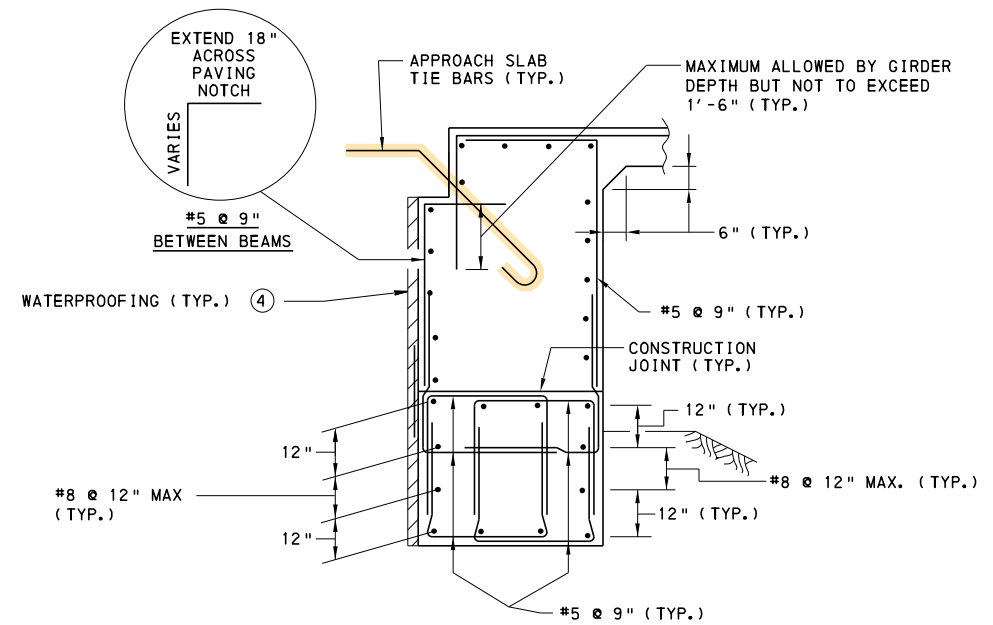
SHEET 2 OF 10  
BD-667M



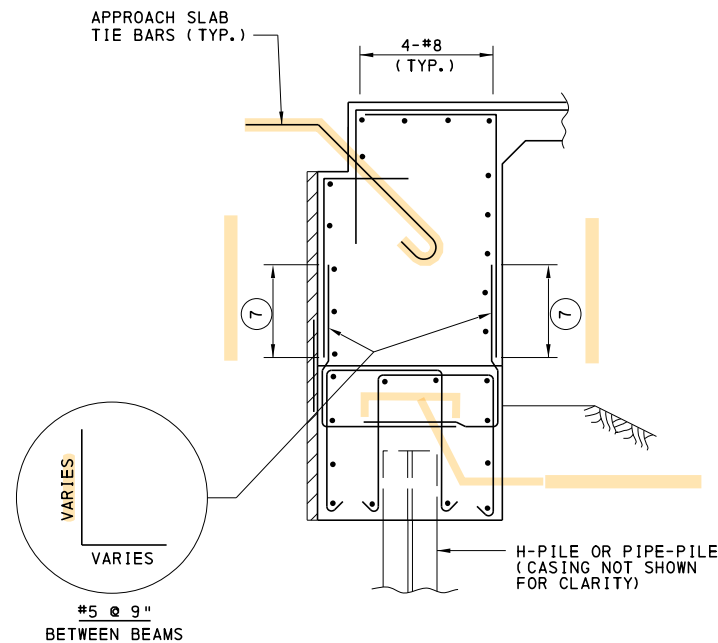
**SECTION A-A**  
**GIRDER WITH PILE** ⑤ ⑥  
DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



**SECTION C-C**  
**GIRDER WITHOUT PILE** ⑤ ⑥  
DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



**SECTION B-B**  
**NO GIRDER, NO PILE** ⑤  
DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.



**SECTION D-D**  
**PILE WITHOUT GIRDER** ⑤  
DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.

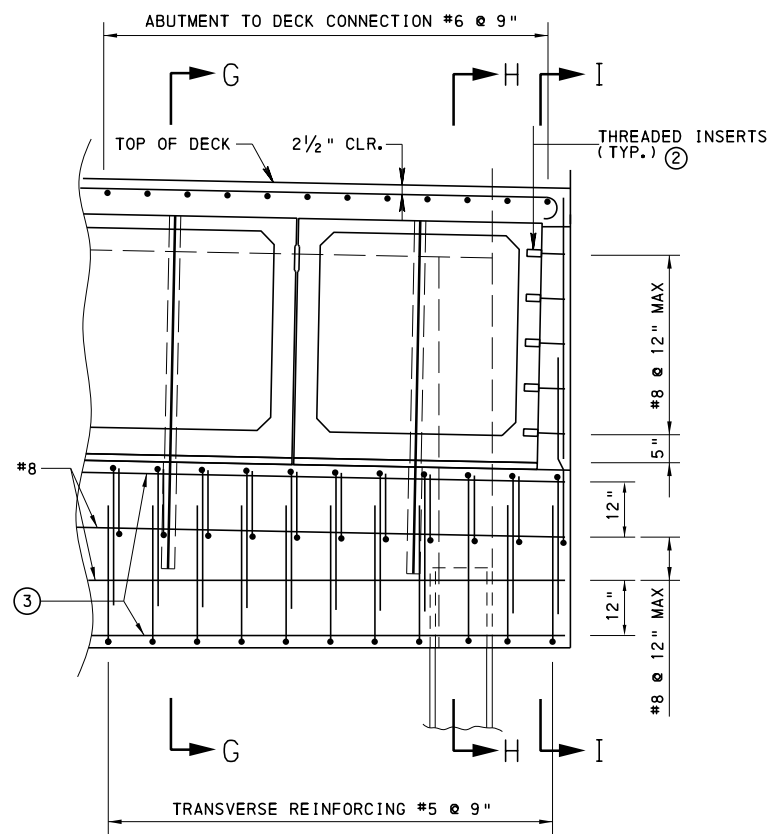
**NOTES:**

1. FOR SECTIONS A-A, B-B, C-C, AND D-D THE REINFORCEMENT AND WATERPROOFING INDICATED AS TYPICAL IN THE SECTIONS IS PRESENT IN ALL SECTIONS WHETHER SPECIFICALLY STATED OR NOT.
2. DETAILS SHOWN ARE FOR STEEL BEAMS, DETAILS SIMILAR FOR P/S BEAMS. SEE SHEET 9 FOR INSERT LOCATIONS.
3. FOR SECTION CUTS A-A, B-B, C-C AND D-D SEE SHEET 2.

**LEGEND:**

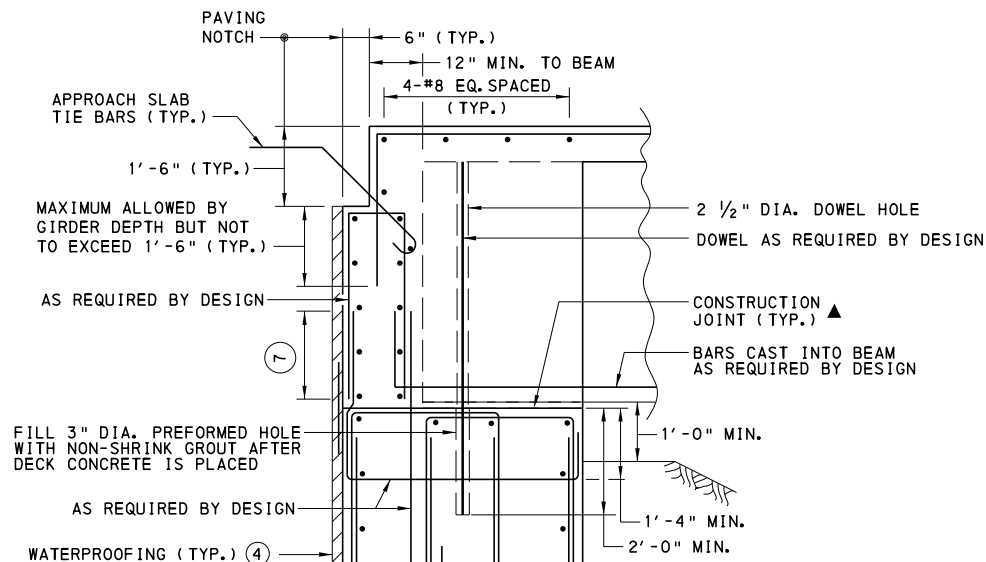
- ③ FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DESIGN MANUAL, PART 4, AP. 6 1.4.3.
- ④ REFER TO WATERPROOFING DETAIL ON **SHEET 5** FOR ADDITIONAL INFORMATION.
- ⑤ SECTIONS ARE DRAWN SHOWING STEEL I-GIRDERS AND H-PILES. SECTIONS WITH CONCRETE GIRDERS AND/OR PIPE PILES WOULD BE SIMILAR EXCEPT FOR THE THREADED INSERTS REQUIRED FOR CONCRETE GIRDERS (SEE NOTE 2) AND THE REINFORCEMENT REQUIRED TO ANCHOR PIPE PILES (SEE DETAIL ON **SHEET 9**).
- ⑥ STEEL BEAM SHOWN P/S BEAMS SIMILAR. SEE **SHEET 9** AND PARTIAL SECTION THRU ABUTMENT CONCRETE GIRDERS ON SHEET 2 FOR INSERT/SLEEVE LOCATIONS.
- ⑦ **ELIMINATE LAP SPLICE IF GIRDERS ARE TOO SHALLOW TO PERMIT LAP.** ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.
- ⑧ IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.

|                                                                               |                                                                                   |                          |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------|
| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BRIDGE OFFICE |                                                                                   |                          |
| STANDARD<br>INTEGRAL ABUTMENT<br>TYPICAL SECTIONS<br>SPREAD BEAMS             |                                                                                   |                          |
| RECOMMENDED NOV. 23, 2022<br><i>[Signature]</i><br>CHIEF BRIDGE ENGINEER      | RECOMMENDED NOV. 23, 2022<br><i>[Signature]</i><br>CHIEF ENGINEER, HIGHWAY ADMIN. | SHEET 3 OF 10<br>BD-667M |



**PARTIAL SECTION THRU ABUTMENT  
CONCRETE ADJACENT BOX BEAMS**

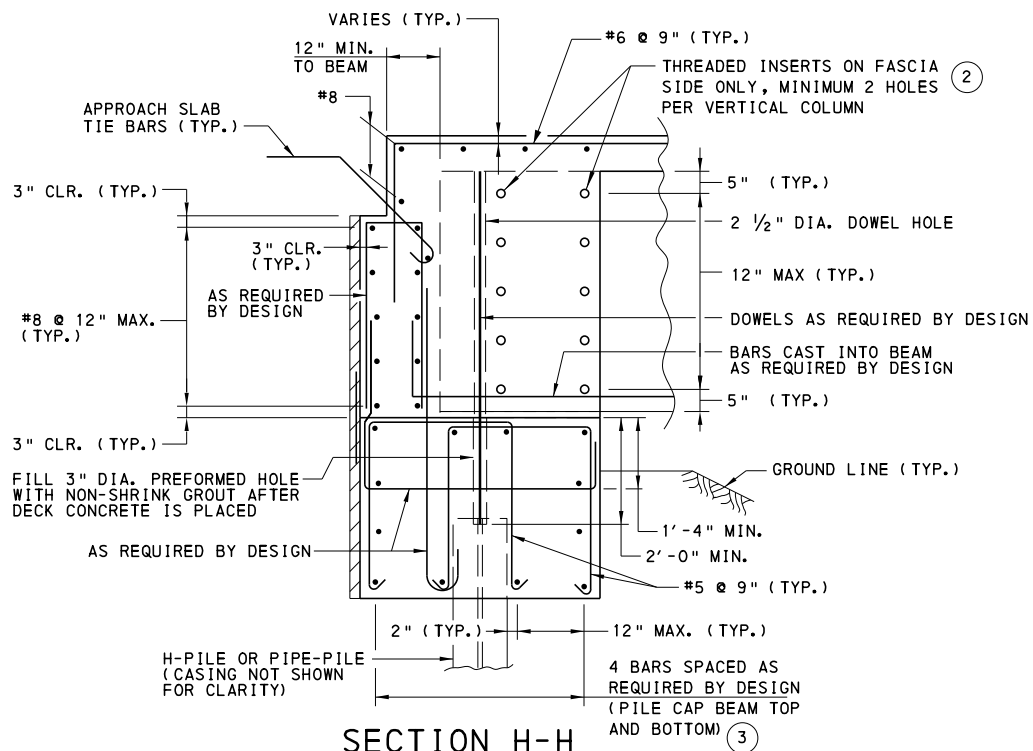
NOTE: DECK REINFORCEMENT NOT SHOWN FOR CLARITY



**SECTION G-G  
GIRDER WITHOUT PILE** (5)

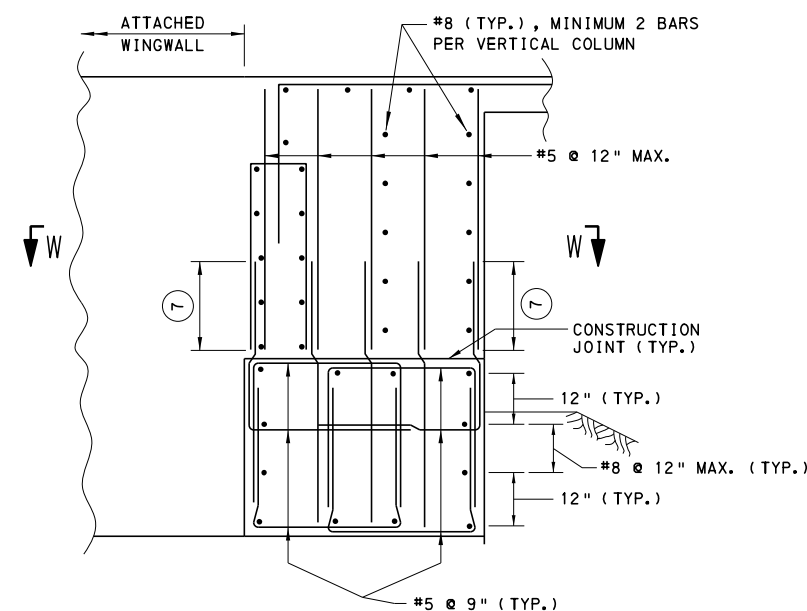
DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.

▲ TROWEL SMOOTH SURFACE OF CONSTRUCTION JOINT DIRECTLY UNDER GIRDER AND AREA EXTENDING 2' OUTSIDE BEARING AREA. PROVIDE RAKED FINISH FOR THE REMAINDER OF CONSTRUCTION JOINT.



**SECTION H-H  
GIRDER WITH PILE** (5)

DECK REINFORCEMENT IS NOT SHOWN FOR CLARITY.

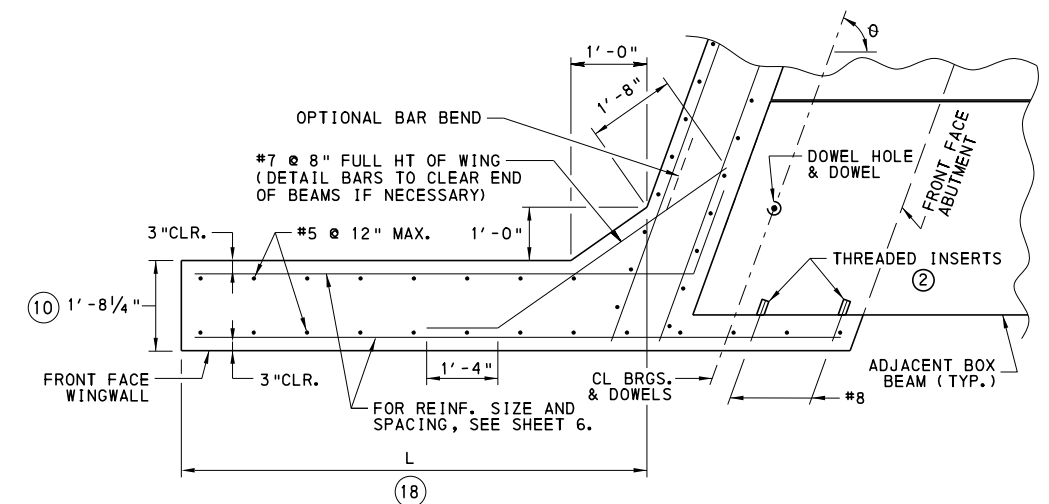


**SECTION I-I  
NO GIRDER, NO PILE**

DECK AND WINGWALL REINFORCEMENT IS NOT SHOWN FOR CLARITY.  
SEE SECTION W-W THIS SHEET AND SHEET 6 FOR WINGWALL REINFORCEMENT

**LEGEND:**

- (2) FOR INSERT DETAILS, SEE BD-655M AND BD-656M FULL DEPTH DIAPHRAGM WITHOUT BACKWALL AND INTEGRAL ABUTMENT DETAILS.
- (3) FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DESIGN MANUAL, PART 4, AP. G 1.4.3.
- (4) REFER TO WATERPROOFING DETAIL ON SHEET 5 FOR ADDITIONAL INFORMATION.
- (5) SECTIONS ARE DRAWN SHOWING H-PILES. SECTIONS WITH PIPE PILES WOULD BE SIMILAR EXCEPT FOR THE REINFORCEMENT REQUIRED TO ANCHOR PIPE PILES (SEE DETAIL ON SHEET 9).
- (7) ELIMINATE LAP SPLICE IF GIRDERS ARE TOO SHALLOW TO PERMIT LAP. ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.
- (8) IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.
- (10) WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE. MINIMUM WINGWALL WIDTH EQUALS 1'-8 1/4".
- (18) SEE SHEET 6 FOR ADDITIONAL WINGWALL DETAILS AND REQUIREMENTS INCLUDING MINIMUM AND MAXIMUM WINGWALL LENGTHS.



**SECTION W-W** (18)

**NOTES:**

1. ADJACENT BOX BEAMS WITH INTEGRAL ABUTMENTS MAY ONLY BE USED WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
2. ADJUST THE PILE CAP WIDTH FOR ADJACENT BOX BEAMS AS REQUIRED. 4'-0" MAY NOT BE SUFFICIENT.
3. FOR SECTIONS G-G, H-H, AND I-I THE REINFORCEMENT AND WATERPROOFING INDICATED AS TYPICAL IN THE SECTIONS IS PRESENT IN ALL SECTIONS WHETHER SPECIFICALLY STATED OR NOT.

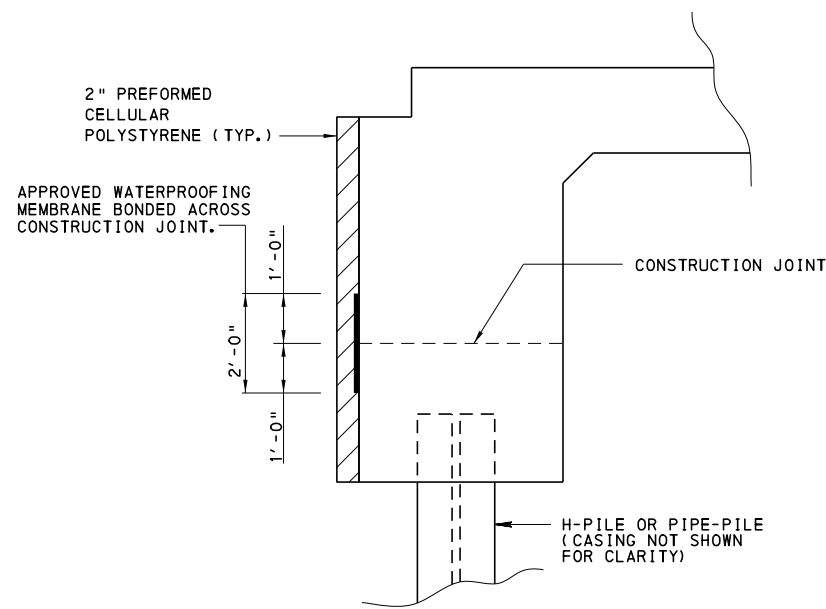
**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE**

**STANDARD  
INTEGRAL ABUTMENT  
TYPICAL SECTIONS  
ADJACENT BEAMS**

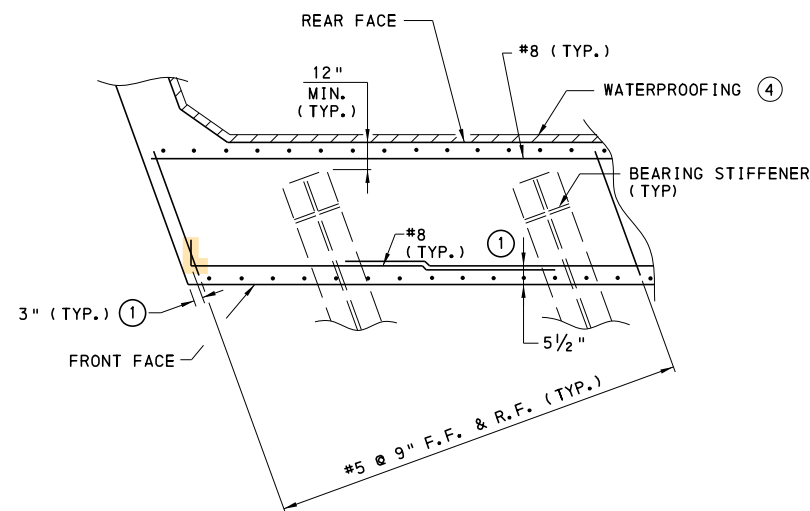
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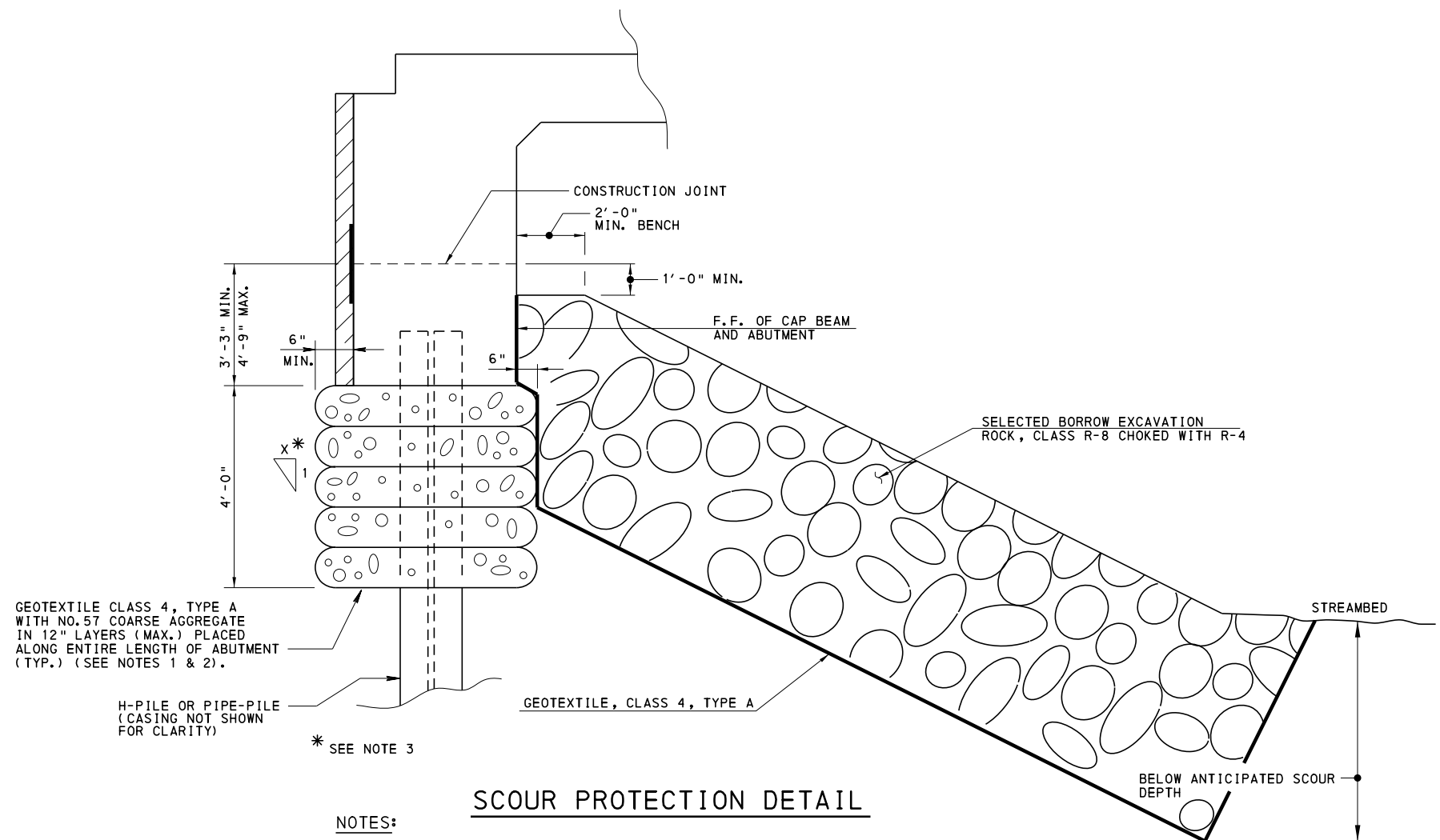
SHEET 4 OF 10  
BD-667M



**WATERPROOFING DETAIL**



**SECTION E-E**



**SCOUR PROTECTION DETAIL**

**NOTES:**

1. MAXIMUM CAP BEAM DEPTH EQUALS 4'-9". IF CAP BEAM EXTENDS BELOW BOTTOM OF SELECT BORROW EXCAVATION ROCK, R-8, THE INDICATED GEOTEXTILE, CLASS 4 (TYPE A) WITH NO.57 COARSE AGGREGATE CAN BE ELIMINATED.
2. NO.8 COARSE AGGREGATE MAY BE USED IN LIEU OF THE NO.57 COARSE AGGREGATE FOR THE GEOTEXTILE.
3. PLACE GEOTEXTILE ALONG A VERTICAL REAR EXCAVATION FACE IF POSSIBLE. IF A VERTICAL EXCAVATION FACE CANNOT BE OBTAINED, GEOTEXTILE MAY BE PLACED ALONG THE EXCAVATION SLOPE NOT TO EXCEED 1.5H TO 1.0V.

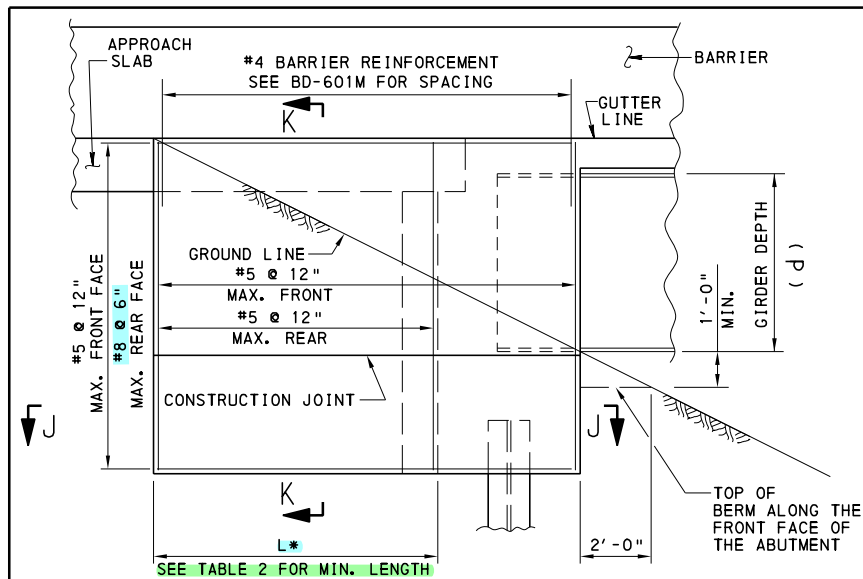
NOTE: PROVIDE WATERPROOFING MEMBRANE IN ACCORDANCE WITH PUBLICATION 408, SECTION 680.2(b) ADHESIVE BACKED PREFORMED MEMBRANE.

**LEGEND:**

- (1) LENGTH OF BARS BETWEEN GIRDERS:
- FOR P/S BEAMS
- FOR STEEL BEAMS
- FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO 3" THREADING + 1/2 GIRDER CLEAR SPACING + 1/2 LAP SPlice LENGTH. IF THE LAP SPlice LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING THE BARS SHOULD EXTEND TO WITHIN 3" OF THE ADJACENT BEAMS.
- BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG AND INCLUDE 3" THREADED.
- FOR BARS BETWEEN INTERIOR BEAMS, USE MINIMUM BAR LENGTH EQUAL TO THE CLEAR SPACING + LAP LENGTH. IF THE LAP SPlice LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING EXTEND BARS TO WITHIN 3" OF THE ADJACENT BEAMS ON EACH SIDE.
- BAR LENGTH ON THE FASCIA SIDE OF THE FASCIA BEAM SHOULD BE TO WITHIN 3" OF THE END OF DIAPHRAGM WITH A 9" BENT LEG.

- (4) REFER TO WATERPROOFING DETAIL FOR ADDITIONAL INFORMATION.

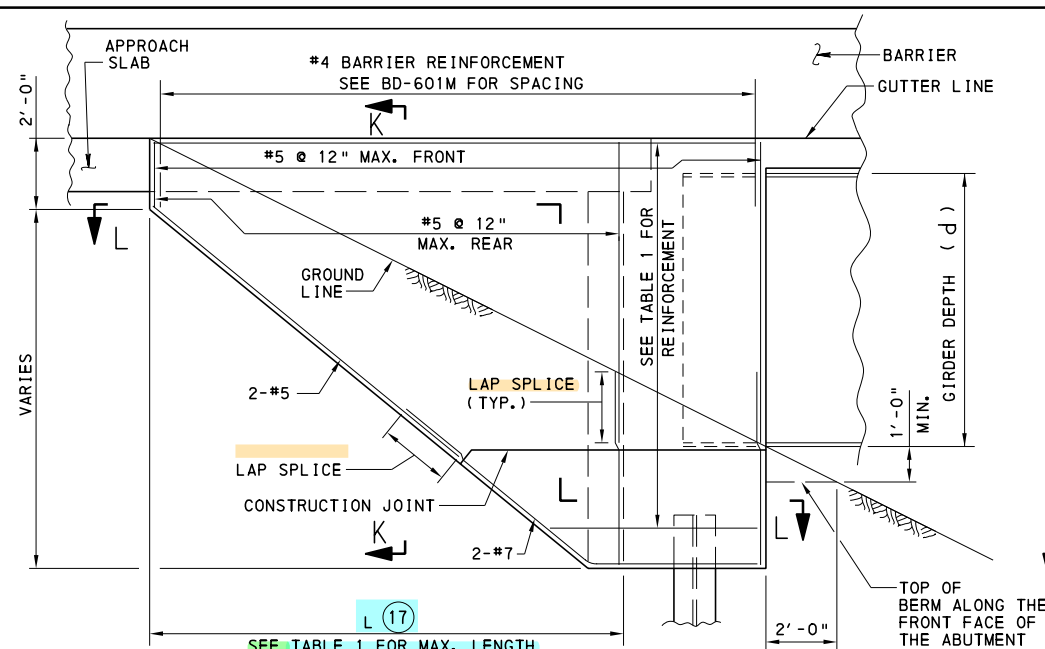
|                                                                               |                                                                                     |                          |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------|
| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BRIDGE OFFICE |                                                                                     |                          |
| STANDARD<br>INTEGRAL ABUTMENT<br>DETAILS                                      |                                                                                     |                          |
| RECOMMENDED NOV. 23, 2022<br><i>L. W. B.</i><br>CHIEF BRIDGE ENGINEER         | RECOMMENDED NOV. 23, 2022<br><i>Gavin E. Gray</i><br>CHIEF ENGINEER, HIGHWAY ADMIN. | SHEET 5 OF 10<br>BD-667M |



### ATTACHED RECTANGULAR WINGWALL ELEVATION

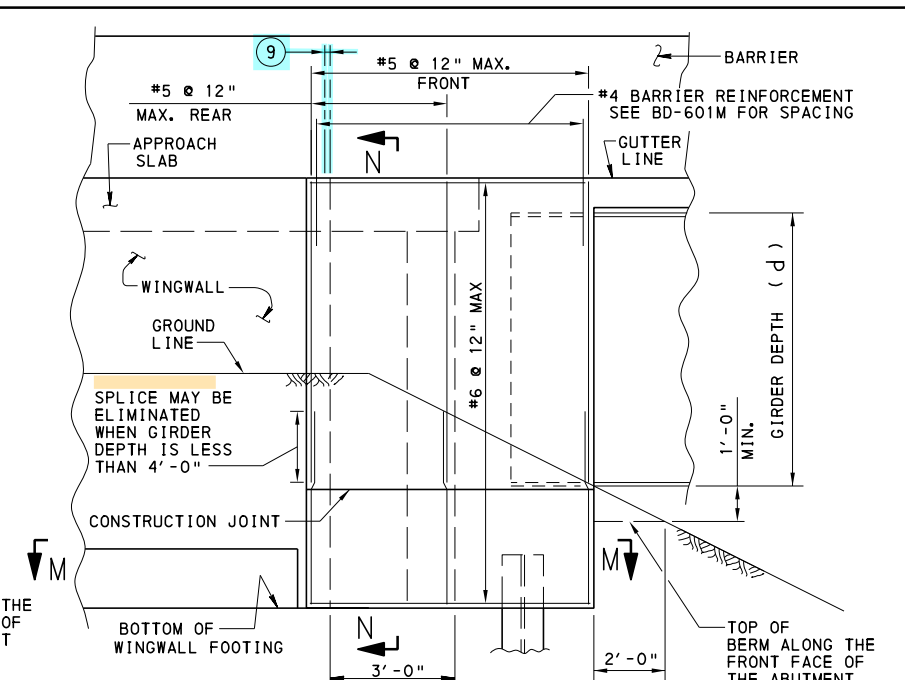
( FOR GIRDER DEPTH  $d < 5'-0"$  )

NOTE TO DESIGNER: THE BEAM DEPTH AND MAXIMUM WINGWALL LENGTHS ARE BASED ON STRUCTURAL CAPACITY OF THE WING WALL ATTACHMENT TO THE CAP. THEREFORE THE BARRIER END TRANSITION LENGTH INDICATED IN TABLE 3 MAY CONTROL THE MINIMUM BEAM DEPTH.

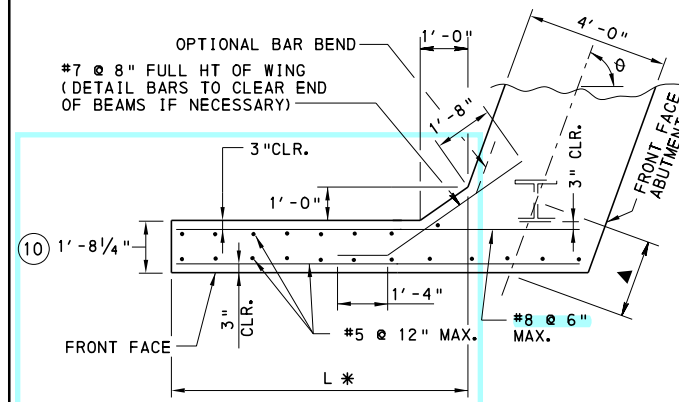


### ATTACHED TAPERED WINGWALL ELEVATION

( FOR GIRDER DEPTH  $5'-0" \leq d < 8'-0"$  )



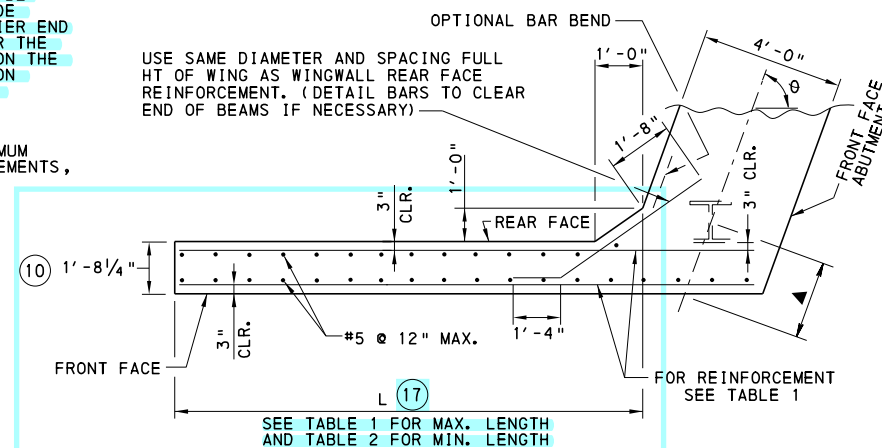
### DETACHED WINGWALL ELEVATION



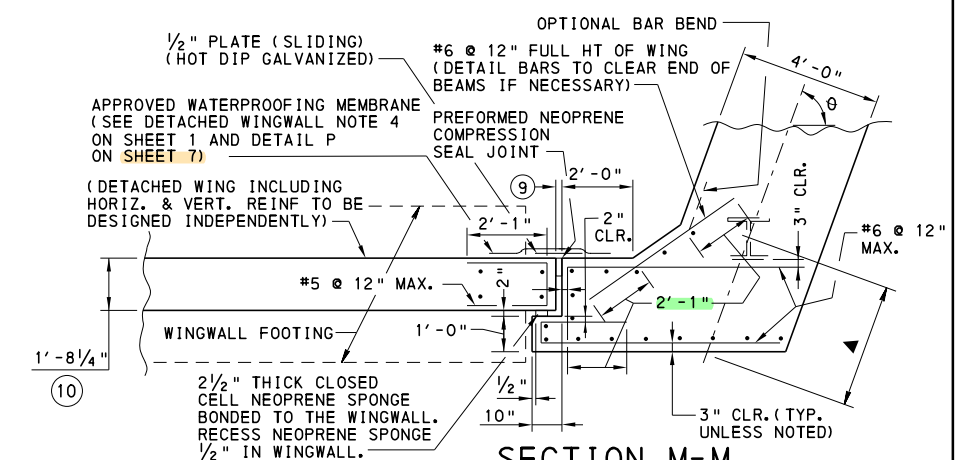
### SECTION J-J

\* THE WING LENGTH MUST BE LONG ENOUGH TO INCLUDE THE APPROPRIATE BARRIER END TRANSITION LENGTH FOR THE BRIDGE BARRIER TYPE ON THE STRUCTURE. SEE NOTE ON SHEET 7. SEE TABLE 3.

▲ FOR MINIMUM AND MAXIMUM EDGE DISTANCE REQUIREMENTS, SEE SHEET 1.

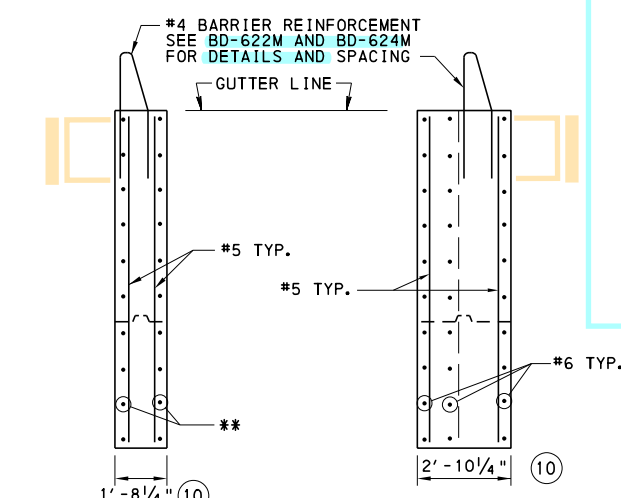


### SECTION L-L



### SECTION M-M

FOR MEMBRANE SLACK, SEE DETAIL P ON SHEET 7.



### SECTION K-K

( RECTANGULAR OR TAPERED WING )

### SECTION N-N

( DETACHED WING )

\*\* FOR RECTANGULAR WINGWALL REINFORCEMENT: SEE SECTION J-J.  
FOR TAPERED WINGWALL REINFORCEMENT: SEE TABLE 1 THIS SHEET.

| TABLE 1: TAPERED WINGWALL REINFORCEMENT |                                                          |               |            |
|-----------------------------------------|----------------------------------------------------------|---------------|------------|
| GIRDER DEPTH (d)                        | WINGWALL LENGTH BEYOND THE REAR FACE OF THE ABUTMENT (L) | REINFORCEMENT |            |
| (in)                                    | (ft)                                                     | REAR FACE     | FRONT FACE |
| $60 \leq d < 72$                        | $L \leq 14'-2"$                                          | #8 @ 6"       | #5 @ 12"   |
| $72 \leq d < 84$                        | $L \leq 15'-0"$                                          | #8 @ 6"       | #5 @ 12"   |
| $84 \leq d < 96$                        | $L \leq 15'-10"$                                         | #8 @ 6"       | #5 @ 12"   |
| $96 \leq d$                             | $L \leq 16'-7"$                                          | #8 @ 6"       | #5 @ 12"   |

\* CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED FOR BEAM DEPTHS GREATER THAN 6'-0"

| TABLE 2: MINIMUM ATTACHED WINGWALL LENGTH (L) *** |                    |           |                   |
|---------------------------------------------------|--------------------|-----------|-------------------|
| WALL                                              | GIRDER DEPTH (d)   | SKIEW=90° | 45° ≤ SKIEW < 90° |
| RECTANGULAR                                       | $d < 48"$          | 7'-6"     | 7'-6"             |
|                                                   | $48" \leq d < 60"$ | 7'-8"     | 9'-0"             |
| TAPERED                                           | $60" \leq d < 72"$ | 9'-8"     | 10'-8"            |
|                                                   | $72" \leq d < 84"$ | 11'-8"    | 12'-8"            |
|                                                   | $84" \leq d < 96"$ | 13'-8"    | 14'-8"            |
|                                                   | $d = 96"$          | 14'-0"    | 15'-0"            |

\*\*\* ACTUAL WINGWALL LENGTH SHALL BE DETERMINED BASED ON GRADING-CONTOURS AND THE MINIMUM BARRIER END TRANSITION LENGTH IN TABLE 3.

| TABLE 3: RECTANGULAR WINGWALL        |                            |                                           |                         |
|--------------------------------------|----------------------------|-------------------------------------------|-------------------------|
| BARRIER TYPE                         | PERMISSIBLE BEAM DEPTH (d) | MINIMUM BARRIER END TRANSITION LENGTH (L) | MAXIMUM WINGWALL LENGTH |
| 32" F-SHAPE CONCRETE BARRIER         | $21" \leq d < 60"$         | 12'-0"                                    | 15'-6"                  |
| 42" AND 45" F-SHAPE CONCRETE BARRIER | $48" \leq d < 60"$         | 12'-0"                                    | 12'-0"                  |
| 32" VERTICAL WALL CONCRETE BARRIER   | $21" \leq d < 60"$         | 7'-0"                                     | 15'-6"                  |
| 42" VERTICAL WALL CONCRETE BARRIER   | $48" \leq d < 60"$         | 10'-0"                                    | 12'-0"                  |
| PA BRIDGE BARRIER                    | $48" \leq d < 60"$         | 9'-0"                                     | 12'-0"                  |
| PA TYPE 10M BRIDGE BARRIER           | $21" \leq d < 60"$         | 9'-0"                                     | 15'-6"                  |

### LEGEND:

- ⑨ DISTANCES TO BE DETERMINED BASED ON DESIGN MOVEMENT, CONSTRUCTION TEMPERATURE, AND COMPRESSION SEAL JOINT MINIMUM INSTALLATION OPENING REQUIREMENTS. SEE NOTE 1 OF DETACHED WINGWALL NOTES, ON SHEET 1.
- ⑩ WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE. MINIMUM WINGWALL WIDTH EQUALS 1'-8 1/4".
- ⑪ FOR MINIMUM BARRIER END TRANSITION LENGTH (L), REFER TO TABLE 3.

COMMONWEALTH OF PENNSYLVANIA  
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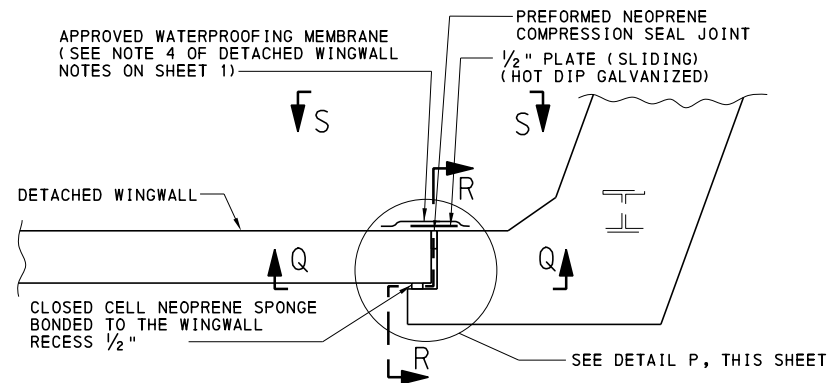
STANDARD  
INTEGRAL ABUTMENT  
WINGWALL DETAILS

RECOMMENDED NOV. 23, 2022  
L. L. W. G.  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 6 OF 10  
BD-667M

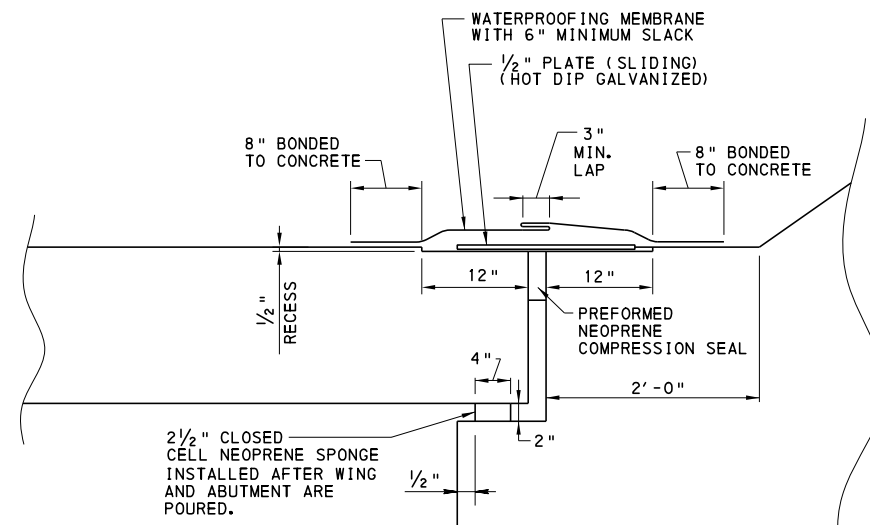




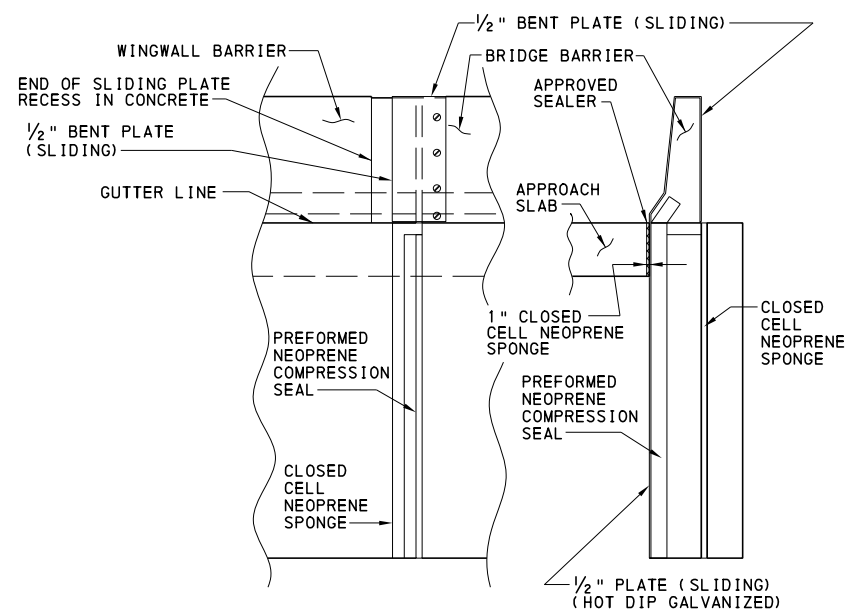
**PARTIAL SECTION THRU DETACHED  
WINGWALL EXPANSION JOINT**

**NOTE:**

IF THE ATTACHED RECTANGULAR WINGWALL CANNOT ACCOMMODATE THE REQUIRED TRANSITION LENGTH, USE THE ATTACHED TAPERED WINGWALL OR DETACHED WINGWALL.

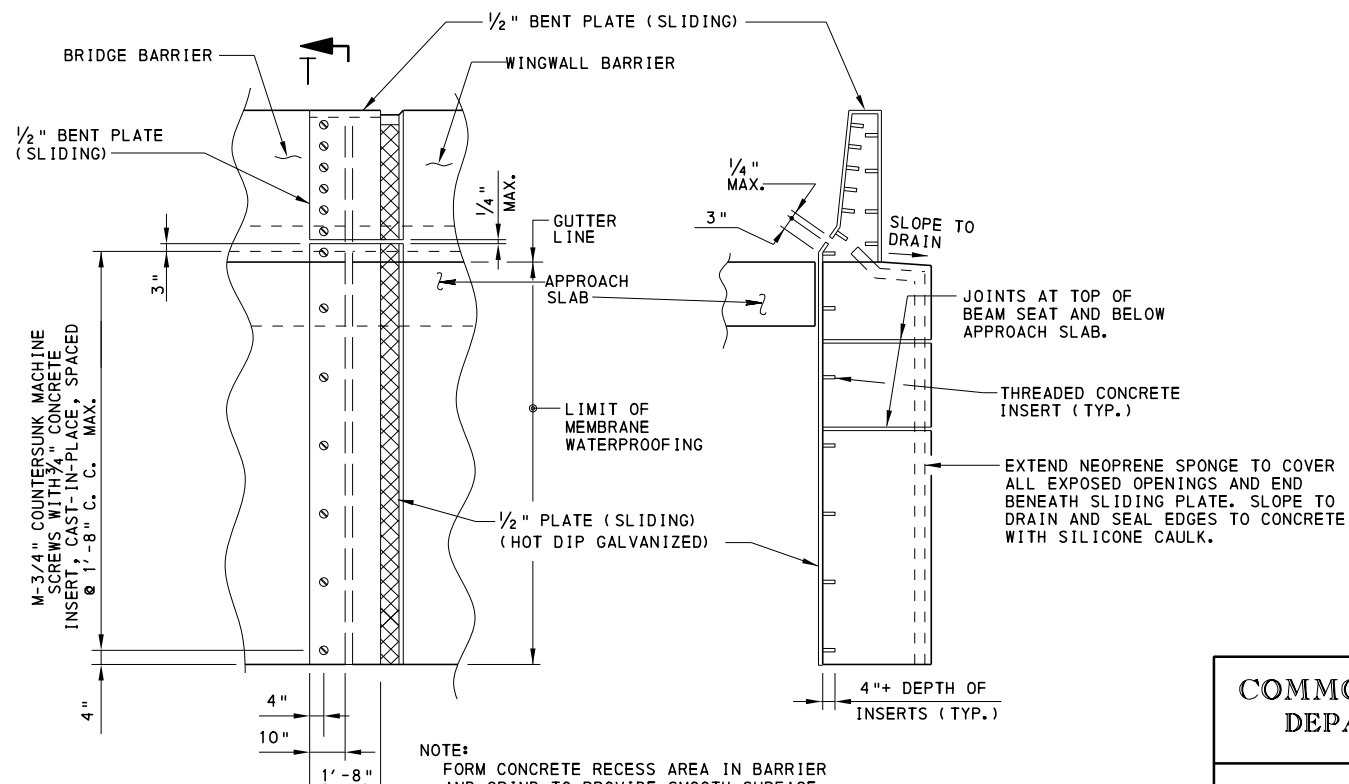


**DETAIL P**



**SECTION Q-Q**

**SECTION R-R**

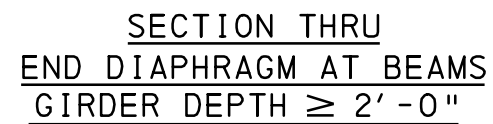
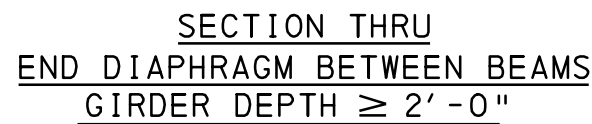


**VIEW S-S**

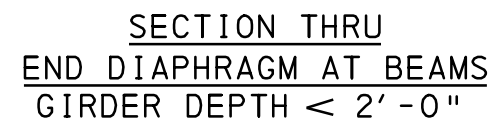
**SECTION T-T**

(WATERPROOFING MEMBRANE AND LIMITS OF RECESS IN CONCRETE REMOVED FOR CLARITY)

| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BRIDGE OFFICE |                                                                                             |                          |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------|
| STANDARD<br>INTEGRAL ABUTMENT<br>DETACHED WINGWALL DETAILS                    |                                                                                             |                          |
| RECOMMENDED NOV. 23, 2022<br><i>L. W. Gray</i><br>CHIEF BRIDGE ENGINEER       | RECOMMENDED NOV. 23, 2022<br><i>Gavin E. Gray</i><br>CHIEF ENGINEER, HIGHWAY ADMINISTRATION | SHEET 7 OF 10<br>BD-667M |



SECTION THRU  
END DIAPHRAGM BETWEEN BEAMS  
GIRDER DEPTH < 2'-0"




DETAIL A

\* - CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED FOR BEAM DEPTHS GREATER THAN 6'-0"

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DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

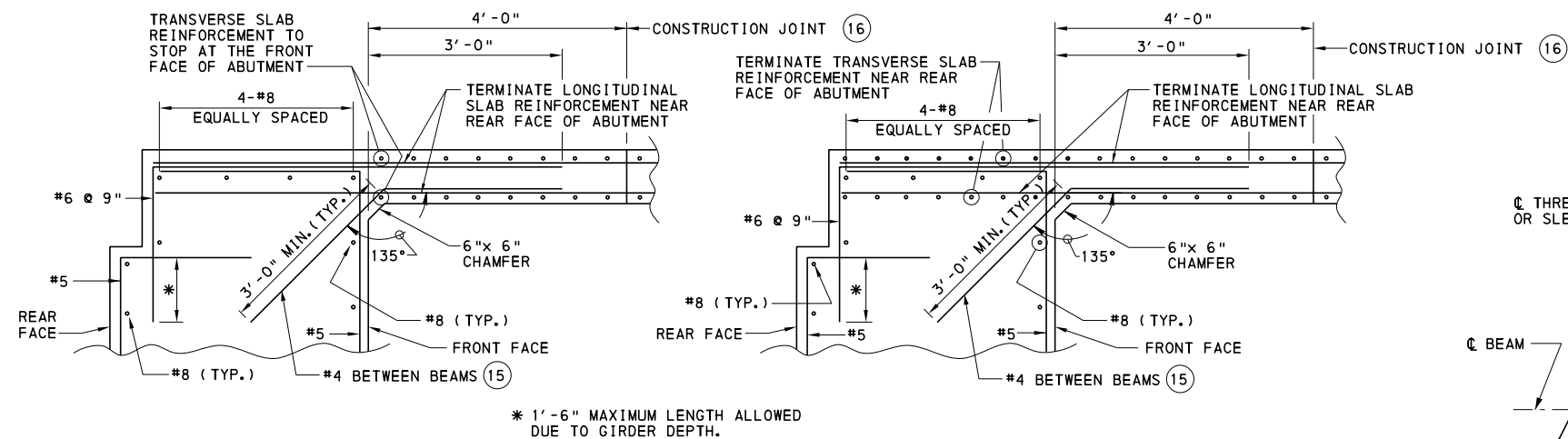
STANDARD  
INTEGRAL ABUTMENT  
APPROACH SLAB DETAILS

RECOMMENDED NOV. 23, 2022  
  
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
 CHIEF ENGINEER - HIGHWAY ADMIN.

SHEET 8 OF 10

BD-667M

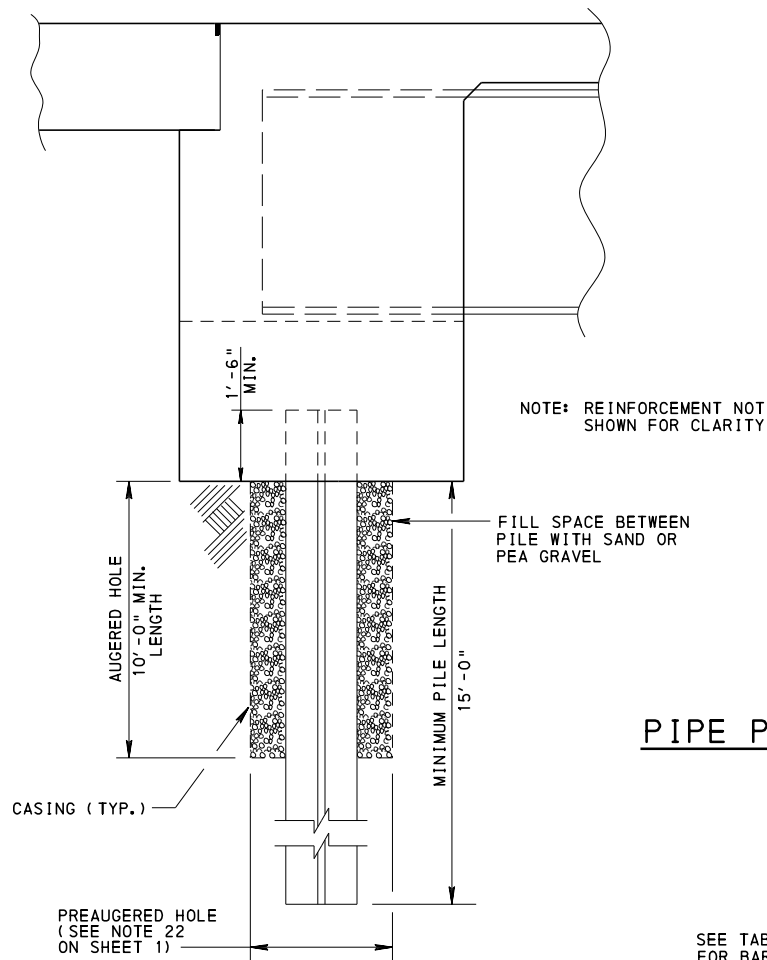


TRANSVERSE SLAB REINFORCEMENT  
PARALLEL TO ABUTMENT  
(SKEWS OF 75° TO 90°)

TRANSVERSE SLAB REINFORCEMENT  
NOT PARALLEL TO ABUTMENT  
(SKEWS < 75°)

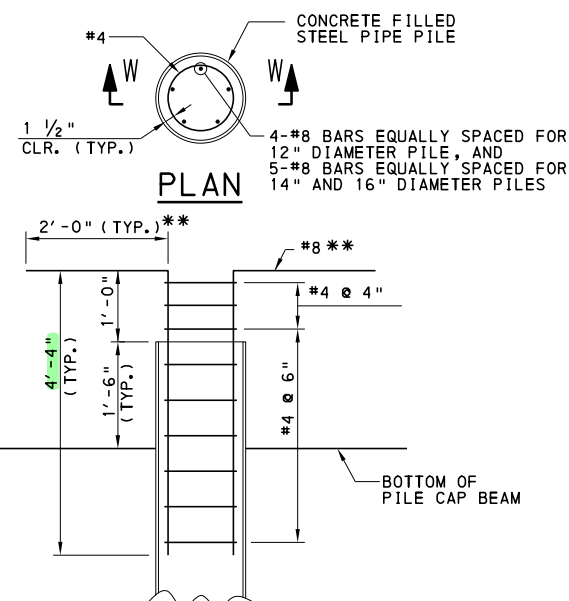
**SLAB-ABUTMENT CONNECTION DETAIL**

- FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.
- SECTIONS BETWEEN GIRDERS SHOWN

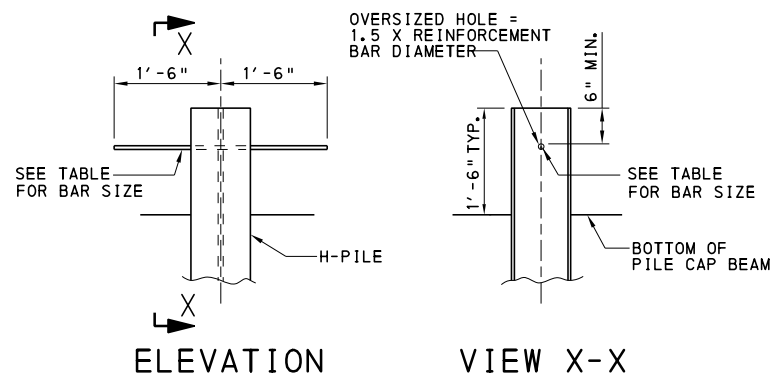


**INTEGRAL ABUTMENT PILE  
INSTALLATION DETAIL**

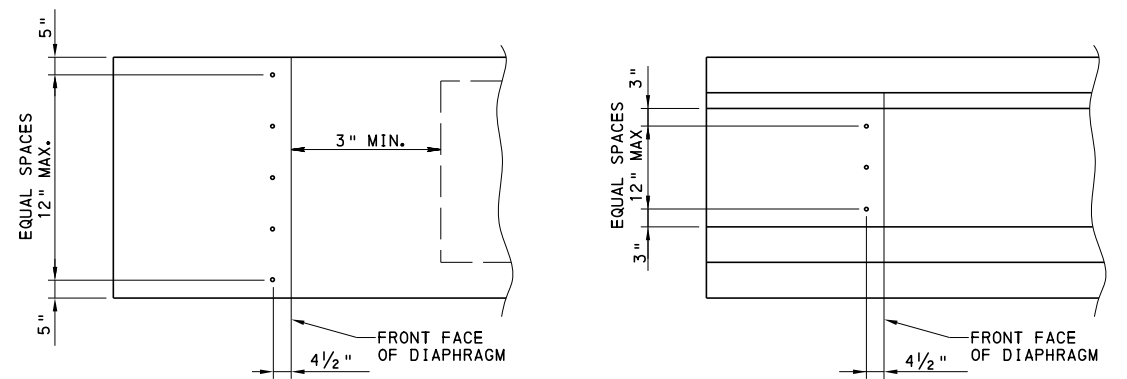
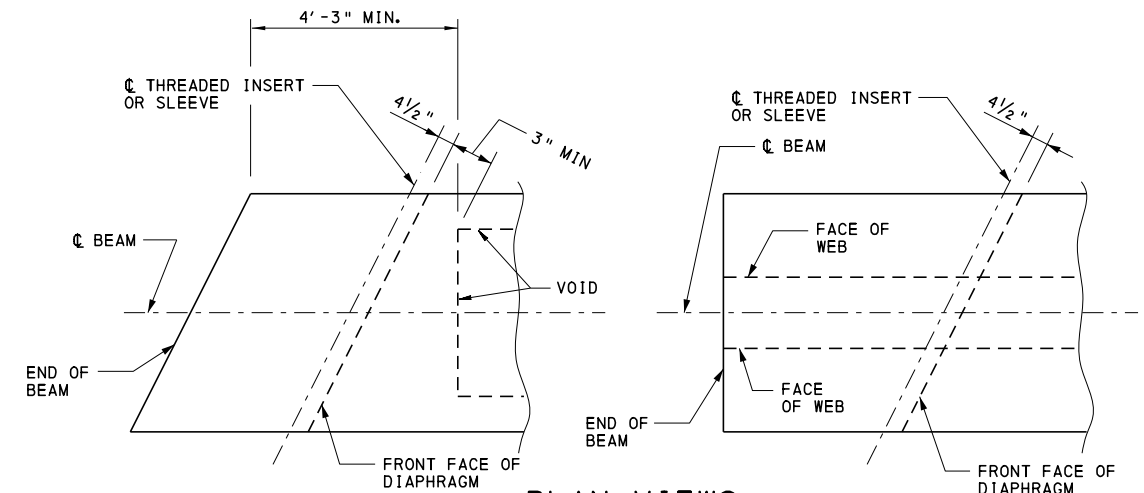
- SEE APPENDIX G OF DESIGN MANUAL PART 4 SECTION 1.4.2 FOR PRE AUGERING REQUIREMENTS
- PREDRILL OVERSIZED HOLES FOR ALL PILES IN ACCORDANCE WITH DESIGN MANUAL PART 4 AP.G.1.4.2.1. PLACE PILES VERTICAL IN THE HOLES BEFORE FILLING THE HOLES. FILL THE HOLES WITH DRY LOOSE SAND OR PEA GRAVEL BEFORE DRIVING THE PILES.



**PIPE PILE-TO-PILE CAP CONNECTION DETAIL**



**H-PILE-TO-PILE CAP CONNECTION DETAIL**



**CONCRETE BOX BEAMS**

**CONCRETE I-BEAMS**

**ELEVATION VIEWS**

**THREADED INSERT LOCATIONS IN SPREAD PRESTRESS BEAMS  
BEAM ENDS SUPPORTED ON INTEGRAL ABUTMENTS**

(SEE SHEET 3 FOR HOLE LOCATION IN WEBS OF STEEL BEAMS)

**LEGEND:**

- (15) SPACED WITH LONGITUDINAL DECK REINFORCEMENT
- (16) DECK PLACEMENT SEQUENCE:
  1. POUR THE ENTIRE DECK EXCEPT THE PORTIONS WITHIN 4'-0" FROM THE FRONT FACES OF THE ABUTMENTS.
  2. THEN POUR THE END DIAPHRAGMS.
  3. FOR GIRDER DEPTHS > 36", WAIT A MINIMUM OF 2 HOURS BEFORE POURING THE REMAINDER OF THE DECK. FOR GIRDER DEPTHS ≤ 36" THE REMAINDER OF THE DECK CAN BE POURED SIMULTANOUSLY WITH THE END DIAPHRAGMS.

| H-PILE TO PILE CAP CONNECTION REINFORCEMENT |     |
|---------------------------------------------|-----|
| PILE SIZE                                   | BAR |
| HP 10 x 57                                  | #6  |
| HP 12 x 53                                  | #6  |
| HP 12 x 63                                  | #6  |
| HP 12 x 74                                  | #6  |
| HP 12 x 84                                  | #7  |
| HP 14 x 73                                  | #6  |
| HP 14 x 89                                  | #7  |
| HP 14 x 102                                 | #7  |
| HP 14 x 117                                 | #8  |

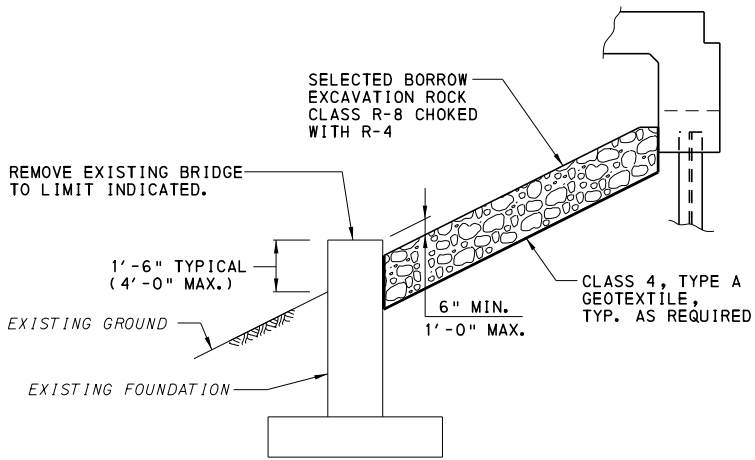
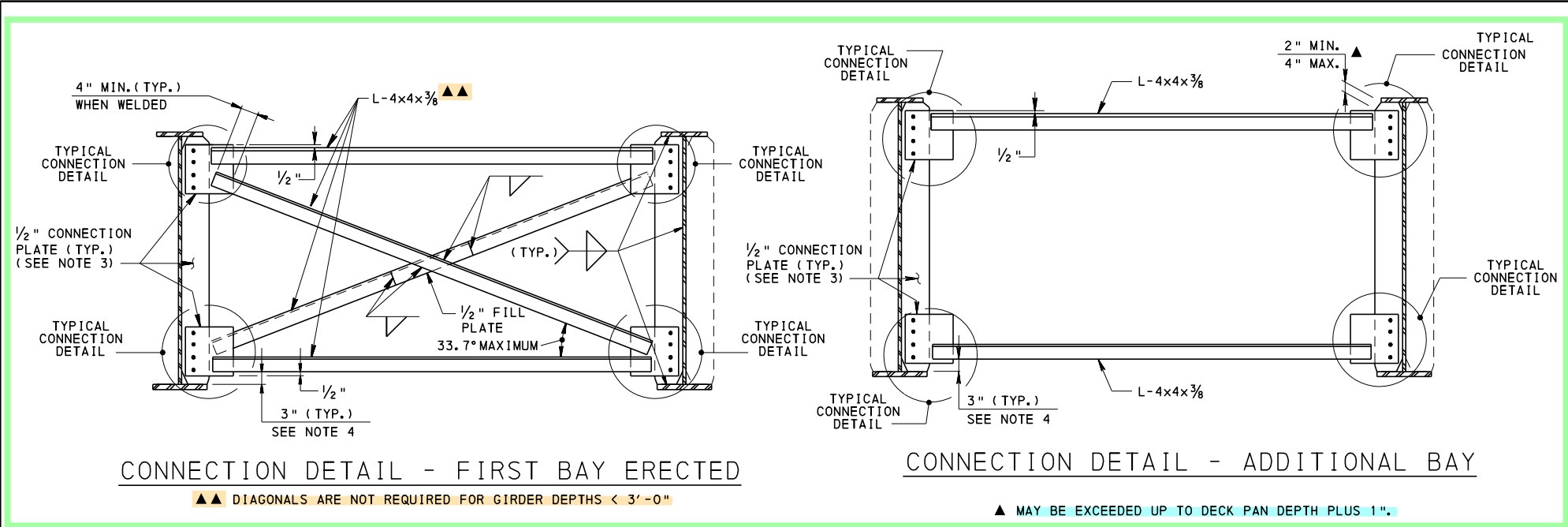
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
INTEGRAL ABUTMENT  
SLAB-ABUTMENT CONNECTION AND  
PILE-ABUTMENT CONNECTION DETAILS

RECOMMENDED NOV. 23, 2022  
L. W. Gray  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
Gavin E. Gray  
CHIEF ENGINEER, HIGHWAY ADMIN.

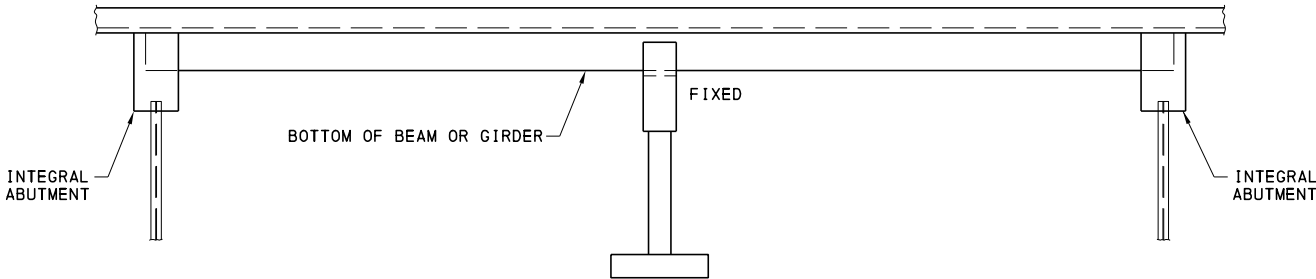
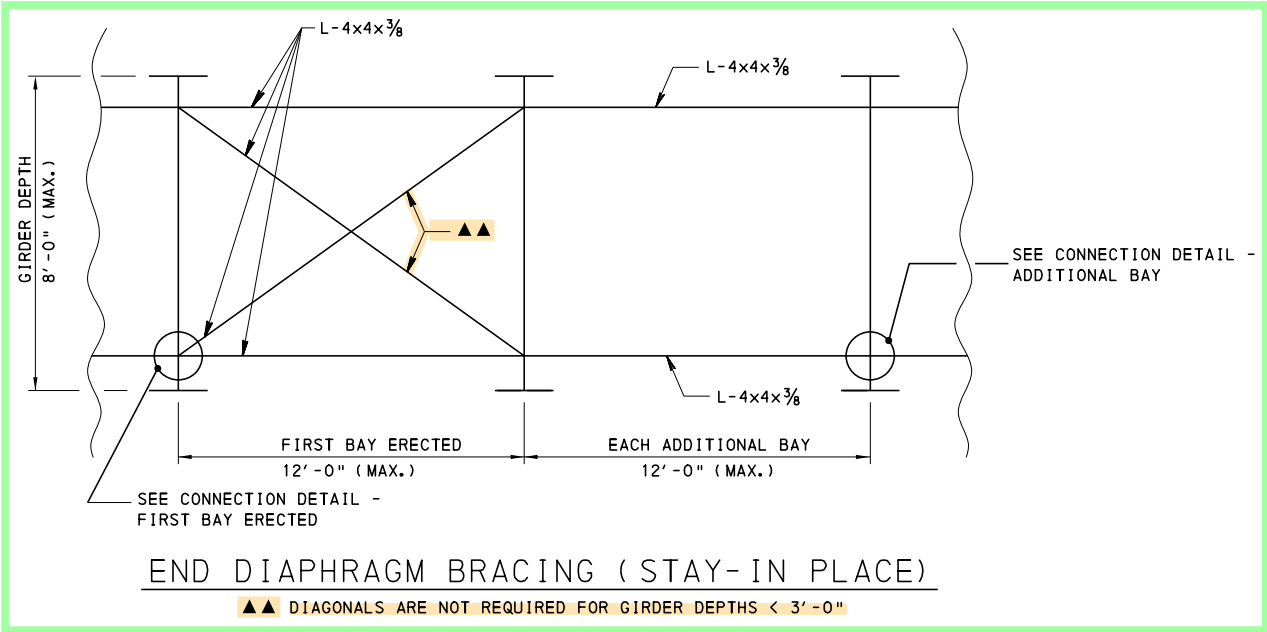
SHEET 9 OF 10  
BD-667M



**DETAIL FOR USING EXISTING SUBSTRUCTURE UNIT FOR SLOPE PROTECTION**

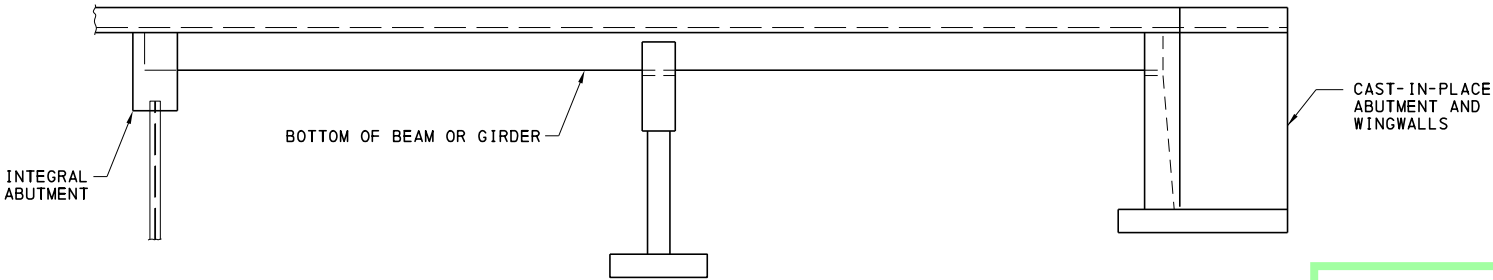
**NOTE:**

THE ABOVE DETAIL HAS PROVEN AN ECONOMICAL OPTION FOR MANY BRIDGE REPLACEMENTS. STABILITY OF THE REMAINING EXISTING STRUCTURE FOR PROPOSED CONDITIONS NEEDS TO BE CHECKED. ADDITIONAL RIPRAP CAN BE ADDED TO AUGMENT THE EXISTING SUBSTRUCTURE UNIT IF THE LENGTH OR POSITION DOES NOT MEET SITE NEEDS COMPLETELY.



**FIXITY ARRANGEMENT FOR MULTI SPAN STRUCTURES**

- NOTES:**
- FOR TWO SPAN ARRANGEMENT THE PIER SHOULD BE FIXED TO MINIMIZE LONGITUDINAL SUPERSTRUCTURE FORCES AT ABUTMENTS.
  - FOR ADDITIONAL SPANS, PIER STIFFNESS MUST BE CONSIDERED TO DEVELOP THE MOST EFFICIENT DESIGNS AND MINIMIZE MOVEMENT.



**MIXED SUBSTRUCTURE TYPES**

**NOTE:**

INTEGRAL ABUTMENTS MAY BE USED WITH OTHER ABUTMENT TYPES TO MEET SITE REQUIREMENTS FOR GEOMETRY OR GEOTECHNICAL FEATURES. FIXITY SHOULD BE CAREFULLY CONSIDERED TO MINIMIZE JOINTS AND FOUNDATION PRESSURES.

- NOTES:**
- CONFIGURATION IS VALID FOR SKEWS 70 TO 90 AND SPANS LENGTH UP TO 200 FEET.
  - MEMBERS, WELDS AND PLATE SIZES SHOWN ARE VALID FOR STRAIGHT GIRDERS WITH MAXIMUM GIRDER SPACING OF 12'-0" AND FOR SKEW ANGLES BETWEEN 70° AND 90°. PROVIDE SPECIAL DESIGNS FOR ALL THE DIAPHRAGM MEMBERS, WELDS AND PLATE SIZES WHEN THE GIRDER SPACING EXCEEDS 12'-0" AND/OR THE SKEW ANGLE IS LESS THAN 70°.
  - SEE BC-753M FOR THE BEARING STIFFENER AND CONNECTION PLATE INSTALLATION DETAILS.
  - MODIFY THE DISTANCE BETWEEN THE GIRDER BOTTOM FLANGE AND THE LOWER DIAPHRAGM COMPONENT WHEN LOWER LATERAL BRACING IS USED. INDICATE MODIFICATIONS ON THE DESIGN DRAWINGS.
  - FOR "TYPICAL CONNECTION DETAIL" SEE BC-754M.

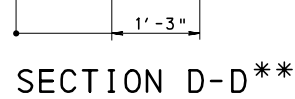
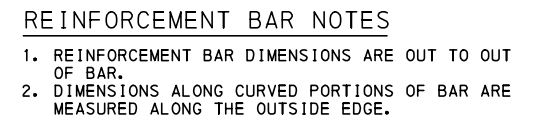
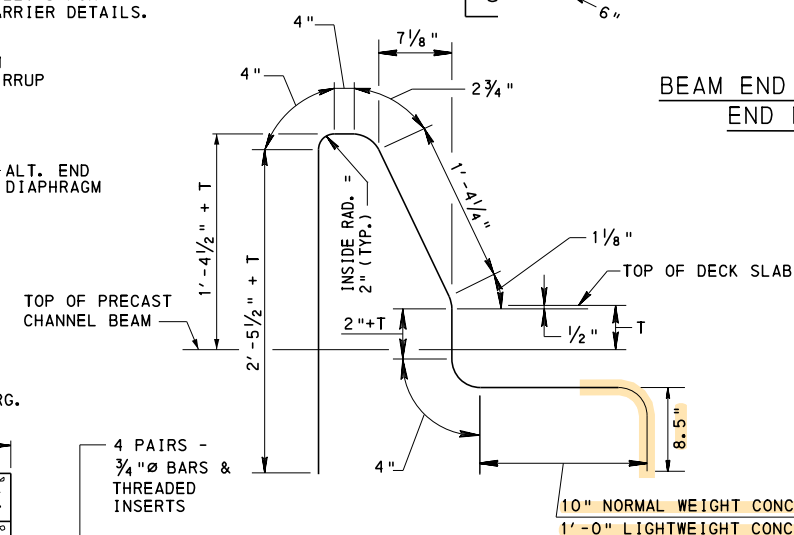
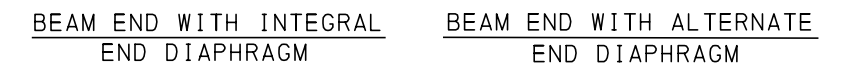
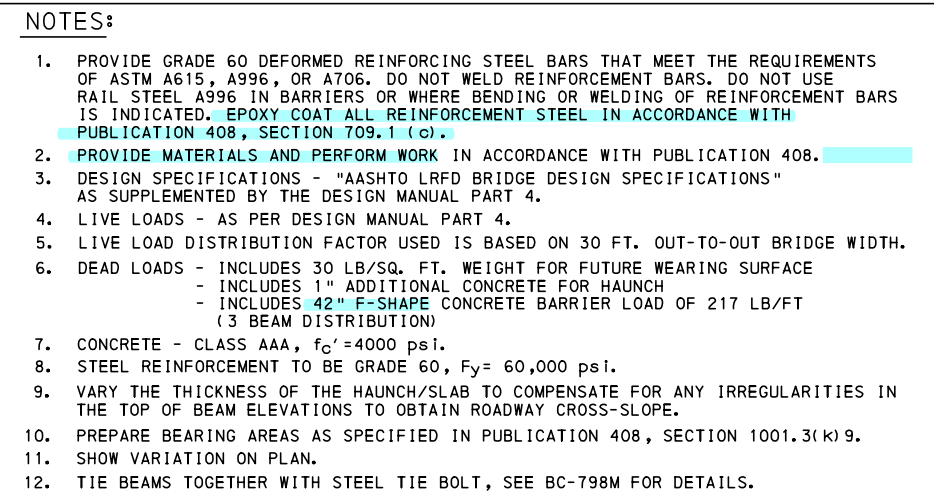
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
INTEGRAL ABUTMENT  
MISCELLANEOUS DETAILS

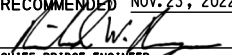
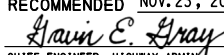
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L. W. G.  
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CHIEF ENGINEER, HIGHWAY ADMINISTRATION

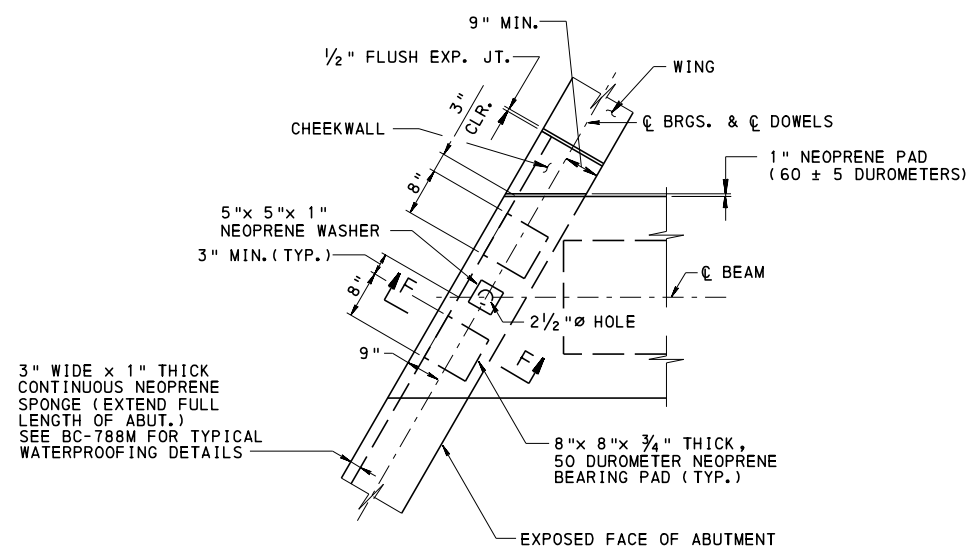
SHEET 10 OF 10  
BD-667M



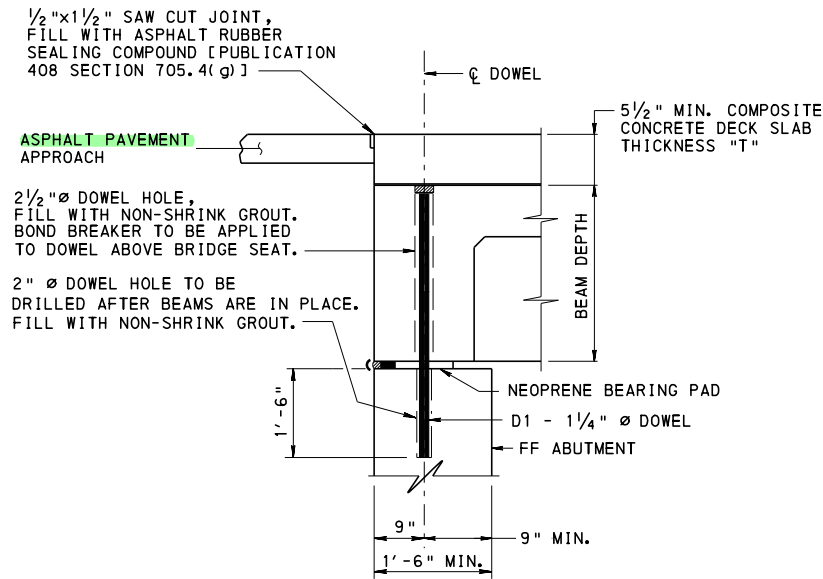
|                    |                                                   |
|--------------------|---------------------------------------------------|
| BD-601M            | CONC. DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES |
| BD-617M            | PA TYPE 10M BRIDGE BARRIER                        |
| BD-618M            | VERTICAL WALL CONCRETE BARRIER                    |
| BD-622M            | R.C. ABUTMENTS WITH BACKWALL                      |
| BD-624M            | R.C. ABUTMENTS WITHOUT BACKWALL                   |
| BD-660M            | DECK SLAB AND STEEL REINFORCEMENT PLACEMENT       |
| BC-734M            | ANCHOR SYSTEMS                                    |
| BC-775M            | MISCELLANEOUS PRESTRESS DETAILS                   |
| BC-788M            | TYPICAL WATERPROOFING AND EXPANSION DETAILS       |
| BC-798M            | MECHANICAL CONNECTION DETAILS                     |
| REFERENCE DRAWINGS |                                                   |

|                                                                                                                                             |                                                                                                                                                      |                             |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <p align="center"><b>COMMONWEALTH OF PENNSYLVANIA</b><br/> <b>DEPARTMENT OF TRANSPORTATION</b><br/> <b>BRIDGE OFFICE</b></p>                |                                                                                                                                                      |                             |
| <p align="center">STANDARD<br/>         PRECAST CHANNEL BEAM BRIDGES<br/>         BEAM SIZES &amp; DETAILS</p>                              |                                                                                                                                                      |                             |
| RECOMMENDED NOV. 23, 2022<br><br>CHIEF BRIDGE ENGINEER | RECOMMENDED NOV. 23, 2022<br><br>CHIEF ENGINEER, HIGHWAY ADMIN. | SHEET 1 OF 3<br><br>BD-668M |

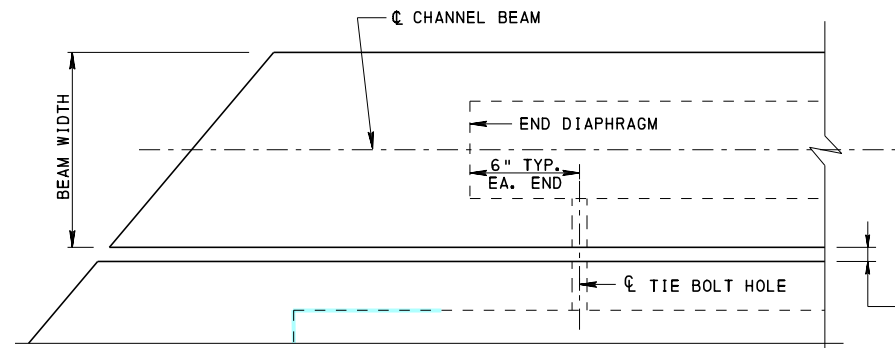




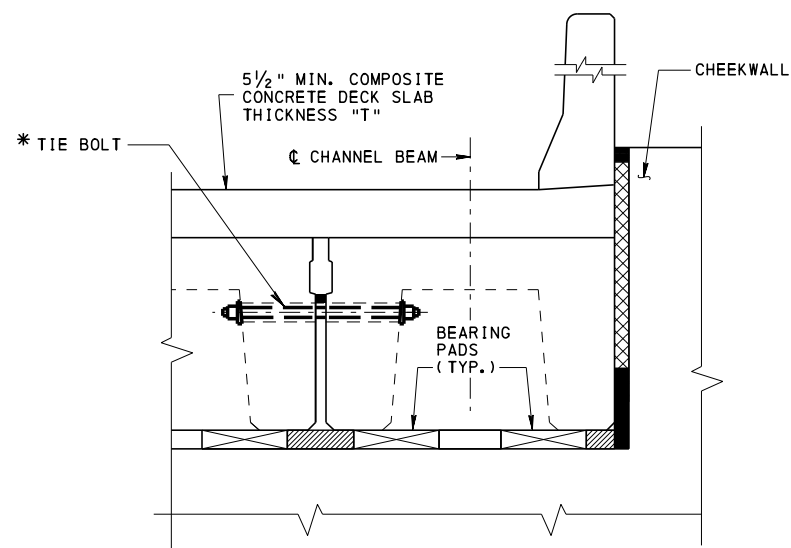
BEARING PAD DETAIL



SECTION F-F



PARTIAL PLAN



TYPICAL SECTION

TIEBOLT LOCATION DETAILS

\* TIE BOLTS TO BE INSTALLED 48 HOURS AFTER PLACEMENT OF SHEAR KEYS BUT NOT BEFORE GROUT HAS OBTAINED A MINIMUM STRENGTH OF 2500 PSI. SEE BC-798M FOR ADDITIONAL DETAILS.

| DESIGN CHART FOR PRECAST CHANNEL BEAMS |                           |                          |
|----------------------------------------|---------------------------|--------------------------|
| BEAM DEPTH                             | CHANNEL LEG REINFORCEMENT |                          |
|                                        | TOP ROW REINFORCEMENT     | BOTTOM ROW REINFORCEMENT |
| 1'-6"                                  | #8                        | #8                       |
| 1'-9 1/2"                              | #9                        | #8                       |
| 2'-0"                                  | #9                        | #9                       |

| PRECAST CHANNEL BEAMS MAXIMUM CAPACITIES |                       |                        |                       |                        |
|------------------------------------------|-----------------------|------------------------|-----------------------|------------------------|
| BEAM DEPTH                               | END (AT DISTANCE d/2) |                        | MID SPAN              |                        |
|                                          | SHEAR CAPACITY (KIPS) | MOMENT CAPACITY (K-FT) | SHEAR CAPACITY (KIPS) | MOMENT CAPACITY (K-FT) |
| 1'-6"                                    | 80                    | 54                     | 31                    | 293                    |
| 1'-9 1/2"                                | 89                    | 59                     | 33                    | 412                    |
| 2'-0"                                    | 97                    | 65                     | 34                    | 568                    |

NOTES:

1. FOR SHEAR KEY DETAIL, SEE BC-775M.
2. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.

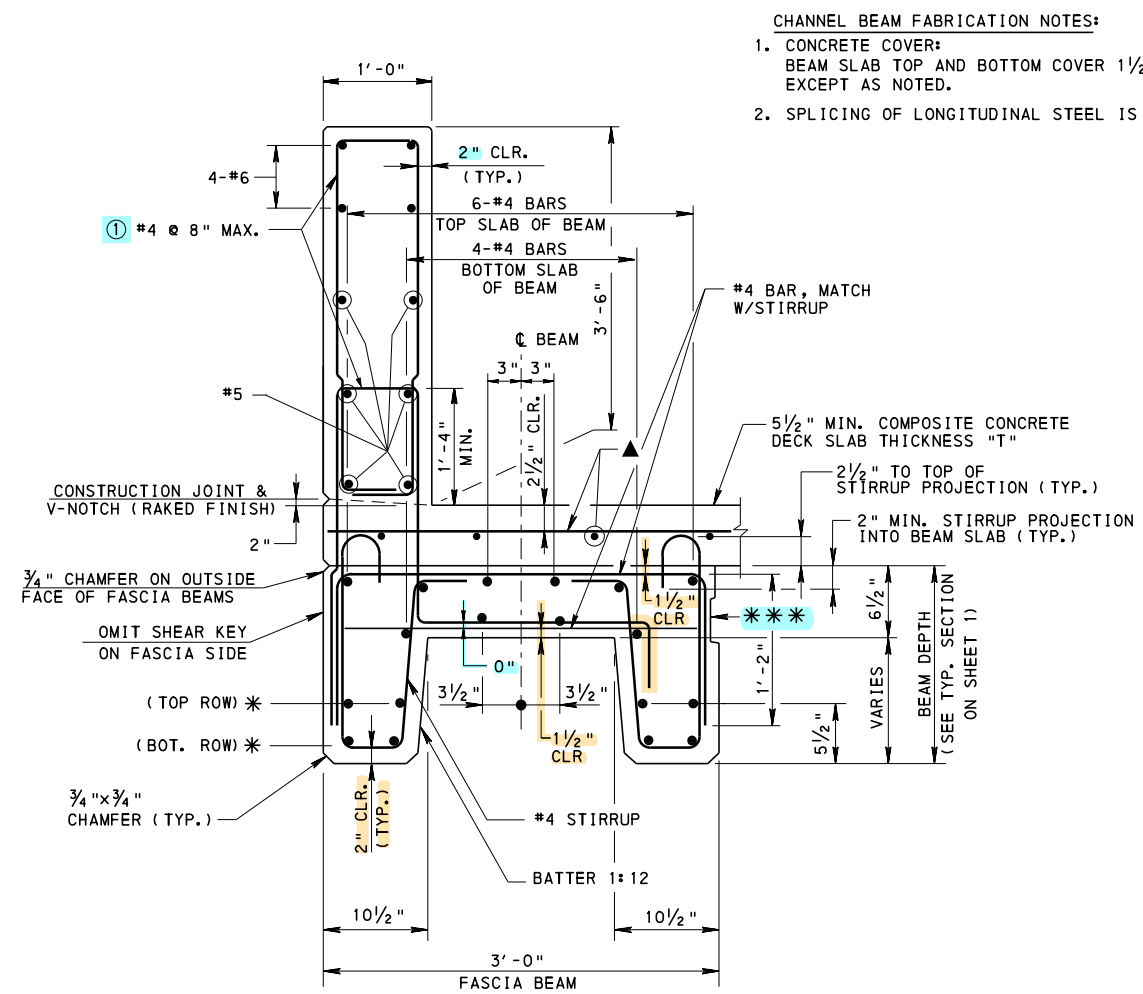
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE

STANDARD  
PRECAST CHANNEL BEAM BRIDGES  
BEAM SIZES & DETAILS

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 23, 2022  
*[Signature]*  
CHIEF ENGINEER, HIGHWAY ADMIN.

SHEET 2 OF 3  
BD-668M

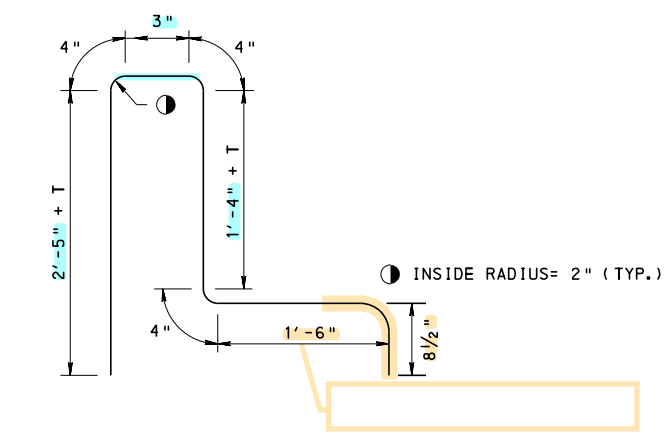


TYPICAL PRECAST CHANNEL SECTION  
WITH 42" VERTICAL WALL CONCRETE BARRIER

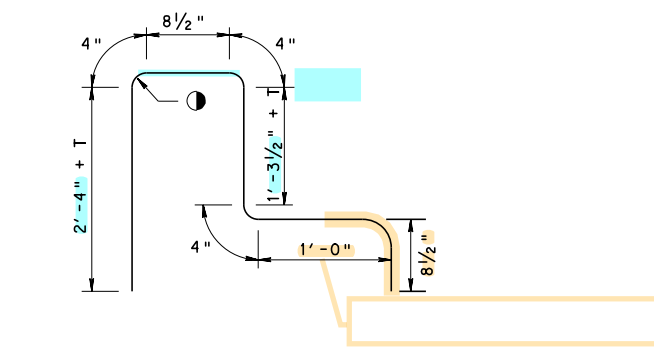
(42" VERTICAL WALL CONCRETE BARRIER SHOWN, 32" VERTICAL WALL CONCRETE BARRIER SIMILAR)

PRECAST CHANNEL BEAM SHOWN SUPPORTING VERTICAL WALL CONCRETE BARRIER. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-618M.

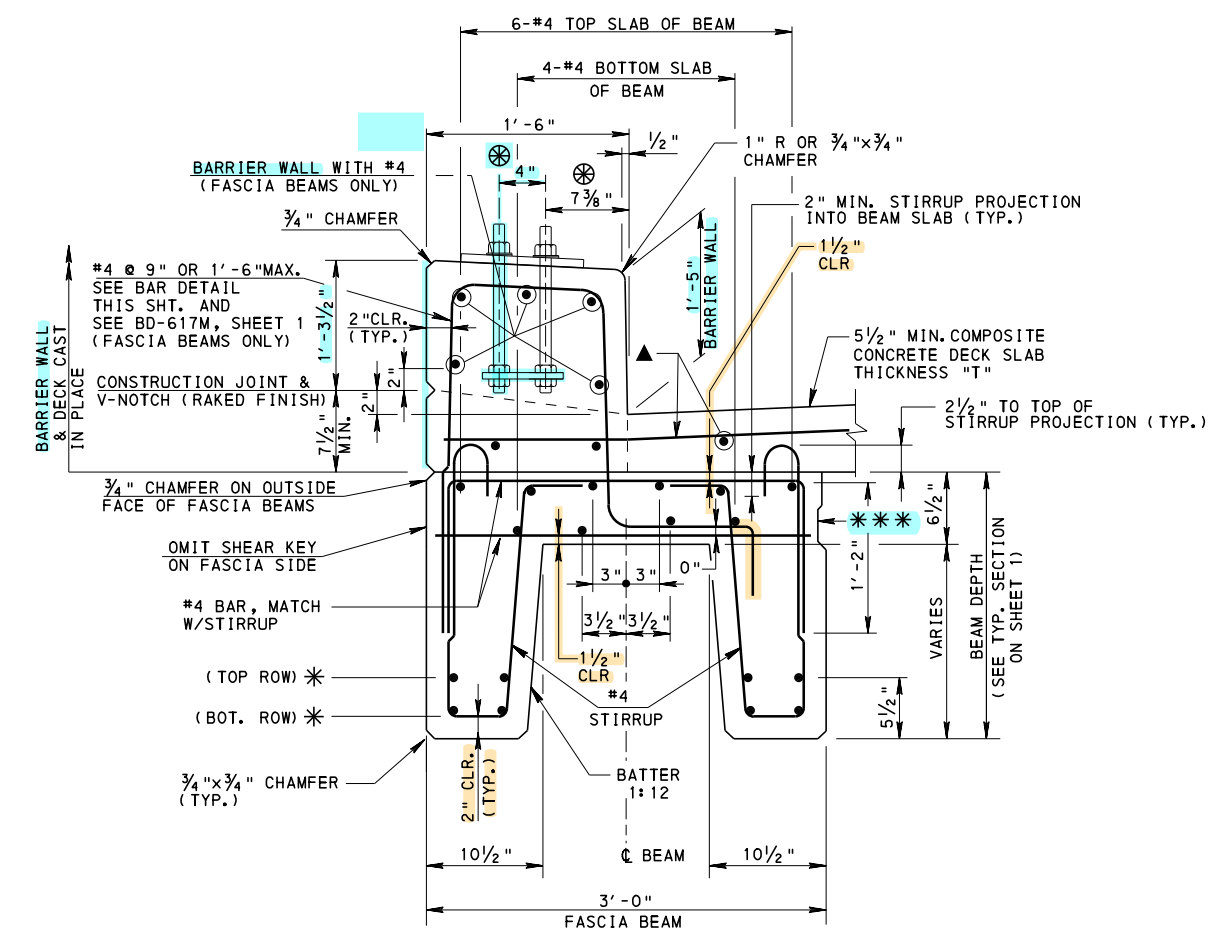
- \* VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.
- \*\*\* FOR SHEAR KEY DETAILS, SEE BC-775M.
- ▲ DECK SLAB REINFORCEMENT PER BD-660M.
- ① WITHIN 10' ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE BARRIER, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING. FOR BARRIER END TRANSITION TO GUIDE RAIL, FOLLOW DETAILS ON BD-622M AND BD-624M.



VERTICAL BARRIER  
BAR DETAIL  
NTS



PA TYPE 10M BARRIER  
BAR DETAIL  
NTS



TYPICAL PRECAST CHANNEL SECTION  
WITH PA TYPE 10M BRIDGE BARRIER

PRECAST CHANNEL BEAM SHOWN SUPPORTING PA TYPE 10M BRIDGE BARRIER. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-617M.

- ⊙ 2 - 1"Ø X 1'-3" ASTM F1554 GRADE 105, ANCHOR BOLTS WITH ASTM A563 NUTS. PROJ 2 1/2". (TYPE B ANCHOR BOLT PER BC-734M MAY BE USED)
- \* VARIES, SEE DESIGN CHART ON SHEET 2 FOR PRECAST CHANNEL BEAMS.
- \*\*\* FOR SHEAR KEY DETAILS, SEE BC-775M.
- ▲ DECK SLAB REINFORCEMENT PER BD-660M.

|                                                                               |                                                                                           |                         |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------|
| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BRIDGE OFFICE |                                                                                           |                         |
| STANDARD<br>PRECAST CHANNEL BEAM BRIDGES<br>BARRIER DETAILS                   |                                                                                           |                         |
| RECOMMENDED NOV. 23, 2022<br><i>[Signature]</i><br>CHIEF BRIDGE ENGINEER      | RECOMMENDED NOV. 23, 2022<br><i>[Signature]</i><br>CHIEF ENGINEER, HIGHWAY ADMINISTRATION | SHEET 3 OF 3<br>BD-668M |

GENERAL NOTES

1. DESIGN SPECIFICATIONS:

● PENNDOT DESIGN MANUAL, PART 4, STRUCTURES.

● 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.

● 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.

● 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.

● DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)
2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:

● PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5)
3. DESIGN LOADS:

● WIND LOAD:

● THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.

● PRECAST CONCRETE PANELS ARE DESIGNED FOR A WIND PRESSURE OF 28 PSF.

● ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.

● SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
5. PANEL HEIGHTS:

● 2'-0" MINIMUM TO 9'-0" MAXIMUM.

● PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 9'-0".
6. HORIZONTAL PANEL JOINTS:

● MINIMIZE THE NUMBER OF HORIZONTAL PANEL JOINTS.

● PROVIDE UNIFORM STEPS.

● IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0".
7. GROUND MOUNTED SOUND BARRIER WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.
8. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PANELS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.
9. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
10. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
11. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
12. FOR ADDITIONAL INFORMATION REFER TO BC-776M.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS ARE DEVELOPED FOR A WIND PRESSURE OF 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.
2. THE DESIGN POST SPACING (CENTER TO CENTER OF POST) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
3. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
4. THE DESIGN PANEL HEIGHT IS TO BE THE ACTUAL PANEL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF PANEL HEIGHT SHOWN ON THE DESIGN TABLES.
5. PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 2'-0" OR GREATER THAN 9'-0".

INDEX OF SHEETS

| SHT. NO. | SHEET TITLE                        |
|----------|------------------------------------|
| 1        | GENERAL NOTES - 1                  |
| 2        | GENERAL NOTES - 2                  |
| 3        | GEOMETRY AND LAYOUT - 1            |
| 4        | GEOMETRY AND LAYOUT - 2            |
| 5        | PRECAST CONCRETE PANEL DETAILS - 1 |
| 6        | PRECAST CONCRETE PANEL DETAILS - 2 |

MATERIAL NOTES

1. REFER TO BC-776M FOR MATERIAL NOTES.

|         |                                                       |
|---------|-------------------------------------------------------|
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                 |
| BC-776M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS |
| BC-777M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS  |
| BC-778M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS             |
| BC-779M | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |
| BD-627M | MOMENT SLABS                                          |
| BD-677M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS  |
| BD-678M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS             |
| BD-679M | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE PANELS

GENERAL NOTES - 1

|                                                                                   |                                                                                             |                         |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|
| RECOMMENDED AUG. 30, 2019<br><i>John J. Russo</i><br>ACTING CHIEF BRIDGE ENGINEER | RECOMMENDED AUG. 30, 2019<br><i>Michael J. Biele</i><br>ACT. DIR., BUR. OF PROJECT DELIVERY | SHEET 1 OF 6<br>BD-676M |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|

NOTES TO DESIGNER

- THE DISTRICT ENVIRONMENTAL MANAGER HAS REVIEWED AND ACCEPTED THE ACOUSTIC REQUIREMENTS OF THE PROPOSED WALL.

DISTRICT ENVIRONMENTAL MANAGER
1. PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL , PART 4 AND THESE STANDARDS.

2. THE FOLLOWING NOTE MUST BE PLACED ON THE DESIGN PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE DESIGN PLANS HAVE BEEN REVIEWED AND ACCEPTED:

3. DETERMINE HEIGHT ZONE AND WIND PRESSURE REQUIRED FOR WALL DESIGN AND INDICATE ON CONTRACT DRAWINGS.

4. DETERMINE ACCEPTABLE POST TYPE. PROVIDE EITHER PRECAST CONCRETE POSTS OR STEEL POSTS. DO NOT MIX POST TYPES WITHOUT PERMISSION FROM THE DISTRICT BRIDGE ENGINEER.

5. SPECIFY IF THE REINFORCEMENT BARS ARE UNCOATED, EPOXY COATED OR GALVANIZED.

6. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED OR GALVANIZED.

7. PROVIDE A CONSTANT POST SPACING FOR THE ENTIRE LENGTH OF WALL. THE CONSTANT POST SPACING MAY BE INTERRUPTED TO MISS DRAINAGE PIPES, UTILITIES, AND/OR ANY OTHER PHYSICAL FEATURES. VARIATIONS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.

8. GROUND MOUNTED SOUND WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.

9. INDICATE IF THE TOP OF PANELS ARE STEPPED OR SLOPED. SLOPED PANELS ARE THE PREFERRED OPTION FOR MOST ARCHITECTURAL SURFACE TREATMENTS.

10. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS ( IF APPLICABLE):
  - OVERALL WALL LENGTH
  - HORIZONTAL GEOMETRY
  - VERTICAL GEOMETRY
  - ACOUSTIC PROFILE ELEVATIONS
  - EXISTING GROUND LINE ELEVATIONS
  - FINISHED GROUND LINE ELEVATIONS
  - GENERAL NOTES
  - FOUNDATION NOTES
  - STAKE-OUT PLAN
  - DETAILS
  - REINFORCEMENT BAR SCHEDULE FOR ALL CAST-IN-PLACE CONCRETE
  - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL

11. THE FOLLOWING GEOTECHNICAL INFORMATION MUST BE INDICATED ON THE DESIGN PLANS:
  - PERMITTED FOUNDATION TYPES (SPREAD FOOTINGS AND/OR DRILLED CAISSONS)
  - FOUNDATION DESIGN PARAMETERS (SITE SPECIFIC)
  - APPROXIMATE TOP OF ROCK ELEVATIONS ALONG LENGTH OF WALL
  - APPROXIMATE GROUND WATER ELEVATIONS ALONG LENGTH OF WALL
  - TYPE OF SOIL TO DETERMINE CAISSON LENGTH IF NO FOUNDATION DESIGN PARAMETERS ARE SPECIFIED
  - TOP AND BOTTOM CAISSON ELEVATIONS
  - TOP AND BOTTOM OF FOOTING ELEVATIONS
  - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL

12. PROVIDE FIRE HYDRANT OPENINGS OR OTHER HIGHWAY ACCESS OPENINGS AS REQUIRED IN THE PRECAST CONCRETE PANELS. PROVIDE REINFORCEMENT AROUND OPENINGS IN ACCORDANCE WITH DETAILS SHOWN ON BC-776M TO PRECLUDE CRACKING.

13. SLOPE THE FINISHED GROUND LINE AWAY FROM THE SOUND BARRIER WALL.

14. INDICATE IF THE ARCHITECTURAL SURFACE TREATMENT TOLERANCES AS PROVIDED IN PUBLICATION 408, SECTION 1086.3 ARE APPLICABLE.

15. THE FOLLOWING INFORMATION MUST BE SPECIFIED ON THE DESIGN PLANS OR INDICATED IN THE CONTRACT SPECIAL PROVISIONS:
  - ARCHITECTURAL SURFACE TREATMENTS ON THE RESIDENTIAL AND ROADWAY SIDES OF THE PRECAST CONCRETE SOUND BARRIER PANELS AND POSTS. INDICATE THE MINIMUM, MAXIMUM AND AVERAGE DEPTHS. ARCHITECTURAL SURFACE TREATMENTS ARE NOT RECOMMENDED ON PRECAST CONCRETE POSTS WITHOUT APPROVAL FROM THE DISTRICT BRIDGE ENGINEER.
  - COLOR OF THE INTEGRAL PIGMENTATION FOR PRECAST CONCRETE SOUND BARRIER PANELS AND THE PRECAST CONCRETE POSTS.
  - COLOR OF JOINT SEALANT AND/OR CAULKING COMPOUND, NON-SHRINK GROUT, AND ANTIGRAFFITI COATING.
  - LIMITS OF ANTIGRAFFITI COATING.
  - PAINT COLOR OF STEEL COMPONENTS.

16. PROVIDE FEDERAL COLOR NUMBERS IN ACCORDANCE WITH FEDERAL STANDARD NUMBER 595A OR 595B.

17. PROVIDE COMPLETE DETAILS AND DESIGN, IF REQUIRED, WHERE A GROUND MOUNTED SOUND BARRIER IS CONNECTED TO A STRUCTURE MOUNTED SOUND BARRIER. REFER TO BD-679M FOR DETAILS.

18. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THE SOUND BARRIER STANDARDS.

19. SPECIFY IF A SOUND BARRIER ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE FOUNDATIONS DUE TO THE INCREASED PANEL WEIGHT.

20. IF NEEDED DETAILS ARE NOT FOUND IN THE SOUND BARRIER STANDARDS A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.
- DESIGN PARAMETERS
1. PRECAST CONCRETE PANELS:

- PANELS ARE DESIGNED FOR WIND PRESSURE EQUAL TO 28 PSF.
  - PANELS ARE DESIGNED USING A 5 INCH STRUCTURAL THICKNESS.
  - PANELS ARE DESIGNED FOR AN ADDITIONAL CONCRETE WEIGHT OF 1½ INCH TO ACCOUNT FOR ARCHITECTURAL SURFACE TREATMENTS.
    - THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½ INCH BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½ INCH.
    - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 1½ INCH.
  - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING BETWEEN POSTS.
  - PANELS ARE DESIGNED USING A 1'-0" STRIP WIDTH.
  - PANELS ARE DESIGNED FOR THE FOLLOWING IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, 5th EDITION, 1999:
    - PANELS ARE DESIGNED FOR STRIPPING FORCES CAUSED BY FORM SUCTION AND IMPACT WHEN THE PANELS ARE STRIPPED FROM THE FORMS IN ACCORDANCE WITH SECTION 5.2.3 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
      - PROVIDE A MINIMUM CONCRETE STRENGTH, AT TIME OF STRIPPING, EQUAL TO 4,000 PSI.
    - PANEL THICKNESS AND REINFORCING IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OF PANEL USING A TWO-POINT PICK-UP OR FOUR-POINT PICK-UP IN ACCORDANCE WITH FIGURE 5.2.4.
    - PANELS ARE DESIGNED FOR TRANSPORTATION IN ACCORDANCE WITH SECTION 5.2.11 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
    - THE FLEXURAL TENSILE STRESSES IN THE CONCRETE ARE CALCULATED USING THE UNCRACKED GROSS SECTION BASED ON THE STRUCTURAL THICKNESS. THE STRESSES ARE COMPARED AGAINST THE MODULUS OF RUPTURE REDUCED BY A SAFETY FACTOR OF 1.50 IN ACCORDANCE WITH SECTION 5.2.4.1.- PANELS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.
- ARCHITECTURAL SURFACE TREATMENTS
1. THE FOLLOWING ARCHITECTURAL SURFACE TREATMENTS ARE PERMITTED ON THE FACE OF THE PRECAST CONCRETE PANELS AND ARE TO BE INDICATED ON THE CONTRACT DRAWINGS AND IN THE CONTRACT SPECIAL PROVISIONS IF REQUIRED:

- NON-FORM LINER FINISHES:
    - SMOOTH FINISH
    - BROOMED FINISH
    - FUZZY OR RAKED FINISH (PERMITTED ON ONE SIDE ONLY)
    - EXPOSED AGGREGATE
  - FORM LINER FINISHES:
    - ASHLAR STONE
    - CUT STONE
    - FRACTURE FIN
    - GRAPE STAKE
    - SHIP LAP
    - ANY OTHER TREATMENT PERMITTED BY THE DEPARTMENT

2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½ INCH, BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½ INCH UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.

3. FORM LINER ARCHITECTURAL SURFACE TREATMENTS ARE NOT RECOMMENDED ON THE PRECAST CONCRETE POSTS.

4. AVOID USING FORM LINER FINISHES ON BOTH SIDES OF THE PRECAST CONCRETE PANELS. A FORM LINER FINISH, ON ONE SIDE OF THE PANEL, ALONG WITH A STAMPED FINISH, ON THE OTHER SIDE OF THE PANEL, IS PERMITTED.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

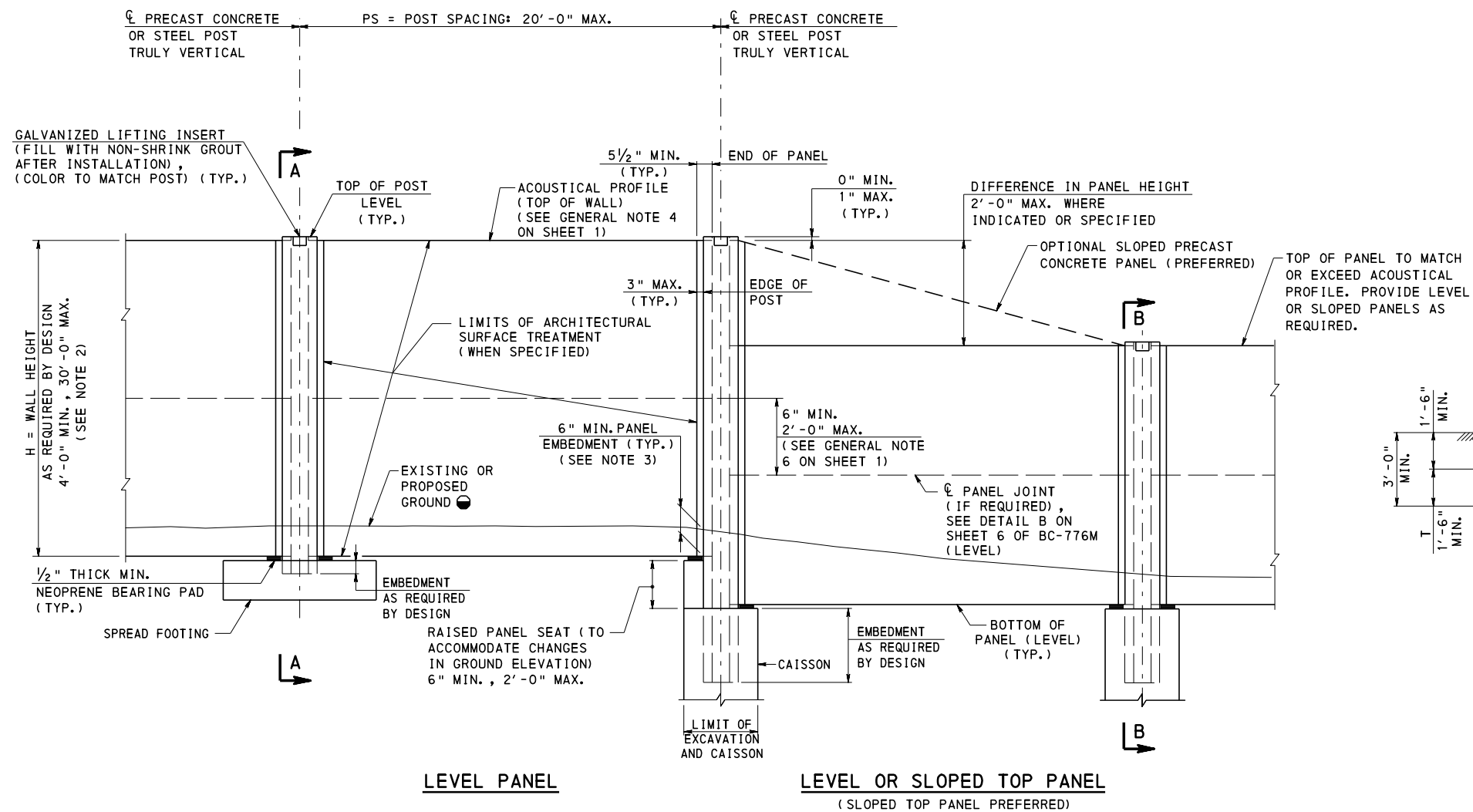
STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE PANELS

GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael V. Biele*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 6  
BD-676M

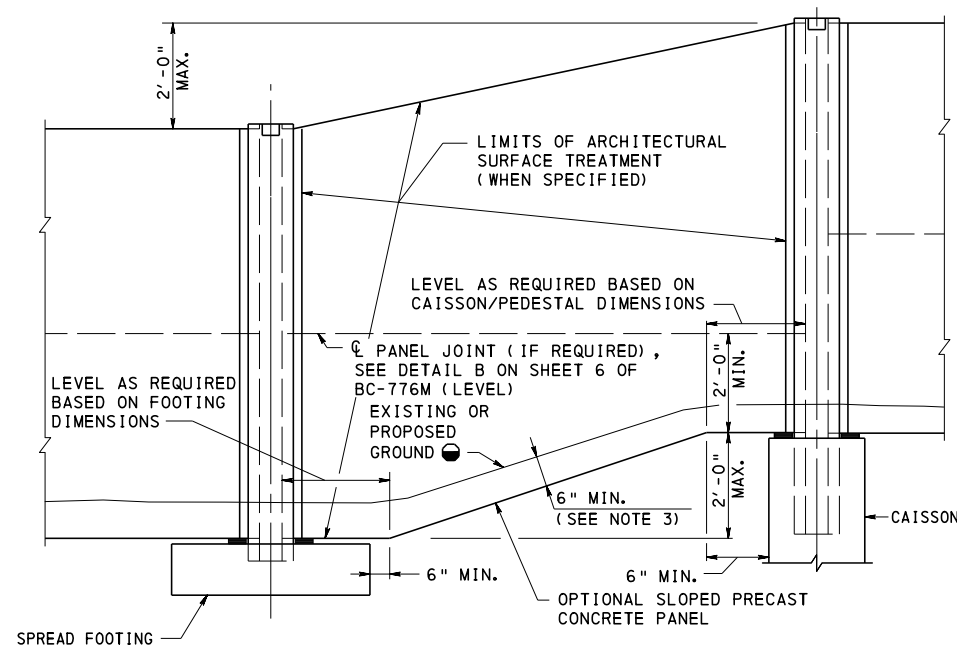


#### LEGEND:

- GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

#### NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- WALL HEIGHT IS DEFINED AS FOLLOWS:
  - POST WITH BASE PLATE: H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL
  - POST WITHOUT BASE PLATE: H = HEIGHT FROM TOP OF FOOTING/CAISSON TO TOP OF WALL
- PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.



**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
BUREAU OF PROJECT DELIVERY

**STANDARD**  
**GROUND MOUNTED SOUND BARRIERS**  
**PRECAST CONCRETE PANELS**

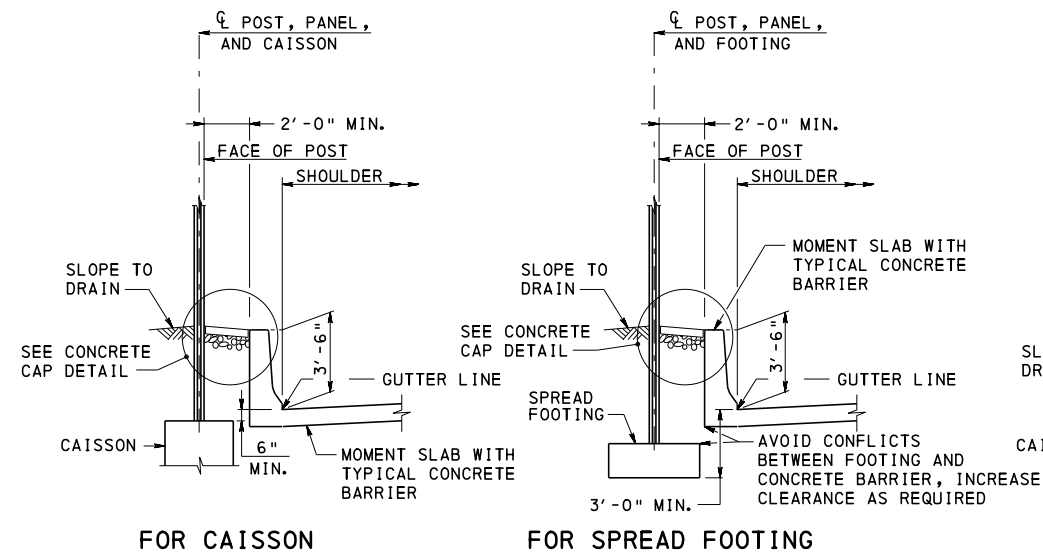
**GEOMETRY AND LAYOUT -1**

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bate*  
ACT. DIR., BUR. OF PROJECT DELIVERY

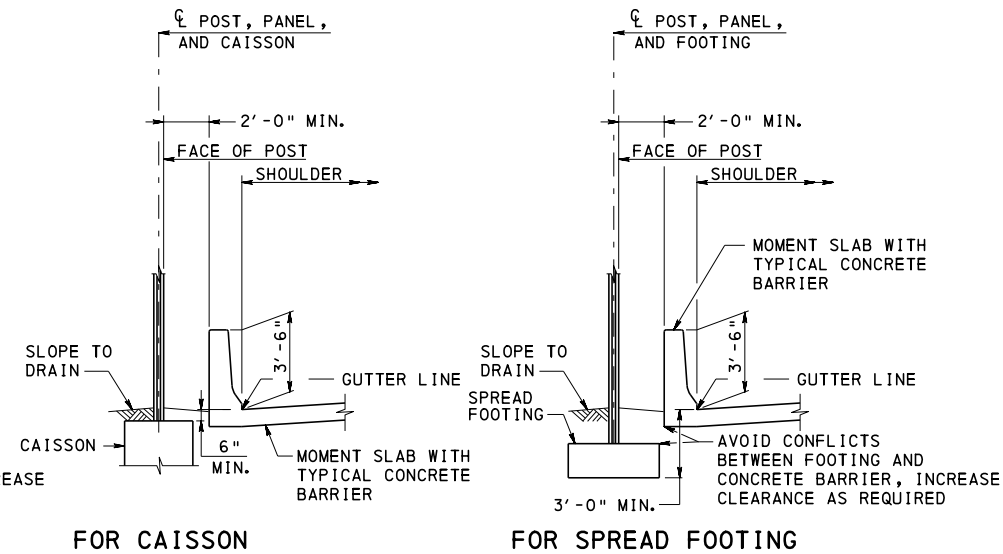
SHEET 3 OF 6  
**BD-676M**





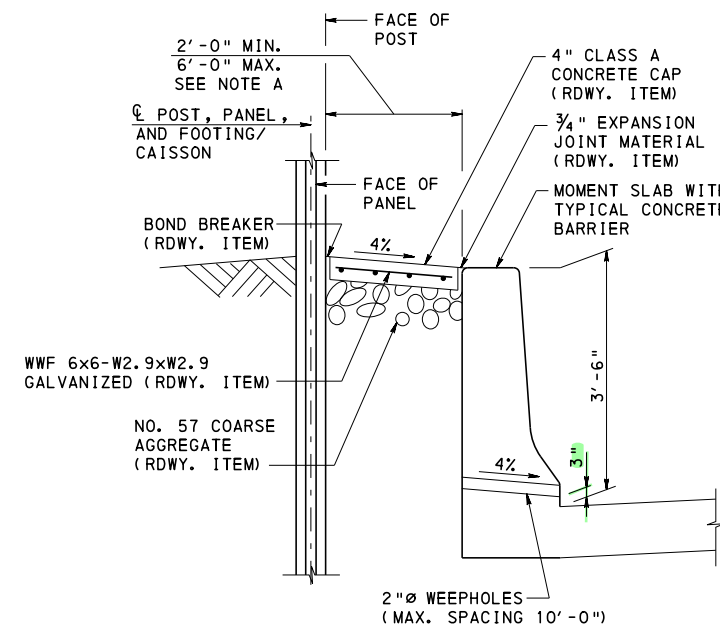
FOR CAISSON FOR SPREAD FOOTING

**SECTION - GROUND MOUNTED  
SOUND BARRIER WALL  
ADJACENT TO ROADWAY BARRIER  
OPTION 1 (SEE NOTE 2)**

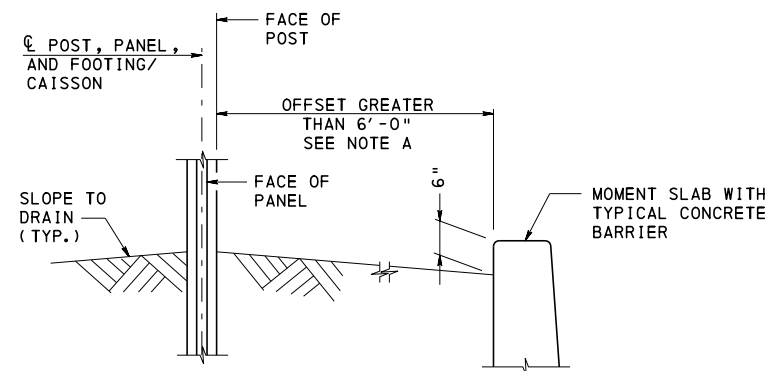


FOR CAISSON FOR SPREAD FOOTING

**SECTION - GROUND MOUNTED  
SOUND BARRIER WALL  
ADJACENT TO ROADWAY BARRIER  
OPTION 2 (SEE NOTE 2)**



**CONCRETE CAP DETAIL**



**NOTE A:**  
IF OFFSET IS GREATER THAN 6'-0" CONCRETE CAP MAY BE ELIMINATED AND SUBSTITUTED WITH PLANTINGS OR ROCK SLOPE PROTECTION. ALTERNATE DETAILS MUST BE SUBMITTED TO THE DISTRICT BRIDGE ENGINEER FOR ACCEPTANCE.

**NOTES:**

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DESIGNER TO SELECT WHICH OPTION IS USED BASED ON THE ROADWAY GEOMETRICS, RIGHT-OF-WAY REQUIREMENTS AND ANY ADDITIONAL CONSTRAINTS. OBTAIN ACCEPTANCE FROM THE DISTRICT BRIDGE ENGINEER. (THE DEPARTMENT PREFERS OPTION 1 USING THE CONCRETE CAP.)

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

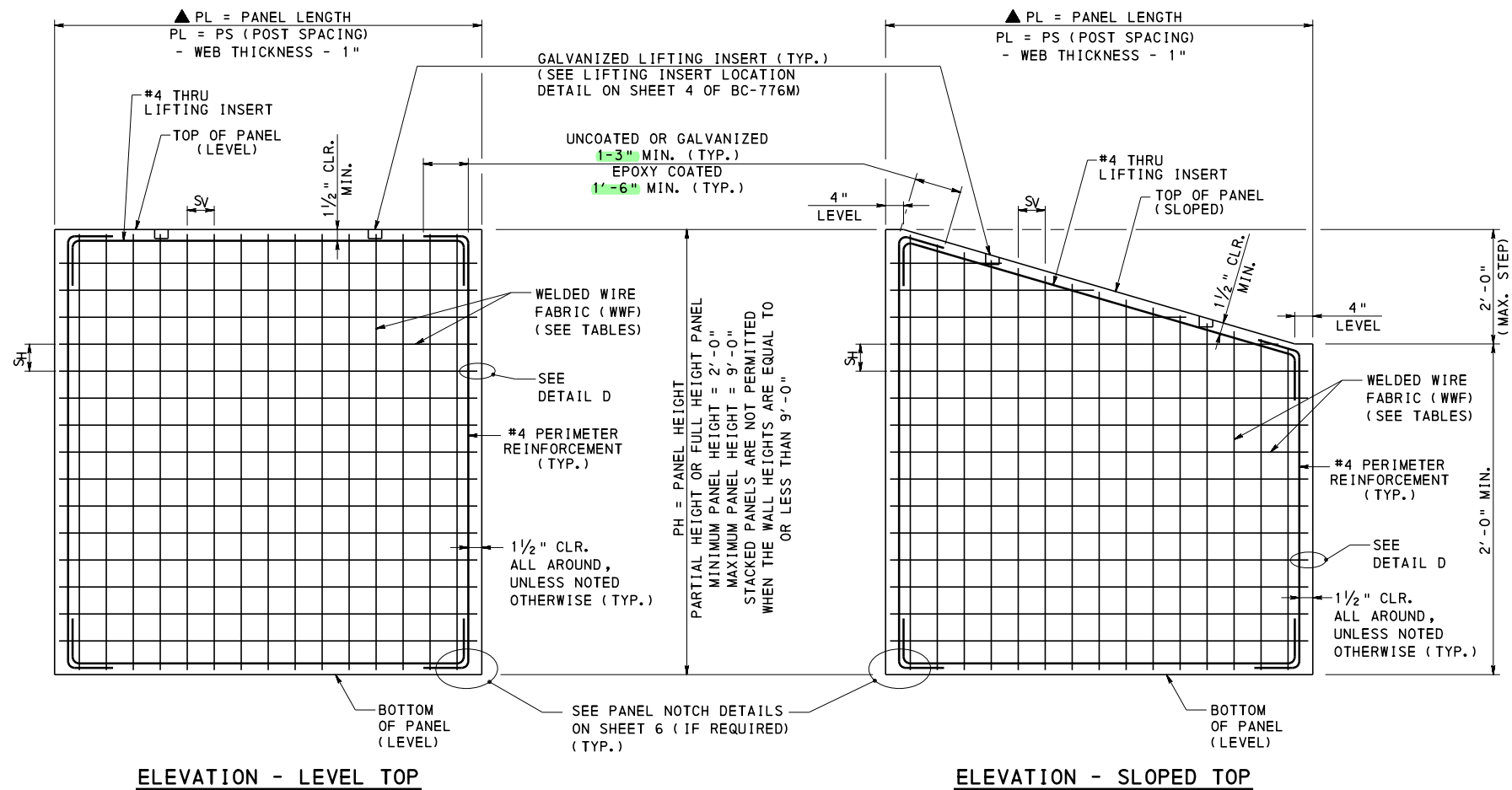
**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE PANELS**

**GEOMETRY AND LAYOUT - 2**

RECOMMENDED AUG. 30, 2019  
*John J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

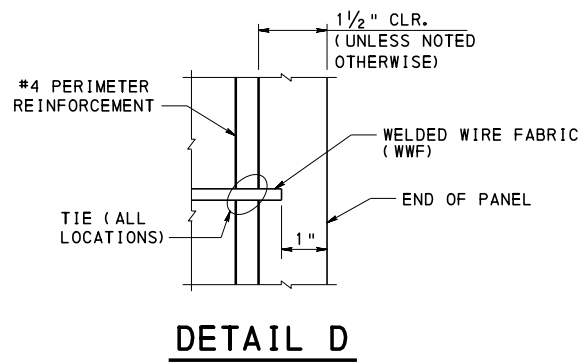
RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 6  
**BD-676M**



## PRECAST CONCRETE PANEL

| DIMENSION TABLE       |           |
|-----------------------|-----------|
| POST SIZE             | "X" (IN.) |
| PRECAST CONCRETE      | 5 1/2     |
| W8 (STEEL)            | 5 1/2     |
| W10 (STEEL)           | 6 1/2     |
| W12 (STEEL)           | 7 1/2     |
| 20" DIA. PIPE (STEEL) | 5 1/2     |

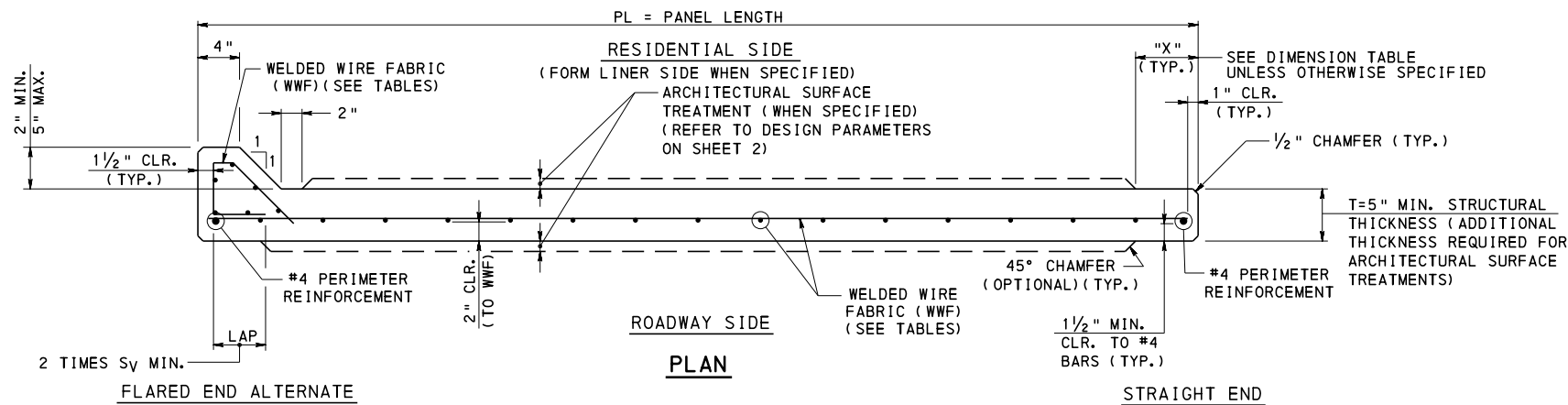


## NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- IF STACKED PANELS ARE REQUIRED REFER TO DETAIL B ON SHEET 6 OF BC-776M.
- DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED FOR ALL PANEL SIZES AS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN..

## LEGEND:

- SH= SPACING OF HORIZONTAL BARS  
 SV= SPACING OF VERTICAL BARS  
 ▲ PANEL LENGTH MAY NEED ADJUSTED TO ACCOMMODATE ANGLED AND CORNER POSTS



## PRECAST CONCRETE PANEL

## PRECAST CONCRETE PANEL REINFORCEMENT U.S. CUSTOMARY UNITS

WIND PRESSURE = 28 PSF

| POST SPACING PS (FT.) | PANEL HEIGHT PH (FT.) | WELDED WIRE FABRIC ** WWF AxB-WC×WD | WELDED WIRE STEEL AREA (IN <sup>2</sup> /FT) |          | MIN. NUMBER OF LIFTING INSERTS |
|-----------------------|-----------------------|-------------------------------------|----------------------------------------------|----------|--------------------------------|
|                       |                       |                                     | HORIZONTAL                                   | VERTICAL |                                |
| 12.0                  | 2.0                   | WWF 6×6-W8×W4                       | 0.16                                         | 0.08     | 2                              |
|                       | 4.0                   | WWF 6×6-W8×W4                       | 0.16                                         | 0.08     | 2                              |
|                       | 6.0                   | WWF 6×6-W8×W8                       | 0.16                                         | 0.16     | 2                              |
|                       | 8.0                   | WWF 6×4-W8×W12                      | 0.16                                         | 0.36     | 2                              |
|                       | 9.0                   | WWF 6×4-W8×W12                      | 0.16                                         | 0.36     | 4                              |
| 16.0                  | 2.0                   | WWF 4×6-W8×W4                       | 0.24                                         | 0.08     | 2                              |
|                       | 4.0                   | WWF 4×6-W8×W4                       | 0.24                                         | 0.08     | 2                              |
|                       | 6.0                   | WWF 4×6-W8×W8                       | 0.24                                         | 0.16     | 2                              |
|                       | 8.0                   | WWF 4×4-W8×W12                      | 0.24                                         | 0.36     | 4                              |
|                       | 9.0                   | WWF 4×4-W8×W12                      | 0.24                                         | 0.36     | 4                              |
| 20.0                  | 2.0                   | WWF 6×6-W20×W4                      | 0.40                                         | 0.08     | 2                              |
|                       | 4.0                   | WWF 6×6-W20×W4                      | 0.40                                         | 0.08     | 2                              |
|                       | 6.0                   | WWF 6×6-W20×W8                      | 0.40                                         | 0.16     | 4                              |
|                       | 8.0                   | WWF 6×4-W20×W12                     | 0.40                                         | 0.36     | 4                              |
|                       | 9.0                   | WWF 6×4-W20×W12                     | 0.40                                         | 0.36     | 4                              |

\*\* A = SPACING OF HORIZONTAL BARS (SH)  
 B = SPACING OF VERTICAL BARS (SV)  
 C = HORIZONTAL WIRE SIZE  
 D = VERTICAL WIRE SIZE  
 WWF = WELDED WIRE FABRIC

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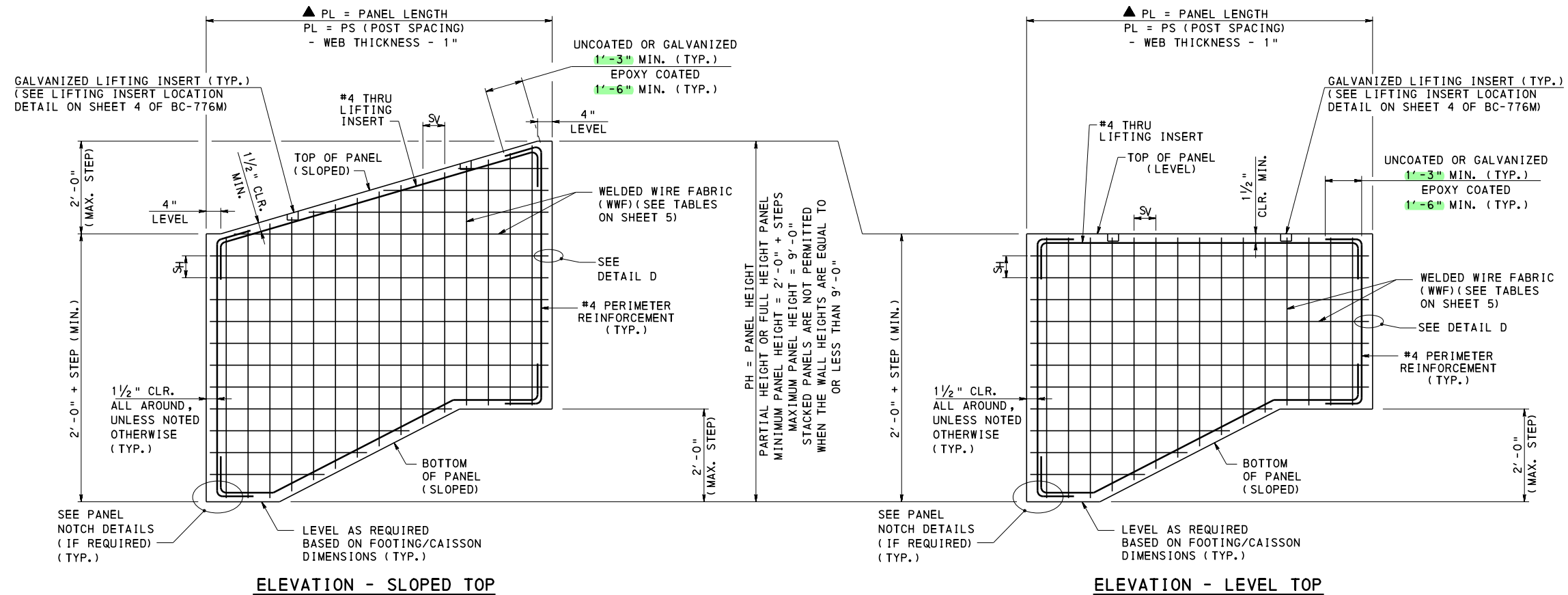
**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE PANELS**

**PRECAST CONCRETE PANEL DETAILS - 1**

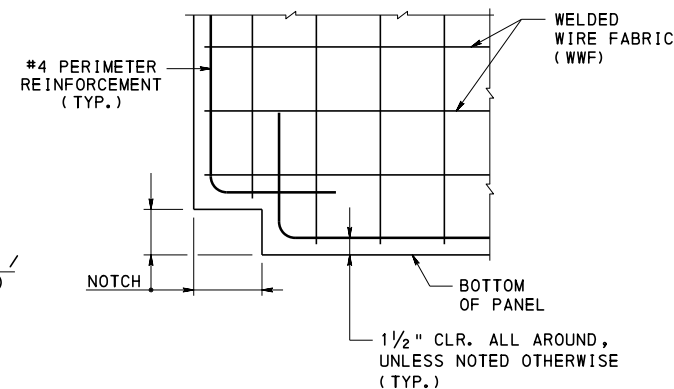
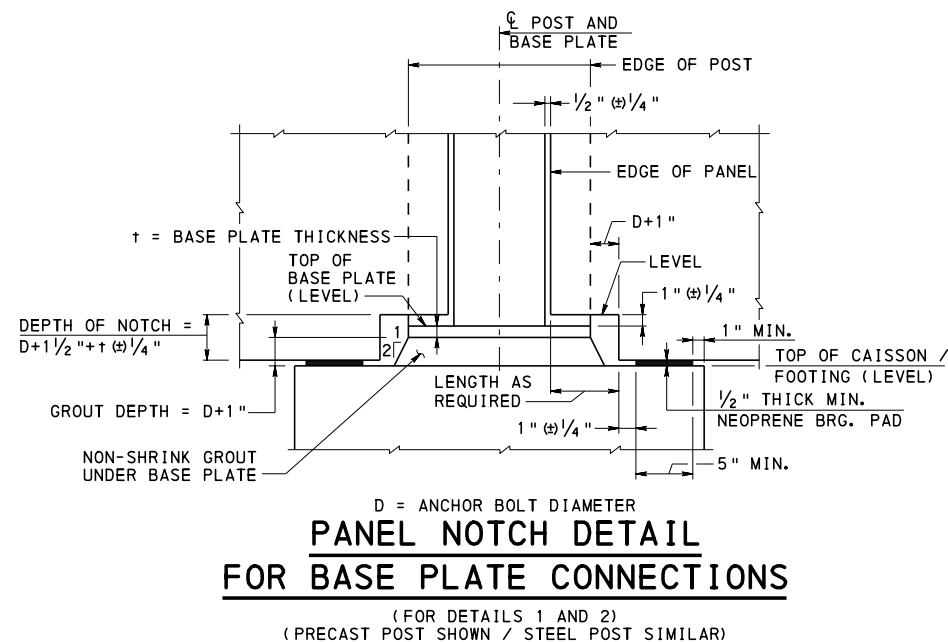
RECOMMENDED AUG. 30, 2019  
*John J. Rizzo*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Mark V. Bito*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 6  
**BD-676M**



## PRECAST CONCRETE PANEL WITH OPTIONAL SLOPED BOTTOM



## REINFORCEMENT DETAIL FOR PANEL NOTCH

### NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL D, REFER TO SHEET 5.

### LEGEND:

▲ PANEL LENGTH MAY NEED ADJUSTED TO  
ACCOMMODATE ANGLED AND CORNER POSTS

SH= SPACING OF HORIZONTAL BARS  
SV= SPACING OF VERTICAL BARS

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**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE PANELS**

**PRECAST CONCRETE PANEL DETAILS - 2**

RECOMMENDED AUG. 30, 2019  
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RECOMMENDED AUG. 30, 2019  
*Michael J. Bate*  
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SHEET 6 OF 6  
**BD-676M**

GENERAL NOTES

1. DESIGN SPECIFICATIONS:

• PENNDOT DESIGN MANUAL, PART 4, STRUCTURES APRIL 2015 EDITION.

• 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.

• 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.

• 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.

• DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)
2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:

• PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5)
3. DESIGN LOADS:

• WIND LOAD:

• THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.

• GROUND MOUNTED SOUND BARRIER WALLS:  
HEIGHT ZONE: 0' TO 14'-0" = 20 PSF  
HEIGHT ZONE: OVER 14'-0" = 28 PSF

• ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.

• SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.

5. PROVIDE EITHER PRECAST CONCRETE POSTS OR STEEL POSTS. DO NOT MIX POST TYPES WITHOUT PERMISSION OF THE DISTRICT BRIDGE ENGINEER.

6. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING AND CAISSONS.

7. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE POSTS AND PEDESTALS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.

8. DO NOT SPLICE VERTICAL POST REINFORCEMENT.

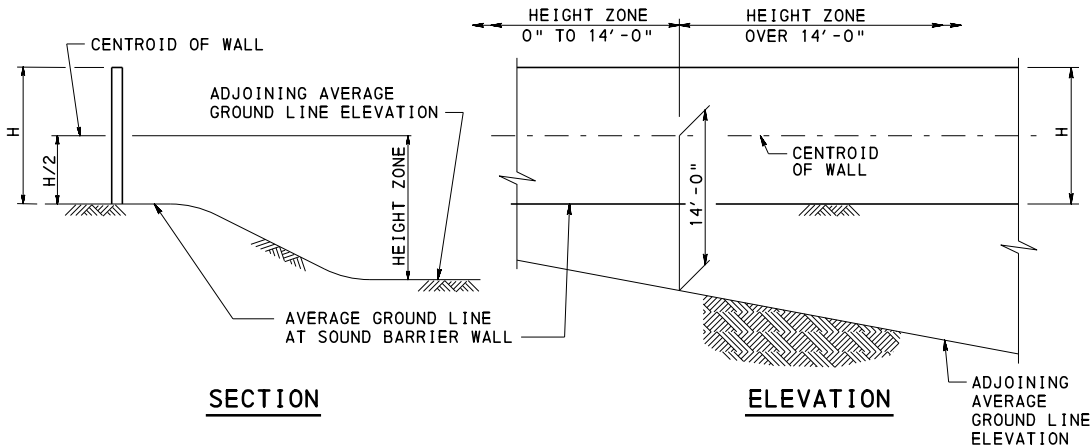
9. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.

10. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.

11. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE POSTS AND SPREAD FOOTINGS ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 20 PSF AND 28 PSF.
2. DESIGN TABLES SHOWN FOR CAISSONS ARE DEVELOPED FOR A WIND PRESSURE OF 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.
3. THE DESIGN POST SPACING (CENTER-TO-CENTER POSTS) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
4. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
5. FOR ANGLED AND CORNER POST NOTES REFER TO SHEET 16.



| HEIGHT ZONE<br>(FEET) | WIND PRESSURE<br>(PSF) |
|-----------------------|------------------------|
| 0 TO 14               | 20                     |
| OVER 14               | 28                     |

HEIGHT ZONES FOR  
GROUND MOUNTED SOUND BARRIERS

INDEX OF SHEETS

| SHT. NO. | SHEET TITLE                                       |
|----------|---------------------------------------------------|
| 1        | GENERAL NOTES - 1                                 |
| 2        | GENERAL NOTES - 2                                 |
| 3        | GEOMETRY AND LAYOUT                               |
| 4        | POST DETAILS                                      |
| 5        | DETAIL 1                                          |
| 6        | DETAIL 1 - POST TYPES A AND B DESIGN TABLES       |
| 7        | DETAIL 1 - POST TYPES C AND D DESIGN TABLES       |
| 8        | DETAIL 2                                          |
| 9        | DETAIL 2 - POST TYPES A AND B DESIGN TABLES       |
| 10       | DETAIL 2 - POST TYPES C AND D DESIGN TABLES       |
| 11       | DETAIL 3                                          |
| 12       | DETAIL 3 - POST TYPES A, B, C AND D DESIGN TABLES |
| 13       | DETAIL 4                                          |
| 14       | DETAIL 4 - POST TYPES A AND B DESIGN TABLES       |
| 15       | DETAIL 4 - POST TYPES C AND D DESIGN TABLES       |
| 16       | DETAIL 5                                          |
| 17       | DETAIL 6                                          |
| 18       | DETAIL 7                                          |
| 19       | DETAIL 8                                          |
| 20       | CAISSON DESIGN TABLES                             |

DESCRIPTION OF DETAILS

| DETAIL | DESCRIPTION                                                                                     |
|--------|-------------------------------------------------------------------------------------------------|
| 1      | PRECAST CONCRETE POST TYPES A, B, C AND D WITH BASE PLATE CONNECTION TO CAISSON                 |
| 2      | PRECAST CONCRETE POST TYPES A, B, C AND D WITH BASE PLATE CONNECTION TO SPREAD FOOTING          |
| 3      | PRECAST CONCRETE POST TYPES A, B, C AND D EMBEDDED IN CAISSON                                   |
| 4      | PRECAST CONCRETE POST TYPES A, B, C AND D EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL) |
| 5      | ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN CAISSON                                         |
| 6      | CORNER PRECAST CONCRETE POST TYPE F EMBEDDED IN CAISSON                                         |
| 7      | ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)       |
| 8      | CORNER PRECAST CONCRETE POST TYPE F EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)       |

MATERIAL NOTES

1. REFER TO BC-777M FOR MATERIAL NOTES.

ARCHITECTURAL SURFACE TREATMENTS NOTES

1. FORM LINER ARCHITECTURAL SURFACE TREATMENTS ARE NOT RECOMMENDED ON THE PRECAST CONCRETE POSTS.

GEOMETRY NOTES

1. CAISSON, FOOTING AND PEDESTAL LOCATIONS MUST BE PROPERLY SET FOR WALL PANEL ALIGNMENT. NOTCHES FOR PANELS ARE NOT CENTERED IN CORNER POST.

COMMONWEALTH OF PENNSYLVANIA  
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STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS

GENERAL NOTES - 1

|                                                                                     |                                                                                             |                          |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------|
| RECOMMENDED AUG. 30, 2019<br><i>James J. Ringer</i><br>ACTING CHIEF BRIDGE ENGINEER | RECOMMENDED AUG. 30, 2019<br><i>Michael J. Bator</i><br>ACT. DIR., BUR. OF PROJECT DELIVERY | SHEET 1 OF 20<br>BD-677M |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------|

REFERENCE DRAWINGS

|         |                                                       |
|---------|-------------------------------------------------------|
| BC-734M | ANCHOR SYSTEMS                                        |
| BC-735M | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS         |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                 |
| BC-776M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS |
| BC-777M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS  |
| BC-778M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS             |
| BC-779M | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |
| BD-676M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS |
| BD-678M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS             |
| BD-679M | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |

CHANGE 2

DESIGN PARAMETERS

1. PRECAST CONCRETE POSTS:
- POSTS ARE DESIGNED AS VERTICAL CANTILEVER BEAMS.
  - POSTS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
  - MAXIMUM PERMITTED POST DEFLECTION EQUALS POST HEIGHT (H) IN INCHES DIVIDED BY 360.
  - POSTS AND CONNECTIONS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.
2. ANCHOR BOLTS:
- ANCHOR BOLTS ARE DESIGNED IN ACCORDANCE WITH SECTION 5.17 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
  - MINIMUM ANCHOR BOLT EMBEDMENT LENGTH IS CALCULATED BASED ON THE DEVELOPMENT LENGTH OF A HOOKED BAR IN TENSION (WITHOUT ANY MODIFICATION FACTORS). REFER TO SECTION 8.29 IN THE 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
  - THE ANCHOR BOLT EMBEDMENT LENGTH MUST EXTEND TO A DEPTH WHERE THE FOOTING/ CAISSON REINFORCEMENT IS FULLY DEVELOPED. DESIGNER MUST INCREASE EMBEDMENT LENGTH AS REQUIRED.
3. BASE PLATES:
- BASE PLATES ARE DESIGNED FOR BENDING DUE TO THE APPLIED BOLTS FORCES, COMPRESSION AND TENSION.
  - BASE PLATES ARE NOT DESIGNED TO SUPPORT THE VERTICAL LOAD OF THE PRECAST CONCRETE PANELS.
  - BASE PLATE THICKNESS IS DETERMINED USING THE ALLOWABLE BENDING STRESS IN ACCORDANCE WITH SECTION 5.8 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
  - BASE PLATE IS SUPPORTED ON THE LEVELING NUTS. THE NON-SHRINK GROUT IS NOT CONSIDERED AS A LOAD-CARRYING ELEMENT.
  - EDGE DISTANCE OF ANCHOR BOLTS:
    - THE CLEAR DISTANCE BETWEEN THE EDGES OF HOLES AND EDGES OF THE BASE PLATE SHALL NOT BE LESS THAN THE DIAMETER OF THE ANCHOR BOLT WHEN OVERSIZED OR SLOTTED HOLES ARE SPECIFIED.
4. SPREAD FOOTINGS:
- SPREAD FOOTINGS ARE DESIGNED BEARING ON SOIL WITH AN ALLOWABLE BEARING PRESSURE EQUAL TO 1.50 TONS/SQ. FT. AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
  - SPREAD FOOTINGS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
  - FACTOR OF SAFETY AGAINST SLIDING = 1.50 MINIMUM
  - FACTOR OF SAFETY AGAINST SLIDING FOR SEISMIC LOADING = 1.125 MINIMUM
  - FACTOR OF SAFETY AGAINST OVERTURNING = 2.00 MINIMUM
  - FACTOR OF SAFETY AGAINST OVERTURNING FOR SEISMIC LOADING = 1.50 MINIMUM
  - WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.
  - PROVIDE A MINIMUM SOIL DEPTH OF 1'-6" ABOVE THE TOP OF FOOTING.
  - SPREAD FOOTINGS ARE DESIGNED FOR NO UPLIFT.
  - SPREAD FOOTINGS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
  - SPREAD FOOTINGS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN FOOTINGS IF LIVE LOAD SURCHARGE IS REQUIRED.
  - ALTERNATE SPREAD FOOTING DESIGNS ARE PERMITTED IF SUPPORTED ON ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.
5. CAISSONS:
- CAISSONS ARE DESIGNED IN SOIL USING THE INDICATED SOIL PROPERTIES.
  - CASSIONS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 28 PSF.
  - FACTOR OF SAFETY AGAINST OVERTURNING = 2.0 MINIMUM
  - MAXIMUM ALLOWABLE LATERAL DESIGN DISPLACEMENT AT TOP OF CAISSON = 1/2 INCH
  - CAISSON LENGTHS DETERMINED USING COM624P COMPUTER PROGRAM. FINAL CAISSON LENGTHS INDICATED INCLUDE AN ADDITIONAL 3'-0" LENGTH TO ACCOUNT FOR FREEZING AND THAWING, WEATHERING, AND OTHER SHALLOW GROUND DISTURBANCE.
  - CAISSON MAXIMUM ALLOWABLE VERTICAL DISPLACEMENT = 1.0 INCH
  - DRILLED CAISSONS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
  - DRILLED CAISSONS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN CAISSONS IF LIVE LOAD SURCHARGE IS REQUIRED.
  - ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED OR IF CAISSON EXTENDS PARTIALLY OR ENTIRELY INTO ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.


NOTES TO DESIGNER

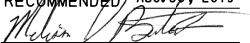
1. REFER TO SHEET 2 OF BD-676M FOR NOTES TO DESIGNER.

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STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS

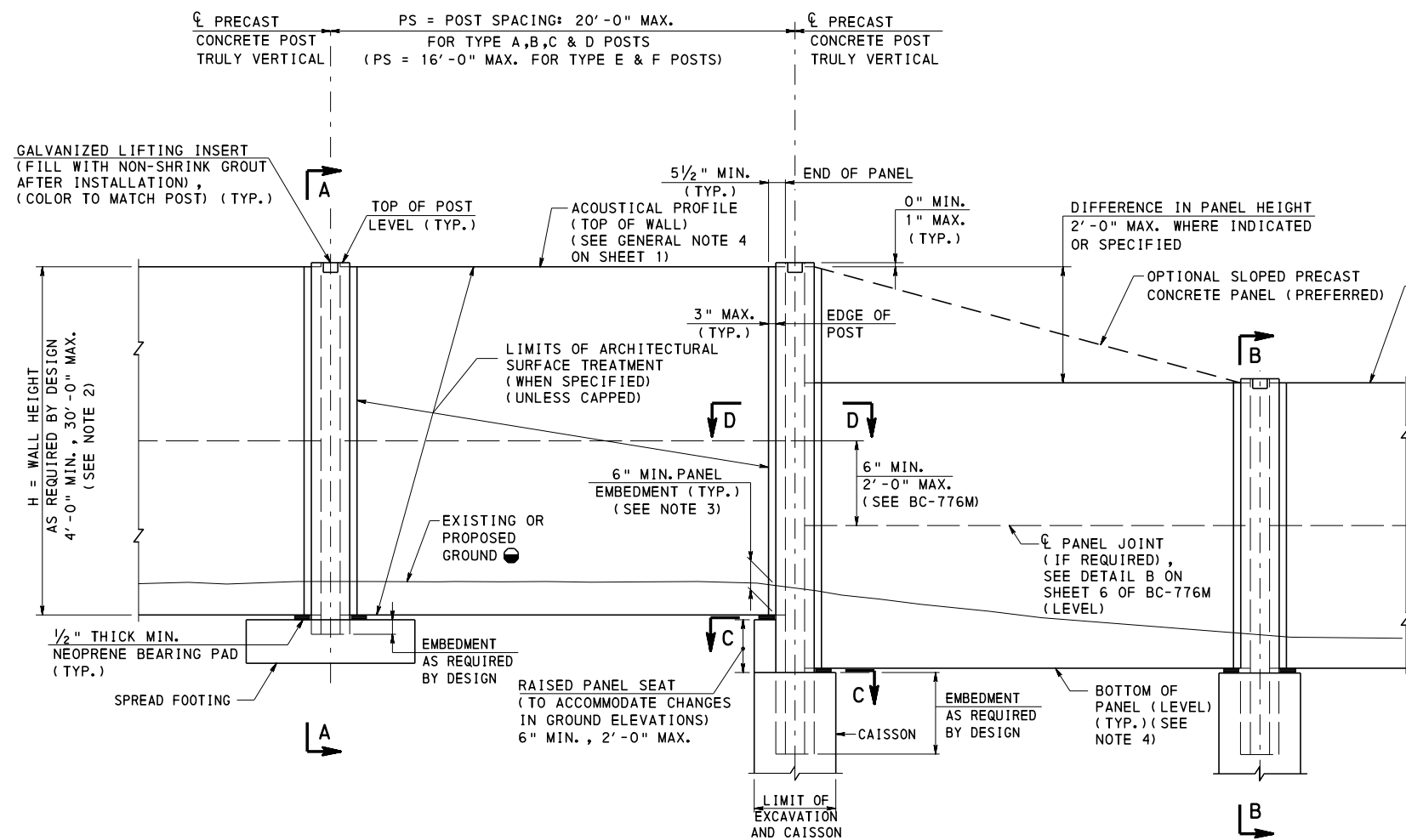
GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019  
  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 20  
BD-677M



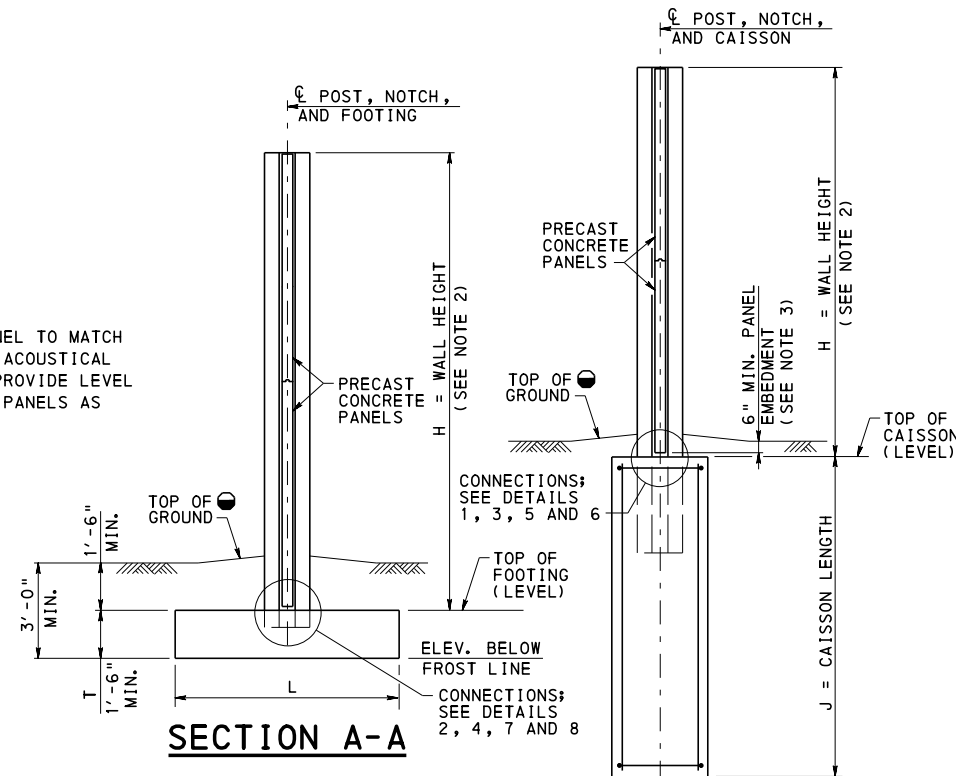


**LEVEL PANEL**

**LEVEL OR SLOPED TOP PANEL**  
(SLOPED TOP PANEL PREFERRED)

## GROUND MOUNTED SOUND BARRIER ELEVATION

FOR POSTS WITH BASE PLATES REFER TO "PANEL NOTCH DETAIL FOR BASE PLATE CONNECTIONS" ON BD-676M, SHT. 6.



**SECTION A-A**

**SECTION B-B**

### LEGEND:

- GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

### NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- WALL HEIGHT IS DEFINED AS FOLLOWS:
  - POST WITH BASE PLATE:  
H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL
  - POST WITHOUT BASE PLATE:  
H = HEIGHT FROM TOP OF FOOTING/CAISSON TO TOP OF WALL
- PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.
- FOR OPTIONAL SLOPED BOTTOM PANEL REFER TO BD-676M, SHEET 3.
- FOR SECTIONS C-C AND D-D REFER TO BC-777M, SHEETS 2 AND 3.

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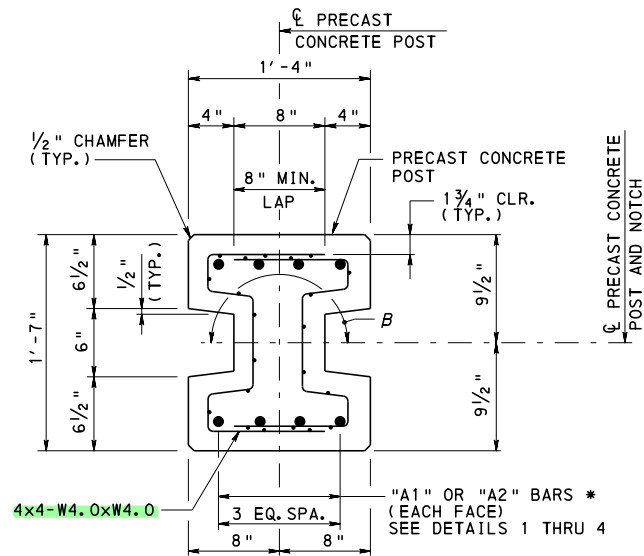
**STANDARD**  
**GROUND MOUNTED SOUND BARRIERS**  
**PRECAST CONCRETE POSTS**

**GEOMETRY AND LAYOUT**

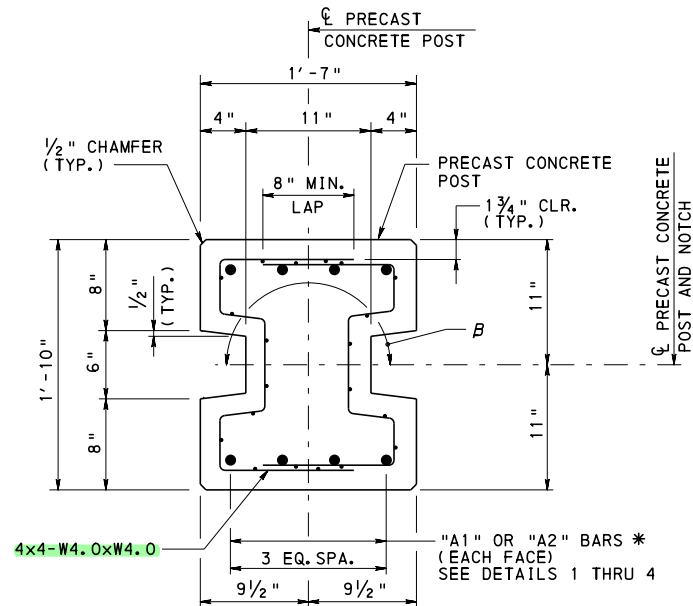
RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

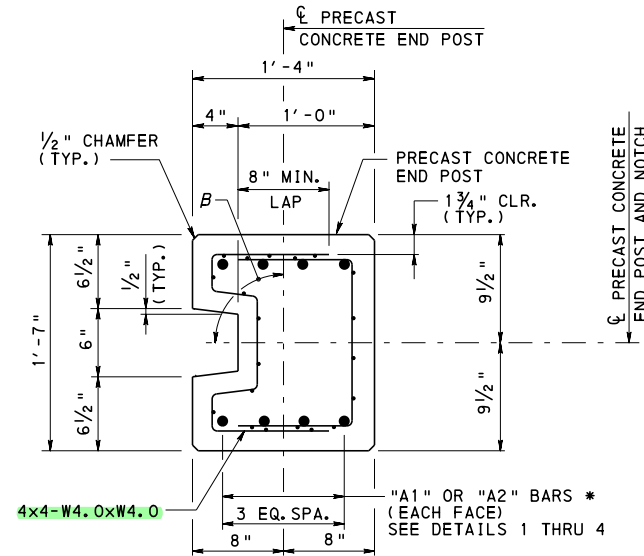
SHEET 3 OF 20  
**BD-677M**



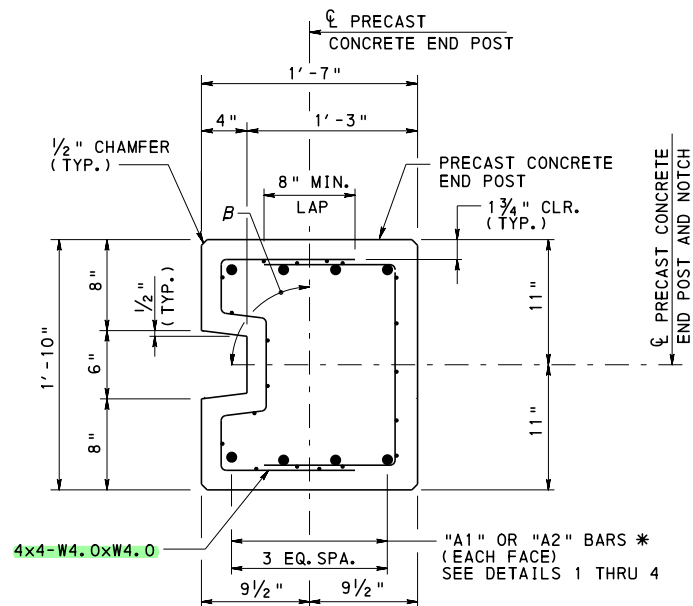
**POST TYPE A - IN-LINE**  
 $B = 180^\circ (\pm 12^\circ)$



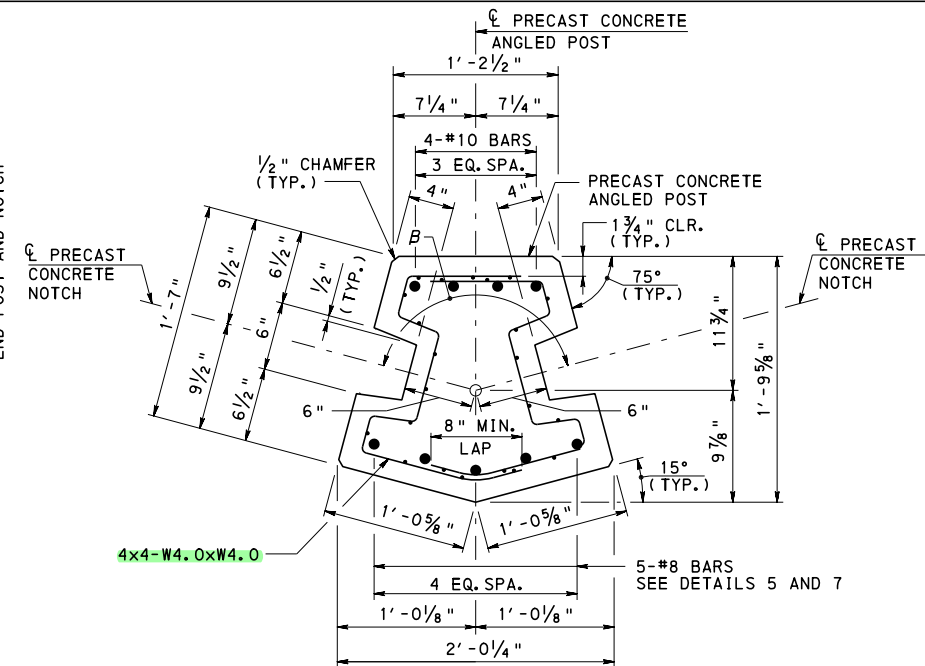
**POST TYPE C - IN-LINE**  
 $B = 180^\circ (\pm 12^\circ)$



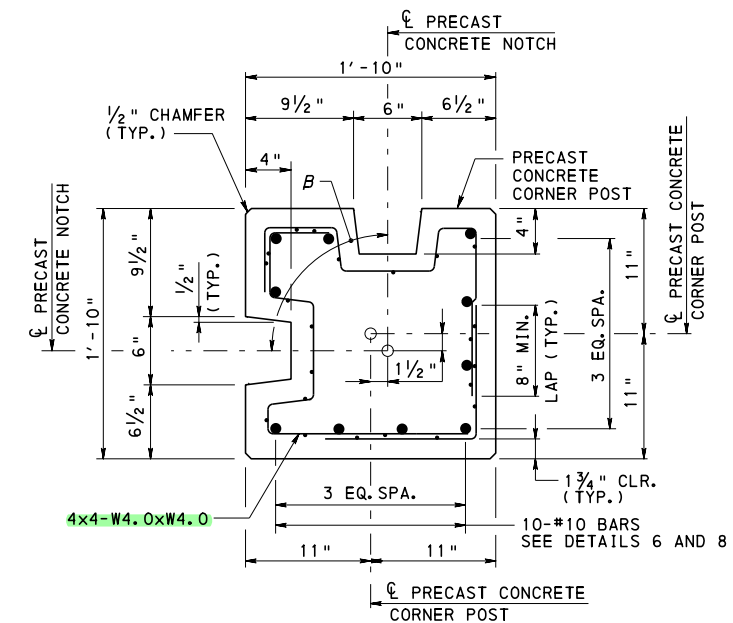
**POST TYPE B - END POST**  
 $B = 90^\circ (\pm 6^\circ)$



**POST TYPE D - END POST**  
 $B = 90^\circ (\pm 6^\circ)$



**POST TYPE E - ANGLED IN-LINE**  
 $B = 150^\circ (\pm 12^\circ)$



**POST TYPE F - CORNER**  
 $B = 90^\circ (\pm 12^\circ)$

\* "A1" BARS ARE USED WITH BASE PLATE CONNECTIONS. BARS ARE EITHER EPOXY COATED OR GALVANIZED AND ARE THREADED AT ONE END. DESIGNER TO USE BAR SIZE SPECIFIED WITH THREADED END OR USE ONE BAR SIZE SMALLER WHEN USING UPSET THREADED END. (SEE DETAILS 1 AND 2)

"A2" BARS ARE NOT THREADED. (SEE DETAILS 3 AND 4)

#### NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- $B$  REFERS TO THE PANEL ORIENTATION. THE MAXIMUM VARIATION IN THE ANGLE BETWEEN THE CENTERLINE OF PANEL AND CENTERLINE OF POST IS 6 DEGREES. REFER TO BC-777M FOR ADDITIONAL INFORMATION.
- POST TYPES A, B, C, D & E ARE PERMITTED A MAXIMUM OF TWO LAP SPLICES FOR ITS HORIZONTAL WIRE MESH TO CREATE A CLOSED STIRRUP. POST TYPE F IS PERMITTED A MAXIMUM OF THREE LAP SPLICE LOCATIONS TO CREATE ITS CLOSED STIRRUP.
- OTHER HORIZONTAL WIRE MESH LAP SPLICE LOCATIONS THAN THOSE SHOWN ARE ALLOWED.

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**STANDARD**  
**GROUND MOUNTED SOUND BARRIERS**  
**PRECAST CONCRETE POSTS**

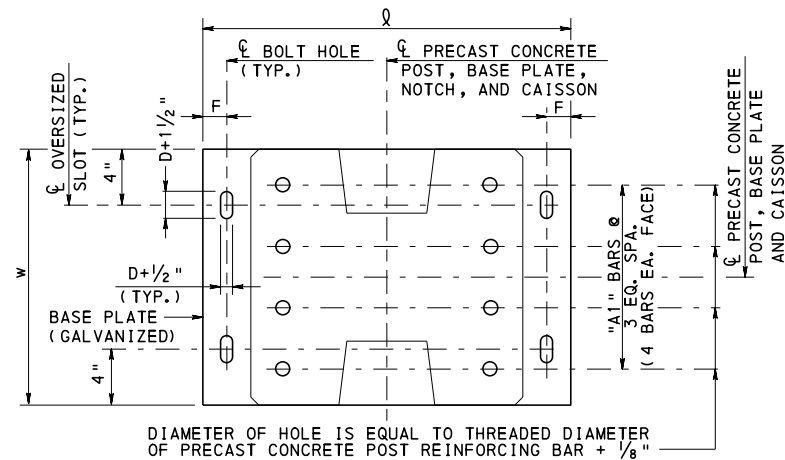
**POST DETAILS**

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
 ACTING CHIEF BRIDGE ENGINEER

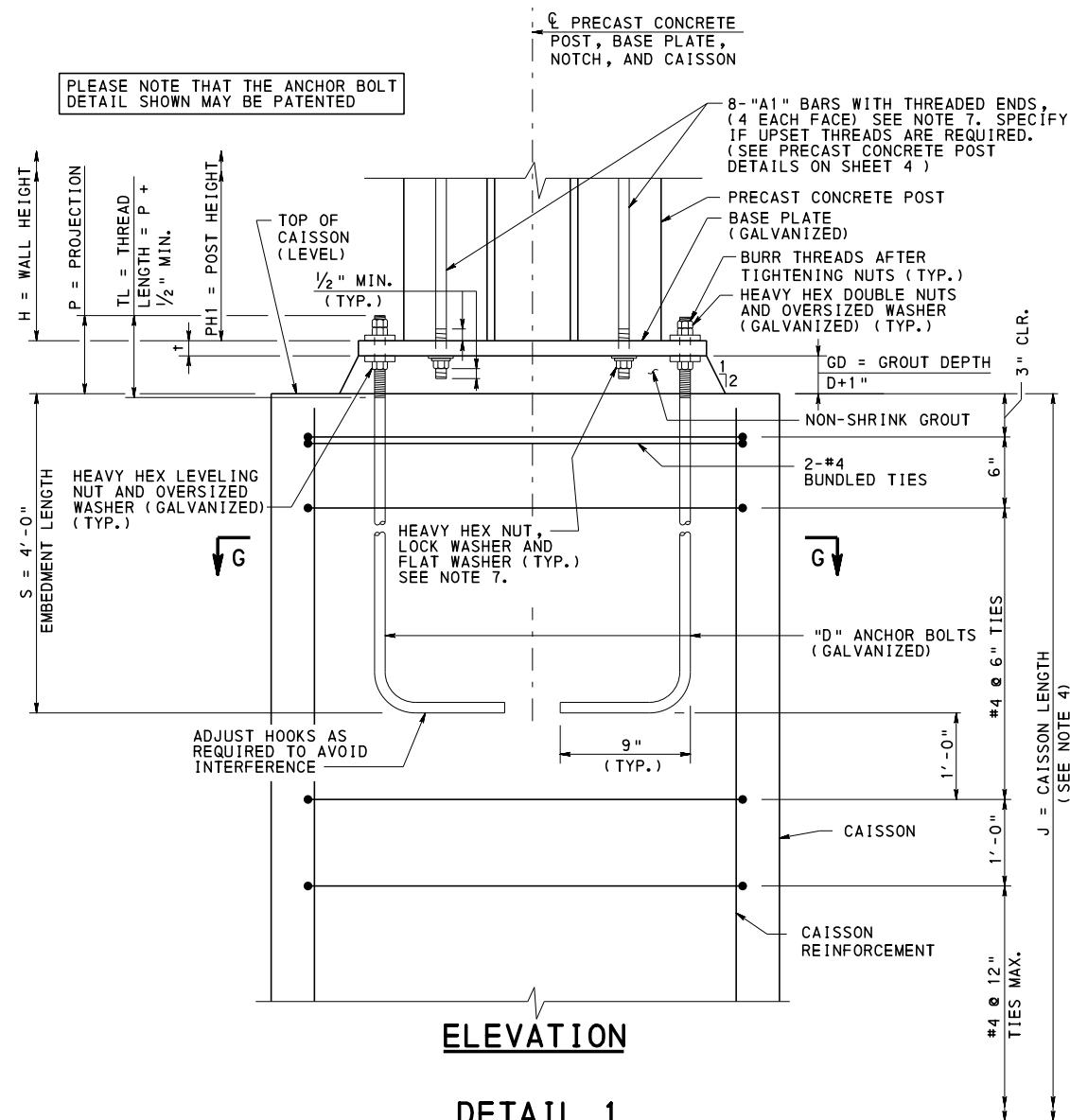
RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 20

**BD-677M**



**PLAN**



**ELEVATION**

**DETAIL 1  
PRECAST CONCRETE POST WITH  
BASE PLATE CONNECTION  
TO CAISSON**

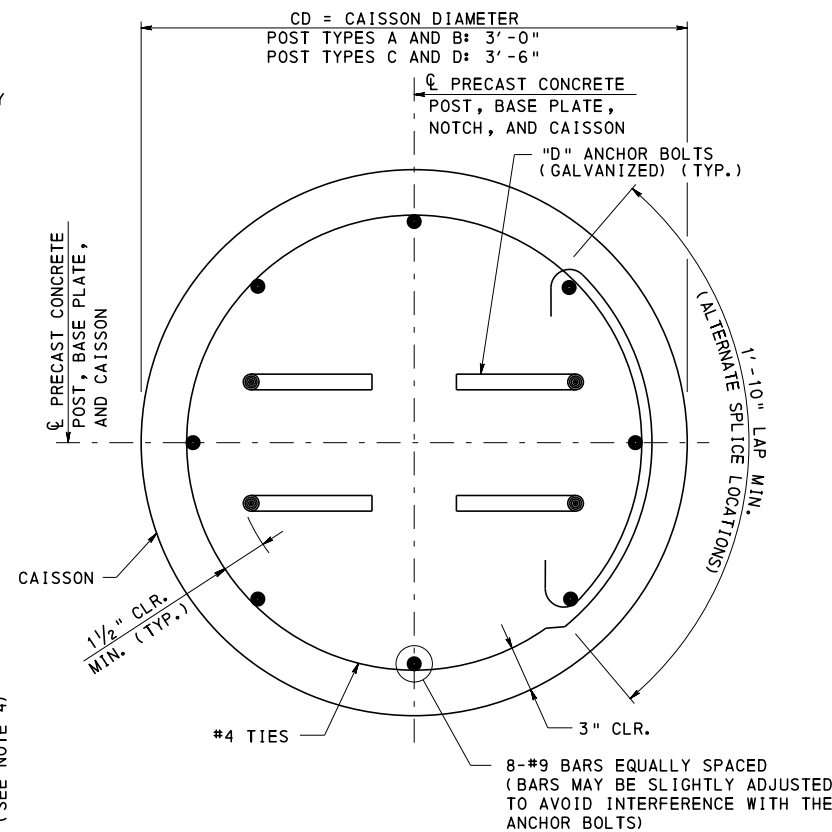
**PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON  
DIMENSION TABLE**

HEIGHT ZONE =  
WIND PRESSURE =

| CONCRETE POST  |                                    |                                   |                                |                    | BASE PLATE              |                      |                     |            | ANCHOR BOLTS           |                                   |                          |                                 | GROUT                         | CAISSON                                  |                                 |                           |             |
|----------------|------------------------------------|-----------------------------------|--------------------------------|--------------------|-------------------------|----------------------|---------------------|------------|------------------------|-----------------------------------|--------------------------|---------------------------------|-------------------------------|------------------------------------------|---------------------------------|---------------------------|-------------|
| POST<br>NUMBER | DESIGN<br>POST<br>SPACING<br>(FT.) | DESIGN<br>WALL<br>HEIGHT<br>(FT.) | POST<br>HEIGHT<br>PH1<br>(FT.) | "A1"<br>(BAR SIZE) | THICKNESS<br>t<br>(IN.) | LENGTH<br>L<br>(IN.) | WIDTH<br>w<br>(IN.) | F<br>(IN.) | DIAMETER<br>D<br>(IN.) | EMBEDMENT<br>LENGTH<br>S<br>(IN.) | PROJECTION<br>P<br>(IN.) | THREAD<br>LENGTH<br>TL<br>(IN.) | GROUT<br>DEPTH<br>GD<br>(IN.) | CAISSON<br>DIAMETER<br>CD<br>(FT. - IN.) | CAISSON<br>LENGTH<br>J<br>(FT.) | VERTICAL<br>REINFORCEMENT |             |
|                |                                    |                                   |                                |                    |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                                          |                                 | NUMBER<br>OF BARS         | BAR<br>SIZE |
|                |                                    |                                   |                                |                    |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                                          |                                 |                           |             |
|                |                                    |                                   |                                |                    |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                                          |                                 |                           |             |

**TABLE NOTES:**

- DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
- TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
- SPECIFY IF UPSET THREADS ARE REQUIRED FOR THE "A1" BARS. (REFER TO SHEET 4)
- CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
- PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



**SECTION G-G**

**NOTES:**

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
- FOR DESIGN TABLES REFER TO SHEETS 6 AND 7.
- FOR CAISSON LENGTHS REFER TO SHEET 20.
- FOR PANEL SEAT DETAILS REFER TO BC-777M, SHEET 4.
- FOR OVERSIZED WASHER DETAIL REFER TO BC-777M, SHEET 6.
- POST "A1" BARS AND HARDWARE OPTIONS:
  - GALVANIZED BARS - IF THE THREADED BAR IS HOT DIP GALVANIZED, INCLUDING THE THREADED PORTION, USE NUTS AND WASHERS THAT ARE HOT-DIP GALVANIZED. IF THREADING IS PERFORMED AFTER GALVANIZING, COAT THE THREADED AREA WITH A COLD GALVANIZING REPAIR COMPOUND PER ASTM A780 AND USE EITHER MECHANICALLY GALVANIZED OR HOT DIP GALVANIZED WASHERS AND MECHANICALLY (ONLY) GALVANIZED NUTS. (WASHER - ASTM F436; NUT-ASTM A563).
  - EPOXY COATED BARS - COAT THREADS WITH COLD GALVANIZING REPAIR COMPOUND PER ASTM A780. USE EITHER MECHANICALLY GALVANIZED OR HOT DIP GALVANIZED WASHERS AND MECHANICALLY (ONLY) GALVANIZED NUTS. (WASHER - ASTM F436; NUT - ASTM A563).

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS**

**DETAIL 1**

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 20

**BD-677M**

| DETAIL 1                                                       |                              |                  |            |            |            |            |              |            |
|----------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|
| PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO CAISSON |                              |                  |            |            |            |            |              |            |
| POST TYPES A AND B                                             |                              |                  |            |            |            |            |              |            |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF                |                              |                  |            |            |            |            |              |            |
| CONCRETE POST                                                  |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |
| POST<br>SPACING<br>PS<br>(FT.)                                 | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Ø<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | P<br>(IN.) |
| 12.0                                                           | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 5          |
|                                                                | 10.0                         | #5               | ¾          | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #5               | 7⁄8        | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 14.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 6          |
|                                                                | 16.0                         | #6               | 1⅛         | 28         | 16         | 2¼         | 1¼           | 6¾         |
|                                                                | 18.0                         | #6               | 1⅜         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 20.0                         | #7               | 1½         | 28         | 16         | 2¼         | 1¼           | 7¼         |
|                                                                | 22.0                         | #8               | 1¾         | 28         | 16         | 2¼         | 1¼           | 7¼         |
| 16.0                                                           | 24.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 8¼         |
|                                                                | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | 7⁄8        | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 6          |
|                                                                | 14.0                         | #6               | 1¼         | 28         | 16         | 2¼         | 1¼           | 6¾         |
|                                                                | 16.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 18.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7¼         |
|                                                                | 20.0                         | #8               | 1¾         | 29         | 16         | 2¾         | 1½           | 8¼         |
| 20.0                                                           | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | 7⁄8        | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #6               | 1⅛         | 28         | 16         | 2¼         | 1¼           | 6¾         |
|                                                                | 14.0                         | #6               | 1⅜         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 16.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7¼         |
|                                                                | 18.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 8¼         |


| DETAIL 1                                                       |                              |                  |            |            |            |            |              |            |
|----------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|
| PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO CAISSON |                              |                  |            |            |            |            |              |            |
| POST TYPES A AND B                                             |                              |                  |            |            |            |            |              |            |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF                |                              |                  |            |            |            |            |              |            |
| CONCRETE POST                                                  |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |
| POST<br>SPACING<br>PS<br>(FT.)                                 | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Ø<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | P<br>(IN.) |
| 12.0                                                           | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | 7⁄8        | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 6          |
|                                                                | 14.0                         | #6               | 1¼         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 16.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 18.0                         | #8               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7¼         |
|                                                                | 20.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 8¼         |
| 16.0                                                           | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 6          |
|                                                                | 12.0                         | #6               | 1¼         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 14.0                         | #7               | 1½         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 16.0                         | #8               | 1¾         | 28         | 16         | 2¼         | 1¼           | 7¼         |
| 20.0                                                           | 17.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 8¼         |
|                                                                | 6.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 8.0                          | #5               | 7⁄8        | 27         | 16         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #6               | 1⅛         | 28         | 16         | 2¼         | 1¼           | 6¾         |
|                                                                | 12.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7          |
|                                                                | 14.0                         | #8               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 7¼         |
|                                                                | 15.0                         | #8               | 1¾         | 29         | 16         | 2¾         | 1½           | 8¼         |


NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 5.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
DETAIL 1 - POST TYPES A AND B  
DESIGN TABLES

RECOMMENDED  
AUG. 30, 2019  
  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED  
AUG. 30, 2019  
  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 20

BD-677M

| DETAIL 1                                                       |                              |                  |            |            |            |            |              |            |
|----------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|
| PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO CAISSON |                              |                  |            |            |            |            |              |            |
| POST TYPES C AND D                                             |                              |                  |            |            |            |            |              |            |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF                |                              |                  |            |            |            |            |              |            |
| CONCRETE POST                                                  |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |
| POST<br>SPACING<br>PS<br>(FT.)                                 | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Ø<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | P<br>(IN.) |
| 12.0                                                           | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 10.0                         | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #5               | ⅞          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 14.0                         | #6               | 1          | 30         | 19         | 2          | 1            | 6          |
|                                                                | 16.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 18.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 20.0                         | #7               | 1¼         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 22.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 24.0                         | #8               | 1½         | 32         | 19         | 2¾         | 1½           | 8          |
| 16.0                                                           | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #6               | ⅞          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 14.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 16.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 18.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 20.0                         | #7               | 1½         | 31         | 19         | 2¼         | 1¼           | 7¼         |
|                                                                | 22.0                         | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 8          |
|                                                                | 24.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 8¼         |
| 20.0                                                           | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | ⅞          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 14.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 16.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 18.0                         | #8               | 1½         | 31         | 19         | 2¼         | 1¼           | 7¼         |
|                                                                | 20.0                         | #8               | 1¾         | 32         | 19         | 2¾         | 1½           | 8¼         |
|                                                                | 22.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 8¼         |
|                                                                | 24.0                         | #10              | 2⅛         | 33         | 19         | 3          | 1¾           | 9¼         |
| 26.0                                                           | #11                          | 2⅝               | 33         | 19         | 3          | 1¾         | 9½           |            |
|                                                                | 27.0                         | #11              | 2½         | 34         | 19         | 3½         | 2            | 10½        |

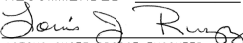
| DETAIL 1                                                       |                              |                  |            |            |            |            |              |            |
|----------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|
| PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO CAISSON |                              |                  |            |            |            |            |              |            |
| POST TYPES C AND D                                             |                              |                  |            |            |            |            |              |            |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF                |                              |                  |            |            |            |            |              |            |
| CONCRETE POST                                                  |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |
| POST<br>SPACING<br>PS<br>(FT.)                                 | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Ø<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | P<br>(IN.) |
| 12.0                                                           | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #6               | ⅞          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 14.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 16.0                         | #6               | 1¼         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 18.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 20.0                         | #8               | 1½         | 32         | 19         | 2¾         | 1½           | 8          |
|                                                                | 22.0                         | #8               | 1¾         | 32         | 19         | 2¾         | 1½           | 8¼         |
|                                                                | 24.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 8¼         |
|                                                                | 26.0                         | #10              | 2⅛         | 33         | 19         | 3          | 1¾           | 9¼         |
|                                                                | 28.0                         | #11              | 2⅝         | 33         | 19         | 3          | 1¾           | 9½         |
| 16.0                                                           | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #5               | ⅞          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 12.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 14.0                         | #6               | 1¼         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 16.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 18.0                         | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 8          |
|                                                                | 20.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 8¼         |
|                                                                | 22.0                         | #10              | 2⅛         | 33         | 19         | 3          | 1¾           | 9¼         |
|                                                                | 24.0                         | #10              | 2¼         | 33         | 19         | 3          | 1¾           | 9½         |
|                                                                | 26.0                         | #11              | 2½         | 34         | 19         | 3½         | 2            | 10½        |
| 20.0                                                           | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 5          |
|                                                                | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 5¾         |
|                                                                | 10.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 12.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 6¾         |
|                                                                | 14.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 7          |
|                                                                | 16.0                         | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 8          |
|                                                                | 18.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 8¼         |
|                                                                | 20.0                         | #10              | 2⅛         | 33         | 19         | 3          | 1¾           | 9¼         |
|                                                                | 22.0                         | #11              | 2⅝         | 33         | 19         | 3          | 1¾           | 9½         |
|                                                                | 23.0                         | #11              | 2½         | 34         | 19         | 3½         | 2            | 10½        |

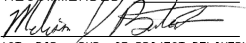
NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 5.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
DETAIL 1 - POST TYPES C AND D  
DESIGN TABLES

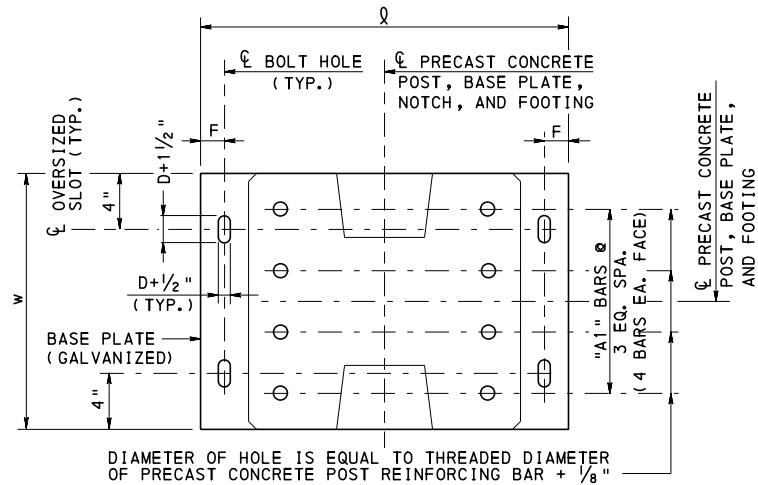
RECOMMENDED  
AUG. 30, 2019  
  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED  
AUG. 30, 2019  
  
ACT. DIR., BUR. OF PROJECT DELIVERY

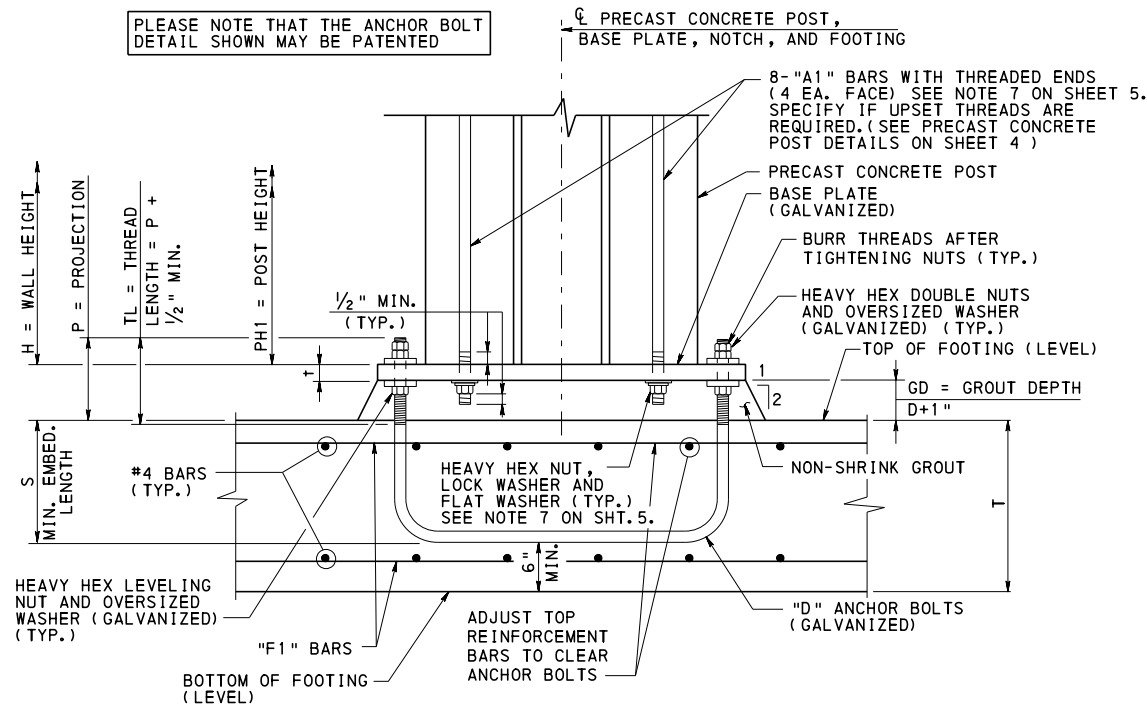
SHEET 7 OF 20

BD-677M





**PLAN**



**ELEVATION**

**DETAIL 2  
PRECAST CONCRETE POST WITH  
BASE PLATE CONNECTION  
TO SPREAD FOOTING**

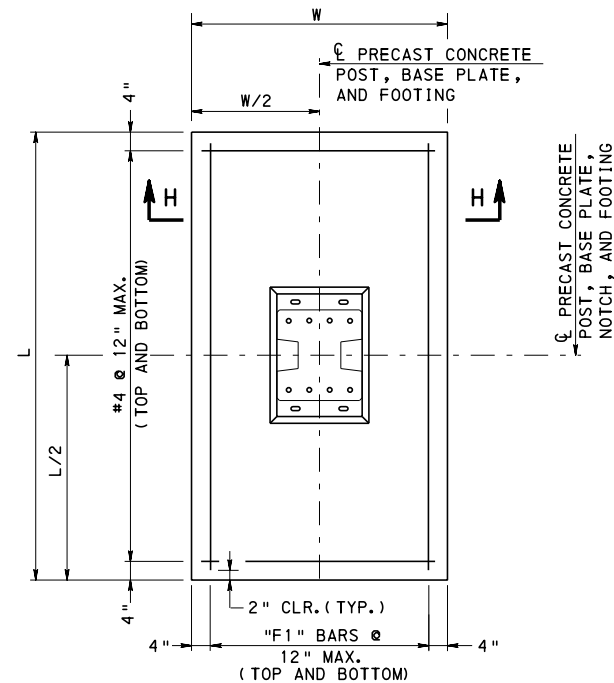
**PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING  
DIMENSION TABLE**

HEIGHT ZONE =  
WIND PRESSURE =

| CONCRETE POST  |                                    |                                   |                                |                    | BASE PLATE              |                      |                     |            | ANCHOR BOLTS           |                                   |                          |                                 | GROUT                         | SPREAD FOOTING          |                      |                     |                    |
|----------------|------------------------------------|-----------------------------------|--------------------------------|--------------------|-------------------------|----------------------|---------------------|------------|------------------------|-----------------------------------|--------------------------|---------------------------------|-------------------------------|-------------------------|----------------------|---------------------|--------------------|
| POST<br>NUMBER | DESIGN<br>POST<br>SPACING<br>(FT.) | DESIGN<br>WALL<br>HEIGHT<br>(FT.) | POST<br>HEIGHT<br>PH1<br>(FT.) | "A1"<br>(BAR SIZE) | THICKNESS<br>t<br>(IN.) | LENGTH<br>Q<br>(IN.) | WIDTH<br>W<br>(IN.) | F<br>(IN.) | DIAMETER<br>D<br>(IN.) | EMBEDMENT<br>LENGTH<br>S<br>(IN.) | PROJECTION<br>P<br>(IN.) | THREAD<br>LENGTH<br>TL<br>(IN.) | GROUT<br>DEPTH<br>GD<br>(IN.) | THICKNESS<br>T<br>(FT.) | LENGTH<br>L<br>(FT.) | WIDTH<br>W<br>(FT.) | "F1"<br>(BAR SIZE) |
|                |                                    |                                   |                                |                    |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                         |                      |                     |                    |
|                |                                    |                                   |                                |                    |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                         |                      |                     |                    |
|                |                                    |                                   |                                |                    |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                         |                      |                     |                    |

**TABLE NOTES:**

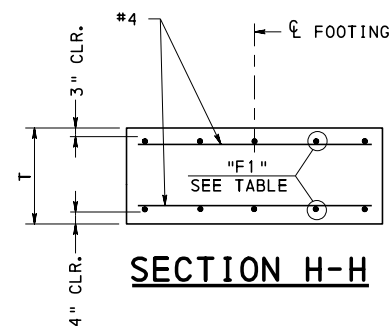
- DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
- TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
- SPECIFY IF UPSET THREADS ARE REQUIRED FOR THE "A1" BARS.  
(REFER TO SHEET 4)
- SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
- PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



**SPREAD FOOTING PLAN**

**NOTES:**

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
- FOR DESIGN TABLES REFER TO SHEETS 9 AND 10.
- FOR OVERSIZED WASHER DETAIL REFER TO BC-777M, SHEET 6.
- FOR PANEL SEAT DETAILS REFER TO BC-777M, SHEET 4.



**SECTION H-H**

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS**

**DETAIL 2**

| DETAIL 2<br>PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO SPREAD FOOTING |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
|-----------------------------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|------------|----------------|------------|------------|------------------|
| POST TYPES A AND B                                                                |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF                                   |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
| CONCRETE POST                                                                     |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |            | SPREAD FOOTING |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                    | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | P<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
| 12.0                                                                              | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 17         | 5          | 2.0            | 5.0        | 5.0        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 17         | 5          | 2.0            | 5.0        | 5.0        | #4               |
|                                                                                   | 10.0                         | #5               | ¾          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 5.0        | 5.0        | #4               |
|                                                                                   | 12.0                         | #5               | ⅞          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 6.0        | 5.0        | #4               |
|                                                                                   | 14.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 22         | 6          | 2.5            | 6.5        | 5.0        | #4               |
|                                                                                   | 16.0                         | #6               | 1⅛         | 28         | 16         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.0        | 5.0        | #4               |
|                                                                                   | 18.0                         | #6               | 1⅜         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.0        | 5.0        | #4               |
|                                                                                   | 20.0                         | #7               | 1½         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 8.5        | 5.0        | #4               |
|                                                                                   | 22.0                         | #8               | 1¾         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 9.5        | 5.0        | #5               |
|                                                                                   | 24.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 10.0       | 5.0        | #5               |
| 16.0                                                                              | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 17         | 5          | 2.0            | 5.0        | 5.0        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 5.0        | 5.0        | #4               |
|                                                                                   | 10.0                         | #5               | ⅞          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 5.5        | 5.0        | #4               |
|                                                                                   | 12.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 22         | 6          | 2.5            | 6.5        | 5.0        | #4               |
|                                                                                   | 14.0                         | #6               | 1¼         | 28         | 16         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.0        | 5.0        | #4               |
|                                                                                   | 16.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.0        | 5.0        | #4               |
|                                                                                   | 18.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 9.0        | 5.0        | #5               |
|                                                                                   | 20.0                         | #8               | 1¾         | 29         | 16         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 9.5        | 5.0        | #5               |
| 20.0                                                                              | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 17         | 5          | 2.0            | 5.0        | 5.0        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 5.0        | 5.0        | #4               |
|                                                                                   | 10.0                         | #5               | ⅞          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 6.0        | 5.0        | #4               |
|                                                                                   | 12.0                         | #6               | 1⅛         | 28         | 16         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.0        | 5.0        | #4               |
|                                                                                   | 14.0                         | #6               | 1⅜         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.0        | 5.0        | #4               |
|                                                                                   | 16.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 8.5        | 5.0        | #5               |
|                                                                                   | 18.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 9.5        | 5.0        | #5               |

| DETAIL 2<br>PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO SPREAD FOOTING |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
|-----------------------------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|------------|----------------|------------|------------|------------------|
| POST TYPES A AND B                                                                |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF                                   |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
| CONCRETE POST                                                                     |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |            | SPREAD FOOTING |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                    | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | P<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
| 12.0                                                                              | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 17         | 5          | 2.0            | 5.0        | 5.0        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 5.5        | 5.0        | #4               |
|                                                                                   | 10.0                         | #5               | ⅞          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 6.5        | 5.0        | #4               |
|                                                                                   | 12.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 22         | 6          | 2.5            | 7.5        | 5.0        | #4               |
|                                                                                   | 14.0                         | #6               | 1¼         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.0        | 5.0        | #4               |
|                                                                                   | 16.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 9.0        | 5.0        | #4               |
|                                                                                   | 18.0                         | #8               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 10.0       | 5.0        | #5               |
|                                                                                   | 20.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 10.5       | 5.5        | #5               |
| 16.0                                                                              | 6.0                          | #5               | ¾          | 26         | 16         | 1½         | ¾            | 17         | 5          | 2.0            | 5.0        | 5.0        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 6.0        | 5.0        | #4               |
|                                                                                   | 10.0                         | #5               | 1          | 27         | 16         | 2          | 1            | 22         | 6          | 2.5            | 7.0        | 5.0        | #4               |
|                                                                                   | 12.0                         | #6               | 1¼         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.0        | 5.0        | #4               |
|                                                                                   | 14.0                         | #7               | 1½         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 9.0        | 5.0        | #4               |
|                                                                                   | 16.0                         | #8               | 1¾         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 10.0       | 5.0        | #5               |
| 20.0                                                                              | 17.0                         | #8               | 1⅞         | 29         | 16         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 10.0       | 5.5        | #5               |
|                                                                                   | 6.0                          | #5               | ¾          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 5.5        | 5.0        | #4               |
|                                                                                   | 8.0                          | #5               | ⅞          | 27         | 16         | 2          | 1            | 22         | 5¾         | 2.5            | 6.5        | 5.0        | #4               |
|                                                                                   | 10.0                         | #6               | 1⅞         | 28         | 16         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.5        | 5.0        | #4               |
|                                                                                   | 12.0                         | #7               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.5        | 5.0        | #4               |
|                                                                                   | 14.0                         | #8               | 1⅝         | 28         | 16         | 2¼         | 1¼           | 28         | 7¼         | 3.0            | 10.0       | 5.0        | #5               |
|                                                                                   | 15.0                         | #8               | 1¾         | 29         | 16         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 10.0       | 5.0        | #5               |

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 8.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
DETAIL 2 - POST TYPES A AND B  
DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 9 OF 20

BD-677M

| DETAIL 2<br>PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO SPREAD FOOTING |                              |                  |            |            |            |            |              |            |            |            |                |            |                  |  |
|-----------------------------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|------------|------------|----------------|------------|------------------|--|
| POST TYPES C AND D                                                                |                              |                  |            |            |            |            |              |            |            |            |                |            |                  |  |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF                                   |                              |                  |            |            |            |            |              |            |            |            |                |            |                  |  |
| CONCRETE POST                                                                     |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |            |            | SPREAD FOOTING |            |                  |  |
| POST<br>SPACING<br>PS<br>(FT.)                                                    | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | P<br>(IN.) | T<br>(FT.) | L<br>(FT.)     | W<br>(FT.) | F1<br>(BAR SIZE) |  |
| 12.0                                                                              | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 17         | 5          | 2.0        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 8.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 17         | 5          | 2.0        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 10.0                         | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 12.0                         | #5               | ⅞          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 14.0                         | #6               | 1          | 30         | 19         | 2          | 1            | 22         | 6          | 2.5        | 6.5            | 5.5        | #4               |  |
|                                                                                   | 16.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0        | 7.0            | 5.5        | #4               |  |
|                                                                                   | 18.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0        | 7.5            | 5.5        | #4               |  |
|                                                                                   | 20.0                         | #7               | 1¼         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0        | 8.0            | 5.5        | #4               |  |
|                                                                                   | 22.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0        | 9.0            | 5.5        | #5               |  |
|                                                                                   | 24.0                         | #8               | 1½         | 32         | 19         | 2¾         | 1½           | 33         | 8          | 3.25       | 9.5            | 5.5        | #5               |  |
|                                                                                   | 26.0                         | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 33         | 8          | 3.25       | 10.0           | 5.5        | #5               |  |
|                                                                                   | 28.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25       | 10.5           | 5.5        | #5               |  |
| 16.0                                                                              | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 17         | 5          | 2.0        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 10.0                         | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 12.0                         | #6               | ⅞          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 6.0            | 5.5        | #4               |  |
|                                                                                   | 14.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0        | 7.0            | 5.5        | #4               |  |
|                                                                                   | 16.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0        | 7.5            | 5.5        | #4               |  |
|                                                                                   | 18.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0        | 8.5            | 5.5        | #4               |  |
|                                                                                   | 20.0                         | #7               | 1½         | 31         | 19         | 2¼         | 1¼           | 28         | 7¼         | 3.0        | 9.0            | 5.5        | #5               |  |
|                                                                                   | 22.0                         | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 33         | 8          | 3.25       | 10.0           | 5.5        | #5               |  |
|                                                                                   | 24.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25       | 10.5           | 5.5        | #6               |  |
|                                                                                   | 26.0                         | #10              | 2          | 33         | 19         | 3          | 1¾           | 39         | 9¼         | 3.75       | 11.0           | 5.5        | #6               |  |
|                                                                                   | 28.0                         | #10              | 2¼         | 33         | 19         | 3          | 1¾           | 39         | 9½         | 3.75       | 11.5           | 6.0        | #6               |  |
| 20.0                                                                              | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 17         | 5          | 2.0        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 5.5            | 5.5        | #4               |  |
|                                                                                   | 10.0                         | #5               | ⅞          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5        | 6.0            | 5.5        | #4               |  |
|                                                                                   | 12.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0        | 6.5            | 5.5        | #4               |  |
|                                                                                   | 14.0                         | #6               | 1⅛         | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0        | 7.5            | 5.5        | #4               |  |
|                                                                                   | 16.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0        | 8.0            | 5.5        | #4               |  |
|                                                                                   | 18.0                         | #8               | 1½         | 31         | 19         | 2¼         | 1¼           | 28         | 7¼         | 3.0        | 9.0            | 5.5        | #5               |  |
|                                                                                   | 20.0                         | #8               | 1¾         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.0        | 10.0           | 5.5        | #5               |  |
|                                                                                   | 22.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25       | 10.5           | 5.5        | #6               |  |
|                                                                                   | 24.0                         | #10              | 2⅛         | 33         | 19         | 3          | 1¾           | 39         | 9¼         | 3.75       | 11.0           | 5.5        | #6               |  |
|                                                                                   | 26.0                         | #11              | 2⅝         | 33         | 19         | 3          | 1¾           | 39         | 9½         | 3.75       | 11.5           | 6.0        | #6               |  |
|                                                                                   | 27.0                         | #11              | 2½         | 34         | 19         | 3½         | 2            | 44         | 10½        | 4.25       | 12.0           | 6.0        | #6               |  |

| DETAIL 2<br>PRECAST CONCRETE POST WITH BASE PLATE<br>CONNECTION TO SPREAD FOOTING |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
|-----------------------------------------------------------------------------------|------------------------------|------------------|------------|------------|------------|------------|--------------|------------|------------|----------------|------------|------------|------------------|
| POST TYPES C AND D                                                                |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF                                   |                              |                  |            |            |            |            |              |            |            |                |            |            |                  |
| CONCRETE POST                                                                     |                              |                  | BASE PLATE |            |            |            | ANCHOR BOLTS |            |            | SPREAD FOOTING |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                    | WALL<br>HEIGHT<br>H<br>(FT.) | A1<br>(BAR SIZE) | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | P<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
| 12.0                                                                              | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 17         | 5          | 2.0            | 5.5        | 5.5        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5            | 5.5        | 5.5        | #4               |
|                                                                                   | 10.0                         | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5            | 6.0        | 5.5        | #4               |
|                                                                                   | 12.0                         | #6               | ⅞          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5            | 7.0        | 5.5        | #4               |
|                                                                                   | 14.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.5        | 5.5        | #4               |
|                                                                                   | 16.0                         | #6               | 1¼         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.5        | 5.5        | #4               |
|                                                                                   | 18.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0            | 9.5        | 5.5        | #4               |
|                                                                                   | 20.0                         | #8               | 1½         | 32         | 19         | 2¾         | 1½           | 33         | 8          | 3.25           | 10.0       | 5.5        | #5               |
|                                                                                   | 22.0                         | #8               | 1¾         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 11.0       | 5.5        | #5               |
|                                                                                   | 24.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 11.5       | 6.0        | #5               |
|                                                                                   | 26.0                         | #10              | 2⅞         | 33         | 19         | 3          | 1¾           | 39         | 9¼         | 3.75           | 12.0       | 6.0        | #5               |
|                                                                                   | 28.0                         | #11              | 2⅞         | 33         | 19         | 3          | 1¾           | 39         | 9½         | 3.75           | 12.0       | 6.5        | #5               |
| 30.0                                                                              | #11                          | 2½               | 34         | 19         | 3½         | 2          | 44           | 10½        | 4.25       | 12.5           | 6.5        | #5         |                  |
| 16.0                                                                              | 6.0                          | #5               | ¾          | 29         | 19         | 1½         | ¾            | 17         | 5          | 2.0            | 5.5        | 5.5        | #4               |
|                                                                                   | 8.0                          | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5            | 5.5        | 5.5        | #4               |
|                                                                                   | 10.0                         | #5               | ⅞          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5            | 6.5        | 5.5        | #4               |
|                                                                                   | 12.0                         | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.5        | 5.5        | #4               |
|                                                                                   | 14.0                         | #6               | 1¼         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0            | 8.5        | 5.5        | #4               |
|                                                                                   | 16.0                         | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0            | 9.5        | 5.5        | #5               |
|                                                                                   | 18.0                         | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 33         | 8          | 3.25           | 10.5       | 5.5        | #5               |
|                                                                                   | 20.0                         | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 11.0       | 6.0        | #5               |
|                                                                                   | 22.0                         | #10              | 2⅞         | 33         | 19         | 3          | 1¾           | 39         | 9¼         | 3.75           | 11.5       | 6.0        | #5               |
|                                                                                   | 24.0                         | #10              | 2¼         | 33         | 19         | 3          | 1¾           | 39         | 9½         | 3.75           | 12.0       | 6.5        | #5               |
|                                                                                   | 26.0                         | #11              | 2½         | 34         | 19         | 3½         | 2            | 44         | 10½        | 4.25           | 12.5       | 6.5        | #6               |
|                                                                                   | 20.0                         | 6.0              | #5         | ¾          | 30         | 19         | 2            | 1          | 22         | 5¾             | 2.5        | 5.5        | 5.5              |
| 8.0                                                                               |                              | #5               | ¾          | 30         | 19         | 2          | 1            | 22         | 5¾         | 2.5            | 6.0        | 5.5        | #4               |
| 10.0                                                                              |                              | #6               | 1          | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 7.0        | 5.5        | #4               |
| 12.0                                                                              |                              | #6               | 1⅞         | 31         | 19         | 2¼         | 1¼           | 28         | 6¾         | 3.0            | 8.5        | 5.5        | #4               |
| 14.0                                                                              |                              | #7               | 1⅜         | 31         | 19         | 2¼         | 1¼           | 28         | 7          | 3.0            | 9.5        | 5.5        | #5               |
| 16.0                                                                              |                              | #8               | 1⅝         | 32         | 19         | 2¾         | 1½           | 33         | 8          | 3.25           | 10.0       | 5.5        | #5               |
| 18.0                                                                              |                              | #9               | 1⅞         | 32         | 19         | 2¾         | 1½           | 33         | 8¼         | 3.25           | 11.0       | 5.5        | #6               |
| 20.0                                                                              |                              | #10              | 2⅞         | 33         | 19         | 3          | 1¾           | 39         | 9¼         | 3.75           | 11.5       | 6.0        | #6               |
| 22.0                                                                              |                              | #11              | 2⅞         | 33         | 19         | 3          | 1¾           | 39         | 9½         | 3.75           | 12.5       | 6.5        | #6               |
| 23.0                                                                              |                              | #11              | 2½         | 34         | 19         | 3½         | 2            | 44         | 10½        | 4.25           | 12.5       | 6.5        | #6               |

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 8.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

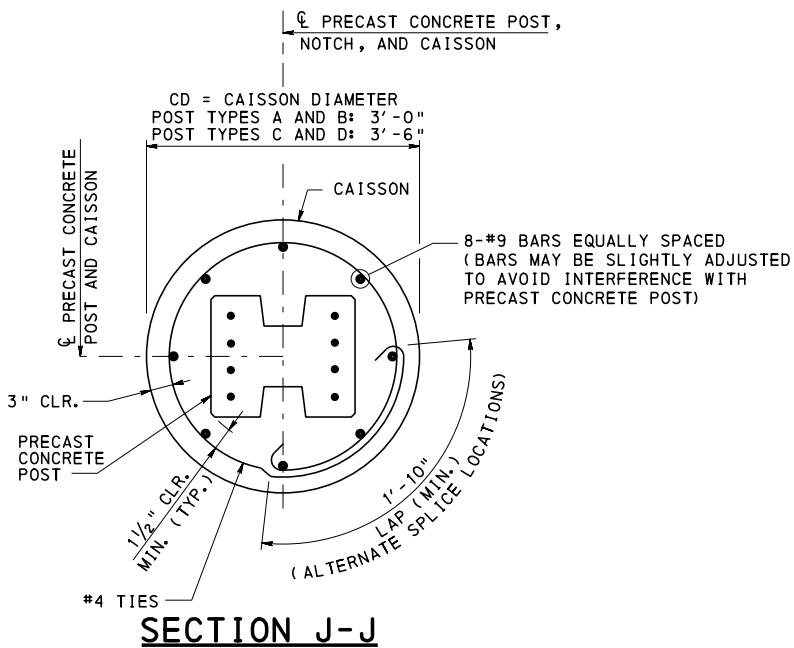
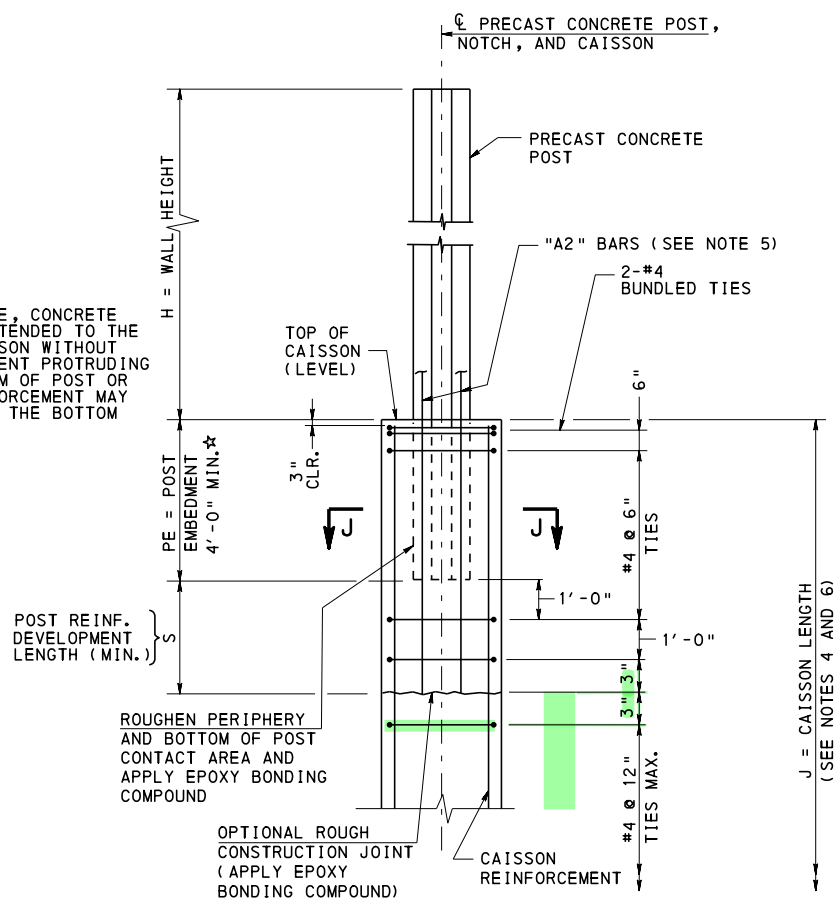
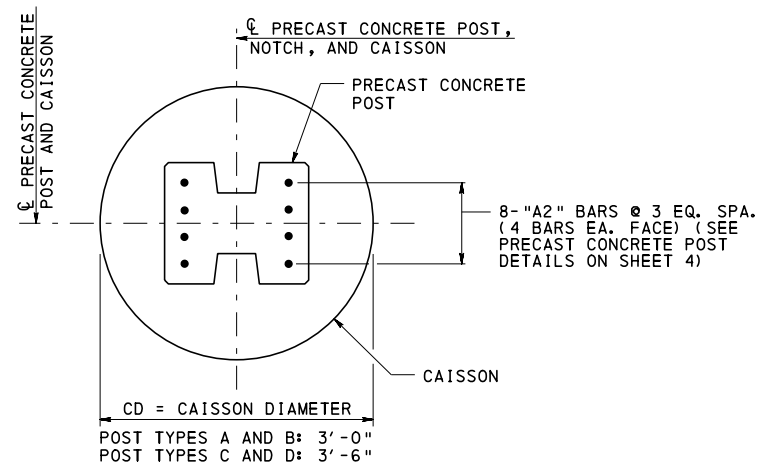
STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
DETAIL 2 - POST TYPES C AND D  
DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bate*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 10 OF 20

BD-677M



| PRECAST CONCRETE POST EMBEDDED IN CAISSON<br>DIMENSION TABLE |                                    |                                   |                                      |                    |                                                   |                                        |                                 |                           |             |
|--------------------------------------------------------------|------------------------------------|-----------------------------------|--------------------------------------|--------------------|---------------------------------------------------|----------------------------------------|---------------------------------|---------------------------|-------------|
| HEIGHT ZONE =<br>WIND PRESSURE =                             |                                    |                                   |                                      |                    |                                                   |                                        |                                 |                           |             |
| CONCRETE POST                                                |                                    |                                   |                                      |                    |                                                   | CAISSON                                |                                 |                           |             |
| POST<br>NUMBER                                               | DESIGN<br>POST<br>SPACING<br>(FT.) | DESIGN<br>WALL<br>HEIGHT<br>(FT.) | POST<br>EMBEDMENT<br>PE<br>(FT.-IN.) | "A2"<br>(BAR SIZE) | POST<br>REINFORCEMENT<br>LENGTH<br>S<br>(FT.-IN.) | CAISSON<br>DIAMETER<br>CD<br>(FT.-IN.) | CAISSON<br>LENGTH<br>J<br>(FT.) | VERTICAL<br>REINFORCEMENT |             |
|                                                              |                                    |                                   |                                      |                    |                                                   |                                        |                                 | NUMBER<br>OF BARS         | BAR<br>SIZE |
|                                                              |                                    |                                   |                                      |                    |                                                   |                                        |                                 |                           |             |
|                                                              |                                    |                                   |                                      |                    |                                                   |                                        |                                 |                           |             |
|                                                              |                                    |                                   |                                      |                    |                                                   |                                        |                                 |                           |             |

- TABLE NOTES:**
- DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
  - TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
  - CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
  - PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

- NOTES:**
- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
  - FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
  - FOR DESIGN TABLES REFER TO SHEET 12.
  - FOR CAISSON LENGTHS REFER TO SHEET 20.
  - PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.
  - DESIGNER TO VERIFY IF REQUIRED CAISSON LENGTH NEEDS TO BE INCREASED TO ACCOMMODATE THE POST EMBEDMENT PLUS POST REINFORCEMENT DEVELOPMENT LENGTH PLUS 6".

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
  
DETAIL 3

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 11 OF 20  
BD-677M

| DETAIL 3<br>PRECAST CONCRETE POST<br>EMBEDDED IN CAISSON |                              |                  |                                              |                         |
|----------------------------------------------------------|------------------------------|------------------|----------------------------------------------|-------------------------|
| POST TYPES A AND B                                       |                              |                  |                                              |                         |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF          |                              |                  |                                              |                         |
| CONCRETE POST REINFORCEMENT                              |                              |                  |                                              |                         |
| POST<br>SPACING<br>PS<br>(FT.)                           | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | S (IN.)<br>UNCOATED OR<br>GALVANIZED<br>BARS | EPOXY<br>COATED<br>BARS |
| 12.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #4               | 12                                           | 18                      |
|                                                          | 14.0                         | #4               | 12                                           | 18                      |
|                                                          | 16.0                         | #5               | 15                                           | 23                      |
|                                                          | 18.0                         | #6               | 20                                           | 29                      |
|                                                          | 20.0                         | #6               | 20                                           | 29                      |
|                                                          | 22.0                         | #7               | 26                                           | 39                      |
|                                                          | 24.0                         | #7               | 26                                           | 39                      |
|                                                          | 26.0                         | #8               | 35                                           | 52                      |
|                                                          | 28.0                         | #9               | 44                                           | 65                      |
| 16.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #4               | 12                                           | 18                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #6               | 20                                           | 29                      |
|                                                          | 18.0                         | #7               | 26                                           | 39                      |
|                                                          | 20.0                         | #7               | 26                                           | 39                      |
|                                                          | 22.0                         | #8               | 35                                           | 52                      |
|                                                          | 24.0                         | #9               | 44                                           | 65                      |
|                                                          | 25.0                         | #9               | 44                                           | 65                      |
|                                                          | 26.0                         | #9               | 44                                           | 65                      |
| 20.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #6               | 20                                           | 29                      |
|                                                          | 16.0                         | #6               | 20                                           | 29                      |
|                                                          | 18.0                         | #7               | 26                                           | 39                      |
|                                                          | 20.0                         | #8               | 35                                           | 52                      |
|                                                          | 22.0                         | #9               | 44                                           | 65                      |
|                                                          | 24.0                         | #10              | 55                                           | 83                      |
|                                                          | 24.0                         | #10              | 55                                           | 83                      |
|                                                          | 24.0                         | #10              | 55                                           | 83                      |

| DETAIL 3<br>PRECAST CONCRETE POST<br>EMBEDDED IN CAISSON |                              |                  |                                              |                         |
|----------------------------------------------------------|------------------------------|------------------|----------------------------------------------|-------------------------|
| POST TYPES A AND B                                       |                              |                  |                                              |                         |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF          |                              |                  |                                              |                         |
| CONCRETE POST REINFORCEMENT                              |                              |                  |                                              |                         |
| POST<br>SPACING<br>PS<br>(FT.)                           | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | S (IN.)<br>UNCOATED OR<br>GALVANIZED<br>BARS | EPOXY<br>COATED<br>BARS |
| 12.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #4               | 12                                           | 18                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #6               | 20                                           | 29                      |
|                                                          | 18.0                         | #7               | 26                                           | 39                      |
|                                                          | 20.0                         | #7               | 26                                           | 39                      |
|                                                          | 22.0                         | #8               | 35                                           | 52                      |
|                                                          | 24.0                         | #9               | 44                                           | 65                      |
|                                                          | 25.0                         | #10              | 55                                           | 83                      |
|                                                          | 25.0                         | #10              | 55                                           | 83                      |
| 16.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #6               | 20                                           | 29                      |
|                                                          | 16.0                         | #7               | 26                                           | 39                      |
|                                                          | 18.0                         | #8               | 35                                           | 52                      |
|                                                          | 20.0                         | #8               | 35                                           | 52                      |
|                                                          | 22.0                         | #9               | 44                                           | 65                      |
|                                                          | 23.0                         | #10              | 55                                           | 83                      |
|                                                          | 23.0                         | #10              | 55                                           | 83                      |
|                                                          | 23.0                         | #10              | 55                                           | 83                      |
| 20.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #5               | 15                                           | 23                      |
|                                                          | 12.0                         | #6               | 20                                           | 29                      |
|                                                          | 14.0                         | #7               | 26                                           | 39                      |
|                                                          | 16.0                         | #8               | 35                                           | 52                      |
|                                                          | 18.0                         | #9               | 44                                           | 65                      |
|                                                          | 20.0                         | #10              | 55                                           | 83                      |

| DETAIL 3<br>PRECAST CONCRETE POST<br>EMBEDDED IN CAISSON |                              |                  |                                              |                         |
|----------------------------------------------------------|------------------------------|------------------|----------------------------------------------|-------------------------|
| POST TYPES C AND D                                       |                              |                  |                                              |                         |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF          |                              |                  |                                              |                         |
| CONCRETE POST REINFORCEMENT                              |                              |                  |                                              |                         |
| POST<br>SPACING<br>PS<br>(FT.)                           | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | S (IN.)<br>UNCOATED OR<br>GALVANIZED<br>BARS | EPOXY<br>COATED<br>BARS |
| 12.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #4               | 12                                           | 18                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #5               | 15                                           | 23                      |
|                                                          | 18.0                         | #5               | 15                                           | 23                      |
|                                                          | 20.0                         | #6               | 20                                           | 29                      |
|                                                          | 22.0                         | #6               | 20                                           | 29                      |
|                                                          | 24.0                         | #7               | 26                                           | 39                      |
|                                                          | 26.0                         | #7               | 26                                           | 39                      |
|                                                          | 28.0                         | #8               | 35                                           | 52                      |
| 16.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #5               | 15                                           | 23                      |
|                                                          | 18.0                         | #6               | 20                                           | 29                      |
|                                                          | 20.0                         | #7               | 26                                           | 39                      |
|                                                          | 22.0                         | #7               | 26                                           | 39                      |
|                                                          | 24.0                         | #8               | 35                                           | 52                      |
|                                                          | 26.0                         | #9               | 44                                           | 65                      |
|                                                          | 28.0                         | #9               | 44                                           | 65                      |
| 20.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #6               | 20                                           | 29                      |
|                                                          | 18.0                         | #7               | 26                                           | 39                      |
|                                                          | 20.0                         | #7               | 26                                           | 39                      |
|                                                          | 22.0                         | #8               | 35                                           | 52                      |
|                                                          | 24.0                         | #9               | 44                                           | 65                      |
|                                                          | 26.0                         | #10              | 55                                           | 83                      |
|                                                          | 28.0                         | #10              | 55                                           | 83                      |

| DETAIL 3<br>PRECAST CONCRETE POST<br>EMBEDDED IN CAISSON |                              |                  |                                              |                         |
|----------------------------------------------------------|------------------------------|------------------|----------------------------------------------|-------------------------|
| POST TYPES C AND D                                       |                              |                  |                                              |                         |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF          |                              |                  |                                              |                         |
| CONCRETE POST REINFORCEMENT                              |                              |                  |                                              |                         |
| POST<br>SPACING<br>PS<br>(FT.)                           | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | S (IN.)<br>UNCOATED OR<br>GALVANIZED<br>BARS | EPOXY<br>COATED<br>BARS |
| 12.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #4               | 12                                           | 18                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #5               | 15                                           | 23                      |
|                                                          | 18.0                         | #6               | 20                                           | 29                      |
|                                                          | 20.0                         | #7               | 26                                           | 39                      |
|                                                          | 22.0                         | #7               | 26                                           | 39                      |
|                                                          | 24.0                         | #8               | 35                                           | 52                      |
|                                                          | 26.0                         | #9               | 44                                           | 65                      |
|                                                          | 28.0                         | #9               | 44                                           | 65                      |
| 16.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #5               | 15                                           | 23                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #5               | 15                                           | 23                      |
|                                                          | 18.0                         | #6               | 20                                           | 29                      |
|                                                          | 20.0                         | #7               | 26                                           | 39                      |
|                                                          | 22.0                         | #8               | 35                                           | 52                      |
|                                                          | 24.0                         | #9               | 44                                           | 65                      |
|                                                          | 26.0                         | #9               | 44                                           | 65                      |
|                                                          | 30.0                         | #10              | 55                                           | 83                      |
| 20.0                                                     | 6.0                          | #4               | 12                                           | 18                      |
|                                                          | 8.0                          | #4               | 12                                           | 18                      |
|                                                          | 10.0                         | #5               | 15                                           | 23                      |
|                                                          | 12.0                         | #5               | 15                                           | 23                      |
|                                                          | 14.0                         | #5               | 15                                           | 23                      |
|                                                          | 16.0                         | #6               | 20                                           | 29                      |
|                                                          | 18.0                         | #7               | 26                                           | 39                      |
|                                                          | 20.0                         | #8               | 35                                           | 52                      |
|                                                          | 22.0                         | #9               | 44                                           | 65                      |
|                                                          | 24.0                         | #9               | 44                                           | 65                      |
|                                                          | 26.0                         | #10              | 55                                           | 83                      |
|                                                          | 28.0                         | #11              | 68                                           | 102                     |

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 11.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
  
DETAIL 3 - POST TYPES A, B, C AND D  
DESIGN TABLES

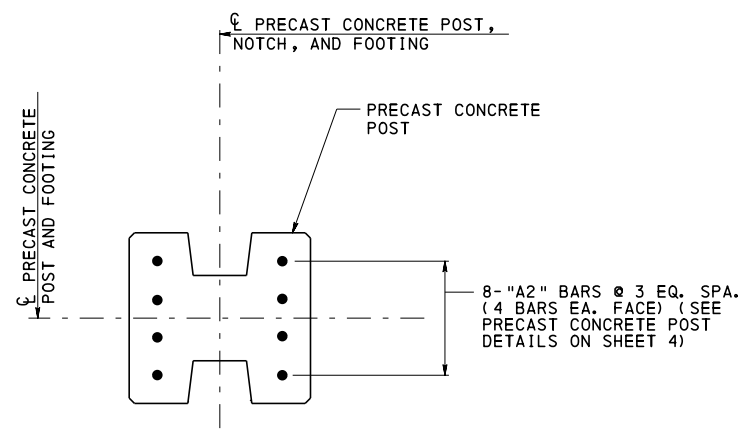
RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

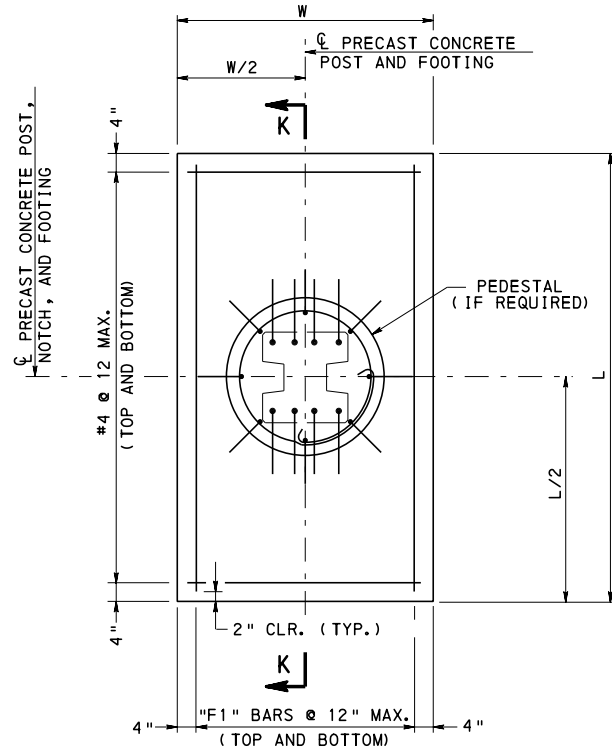
SHEET 12 OF 20

BD-677M

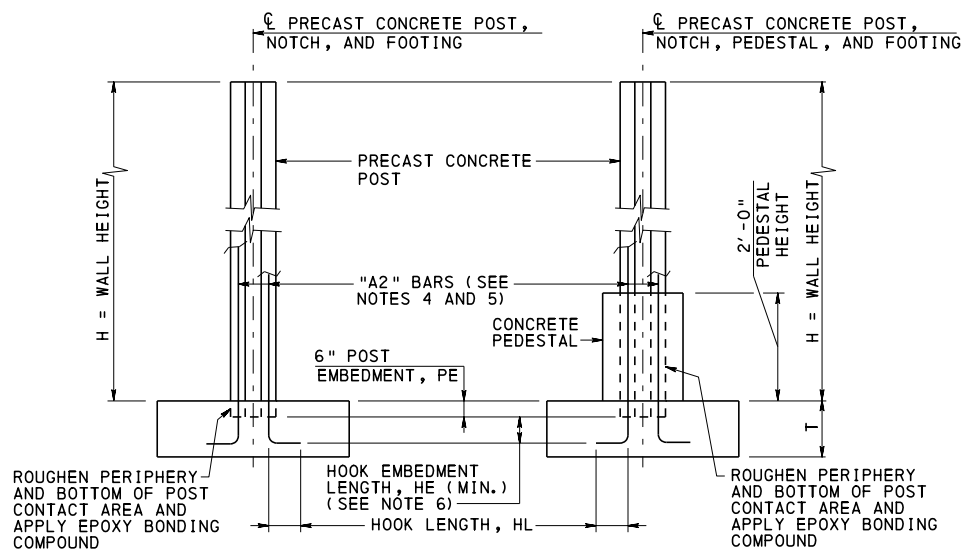




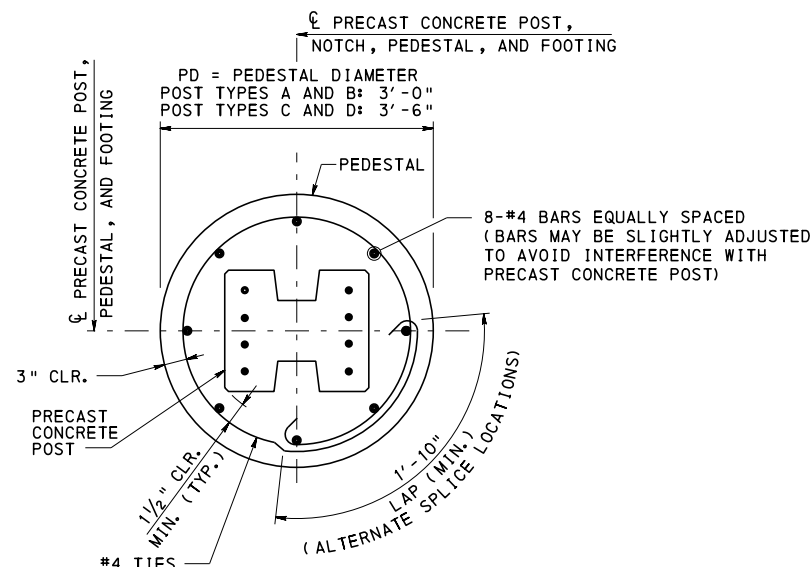
PLAN



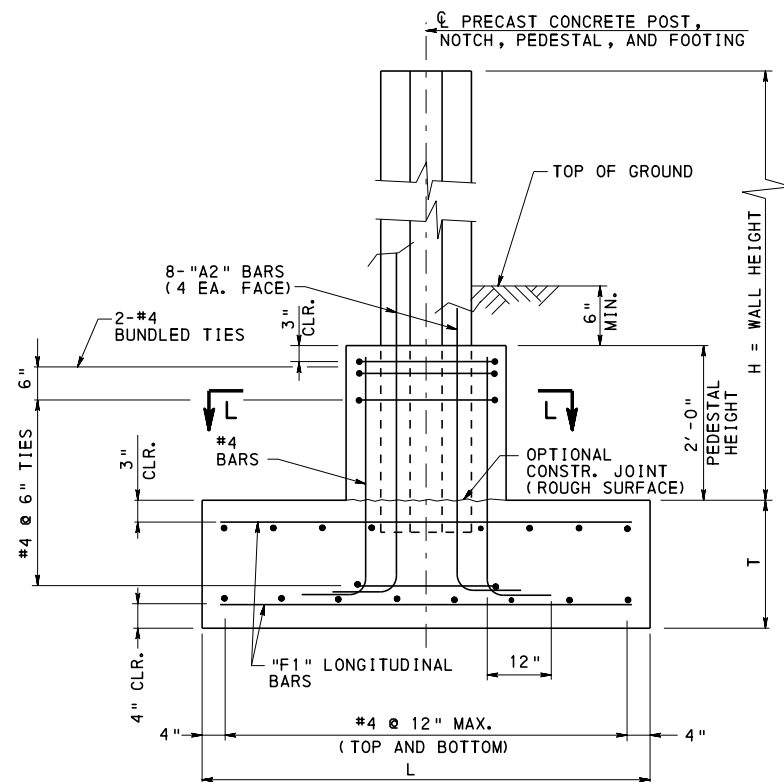
SPREAD FOOTING PLAN



WITHOUT PEDESTAL WITH PEDESTAL  
ELEVATION



SECTION L-L  
PEDESTAL (IF SPECIFIED)



SECTION K-K (WITH PEDESTAL)  
ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.

| PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING DIMENSION TABLE |                           |                          |                             |                 |                                |                      |                   |                |               |                 |
|------------------------------------------------------------------|---------------------------|--------------------------|-----------------------------|-----------------|--------------------------------|----------------------|-------------------|----------------|---------------|-----------------|
| HEIGHT ZONE =<br>WIND PRESSURE =                                 |                           |                          |                             |                 |                                |                      |                   |                |               |                 |
| CONCRETE POST                                                    |                           |                          |                             |                 |                                |                      | SPREAD FOOTING    |                |               |                 |
| POST NUMBER                                                      | DESIGN POST SPACING (FT.) | DESIGN WALL HEIGHT (FT.) | POST EMBEDMENT PE (FT.-IN.) | "A2" (BAR SIZE) | HOOK EMBEDMENT LENGTH HE (IN.) | HOOK LENGTH HL (IN.) | THICKNESS T (FT.) | LENGTH L (FT.) | WIDTH W (FT.) | "F1" (BAR SIZE) |
|                                                                  |                           |                          |                             |                 |                                |                      |                   |                |               |                 |
|                                                                  |                           |                          |                             |                 |                                |                      |                   |                |               |                 |

- TABLE NOTES:**
- DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
  - TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
  - SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
  - PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.
  - INDICATE AND DETAIL PEDESTAL IF REQUIRED.

DETAIL 4  
PRECAST CONCRETE POST  
EMBEDDED IN SPREAD FOOTING  
(WITH OR WITHOUT PEDESTAL)

- NOTES:**
- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
  - FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
  - FOR DESIGN TABLES REFER TO SHEETS 14 AND 15.
  - PROVIDE UNCOATED OR EPOXY COATED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS. GALVANIZED BARS NOT PERMITTED.
  - BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
  - DESIGNER IS PERMITTED TO INCREASE THE EMBEDMENT LENGTH OF THE POST REINFORCEMENT BARS SO BARS CAN BE TIED TO THE BOTTOM FOOTING REINFORCEMENT BARS.

| DETAIL 4<br>PRECAST CONCRETE POST<br>EMBEDDED IN SPREAD FOOTING |                              |                  |                |       |                |            |            |            |                  |
|-----------------------------------------------------------------|------------------------------|------------------|----------------|-------|----------------|------------|------------|------------|------------------|
| POST TYPES A AND B                                              |                              |                  |                |       |                |            |            |            |                  |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF                 |                              |                  |                |       |                |            |            |            |                  |
| CONCRETE POST REINFORCEMENT                                     |                              |                  |                |       | SPREAD FOOTING |            |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                  | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | HE (IN.)(MIN.) |       | HL<br>(IN.)    | T<br>(FT.) | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
|                                                                 |                              |                  | UNCOATED       | EPOXY |                |            |            |            |                  |
| 12.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 5.0        | 5.0        | #4               |
|                                                                 | 12.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.0        | #4               |
|                                                                 | 14.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.5        | 5.0        | #4               |
|                                                                 | 16.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.0        | 5.0        | #4               |
|                                                                 | 18.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.0        | 5.0        | #4               |
|                                                                 | 20.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.5        | 5.0        | #4               |
|                                                                 | 22.0                         | #7               | 14             | 17    | 14             | 3.0        | 9.5        | 5.0        | #5               |
|                                                                 | 24.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.0       | 5.0        | #5               |
|                                                                 | 26.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.5       | 5.5        | #5               |
|                                                                 | 28.0                         | #9               | 18             | 21    | 19             | 3.75       | 10.5       | 5.5        | #5               |
| 16.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.0        | 5.0        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.0        | #4               |
|                                                                 | 12.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.5        | 5.0        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.0        | 5.0        | #4               |
|                                                                 | 16.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.0        | 5.0        | #4               |
|                                                                 | 18.0                         | #7               | 14             | 17    | 14             | 3.0        | 9.0        | 5.0        | #5               |
|                                                                 | 20.0                         | #7               | 14             | 17    | 14             | 3.25       | 9.5        | 5.0        | #5               |
|                                                                 | 22.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.0       | 5.5        | #5               |
|                                                                 | 24.0                         | #9               | 18             | 21    | 19             | 3.75       | 10.5       | 5.5        | #5               |
|                                                                 | 25.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.0       | 5.5        | #5               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
| 20.0                                                            | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.0        | 5.0        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.0        | #4               |
|                                                                 | 12.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.0        | 5.0        | #4               |
|                                                                 | 14.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.0        | 5.0        | #4               |
|                                                                 | 16.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.5        | 5.0        | #5               |
|                                                                 | 18.0                         | #7               | 14             | 17    | 14             | 3.25       | 9.5        | 5.0        | #5               |
|                                                                 | 20.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.0       | 5.0        | #6               |
|                                                                 | 22.0                         | #9               | 18             | 21    | 19             | 3.75       | 10.5       | 5.5        | #6               |
|                                                                 | 24.0                         | #10              | 20             | 24    | 22             | 3.75       | 11.0       | 6.0        | #6               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.0        | 5.0        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.0        | #4               |

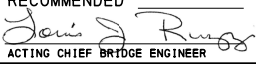
| DETAIL 4<br>PRECAST CONCRETE POST<br>EMBEDDED IN SPREAD FOOTING |                              |                  |                |       |                |            |            |            |                  |
|-----------------------------------------------------------------|------------------------------|------------------|----------------|-------|----------------|------------|------------|------------|------------------|
| POST TYPES A AND B                                              |                              |                  |                |       |                |            |            |            |                  |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF                 |                              |                  |                |       |                |            |            |            |                  |
| CONCRETE POST REINFORCEMENT                                     |                              |                  |                |       | SPREAD FOOTING |            |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                  | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | HE (IN.)(MIN.) |       | HL<br>(IN.)    | T<br>(FT.) | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
|                                                                 |                              |                  | UNCOATED       | EPOXY |                |            |            |            |                  |
| 12.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.0        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.5        | 5.0        | #4               |
|                                                                 | 12.0                         | #4               | 8              | 10    | 8              | 2.5        | 7.5        | 5.0        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 3.0        | 8.0        | 5.0        | #4               |
|                                                                 | 16.0                         | #6               | 12             | 14    | 12             | 3.0        | 9.0        | 5.0        | #4               |
|                                                                 | 18.0                         | #7               | 14             | 17    | 14             | 3.0        | 10.0       | 5.0        | #5               |
|                                                                 | 20.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.5       | 5.5        | #5               |
|                                                                 | 22.0                         | #8               | 16             | 19    | 16             | 3.25       | 11.0       | 5.5        | #5               |
|                                                                 | 24.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.5       | 6.0        | #5               |
|                                                                 | 25.0                         | #10              | 20             | 24    | 22             | 3.75       | 11.5       | 6.0        | #5               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.0        | 5.0        | #4               |
| 16.0                                                            | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.0        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 7.0        | 5.0        | #4               |
|                                                                 | 12.0                         | #5               | 10             | 12    | 10             | 3.0        | 8.0        | 5.0        | #4               |
|                                                                 | 14.0                         | #6               | 12             | 14    | 12             | 3.0        | 9.0        | 5.0        | #4               |
|                                                                 | 16.0                         | #7               | 14             | 17    | 14             | 3.0        | 10.0       | 5.0        | #5               |
|                                                                 | 18.0                         | #8               | 16             | 19    | 16             | 3.25       | 11.0       | 5.5        | #5               |
|                                                                 | 20.0                         | #8               | 16             | 19    | 16             | 3.25       | 11.0       | 6.0        | #5               |
|                                                                 | 22.0                         | #9               | 18             | 21    | 19             | 3.75       | 12.0       | 6.0        | #5               |
|                                                                 | 23.0                         | #10              | 20             | 24    | 22             | 3.75       | 12.0       | 6.0        | #6               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.0        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 6.5        | 5.0        | #4               |
|                                                                 | 10.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.5        | 5.0        | #4               |
| 20.0                                                            | 12.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.5        | 5.0        | #4               |
|                                                                 | 14.0                         | #7               | 14             | 17    | 14             | 3.0        | 10.0       | 5.0        | #5               |
|                                                                 | 16.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.5       | 5.5        | #5               |
|                                                                 | 18.0                         | #9               | 18             | 21    | 19             | 3.25       | 11.0       | 6.0        | #5               |
|                                                                 | 20.0                         | #10              | 20             | 24    | 22             | 3.75       | 12.0       | 6.0        | #6               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.0        | #4               |

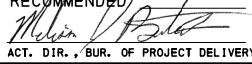
NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 13.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
DETAIL 4 - POST TYPES A AND B  
DESIGN TABLES

RECOMMENDED  
  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED  
  
ACT. DIR., BUR. OF PROJECT DELIVERY

AUG. 30, 2019

SHEET 14 OF 20  
BD-677M

| DETAIL 4<br>PRECAST CONCRETE POST<br>EMBEDDED IN SPREAD FOOTING |                              |                  |                |       |                |            |            |            |                  |
|-----------------------------------------------------------------|------------------------------|------------------|----------------|-------|----------------|------------|------------|------------|------------------|
| POST TYPES C AND D                                              |                              |                  |                |       |                |            |            |            |                  |
| HEIGHT ZONE 0' TO 14'<br>WIND PRESSURE = 20 PSF                 |                              |                  |                |       |                |            |            |            |                  |
| CONCRETE POST REINFORCEMENT                                     |                              |                  |                |       | SPREAD FOOTING |            |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                  | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | HE (IN.)(MIN.) |       | HL<br>(IN.)    | T<br>(FT.) | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
|                                                                 |                              |                  | UNCOATED       | EPOXY |                |            |            |            |                  |
| 12.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.5        | 5.5        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.5        | 5.5        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 12.0                         | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 2.5        | 6.5        | 5.5        | #4               |
|                                                                 | 16.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.0        | 5.5        | #4               |
|                                                                 | 18.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.5        | 5.5        | #4               |
|                                                                 | 20.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.0        | 5.5        | #4               |
|                                                                 | 22.0                         | #6               | 12             | 14    | 12             | 3.0        | 9.0        | 5.5        | #5               |
|                                                                 | 24.0                         | #7               | 14             | 17    | 14             | 3.25       | 9.5        | 5.5        | #5               |
|                                                                 | 26.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.0       | 5.5        | #5               |
|                                                                 | 28.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.5       | 5.5        | #5               |
| 16.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.5        | 5.5        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 12.0                         | #5               | 10             | 12    | 10             | 2.5        | 6.0        | 5.5        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.0        | 5.5        | #4               |
|                                                                 | 16.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.5        | 5.5        | #4               |
|                                                                 | 18.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.5        | 5.5        | #4               |
|                                                                 | 20.0                         | #7               | 14             | 17    | 14             | 3.0        | 9.0        | 5.5        | #5               |
|                                                                 | 22.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.0       | 5.5        | #5               |
|                                                                 | 24.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.5       | 5.5        | #6               |
|                                                                 | 26.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.0       | 5.5        | #6               |
|                                                                 | 28.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.5       | 6.0        | #6               |
| 20.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.5        | 5.5        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.5        | #4               |
|                                                                 | 12.0                         | #5               | 10             | 12    | 10             | 3.0        | 6.5        | 5.5        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.5        | 5.5        | #4               |
|                                                                 | 16.0                         | #6               | 12             | 14    | 12             | 3.0        | 8.0        | 5.5        | #4               |
|                                                                 | 18.0                         | #7               | 14             | 17    | 14             | 3.0        | 9.0        | 5.5        | #5               |
|                                                                 | 20.0                         | #7               | 14             | 17    | 14             | 3.0        | 10.0       | 5.5        | #5               |
|                                                                 | 22.0                         | #8               | 16             | 19    | 16             | 3.25       | 10.5       | 5.5        | #6               |
|                                                                 | 24.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.0       | 5.5        | #6               |
|                                                                 | 26.0                         | #10              | 20             | 24    | 22             | 3.75       | 11.5       | 6.0        | #6               |
|                                                                 | 28.0                         | #10              | 20             | 24    | 22             | 4.25       | 12.0       | 6.0        | #6               |

| DETAIL 4<br>PRECAST CONCRETE POST<br>EMBEDDED IN SPREAD FOOTING |                              |                  |                |       |                |            |            |            |                  |
|-----------------------------------------------------------------|------------------------------|------------------|----------------|-------|----------------|------------|------------|------------|------------------|
| POST TYPES C AND D                                              |                              |                  |                |       |                |            |            |            |                  |
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF                 |                              |                  |                |       |                |            |            |            |                  |
| CONCRETE POST REINFORCEMENT                                     |                              |                  |                |       | SPREAD FOOTING |            |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                  | WALL<br>HEIGHT<br>H<br>(FT.) | A2<br>(BAR SIZE) | HE (IN.)(MIN.) |       | HL<br>(IN.)    | T<br>(FT.) | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
|                                                                 |                              |                  | UNCOATED       | EPOXY |                |            |            |            |                  |
| 12.0                                                            | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.5        | 5.5        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 10.0                         | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.5        | #4               |
|                                                                 | 12.0                         | #5               | 10             | 12    | 10             | 2.5        | 7.0        | 5.5        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.5        | 5.5        | #4               |
|                                                                 | 16.0                         | #5               | 10             | 12    | 10             | 3.0        | 8.5        | 5.5        | #4               |
|                                                                 | 18.0                         | #6               | 12             | 14    | 12             | 3.0        | 9.5        | 5.5        | #4               |
|                                                                 | 20.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.0       | 5.5        | #5               |
|                                                                 | 22.0                         | #7               | 14             | 17    | 14             | 3.25       | 11.0       | 5.5        | #5               |
|                                                                 | 24.0                         | #8               | 16             | 19    | 16             | 3.25       | 11.5       | 6.0        | #5               |
|                                                                 | 26.0                         | #9               | 18             | 21    | 19             | 3.75       | 12.0       | 6.0        | #5               |
|                                                                 | 28.0                         | #9               | 18             | 21    | 19             | 3.75       | 12.0       | 6.5        | #5               |
|                                                                 | 30.0                         | #10              | 20             | 24    | 22             | 4.25       | 12.5       | 6.5        | #5               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.0        | 5.5        | 5.5        | #4               |
| 16.0                                                            | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 10.0                         | #5               | 10             | 12    | 10             | 2.5        | 6.5        | 5.5        | #4               |
|                                                                 | 12.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.5        | 5.5        | #4               |
|                                                                 | 14.0                         | #5               | 10             | 12    | 10             | 3.0        | 8.5        | 5.5        | #4               |
|                                                                 | 16.0                         | #6               | 12             | 14    | 12             | 3.0        | 9.5        | 5.5        | #5               |
|                                                                 | 18.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.5       | 5.5        | #5               |
|                                                                 | 20.0                         | #8               | 16             | 19    | 16             | 3.25       | 11.0       | 6.0        | #5               |
|                                                                 | 22.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.5       | 6.0        | #5               |
|                                                                 | 24.0                         | #9               | 18             | 21    | 19             | 3.75       | 12.0       | 6.5        | #5               |
|                                                                 | 26.0                         | #10              | 20             | 24    | 22             | 4.25       | 12.5       | 6.5        | #6               |
|                                                                 | 28.0                         | #11              | 22             | 26    | 24             | 4.25       | 13.0       | 7.0        | #6               |
|                                                                 | 6.0                          | #4               | 8              | 10    | 8              | 2.5        | 5.5        | 5.5        | #4               |
|                                                                 | 8.0                          | #4               | 8              | 10    | 8              | 2.5        | 6.0        | 5.5        | #4               |
|                                                                 | 10.0                         | #5               | 10             | 12    | 10             | 3.0        | 7.0        | 5.5        | #4               |
| 20.0                                                            | 12.0                         | #5               | 10             | 12    | 10             | 3.0        | 8.5        | 5.5        | #4               |
|                                                                 | 14.0                         | #6               | 12             | 14    | 12             | 3.0        | 9.5        | 5.5        | #5               |
|                                                                 | 16.0                         | #7               | 14             | 17    | 14             | 3.25       | 10.0       | 5.5        | #5               |
|                                                                 | 18.0                         | #8               | 16             | 19    | 16             | 3.25       | 11.0       | 5.5        | #6               |
|                                                                 | 20.0                         | #9               | 18             | 21    | 19             | 3.75       | 11.5       | 6.0        | #6               |
|                                                                 | 22.0                         | #10              | 20             | 24    | 22             | 3.75       | 12.5       | 6.5        | #6               |
|                                                                 | 24.0                         | #10              | 20             | 24    | 22             | 4.25       | 13.0       | 6.5        | #6               |
|                                                                 | 25.0                         | #11              | 22             | 26    | 24             | 4.25       | 13.0       | 7.0        | #6               |

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 13.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

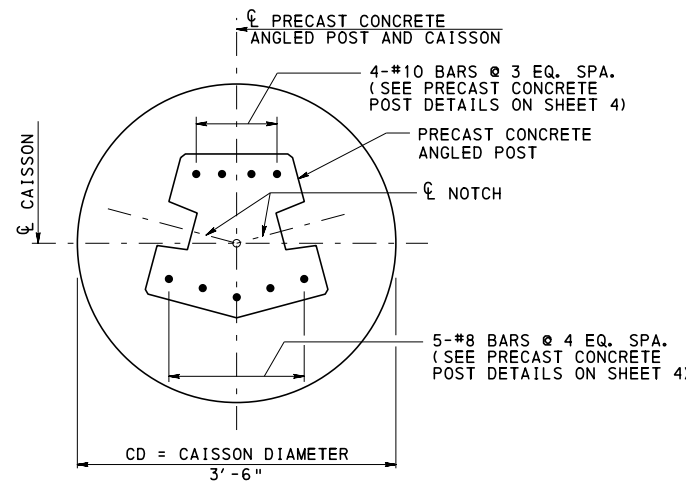
STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS  
DETAIL 4 - POST TYPES C AND D  
DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

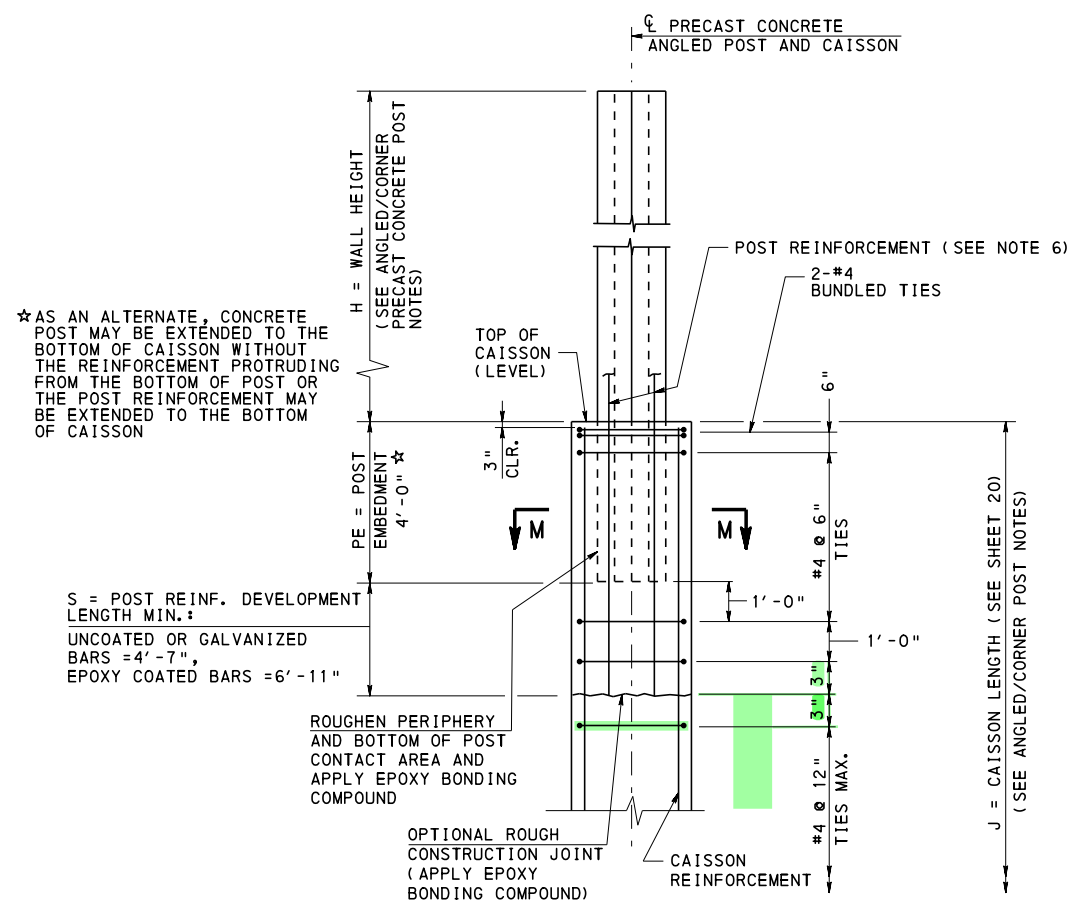
RECOMMENDED AUG. 30, 2019  
*Michael J. Bate*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 15 OF 20

BD-677M

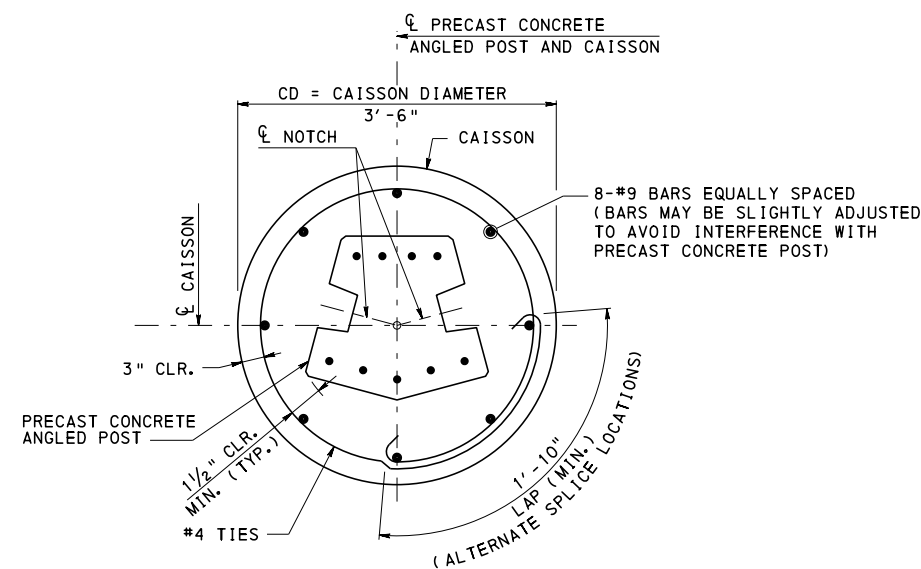


**PLAN**



**ELEVATION**

**DETAIL 5  
ANGLED PRECAST CONCRETE POST TYPE E  
EMBEDDED IN CAISSON**



**SECTION M-M**

## ANGLED/CORNER PRECAST CONCRETE POST NOTES:

1. THE ANGLED IN-LINE PRECAST CONCRETE POST (POST TYPE E) MAY ONLY BE USED WHEN THE INTERSECTING ANGLES BETWEEN THE PRECAST CONCRETE PANELS IS GREATER THAN 138 DEGREES AND LESS THAN 162 DEGREES.
2. THE CORNER PRECAST CONCRETE POST (POST TYPE F) MAY ONLY BE USED WHEN THE INTERSECTING ANGLE BETWEEN THE PRECAST CONCRETE PANELS IS GREATER THAN 78 DEGREES AND LESS THAN 102 DEGREES.
3. THE ANGLED/CORNER PRECAST CONCRETE POSTS WERE DESIGNED FOR THE FOLLOWING POST SPACINGS, WIND PRESSURES, AND MAXIMUM WALL HEIGHTS:
  - 12'-0" POST SPACING:
    - WIND PRESSURE = 20 PSF: MAXIMUM WALL HEIGHT = 28'-0"
    - WIND PRESSURE = 28 PSF: MAXIMUM WALL HEIGHT = 24'-0"
  - 16'-0" POST SPACING:
    - WIND PRESSURE = 20 PSF: MAXIMUM WALL HEIGHT = 24'-0"
    - WIND PRESSURE = 28 PSF: MAXIMUM WALL HEIGHT = 20'-0"
4. DETAILS 5 AND 6 - ANGLED/CORNER PRECAST CONCRETE POST EMBEDDED IN CAISSON:
  - INDICATE THE REQUIRED WALL HEIGHT ON THE CONTRACT PLANS.
  - DETERMINE CAISSON LENGTH BASED ON THE POST SPACING AND WALL HEIGHT. REFER TO DESIGN TABLES ON SHEET 20.
  - PROVIDE DIMENSION TABLE SIMILAR TO TABLE SHOWN FOR DETAIL 3 OR COMPLETELY DETAIL POST AND CAISSON ON THE CONTRACT DRAWINGS.
5. DETAILS 7 AND 8 - ANGLED/CORNER PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL):
  - INDICATE THE REQUIRED WALL HEIGHT ON THE CONTRACT PLANS.
  - PROVIDE SPREAD FOOTING DESIGN COMPUTATIONS TO DETERMINE THE FOOTING DIMENSIONS AND REINFORCEMENT REQUIREMENTS FOR THE REQUIRED POST SPACING AND WALL HEIGHT. PROVIDE THE FOLLOWING MINIMUM FOOTING DIMENSIONS:
    - MINIMUM FOOTING LENGTH (L) = 6'-6"
    - MINIMUM FOOTING WIDTH (W) = 6'-6"
    - MINIMUM FOOTING THICKNESS (T) = 3'-0"
    - REFER TO DESIGN PARAMETERS ON SHEET 2 FOR ADDITIONAL INFORMATION.
  - PROVIDE DIMENSION TABLE SIMILAR TO TABLE SHOWN FOR DETAIL 4 OR COMPLETELY DETAIL POST AND SPREAD FOOTING ON THE CONTRACT DRAWINGS.

## NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL 6, REFER TO SHEET 17.
3. FOR DETAIL 7, REFER TO SHEET 18.
4. FOR DETAIL 8, REFER TO SHEET 19.
5. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
6. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS**

**DETAIL 5**

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 16 OF 20

**BD-677M**



SECTION N-N

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.
4. FOR ANGLED/CORNER PRECAST CONCRETE POST NOTES REFER TO SHEET 16.

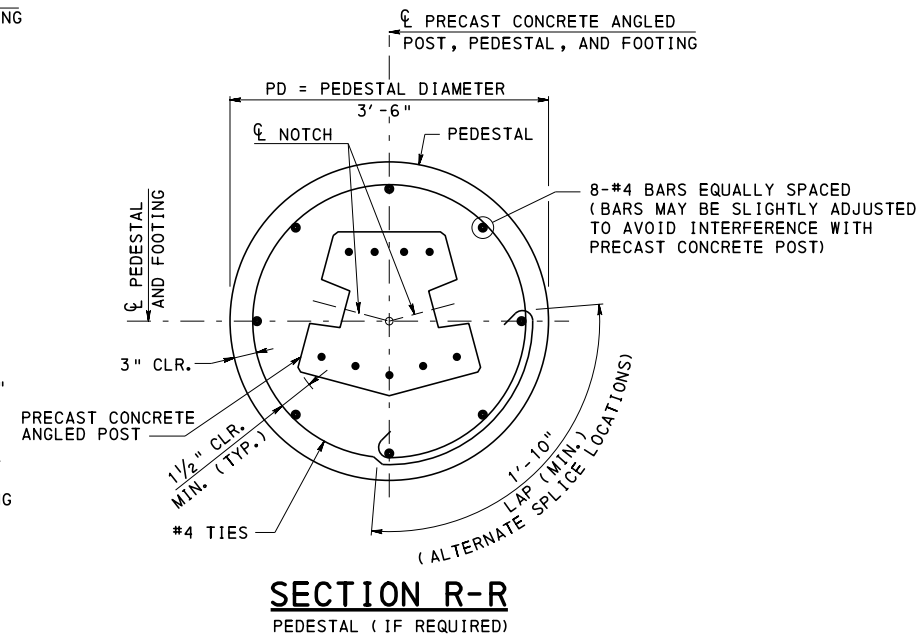
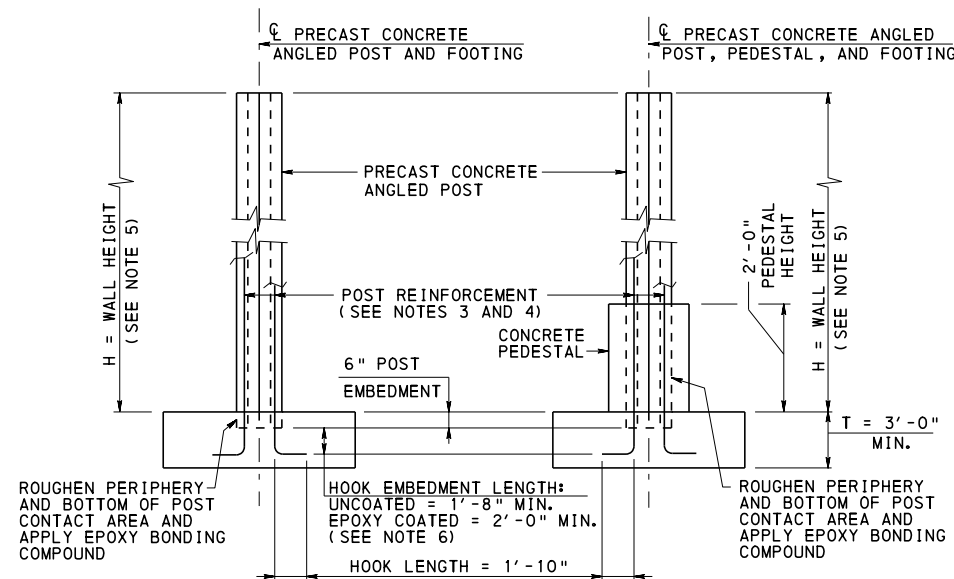
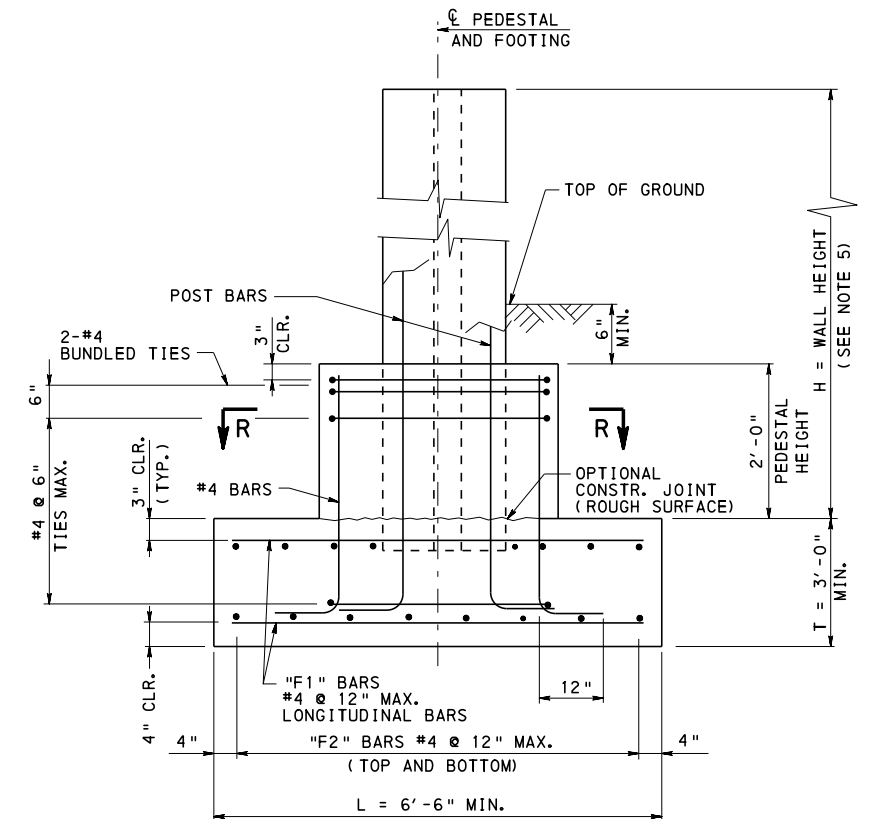
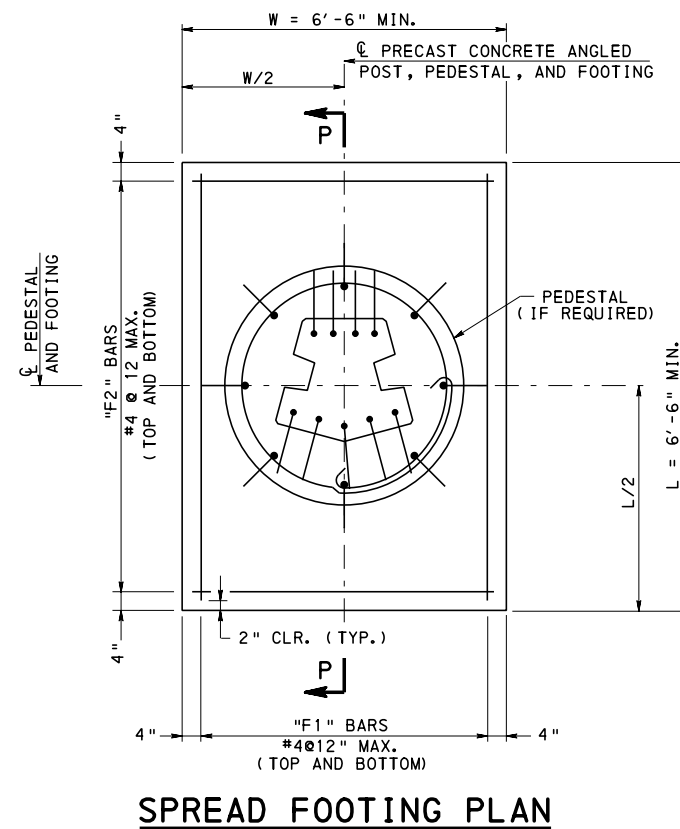
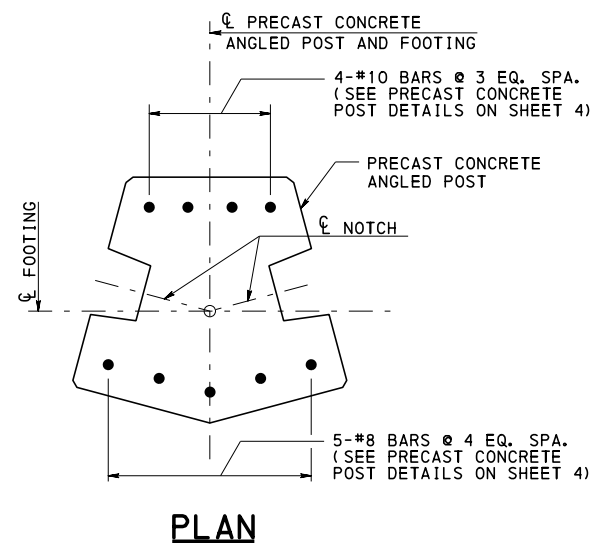
# STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS

DETAIL 6

SHEET 17 OF 20

BD-677M





# NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
- PROVIDE UNCOATED OR EPOXY COATED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS. GALVANIZED BARS NOT PERMITTED.
- BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
- FOR ANGLED/CORNER PRECAST CONCRETE POST NOTES REFER TO SHEET 16.
- DESIGNER IS PERMITTED TO INCREASE THE EMBEDMENT LENGTH OF THE POST REINFORCEMENT BARS SO BARS CAN BE TIED TO THE BOTTOM FOOTING REINFORCEMENT BARS.

## DETAIL 7 ANGLED PRECAST CONCRETE POST TYPE E EMBEDDED IN SPREAD FOOTING (WITH OR WITHOUT PEDESTAL)

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS

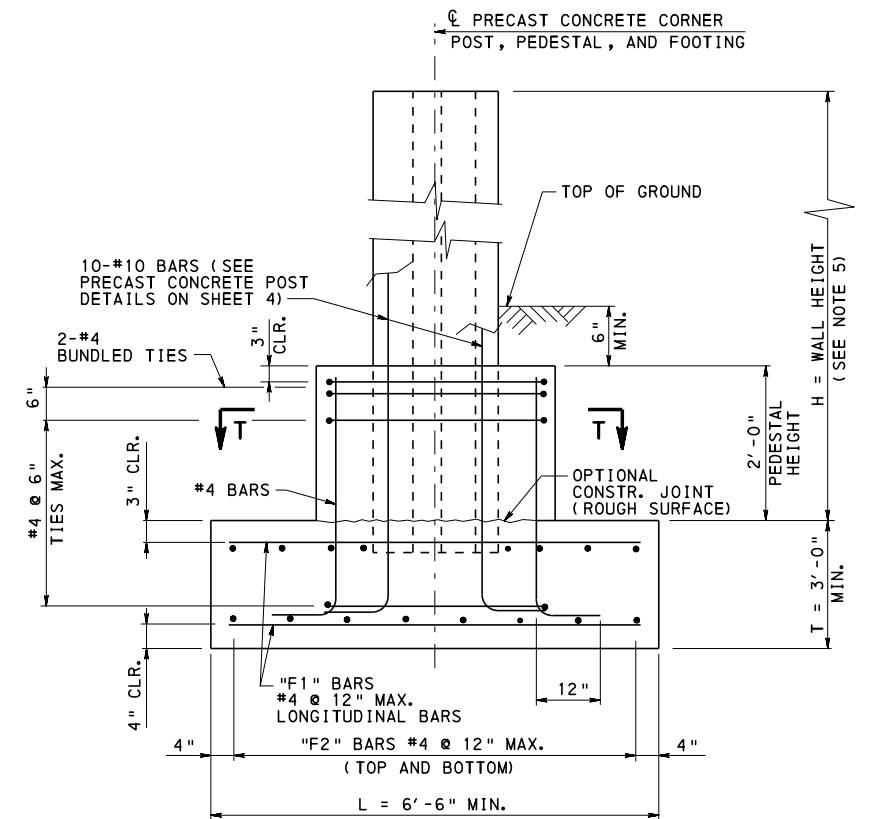
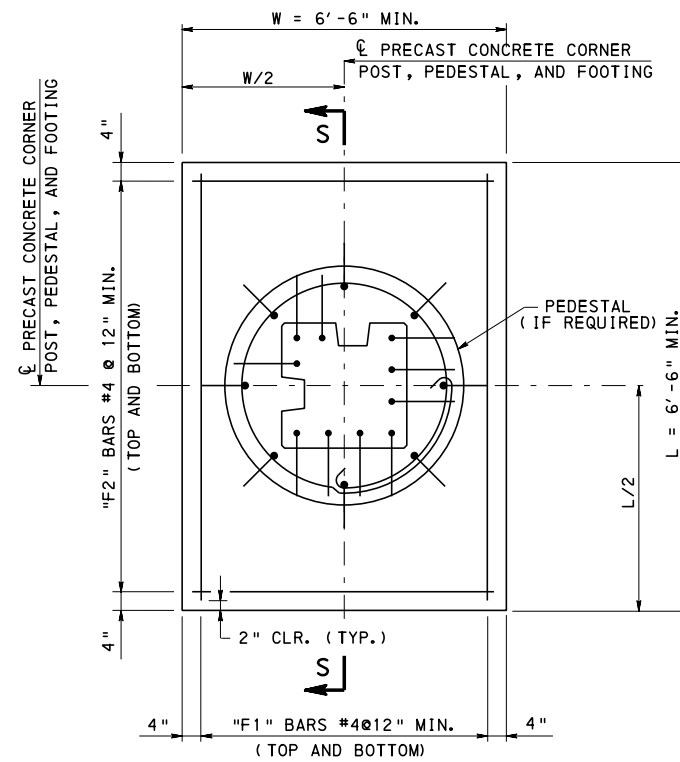
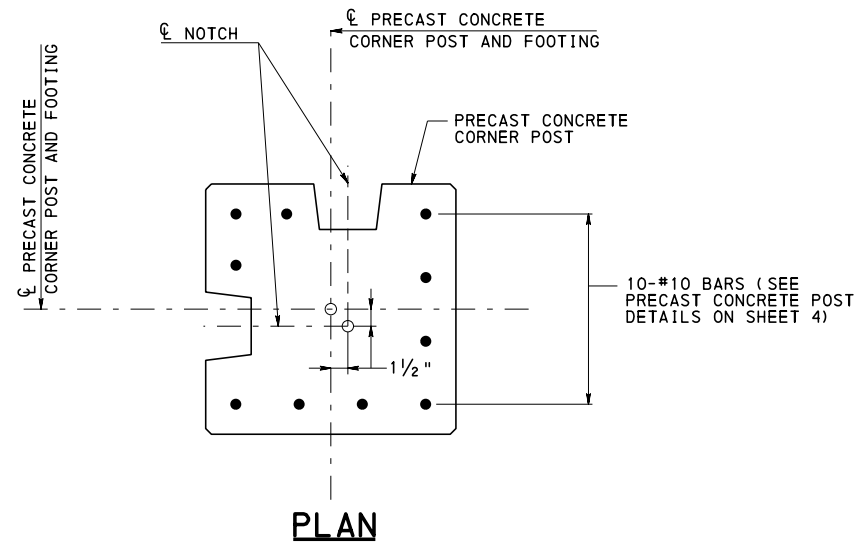
DETAIL 7

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

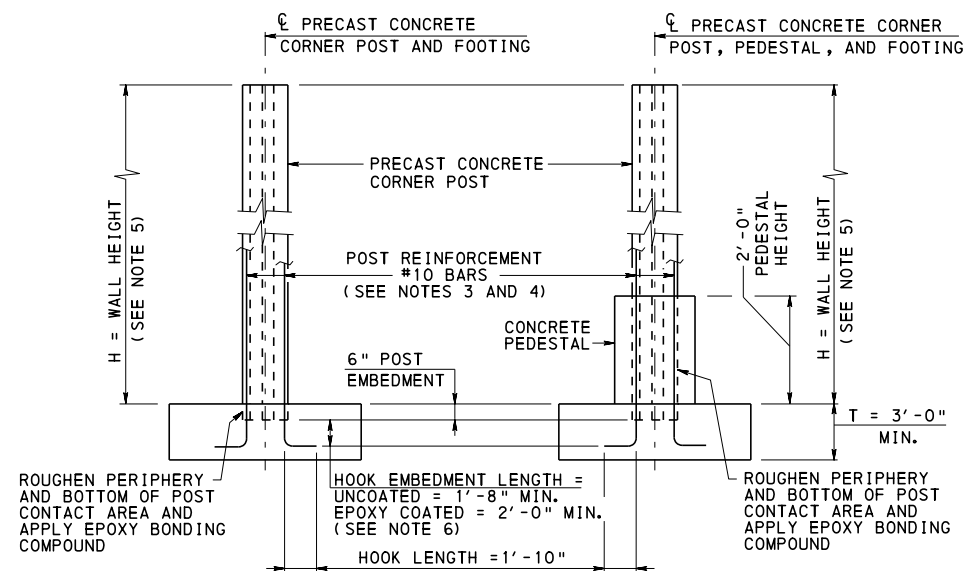
RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 18 OF 20

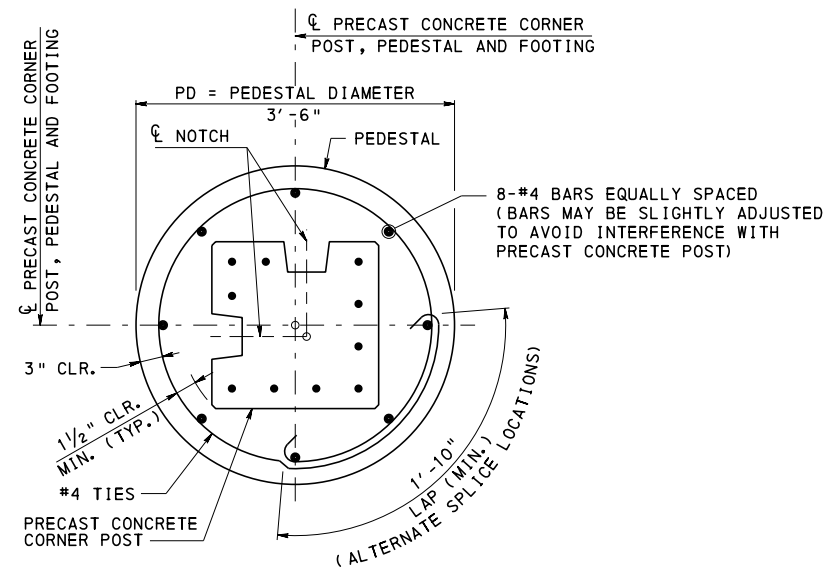
BD-677M



**SECTION S-S (WITH PEDESTAL)**  
ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.



**WITHOUT PEDESTAL WITH PEDESTAL**  
**ELEVATION**



**SECTION T-T**  
PEDESTAL (IF REQUIRED)

**NOTES:**

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. PROVIDE UNCOATED OR EPOXY COATED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS. GALVANIZED BARS NOT PERMITTED.
4. BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
5. FOR ANGLED/CORNER PRECAST CONCRETE POST NOTES REFER TO SHEET 16.
6. DESIGNER IS PERMITTED TO INCREASE THE EMBEDMENT LENGTH OF THE POST REINFORCEMENT BARS SO BARS CAN BE TIED TO THE BOTTOM FOOTING REINFORCEMENT BARS.

**DETAIL 8**  
**CORNER PRECAST CONCRETE POST TYPE F**  
**EMBEDDED IN SPREAD FOOTING**  
**(WITH OR WITHOUT PEDESTAL)**

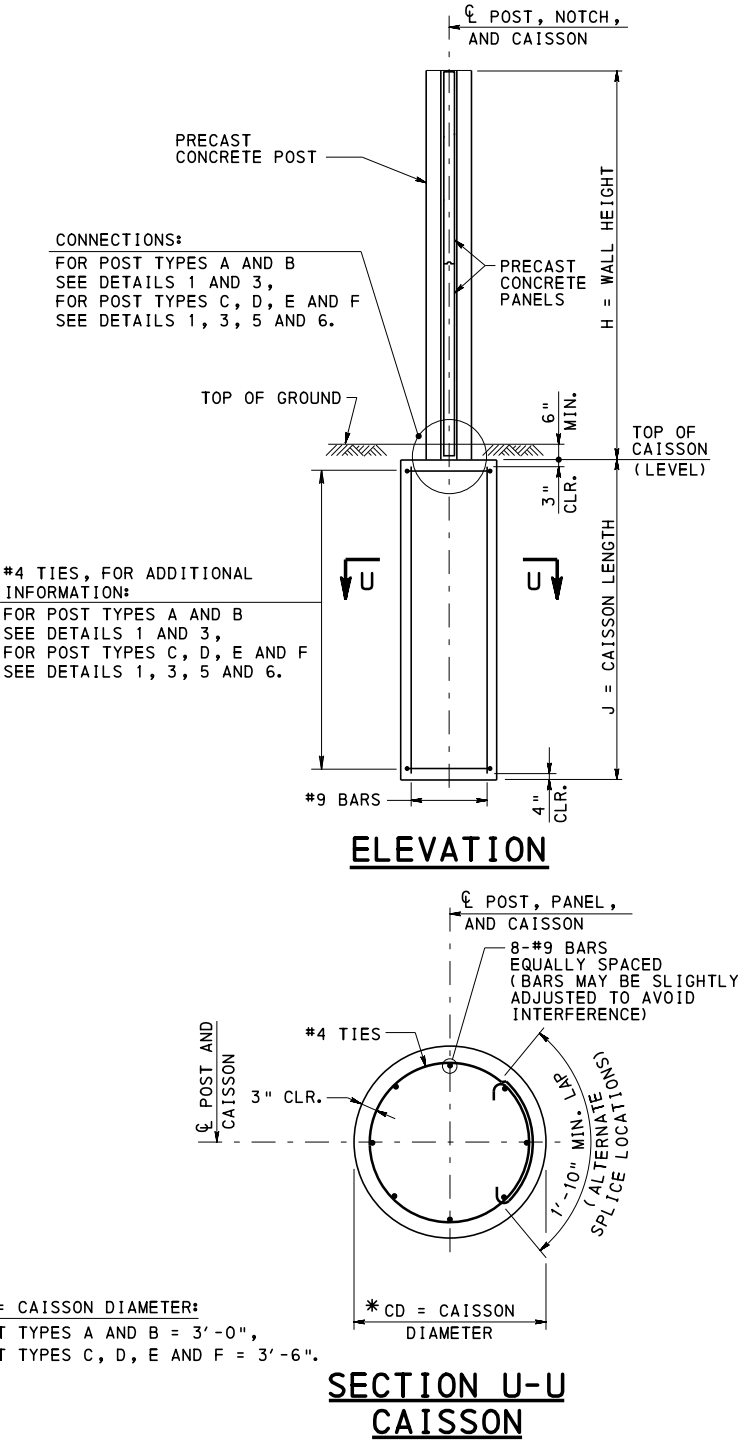
**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

**STANDARD**  
**GROUND MOUNTED SOUND BARRIERS**  
**PRECAST CONCRETE POSTS**

**DETAIL 8**

| CAISSON LENGTH                                                                                                                         |                           |            |                                                                                                                                          |                           |            |                                                                                                                                          |                           |            |                                                                                                                                           |                           |            |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|
| PRECAST CONCRETE POST TYPES A AND B                                                                                                    |                           |            |                                                                                                                                          |                           |            |                                                                                                                                          |                           |            |                                                                                                                                           |                           |            |
| WIND PRESSURE = 28 PSF                                                                                                                 |                           |            |                                                                                                                                          |                           |            |                                                                                                                                          |                           |            |                                                                                                                                           |                           |            |
| TYPE 1 SOIL<br>SATURATED LOOSE SAND                                                                                                    |                           |            | TYPE 2 SOIL<br>DRY MEDIUM DENSE SAND                                                                                                     |                           |            | TYPE 3 SOIL<br>SATURATED SOFT CLAY                                                                                                       |                           |            | TYPE 4 SOIL<br>DRY MEDIUM STIFF CLAY                                                                                                      |                           |            |
| SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 30°<br>2. C = 0 LB./SQ. FT.<br>3. UNIT WEIGHT = 100 LB./CU. FT.<br>4. K = 20 LB./CU. IN. |                           |            | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 34°<br>2. C = 0.0 LB./SQ. FT.<br>3. UNIT WEIGHT = 120 LB./CU. FT.<br>4. K = 90 LB./CU. IN. |                           |            | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 0°<br>2. C = 500 LB./SQ. FT.<br>3. UNIT WEIGHT = 100 LB./CU. FT.<br>4. K = 100 LB./CU. IN. |                           |            | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 0°<br>2. C = 1000 LB./SQ. FT.<br>3. UNIT WEIGHT = 120 LB./CU. FT.<br>4. K = 200 LB./CU. IN. |                           |            |
| POST SPACING<br>PS<br>(FT.)                                                                                                            | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) | POST SPACING<br>PS<br>(FT.)                                                                                                              | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) | POST SPACING<br>PS<br>(FT.)                                                                                                              | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) | POST SPACING<br>PS<br>(FT.)                                                                                                               | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) |
| 12.0                                                                                                                                   | 6.0                       | 12.0       | 12.0                                                                                                                                     | 6.0                       | 9.0        | 12.0                                                                                                                                     | 6.0                       | 9.5        | 12.0                                                                                                                                      | 6.0                       | 9.0        |
|                                                                                                                                        | 8.0                       | 13.0       |                                                                                                                                          | 8.0                       | 9.0        |                                                                                                                                          | 8.0                       | 11.0       |                                                                                                                                           | 8.0                       | 9.0        |
|                                                                                                                                        | 10.0                      | 14.5       |                                                                                                                                          | 10.0                      | 10.0       |                                                                                                                                          | 10.0                      | 13.0       |                                                                                                                                           | 10.0                      | 9.0        |
|                                                                                                                                        | 12.0                      | 15.5       |                                                                                                                                          | 12.0                      | 10.5       |                                                                                                                                          | 12.0                      | 14.5       |                                                                                                                                           | 12.0                      | 10.0       |
|                                                                                                                                        | 14.0                      | 16.5       |                                                                                                                                          | 14.0                      | 11.0       |                                                                                                                                          | 14.0                      | 16.0       |                                                                                                                                           | 14.0                      | 10.5       |
|                                                                                                                                        | 16.0                      | 17.5       |                                                                                                                                          | 16.0                      | 11.5       |                                                                                                                                          | 16.0                      | 18.0       |                                                                                                                                           | 16.0                      | 11.5       |
|                                                                                                                                        | 18.0                      | 18.5       |                                                                                                                                          | 18.0                      | 12.0       |                                                                                                                                          | 18.0                      | 19.5       |                                                                                                                                           | 18.0                      | 12.5       |
|                                                                                                                                        | 20.0                      | 19.0       |                                                                                                                                          | 20.0                      | 12.5       |                                                                                                                                          | 20.0                      | 21.0       |                                                                                                                                           | 20.0                      | 13.5       |
|                                                                                                                                        | 22.0                      | 20.0       |                                                                                                                                          | 22.0                      | 13.0       |                                                                                                                                          | 22.0                      | 22.5       |                                                                                                                                           | 22.0                      | 14.5       |
|                                                                                                                                        | 24.0                      | 21.0       |                                                                                                                                          | 24.0                      | 13.5       |                                                                                                                                          | 24.0                      | 24.0       |                                                                                                                                           | 24.0                      | 15.0       |
| 16.0                                                                                                                                   | 6.0                       | 13.0       | 16.0                                                                                                                                     | 6.0                       | 9.0        | 16.0                                                                                                                                     | 6.0                       | 10.5       | 16.0                                                                                                                                      | 6.0                       | 9.0        |
|                                                                                                                                        | 8.0                       | 14.0       |                                                                                                                                          | 8.0                       | 9.5        |                                                                                                                                          | 8.0                       | 13.0       |                                                                                                                                           | 8.0                       | 9.0        |
|                                                                                                                                        | 10.0                      | 15.5       |                                                                                                                                          | 10.0                      | 10.5       |                                                                                                                                          | 10.0                      | 15.0       |                                                                                                                                           | 10.0                      | 10.0       |
|                                                                                                                                        | 12.0                      | 17.0       |                                                                                                                                          | 12.0                      | 11.0       |                                                                                                                                          | 12.0                      | 17.0       |                                                                                                                                           | 12.0                      | 11.0       |
|                                                                                                                                        | 14.0                      | 18.0       |                                                                                                                                          | 14.0                      | 12.0       |                                                                                                                                          | 14.0                      | 18.5       |                                                                                                                                           | 14.0                      | 12.0       |
|                                                                                                                                        | 16.0                      | 19.0       |                                                                                                                                          | 16.0                      | 12.5       |                                                                                                                                          | 16.0                      | 20.5       |                                                                                                                                           | 16.0                      | 13.0       |
|                                                                                                                                        | 18.0                      | 20.0       |                                                                                                                                          | 18.0                      | 13.0       |                                                                                                                                          | 18.0                      | 22.0       |                                                                                                                                           | 18.0                      | 14.0       |
|                                                                                                                                        | 20.0                      | 21.0       |                                                                                                                                          | 20.0                      | 13.5       |                                                                                                                                          | 20.0                      | 24.0       |                                                                                                                                           | 20.0                      | 15.0       |
|                                                                                                                                        | 22.0                      | 22.0       |                                                                                                                                          | 22.0                      | 14.5       |                                                                                                                                          | 22.0                      | 26.0       |                                                                                                                                           | 22.0                      | 16.0       |
|                                                                                                                                        | 24.0                      | 23.5       |                                                                                                                                          | 24.0                      | 15.0       |                                                                                                                                          | 24.0                      | 28.0       |                                                                                                                                           | 24.0                      | 17.0       |
| 20.0                                                                                                                                   | 6.0                       | 13.5       | 20.0                                                                                                                                     | 6.0                       | 9.5        | 20.0                                                                                                                                     | 6.0                       | 12.0       | 20.0                                                                                                                                      | 6.0                       | 9.0        |
|                                                                                                                                        | 8.0                       | 15.5       |                                                                                                                                          | 8.0                       | 10.5       |                                                                                                                                          | 8.0                       | 14.0       |                                                                                                                                           | 8.0                       | 9.5        |
|                                                                                                                                        | 10.0                      | 17.0       |                                                                                                                                          | 10.0                      | 11.0       |                                                                                                                                          | 10.0                      | 16.5       |                                                                                                                                           | 10.0                      | 10.5       |
|                                                                                                                                        | 12.0                      | 18.0       |                                                                                                                                          | 12.0                      | 12.0       |                                                                                                                                          | 12.0                      | 18.5       |                                                                                                                                           | 12.0                      | 12.0       |
|                                                                                                                                        | 14.0                      | 19.0       |                                                                                                                                          | 14.0                      | 12.5       |                                                                                                                                          | 14.0                      | 21.0       |                                                                                                                                           | 14.0                      | 13.0       |
|                                                                                                                                        | 16.0                      | 20.5       |                                                                                                                                          | 16.0                      | 13.5       |                                                                                                                                          | 16.0                      | 23.0       |                                                                                                                                           | 16.0                      | 14.5       |
|                                                                                                                                        | 18.0                      | 22.0       |                                                                                                                                          | 18.0                      | 14.0       |                                                                                                                                          | 18.0                      | 25.0       |                                                                                                                                           | 18.0                      | 15.5       |
|                                                                                                                                        | 20.0                      | 23.5       |                                                                                                                                          | 20.0                      | 14.5       |                                                                                                                                          | 20.0                      | 27.0       |                                                                                                                                           | 20.0                      | 17.0       |
|                                                                                                                                        | 22.0                      | 25.0       |                                                                                                                                          | 22.0                      | 15.5       |                                                                                                                                          | 22.0                      | 29.5       |                                                                                                                                           | 22.0                      | 18.0       |

| CAISSON LENGTH                                                                                                                         |                           |            |                                                                                                                                          |                           |            |                                                                                                                                          |                           |            |                                                                                                                                           |                           |            |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------|
| PRECAST CONCRETE POST TYPES C, D, E AND F                                                                                              |                           |            |                                                                                                                                          |                           |            |                                                                                                                                          |                           |            |                                                                                                                                           |                           |            |
| WIND PRESSURE = 28 PSF                                                                                                                 |                           |            |                                                                                                                                          |                           |            |                                                                                                                                          |                           |            |                                                                                                                                           |                           |            |
| TYPE 1 SOIL<br>SATURATED LOOSE SAND                                                                                                    |                           |            | TYPE 2 SOIL<br>DRY MEDIUM DENSE SAND                                                                                                     |                           |            | TYPE 3 SOIL<br>SATURATED SOFT CLAY                                                                                                       |                           |            | TYPE 4 SOIL<br>DRY MEDIUM STIFF CLAY                                                                                                      |                           |            |
| SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 30°<br>2. C = 0 LB./SQ. FT.<br>3. UNIT WEIGHT = 100 LB./CU. FT.<br>4. K = 20 LB./CU. IN. |                           |            | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 34°<br>2. C = 0.0 LB./SQ. FT.<br>3. UNIT WEIGHT = 120 LB./CU. FT.<br>4. K = 90 LB./CU. IN. |                           |            | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 0°<br>2. C = 500 LB./SQ. FT.<br>3. UNIT WEIGHT = 100 LB./CU. FT.<br>4. K = 100 LB./CU. IN. |                           |            | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 0°<br>2. C = 1000 LB./SQ. FT.<br>3. UNIT WEIGHT = 120 LB./CU. FT.<br>4. K = 200 LB./CU. IN. |                           |            |
| POST SPACING<br>PS<br>(FT.)                                                                                                            | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) | POST SPACING<br>PS<br>(FT.)                                                                                                              | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) | POST SPACING<br>PS<br>(FT.)                                                                                                              | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) | POST SPACING<br>PS<br>(FT.)                                                                                                               | WALL HEIGHT<br>H<br>(FT.) | J<br>(FT.) |
| 12.0                                                                                                                                   | 6.0                       | 11.5       | 12.0                                                                                                                                     | 6.0                       | 10.5**     | 12.0                                                                                                                                     | 6.0                       | 10.5**     | 12.0                                                                                                                                      | 6.0                       | 10.5**     |
|                                                                                                                                        | 8.0                       | 13.0       |                                                                                                                                          | 8.0                       | 10.5**     |                                                                                                                                          | 8.0                       | 11.0**     |                                                                                                                                           | 8.0                       | 10.5**     |
|                                                                                                                                        | 10.0                      | 14.0       |                                                                                                                                          | 10.0                      | 10.5**     |                                                                                                                                          | 10.0                      | 12.5       |                                                                                                                                           | 10.0                      | 10.5**     |
|                                                                                                                                        | 12.0                      | 15.0       |                                                                                                                                          | 12.0                      | 10.5**     |                                                                                                                                          | 12.0                      | 14.0       |                                                                                                                                           | 12.0                      | 10.5**     |
|                                                                                                                                        | 14.0                      | 16.0       |                                                                                                                                          | 14.0                      | 11.0**     |                                                                                                                                          | 14.0                      | 15.5       |                                                                                                                                           | 14.0                      | 10.5**     |
|                                                                                                                                        | 16.0                      | 17.0       |                                                                                                                                          | 16.0                      | 11.5       |                                                                                                                                          | 16.0                      | 17.0       |                                                                                                                                           | 16.0                      | 11.5       |
|                                                                                                                                        | 18.0                      | 18.0       |                                                                                                                                          | 18.0                      | 12.0       |                                                                                                                                          | 18.0                      | 18.5       |                                                                                                                                           | 18.0                      | 12.0       |
|                                                                                                                                        | 20.0                      | 19.0       |                                                                                                                                          | 20.0                      | 12.5       |                                                                                                                                          | 20.0                      | 20.0       |                                                                                                                                           | 20.0                      | 13.0       |
|                                                                                                                                        | 22.0                      | 20.0       |                                                                                                                                          | 22.0                      | 13.0       |                                                                                                                                          | 22.0                      | 21.5       |                                                                                                                                           | 22.0                      | 14.0       |
|                                                                                                                                        | 24.0                      | 20.5       |                                                                                                                                          | 24.0                      | 13.5       |                                                                                                                                          | 24.0                      | 23.0       |                                                                                                                                           | 24.0                      | 14.5       |
| 16.0                                                                                                                                   | 6.0                       | 12.5       | 16.0                                                                                                                                     | 6.0                       | 10.5**     | 16.0                                                                                                                                     | 6.0                       | 10.5**     | 16.0                                                                                                                                      | 6.0                       | 10.5**     |
|                                                                                                                                        | 8.0                       | 14.0       |                                                                                                                                          | 8.0                       | 10.5**     |                                                                                                                                          | 8.0                       | 12.5       |                                                                                                                                           | 8.0                       | 10.5**     |
|                                                                                                                                        | 10.0                      | 15.5       |                                                                                                                                          | 10.0                      | 10.5**     |                                                                                                                                          | 10.0                      | 14.5       |                                                                                                                                           | 10.0                      | 10.5**     |
|                                                                                                                                        | 12.0                      | 16.5       |                                                                                                                                          | 12.0                      | 11.0**     |                                                                                                                                          | 12.0                      | 16.0       |                                                                                                                                           | 12.0                      | 10.5**     |
|                                                                                                                                        | 14.0                      | 18.0       |                                                                                                                                          | 14.0                      | 12.0       |                                                                                                                                          | 14.0                      | 18.0       |                                                                                                                                           | 14.0                      | 11.5       |
|                                                                                                                                        | 16.0                      | 19.0       |                                                                                                                                          | 16.0                      | 12.5       |                                                                                                                                          | 16.0                      | 19.5       |                                                                                                                                           | 16.0                      | 12.5       |
|                                                                                                                                        | 18.0                      | 20.0       |                                                                                                                                          | 18.0                      | 13.0       |                                                                                                                                          | 18.0                      | 21.5       |                                                                                                                                           | 18.0                      | 13.5       |
|                                                                                                                                        | 20.0                      | 21.0       |                                                                                                                                          | 20.0                      | 13.5       |                                                                                                                                          | 20.0                      | 23.0       |                                                                                                                                           | 20.0                      | 14.5       |
|                                                                                                                                        | 22.0                      | 22.0       |                                                                                                                                          | 22.0                      | 14.0       |                                                                                                                                          | 22.0                      | 25.0       |                                                                                                                                           | 22.0                      | 15.5       |
|                                                                                                                                        | 24.0                      | 23.0       |                                                                                                                                          | 24.0                      | 14.5       |                                                                                                                                          | 24.0                      | 26.5       |                                                                                                                                           | 24.0                      | 16.5       |
| 20.0<br>(FOR<br>TYPES<br>C & D<br>ONLY)                                                                                                | 6.0                       | 13.5       | 20.0<br>(FOR<br>TYPES<br>C & D<br>ONLY)                                                                                                  | 6.0                       | 10.5       | 20.0<br>(FOR<br>TYPES<br>C & D<br>ONLY)                                                                                                  | 6.0                       | 11.5       | 20.0<br>(FOR<br>TYPES<br>C & D<br>ONLY)                                                                                                   | 6.0                       | 10.5       |
|                                                                                                                                        | 8.0                       | 15.0       |                                                                                                                                          | 8.0                       | 10.5       |                                                                                                                                          | 8.0                       | 13.5       |                                                                                                                                           | 8.0                       | 10.5       |
|                                                                                                                                        | 10.0                      | 16.5       |                                                                                                                                          | 10.0                      | 11.0       |                                                                                                                                          | 10.0                      | 16.0       |                                                                                                                                           | 10.0                      | 10.5       |
|                                                                                                                                        | 12.0                      | 18.0       |                                                                                                                                          | 12.0                      | 12.0       |                                                                                                                                          | 12.0                      | 18.0       |                                                                                                                                           | 12.0                      | 11.5       |
|                                                                                                                                        | 14.0                      | 19.0       |                                                                                                                                          | 14.0                      | 12.5       |                                                                                                                                          | 14.0                      | 20.0       |                                                                                                                                           | 14.0                      | 12.5       |
|                                                                                                                                        | 16.0                      | 20.0       |                                                                                                                                          | 16.0                      | 13.0       |                                                                                                                                          | 16.0                      | 22.0       |                                                                                                                                           | 16.0                      | 14.0       |
|                                                                                                                                        | 18.0                      | 21.0       |                                                                                                                                          | 18.0                      | 14.0       |                                                                                                                                          | 18.0                      | 24.0       |                                                                                                                                           | 18.0                      | 15.0       |
|                                                                                                                                        | 20.0                      | 22.5       |                                                                                                                                          | 20.0                      | 14.5       |                                                                                                                                          | 20.0                      | 26.0       |                                                                                                                                           | 20.0                      | 16.0       |
|                                                                                                                                        | 22.0                      | 23.5       |                                                                                                                                          | 22.0                      | 15.0       |                                                                                                                                          | 22.0                      | 28.0       |                                                                                                                                           | 22.0                      | 17.5       |
|                                                                                                                                        | 24.0                      | 24.5       |                                                                                                                                          | 24.0                      | 15.5       |                                                                                                                                          | 24.0                      | 30.0       |                                                                                                                                           | 24.0                      | 18.5       |



**INSTRUCTIONS FOR DETERMINING CAISSON LENGTHS:**

- DETERMINE REQUIRED POST SPACING AND WALL HEIGHT.
- DETERMINE SOIL TYPE BASED ON THE INFORMATION SHOWN IN THE ACCEPTED STRUCTURE FOUNDATION GEOTECHNICAL REPORT. SELECT THE SOIL TYPE WHICH HAS A STRENGTH LESS THAN OR EQUAL TO THE ACTUAL SOIL STRENGTH. ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED FOR THE FOUR SOIL TYPES.
- DETERMINE GROUND WATER LEVEL. IF GROUND WATER IS WITHIN THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 AND TYPE 4 SOILS, USE THE CAISSON LENGTH IN THE TABLES FOR TYPE 1 OR TYPE 3 SOILS. IF GROUND WATER IS NOT WITHIN CAISSON LENGTH, USE THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 OR TYPE 4 SOILS.
- MINIMUM CAISSON LENGTH IN SOIL:  
POST TYPES A AND B = 9'-0"  
POST TYPES C AND D = 10'-6"  
POST TYPES E AND F WITH UNCOATED OR GALVANIZED BARS IN POST = 10'-6"  
\*\* POST TYPES E AND F WITH COATED BARS IN POST = 11'-6"

**NOTES:**

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
- FOR DETAIL 1 REFER TO SHEET 5.
- FOR DETAIL 3 REFER TO SHEET 11.
- FOR DETAIL 5 REFER TO SHEET 16.
- FOR DETAIL 6 REFER TO SHEET 17.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
PRECAST CONCRETE POSTS**

**CAISSON DESIGN TABLES**

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. B.*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 20 OF 20

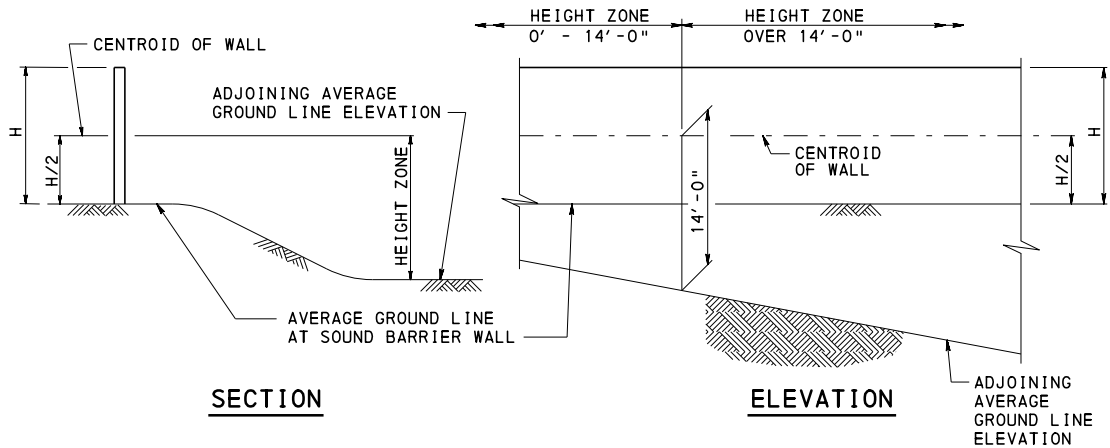
**BD-677M**

GENERAL NOTES

1. DESIGN SPECIFICATIONS:
- PENNDOT DESIGN MANUAL, PART 4, STRUCTURES APRIL 2015 EDITION.
  - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS" INCLUDING THE 1992 AND 2002 INTERIMS.
  - 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
  - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
  - DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)
2. CONSTRUCTION SPECIFICATIONS AND **WORK QUALITY**:
- PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5.)
3. DESIGN LOADS:
- WIND LOAD:
    - THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.
    - GROUND MOUNTED SOUND BARRIER WALLS:
      - HEIGHT ZONE: 0' TO 14'-0" = 20 PSF
      - HEIGHT ZONE: OVER 14'-0" = 28 PSF
  - ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.
  - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO **0.15**.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
5. PROVIDE EITHER PRECAST CONCRETE POSTS OR STEEL POSTS. DO NOT MIX POST TYPES WITHOUT PERMISSION FROM THE DISTRICT BRIDGE ENGINEER.
6. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING AND CAISSONS.
7. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PEDESTALS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.
8. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
9. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
10. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE POSTS AND SPREAD FOOTINGS ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 20 PSF AND 28 PSF.
2. DESIGN TABLES SHOWN FOR CAISSONS ARE DEVELOPED FOR A 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.
3. THE DESIGN POST SPACING (CENTER-TO-CENTER POSTS) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
4. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
5. FOR CORNER/ANGLED STEEL PIPE POST NOTES REFER TO SHEET 13.



| HEIGHT ZONE<br>( FEET ) | WIND PRESSURE<br>( PSF ) |
|-------------------------|--------------------------|
| 0-14                    | 20                       |
| OVER 14                 | 28                       |

HEIGHT ZONES FOR  
GROUND MOUNTED SOUND BARRIERS

MATERIAL NOTES

1. REFER TO SHEET 1 OF BC-778M, FOR MATERIAL NOTES.

INDEX OF SHEETS

| SHT. NO. | SHEET TITLE                         |
|----------|-------------------------------------|
| 1        | GENERAL NOTES - 1                   |
| 2        | GENERAL NOTES - 2                   |
| 3        | GEOMETRY AND LAYOUT                 |
| 4        | DETAIL 1                            |
| 5        | DETAIL 1 DESIGN TABLES              |
| 6        | DETAIL 2                            |
| 7        | DETAIL 2 DESIGN TABLES              |
| 8        | DETAIL 3                            |
| 9        | DETAIL 4                            |
| 10       | DETAIL 3 AND DETAIL 4 DESIGN TABLES |
| 11       | DETAIL 5                            |
| 12       | DETAIL 6                            |
| 13       | STEEL PIPE POST DETAILS             |
| 14       | CAISSON DESIGN TABLES               |

DESCRIPTION OF DETAILS

| DETAIL | DESCRIPTION                                                            |
|--------|------------------------------------------------------------------------|
| 1      | STEEL POST WITH BASE PLATE CONNECTION TO CAISSON                       |
| 2      | STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING                |
| 3      | STEEL POST EMBEDDED IN CAISSON                                         |
| 4      | STEEL POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL                    |
| 5      | CORNER/ANGLED STEEL PIPE POST EMBEDDED IN CAISSON                      |
| 6      | CORNER/ANGLED STEEL PIPE POST EMBEDDED IN SPREAD FOOTING WITH PEDESTAL |

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

GENERAL NOTES - 1

|         |                                                       |
|---------|-------------------------------------------------------|
| BC-734M | ANCHOR SYSTEMS                                        |
| BC-735M | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS         |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                 |
| BC-776M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS |
| BC-777M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS  |
| BC-778M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS             |
| BC-779M | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |
| BD-676M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS |
| BD-677M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS  |
| BD-679M | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |

REFERENCE DRAWINGS

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 14

BD-678M

CHANGE 2

DESIGN PARAMETERS

1. STEEL POSTS:
- POSTS ARE DESIGNED AS VERTICAL CANTILEVER BEAMS.
  - POSTS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
  - MAXIMUM PERMITTED POST DEFLECTION EQUALS POST HEIGHT (H) DIVIDED BY 360.
  - POSTS AND CONNECTIONS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.
  - FATIGUE DESIGN FOR WELDED STUDS IS EVALUATED AT TWO MILLION CYCLES, NON-REDUNDANT, CATEGORY C.
2. ANCHOR BOLTS:
- ANCHOR BOLTS ARE DESIGNED IN ACCORDANCE WITH SECTION 5.17 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
  - MINIMUM ANCHOR BOLT EMBEDMENT LENGTH IS CALCULATED BASED ON THE DEVELOPMENT LENGTH OF A HOOKED BAR IN TENSION (WITHOUT ANY MODIFICATION FACTORS). REFER TO SECTION 8.29 IN THE 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
  - THE ANCHOR BOLT EMBEDMENT LENGTH MUST EXTEND TO A DEPTH WHERE THE FOOTING/ CAISSON REINFORCEMENT IS FULLY DEVELOPED. DESIGNER MUST INCREASE EMBEDMENT LENGTH AS REQUIRED.
3. BASE PLATES:
- BASE PLATES ARE DESIGNED FOR BENDING DUE TO THE APPLIED BOLTS FORCES, COMPRESSION AND TENSION.
  - BASE PLATES ARE NOT DESIGNED TO SUPPORT THE VERTICAL LOAD OF THE PRECAST CONCRETE PANELS.
  - BASE PLATE THICKNESS IS DETERMINED USING THE ALLOWABLE BENDING STRESS IN ACCORDANCE WITH SECTION 5.8 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
  - BASE PLATE IS SUPPORTED ON THE LEVELING NUTS. THE NON-SHRINK GROUT IS NOT CONSIDERED AS A LOAD-CARRYING ELEMENT.
  - EDGE DISTANCE OF ANCHOR BOLTS:
    - THE CLEAR DISTANCE BETWEEN THE EDGES OF HOLES AND EDGES OF THE BASE PLATE SHALL NOT BE LESS THAN THE DIAMETER OF THE ANCHOR BOLT WHEN OVERSIZED OR SLOTTED HOLES ARE SPECIFIED.
4. SPREAD FOOTINGS:
- SPREAD FOOTINGS ARE DESIGNED BEARING ON SOIL WITH AN ALLOWABLE BEARING PRESSURE EQUAL TO 1.50 TONS/SQ. FT. AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
  - SPREAD FOOTINGS ARE DESIGNED FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
  - FACTOR OF SAFETY AGAINST SLIDING = 1.50 MINIMUM
  - FACTOR OF SAFETY AGAINST SLIDING FOR SEISMIC LOADING = 1.125 MINIMUM
  - FACTOR OF SAFETY AGAINST OVERTURNING = 2.00 MINIMUM
  - FACTOR OF SAFETY AGAINST OVERTURNING FOR SEISMIC LOADING = 1.50 MINIMUM
  - WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.
  - PROVIDE A MINIMUM SOIL DEPTH OF 1'-6" ABOVE THE TOP OF FOOTING.
  - SPREAD FOOTINGS ARE DESIGNED FOR NO UPLIFT.
  - SPREAD FOOTINGS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
  - SPREAD FOOTINGS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN FOOTINGS IF LIVE LOAD SURCHARGE IS REQUIRED.
  - ALTERNATE SPREAD FOOTING DESIGNS ARE PERMITTED IF SUPPORTED ON ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DEPARTMENT.
5. CAISSONS:
- CAISSONS ARE DESIGNED IN SOIL USING THE INDICATED SOIL PROPERTIES.
  - CASSIONS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 28 PSF.
  - FACTOR OF SAFETY AGAINST OVERTURNING = 2.0 MINIMUM
  - MAXIMUM ALLOWABLE LATERAL DESIGN DISPLACEMENT AT TOP OF CAISSON = 1/2"
  - CAISSON LENGTHS DETERMINED USING COM624P COMPUTER PROGRAM. FINAL CAISSON LENGTHS INDICATED INCLUDES AN ADDITIONAL 3'-0" LENGTH TO ACCOUNT FOR FREEZING AND THAWING, WEATHERING, AND OTHER SHALLOW GROUND DISTURBANCE.
  - CAISSON MAXIMUM ALLOWABLE VERTICAL DISPLACEMENT = 1.0 INCH
  - DRILLED CAISSONS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
  - DRILLED CAISSONS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN CAISSONS IF LIVE LOAD SURCHARGE IS REQUIRED.
  - ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED OR IF CAISSON EXTENDS PARTIALLY OR ENTIRELY INTO ROCK. FOUNDATION DESIGN PARAMETERS MUST BE ACCEPTED BY THE DEPARTMENT.

NOTES TO DESIGNER

1. REFER TO SHEET 2 OF BD-676M, FOR NOTES TO DESIGNER.

COMMONWEALTH OF PENNSYLVANIA  
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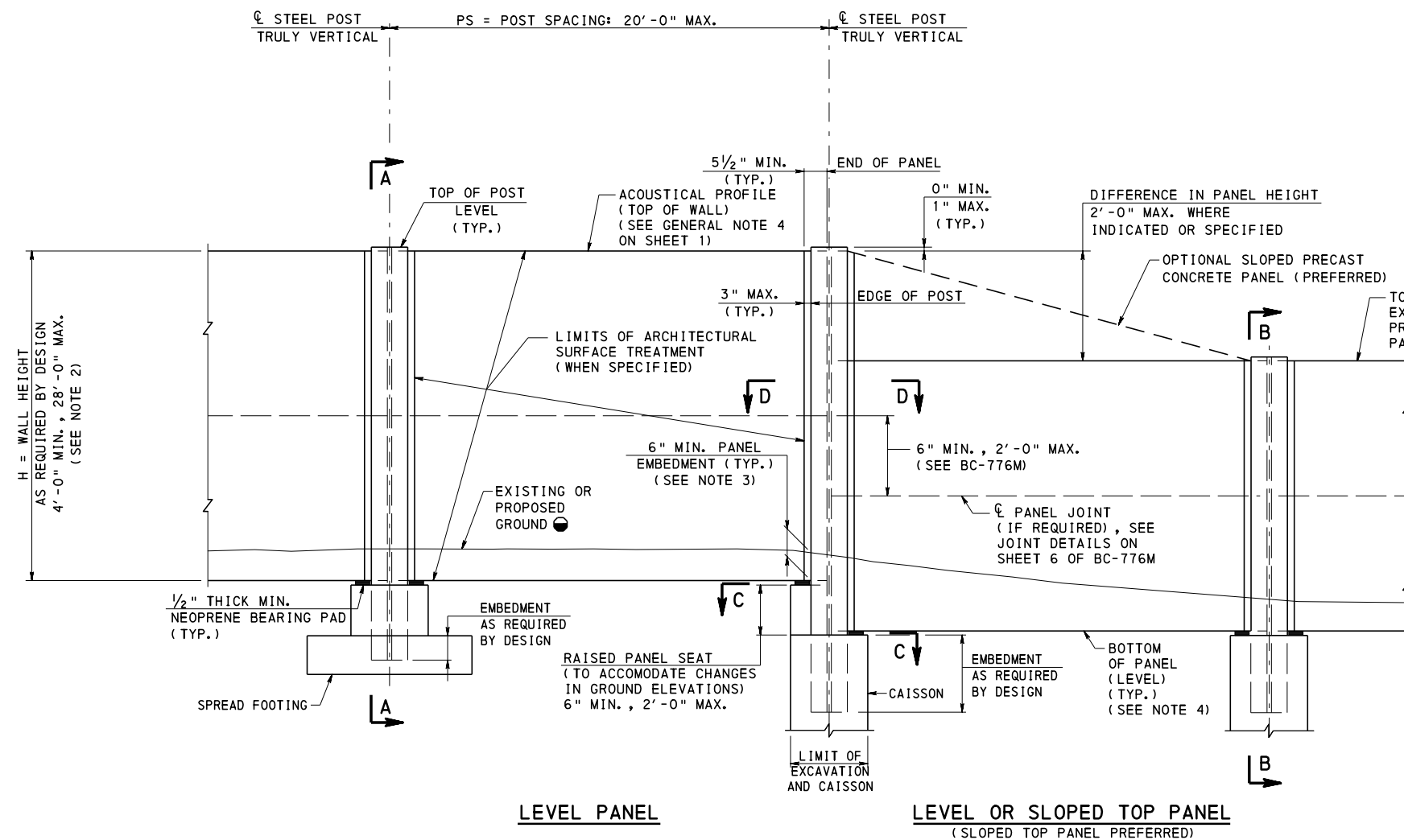
STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

GENERAL NOTES - 2

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

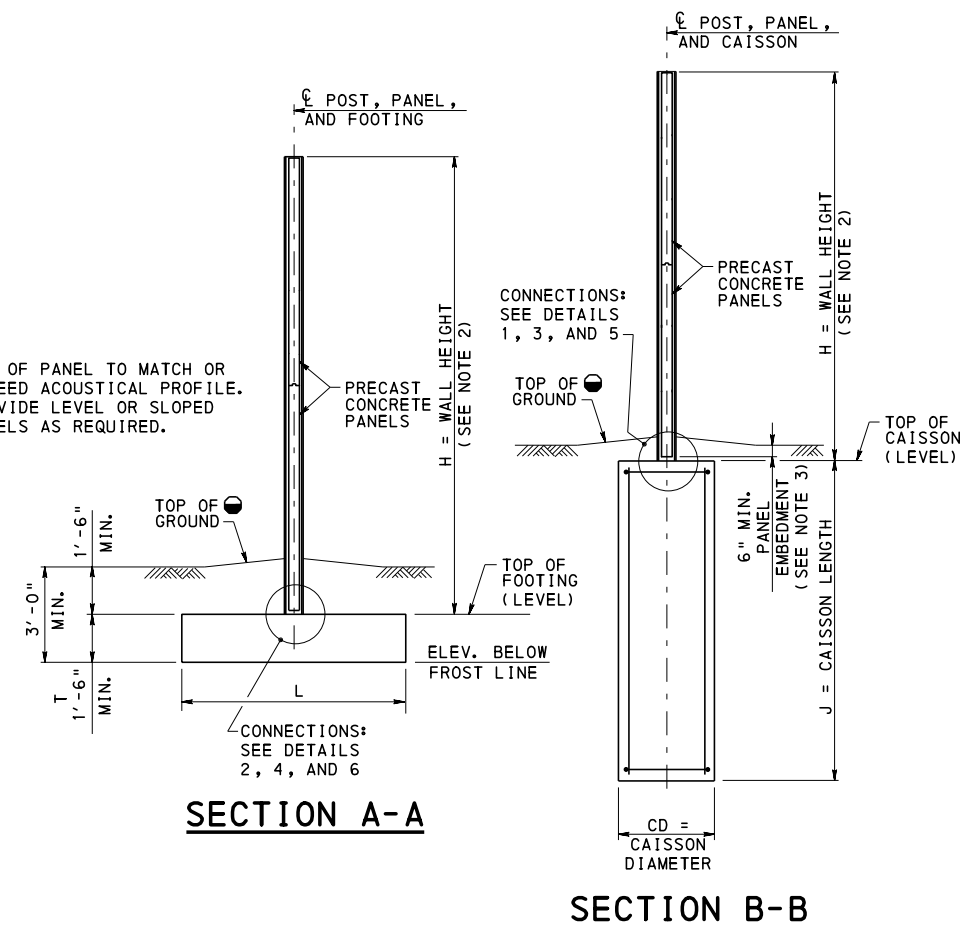
RECOMMENDED AUG. 30, 2019  
*Michael V. Biele*  
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SHEET 2 OF 14  
BD-678M



## GROUND MOUNTED SOUND BARRIER ELEVATION

FOR POSTS WITH BASE PLATES REFER TO "PANEL NOTCH DETAIL FOR BASE PLATE CONNECTIONS" ON BD-676M, SHEET 6.



### LEGEND:

- GRADE GROUND TO DRAIN AWAY FROM WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

### NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- WALL HEIGHT IS DEFINED AS FOLLOWS:
  - POST WITH BASE PLATE: H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL.
  - POST WITHOUT BASE PLATE: H = HEIGHT FROM TOP OF FOOTING/CAISSON TO TOP OF WALL.
- PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.
- FOR OPTIONAL SLOPED BOTTOM PANEL REFER TO BD-676M.
- FOR SECTION C-C AND D-D, REFER TO BC-778M SHEETS 2 AND 3.

COMMONWEALTH OF PENNSYLVANIA  
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STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

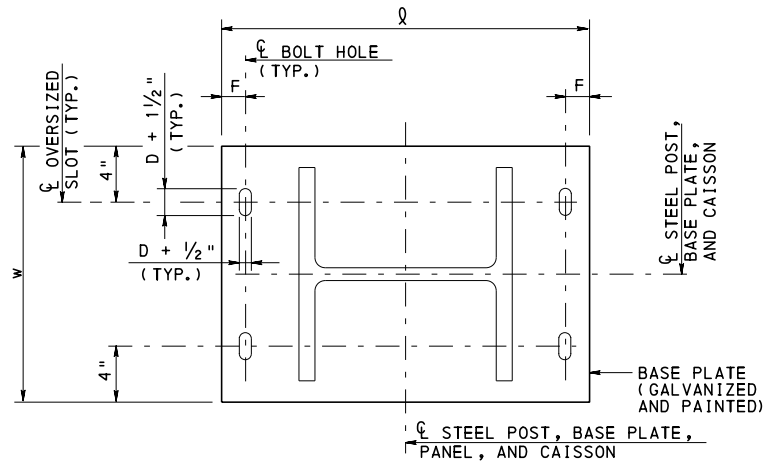
GEOMETRY AND LAYOUT

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

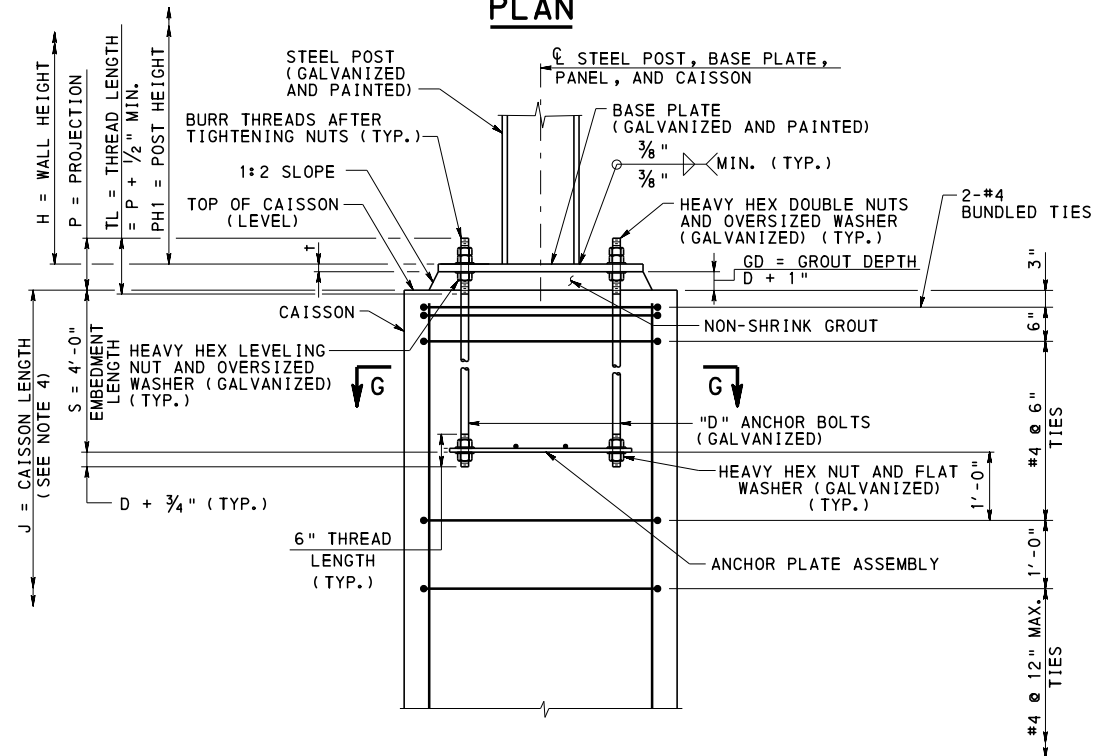
RECOMMENDED AUG. 30, 2019  
*Michael V. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 14  
BD-678M



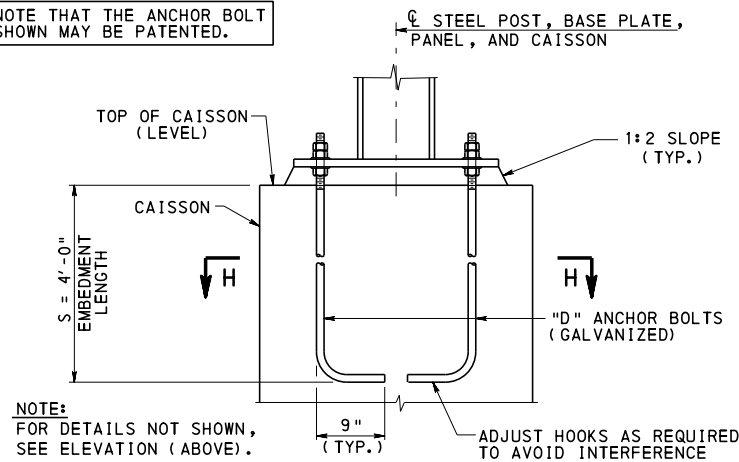


**PLAN**



**ELEVATION (ANCHOR BOLTS W/ANCHOR PLATE ASSEMBLY)**

PLEASE NOTE THAT THE ANCHOR BOLT DETAIL SHOWN MAY BE PATENTED.



**ELEVATION (ANCHOR BOLTS W/HOOKS)**

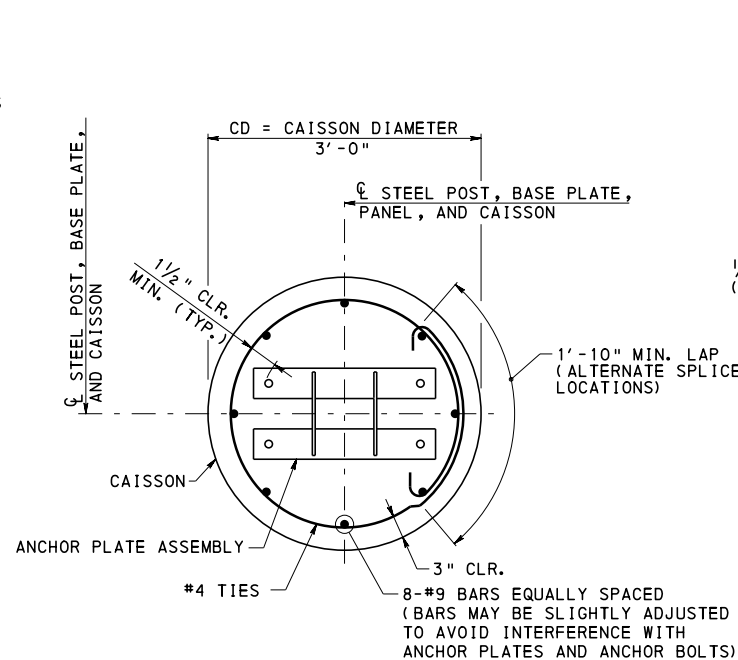
**DETAIL 1  
STEEL POST WITH BASE PLATE  
CONNECTION TO CAISSON**

**STEEL POST WITH BASE PLATE CONNECTION TO CAISSON  
DIMENSION TABLE**

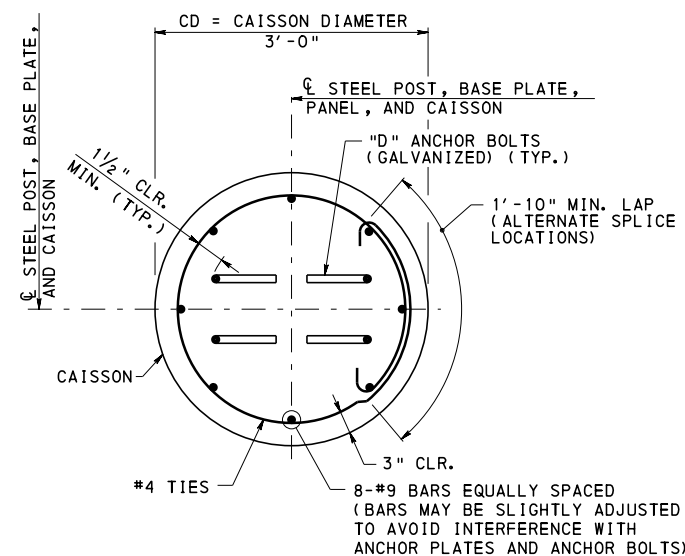
| HEIGHT ZONE=<br>WIND PRESSURE = |                           |                          |                 |                       |                 |                |               |         |                |          |                  |                          |                    |                        |                      |                                 |                        |                                       |
|---------------------------------|---------------------------|--------------------------|-----------------|-----------------------|-----------------|----------------|---------------|---------|----------------|----------|------------------|--------------------------|--------------------|------------------------|----------------------|---------------------------------|------------------------|---------------------------------------|
| STEEL POST                      |                           |                          |                 |                       | BASE PLATE      |                |               |         | ANCHOR PLATE   |          | ANCHOR BOLTS     |                          |                    |                        | GROUT                | CAISSON                         |                        |                                       |
| POST NUMBER                     | DESIGN POST SPACING (FT.) | DESIGN WALL HEIGHT (FT.) | STEEL POST SIZE | POST HEIGHT PH1 (FT.) | THICKNESS (IN.) | LENGTH L (IN.) | WIDTH W (IN.) | F (IN.) | LENGTH Q (IN.) | F1 (IN.) | DIAMETER D (IN.) | EMBEDMENT LENGTH S (IN.) | PROJECTION P (IN.) | THREAD LENGTH TL (IN.) | GROUT DEPTH GD (IN.) | CAISSON DIAMETER CD (FT. - IN.) | CAISSON LENGTH J (FT.) | VERTICAL REINFORCEMENT NUMBER OF BARS |
|                                 |                           |                          |                 |                       |                 |                |               |         |                |          |                  |                          |                    |                        |                      |                                 |                        | BAR SIZE                              |
|                                 |                           |                          |                 |                       |                 |                |               |         |                |          |                  |                          |                    |                        |                      |                                 |                        |                                       |
|                                 |                           |                          |                 |                       |                 |                |               |         |                |          |                  |                          |                    |                        |                      |                                 |                        |                                       |

**TABLE NOTES:**

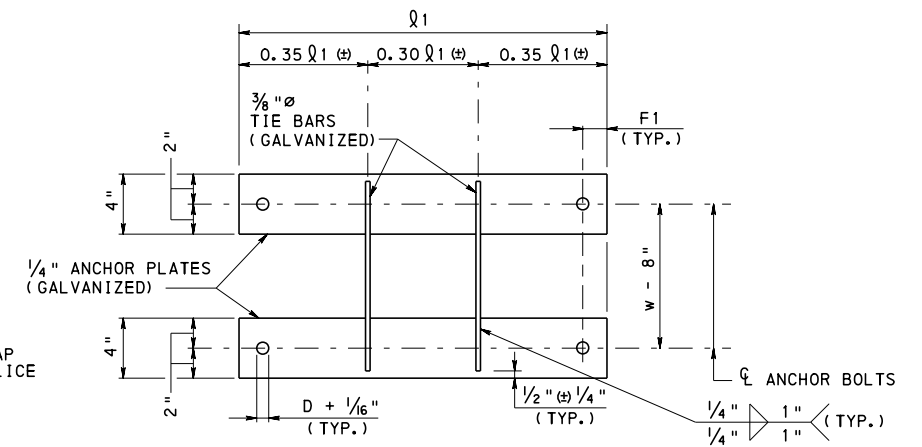
1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPECIFY IF ANCHOR PLATES ARE REQUIRED.
4. CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
5. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



**SECTION G-G**



**SECTION H-H**



**PLAN - ANCHOR PLATE ASSEMBLY**

**NOTES:**

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DESIGNER TO DETERMINE WHICH DETAIL IS TO BE USED. ONLY USE ONE DETAIL ON THE CONTRACT DRAWINGS.
3. FOR DESIGN TABLES REFER TO SHEET 5.
4. FOR CAISSON LENGTHS REFER TO SHEET 14.
5. FOR PANEL SEAT DETAILS REFER TO BC-778M.
6. FOR OVERSIZED WASHER DETAIL REFER TO BC-778M.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS**

**DETAIL 1**

RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bator*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 14  
**BD-678M**

| DETAIL 1<br>DESIGN TABLE                                                                      |                              |               |            |            |            |            |              |            |               |             |
|-----------------------------------------------------------------------------------------------|------------------------------|---------------|------------|------------|------------|------------|--------------|------------|---------------|-------------|
| STEEL POST WITH BASE PLATE CONNECTION TO CAISSON<br>HEIGHT ZONE 0'-14' WIND PRESSURE = 20 PSF |                              |               |            |            |            |            |              |            |               |             |
| STEEL POST                                                                                    |                              |               | BASE PLATE |            |            |            | ANCHOR BOLTS |            | ANCHOR PLATES |             |
| POST<br>SPACING<br>PS<br>(FT.)                                                                | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | P<br>(IN.) | Q1<br>(IN.)   | F1<br>(IN.) |
| 12.0                                                                                          | 6.0                          | W8x31         | 3/4        | 16         | 12         | 1 1/2      | 3/4          | 5          | 15            | 1           |
|                                                                                               | 8.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                               | 10.0                         | W8x31         | 7/8        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                               | 12.0                         | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                               | 14.0                         | W8x48         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                               | 16.0                         | W10x49        | 1 1/4      | 20         | 14         | 2 1/4      | 1 1/4        | 7          | 18            | 1 1/4       |
|                                                                                               | 18.0                         | W10x60        | 1 5/8      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                               | 20.0                         | W10x77        | 1 1/2      | 22         | 14         | 2 3/4      | 1 1/2        | 8          | 19 1/2        | 1 1/2       |
|                                                                                               | 22.0                         | W10x100       | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 8          | 19 1/2        | 1 1/2       |
|                                                                                               | 24.0                         | W12x120       | 1 3/4      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                               | 26.0                         | W12x120       | 1 3/4      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                               | 28.0                         | W12x136       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
| 16.0                                                                                          | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                               | 8.0                          | W8x31         | 7/8        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                               | 10.0                         | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                               | 12.0                         | W8x35         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                               | 14.0                         | W10x49        | 1 1/4      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                               | 16.0                         | W10x54        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                               | 18.0                         | W10x77        | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 8          | 19 1/2        | 1 1/2       |
|                                                                                               | 20.0                         | W10x100       | 1 3/4      | 22         | 14         | 2 3/4      | 1 1/2        | 8 1/4      | 19 1/2        | 1 1/2       |
|                                                                                               | 22.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                               | 24.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                               | 26.0                         | W12x152       | 2          | 27         | 16         | 3 1/2      | 2            | 10         | 24            | 2           |
|                                                                                               | 28.0                         | W12x170       | 2 1/8      | 27         | 16         | 3 1/2      | 2            | 10         | 24            | 2           |
| 20.0                                                                                          | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                               | 8.0                          | W8x31         | 7/8        | 18         | 14         | 2 1/4      | 1 1/4        | 6 1/2      | 16            | 1 1/4       |
|                                                                                               | 10.0                         | W8x31         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                               | 12.0                         | W8x48         | 1 1/4      | 19         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 16 1/2        | 1 1/2       |
|                                                                                               | 14.0                         | W10x49        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                               | 16.0                         | W10x68        | 1 5/8      | 21         | 14         | 2 3/4      | 1 1/2        | 8          | 18 1/2        | 1 1/2       |
|                                                                                               | 18.0                         | W10x88        | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 9          | 20 1/2        | 1 3/4       |
|                                                                                               | 20.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                               | 22.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                               | 24.0                         | W12x152       | 2          | 27         | 16         | 3 1/2      | 2            | 10         | 24            | 2           |
|                                                                                               | 26.0                         | W12x170       | 2 1/4      | 27         | 16         | 3 1/2      | 2            | 10 1/4     | 24            | 2           |

| DETAIL 1<br>DESIGN TABLE                                                                         |                              |               |            |            |            |            |              |            |               |             |
|--------------------------------------------------------------------------------------------------|------------------------------|---------------|------------|------------|------------|------------|--------------|------------|---------------|-------------|
| STEEL POST WITH BASE PLATE CONNECTION TO CAISSON<br>HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF |                              |               |            |            |            |            |              |            |               |             |
| STEEL POST                                                                                       |                              |               | BASE PLATE |            |            |            | ANCHOR BOLTS |            | ANCHOR PLATES |             |
| POST<br>SPACING<br>PS<br>(FT.)                                                                   | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | P<br>(IN.) | Q1<br>(IN.)   | F1<br>(IN.) |
| 12.0                                                                                             | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                                  | 8.0                          | W8x31         | 7/8        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                                  | 10.0                         | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                                  | 12.0                         | W8x40         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                                  | 14.0                         | W10x49        | 1 1/4      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                                  | 16.0                         | W10x60        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                                  | 18.0                         | W10x77        | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 8          | 19 1/2        | 1 1/2       |
|                                                                                                  | 20.0                         | W10x100       | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 9          | 20 1/2        | 1 3/4       |
|                                                                                                  | 22.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                                  | 24.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                                  | 26.0                         | W12x152       | 2          | 27         | 16         | 3 1/2      | 2            | 10         | 24            | 2           |
|                                                                                                  | 28.0                         | W12x190       | 2 1/4      | 27         | 16         | 3 1/2      | 2            | 10 1/4     | 24            | 2           |
| 16.0                                                                                             | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                                  | 8.0                          | W8x31         | 7/8        | 18         | 14         | 2 1/4      | 1 1/4        | 6 1/2      | 16            | 1 1/4       |
|                                                                                                  | 10.0                         | W8x31         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                                  | 12.0                         | W8x48         | 1 3/8      | 19         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 16 1/2        | 1 1/2       |
|                                                                                                  | 14.0                         | W10x54        | 1 1/2      | 21         | 14         | 2 3/4      | 1 1/2        | 8          | 18 1/2        | 1 1/2       |
|                                                                                                  | 16.0                         | W10x77        | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 8          | 19 1/2        | 1 1/2       |
|                                                                                                  | 18.0                         | W10x100       | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 9          | 20 1/2        | 1 3/4       |
|                                                                                                  | 20.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                                  | 22.0                         | W12x120       | 2          | 26         | 16         | 3 1/2      | 2            | 10         | 23            | 2           |
|                                                                                                  | 24.0                         | W12x152       | 2 1/8      | 27         | 16         | 3 1/2      | 2            | 10         | 24            | 2           |
| 20.0                                                                                             | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 5 3/4      | 15            | 1           |
|                                                                                                  | 8.0                          | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 6 3/4      | 16            | 1 1/4       |
|                                                                                                  | 10.0                         | W8x35         | 1 1/4      | 19         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 16 1/2        | 1 1/2       |
|                                                                                                  | 12.0                         | W10x49        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 7 3/4      | 18 1/2        | 1 1/2       |
|                                                                                                  | 14.0                         | W10x68        | 1 5/8      | 21         | 14         | 2 3/4      | 1 1/2        | 8          | 18 1/2        | 1 1/2       |
|                                                                                                  | 16.0                         | W10x88        | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 9          | 20 1/2        | 1 3/4       |
|                                                                                                  | 18.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 9          | 22 1/2        | 1 3/4       |
|                                                                                                  | 22.0                         | W12x170       | 2 1/4      | 27         | 16         | 3 1/2      | 2            | 10 1/4     | 24            | 2           |

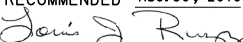
NOTES:

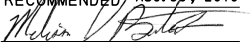
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 4.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

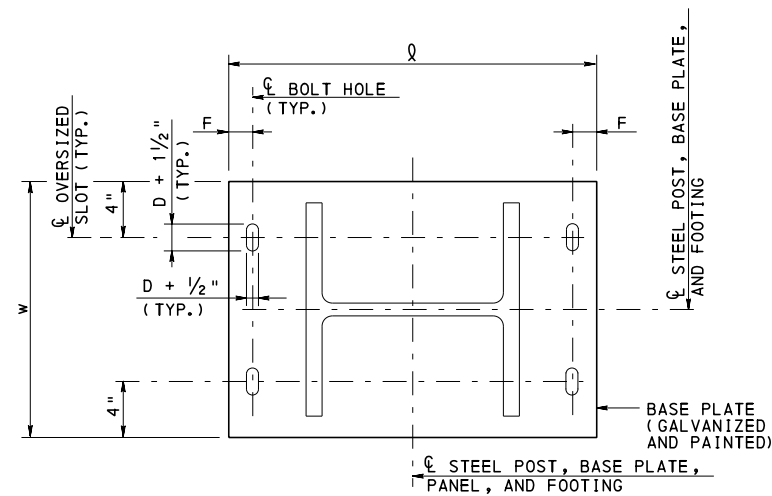
DETAIL 1 DESIGN TABLES

RECOMMENDED  
AUG. 30, 2019  
  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED  
AUG. 30, 2019  
  
ACT. DIR., BUR. OF PROJECT DELIVERY

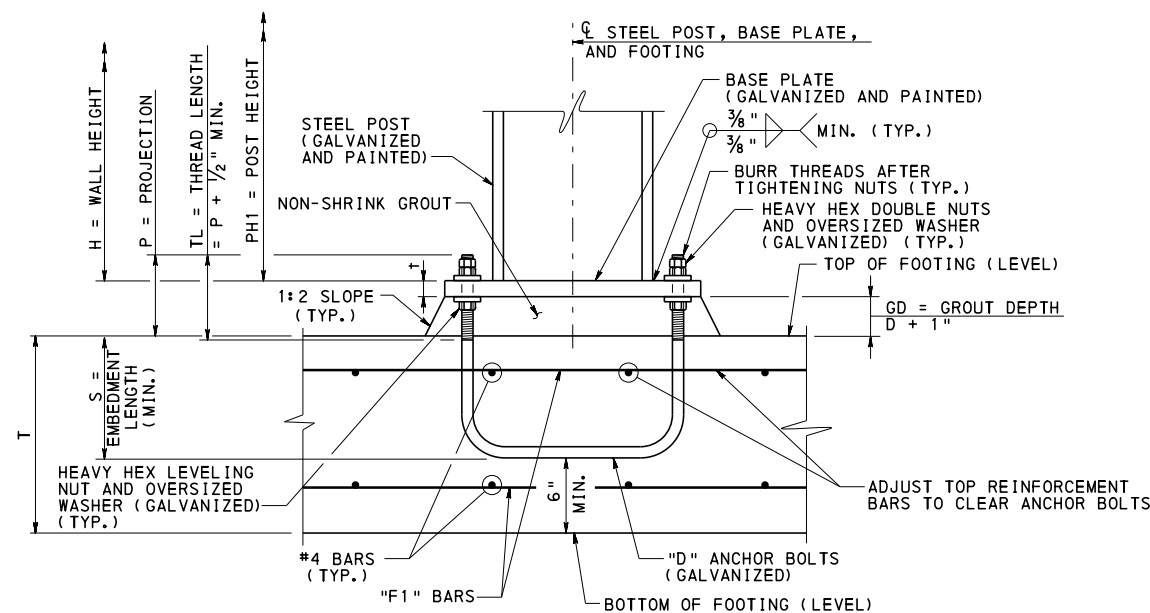
SHEET 5 OF 14

BD-678M



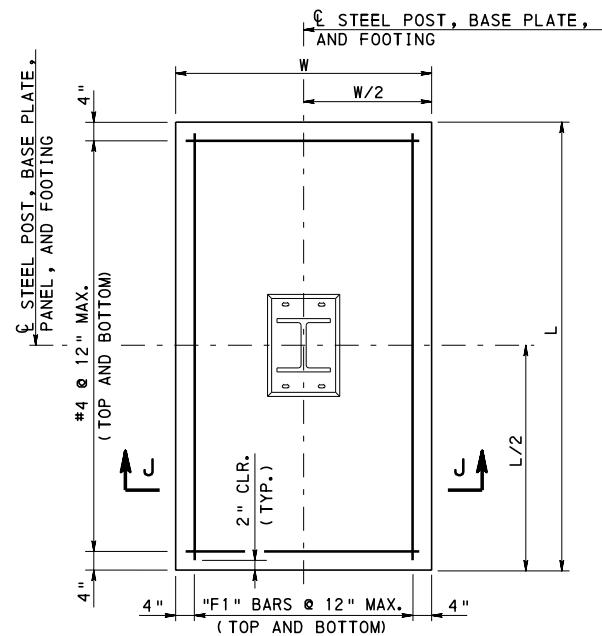
PLAN

PLEASE NOTE THAT THE ANCHOR BOLT  
DETAIL SHOWN MAY BE PATENTED.

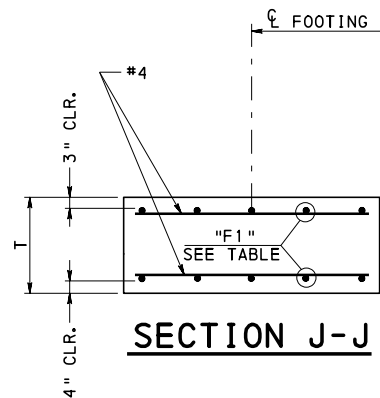


ELEVATION

DETAIL 2  
STEEL POST WITH BASE PLATE  
CONNECTION TO SPREAD FOOTING



SPREAD FOOTING PLAN



SECTION J-J

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DESIGN TABLES REFER TO SHEET 7.
3. FOR PANEL SEAT DETAILS REFER TO BC-778M.
4. FOR OVERSIZED WASHER DETAIL REFER TO BC-778M.

| STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING<br>DIMENSION TABLE |                                    |                                   |                       |                                |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                             |                      |                     |                  |
|----------------------------------------------------------------------------|------------------------------------|-----------------------------------|-----------------------|--------------------------------|-------------------------|----------------------|---------------------|------------|------------------------|-----------------------------------|--------------------------|---------------------------------|-------------------------------|-----------------------------|----------------------|---------------------|------------------|
| HEIGHT ZONE=<br>WIND PRESSURE =                                            |                                    |                                   |                       |                                |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                             |                      |                     |                  |
| STEEL POST                                                                 |                                    |                                   |                       |                                | BASE PLATE              |                      |                     |            | ANCHOR BOLTS           |                                   |                          |                                 | GROUT                         | SPREAD FOOTING              |                      |                     |                  |
| POST<br>NUMBER                                                             | DESIGN<br>POST<br>SPACING<br>(FT.) | DESIGN<br>WALL<br>HEIGHT<br>(FT.) | STEEL<br>POST<br>SIZE | POST<br>HEIGHT<br>PH1<br>(FT.) | THICKNESS<br>T<br>(IN.) | LENGTH<br>L<br>(IN.) | WIDTH<br>W<br>(IN.) | F<br>(IN.) | DIAMETER<br>D<br>(IN.) | EMBEDMENT<br>LENGTH<br>S<br>(IN.) | PROJECTION<br>P<br>(IN.) | THREAD<br>LENGTH<br>TL<br>(IN.) | GROUT<br>DEPTH<br>GD<br>(IN.) | THICKNESS<br>T<br>(FT.-IN.) | LENGTH<br>L<br>(FT.) | WIDTH<br>W<br>(FT.) | "F1"<br>BAR SIZE |
|                                                                            |                                    |                                   |                       |                                |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                             |                      |                     |                  |
|                                                                            |                                    |                                   |                       |                                |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                             |                      |                     |                  |
|                                                                            |                                    |                                   |                       |                                |                         |                      |                     |            |                        |                                   |                          |                                 |                               |                             |                      |                     |                  |

TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

DETAIL 2

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. [Signature]*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 6 OF 14  
BD-678M

| DETAIL 2<br>DESIGN TABLE                                                                               |                              |               |            |            |            |            |              |            |            |                |            |            |                  |
|--------------------------------------------------------------------------------------------------------|------------------------------|---------------|------------|------------|------------|------------|--------------|------------|------------|----------------|------------|------------|------------------|
| STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING<br>HEIGHT ZONE 0' - 14' WIND PRESSURE = 20 PSF |                              |               |            |            |            |            |              |            |            |                |            |            |                  |
| STEEL POST                                                                                             |                              |               | BASE PLATE |            |            |            | ANCHOR BOLTS |            |            | SPREAD FOOTING |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                                         | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | P<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
| 12.0                                                                                                   | 6.0                          | W8x31         | 3/4        | 16         | 12         | 1 1/2      | 3/4          | 17         | 5          | 2.0            | 4.5        | 3.0        | #4               |
|                                                                                                        | 8.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 5.5        | 3.0        | #4               |
|                                                                                                        | 10.0                         | W8x31         | 7/8        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 6.0        | 3.5        | #4               |
|                                                                                                        | 12.0                         | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 6.5        | 3.5        | #4               |
|                                                                                                        | 14.0                         | W8x48         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 7.5        | 4.0        | #4               |
|                                                                                                        | 16.0                         | W10x49        | 1 1/4      | 20         | 14         | 2 1/4      | 1 1/4        | 28         | 7          | 3.0            | 8.0        | 4.0        | #4               |
|                                                                                                        | 18.0                         | W10x60        | 1 5/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.5        | 4.5        | #5               |
|                                                                                                        | 20.0                         | W10x77        | 1 1/2      | 22         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 9.0        | 4.5        | #5               |
|                                                                                                        | 22.0                         | W10x100       | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 9.5        | 5.0        | #5               |
|                                                                                                        | 24.0                         | W12x120       | 1 3/4      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.0       | 5.0        | #5               |
|                                                                                                        | 26.0                         | W12x120       | 1 3/4      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.5       | 5.5        | #5               |
|                                                                                                        | 28.0                         | W12x136       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.0       | 5.5        | #5               |
| 16.0                                                                                                   | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 5.0        | 3.0        | #4               |
|                                                                                                        | 8.0                          | W8x31         | 7/8        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 6.0        | 3.0        | #4               |
|                                                                                                        | 10.0                         | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 6.5        | 3.5        | #4               |
|                                                                                                        | 12.0                         | W8x35         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 7.0        | 4.0        | #4               |
|                                                                                                        | 14.0                         | W10x49        | 1 1/4      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.0        | 4.0        | #5               |
|                                                                                                        | 16.0                         | W10x54        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.5        | 4.5        | #5               |
|                                                                                                        | 18.0                         | W10x77        | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 9.0        | 5.0        | #5               |
|                                                                                                        | 20.0                         | W10x100       | 1 3/4      | 22         | 14         | 2 3/4      | 1 1/2        | 33         | 8 1/4      | 3.25           | 10.0       | 5.0        | #5               |
|                                                                                                        | 22.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.5       | 5.5        | #5               |
|                                                                                                        | 24.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.0       | 5.5        | #5               |
|                                                                                                        | 26.0                         | W12x152       | 2          | 27         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 11.0       | 6.0        | #5               |
|                                                                                                        | 28.0                         | W12x170       | 2 1/8      | 27         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 11.5       | 6.0        | #6               |
| 20.0                                                                                                   | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 5.0        | 3.0        | #4               |
|                                                                                                        | 8.0                          | W8x31         | 7/8        | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 1/2      | 3.0            | 6.0        | 3.5        | #4               |
|                                                                                                        | 10.0                         | W8x31         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 7.0        | 3.5        | #4               |
|                                                                                                        | 12.0                         | W8x48         | 1 1/4      | 19         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 7.5        | 4.0        | #5               |
|                                                                                                        | 14.0                         | W10x49        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.5        | 4.5        | #5               |
|                                                                                                        | 16.0                         | W10x68        | 1 5/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 9.0        | 4.5        | #5               |
|                                                                                                        | 18.0                         | W10x88        | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 9.5        | 5.0        | #5               |
|                                                                                                        | 20.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.0       | 5.5        | #5               |
|                                                                                                        | 22.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.0       | 5.5        | #6               |
|                                                                                                        | 24.0                         | W12x152       | 2          | 27         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 11.5       | 6.0        | #6               |
|                                                                                                        | 26.0                         | W12x170       | 2 1/4      | 27         | 16         | 3 1/2      | 2            | 44         | 10 1/4     | 4.25           | 12.0       | 6.0        | #6               |

| DETAIL 2<br>DESIGN TABLE                                                                                |                              |               |            |            |            |            |              |            |            |                |            |            |                  |
|---------------------------------------------------------------------------------------------------------|------------------------------|---------------|------------|------------|------------|------------|--------------|------------|------------|----------------|------------|------------|------------------|
| STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING<br>HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF |                              |               |            |            |            |            |              |            |            |                |            |            |                  |
| STEEL POST                                                                                              |                              |               | BASE PLATE |            |            |            | ANCHOR BOLTS |            |            | SPREAD FOOTING |            |            |                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                                          | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | t<br>(IN.) | Q<br>(IN.) | w<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | P<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR SIZE) |
| 12.0                                                                                                    | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 5.5        | 3.0        | #4               |
|                                                                                                         | 8.0                          | W8x31         | 7/8        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 6.5        | 3.5        | #4               |
|                                                                                                         | 10.0                         | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 7.0        | 4.0        | #4               |
|                                                                                                         | 12.0                         | W8x40         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 8.0        | 4.0        | #4               |
|                                                                                                         | 14.0                         | W10x49        | 1 1/4      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.5        | 4.5        | #4               |
|                                                                                                         | 16.0                         | W10x60        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 9.0        | 5.0        | #4               |
|                                                                                                         | 18.0                         | W10x77        | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 10.0       | 5.0        | #5               |
|                                                                                                         | 20.0                         | W10x100       | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.5       | 5.5        | #5               |
|                                                                                                         | 22.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.0       | 6.0        | #5               |
|                                                                                                         | 24.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.5       | 6.0        | #5               |
|                                                                                                         | 26.0                         | W12x152       | 2          | 27         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 12.0       | 6.0        | #5               |
|                                                                                                         | 28.0                         | W12x190       | 2 1/4      | 27         | 16         | 3 1/2      | 2            | 44         | 10 1/4     | 4.25           | 12.5       | 6.5        | #5               |
| 16.0                                                                                                    | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 6.0        | 3.0        | #4               |
|                                                                                                         | 8.0                          | W8x31         | 7/8        | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 1/2      | 3.0            | 7.0        | 3.5        | #4               |
|                                                                                                         | 10.0                         | W8x31         | 1 1/8      | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 8.0        | 4.0        | #4               |
|                                                                                                         | 12.0                         | W8x48         | 1 3/8      | 19         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.5        | 4.5        | #4               |
|                                                                                                         | 14.0                         | W10x54        | 1 1/2      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 9.0        | 5.0        | #5               |
|                                                                                                         | 16.0                         | W10x77        | 1 5/8      | 22         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 10.0       | 5.0        | #5               |
|                                                                                                         | 18.0                         | W10x100       | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.5       | 5.5        | #5               |
|                                                                                                         | 20.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.0       | 6.0        | #5               |
|                                                                                                         | 22.0                         | W12x120       | 2          | 26         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 12.0       | 6.0        | #5               |
|                                                                                                         | 24.0                         | W12x152       | 2 1/8      | 27         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 12.0       | 6.5        | #5               |
| 20.0                                                                                                    | 6.0                          | W8x31         | 3/4        | 17         | 13         | 2          | 1            | 22         | 5 3/4      | 2.5            | 6.0        | 3.5        | #4               |
|                                                                                                         | 8.0                          | W8x31         | 1          | 18         | 14         | 2 1/4      | 1 1/4        | 28         | 6 3/4      | 3.0            | 7.0        | 4.0        | #4               |
|                                                                                                         | 10.0                         | W8x35         | 1 1/4      | 19         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 8.0        | 4.5        | #4               |
|                                                                                                         | 12.0                         | W10x49        | 1 3/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 7 3/4      | 3.25           | 9.0        | 4.5        | #5               |
|                                                                                                         | 14.0                         | W10x68        | 1 5/8      | 21         | 14         | 2 3/4      | 1 1/2        | 33         | 8          | 3.25           | 10.0       | 5.0        | #5               |
|                                                                                                         | 16.0                         | W10x88        | 1 3/4      | 23         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 10.5       | 5.5        | #5               |
|                                                                                                         | 18.0                         | W12x120       | 1 7/8      | 25         | 15         | 3          | 1 3/4        | 39         | 9          | 3.75           | 11.0       | 6.0        | #5               |
|                                                                                                         | 20.0                         | W12x136       | 2 1/8      | 26         | 16         | 3 1/2      | 2            | 44         | 10         | 4.25           | 12.0       | 6.0        | #5               |
|                                                                                                         | 22.0                         | W12x170       | 2 1/4      | 27         | 16         | 3 1/2      | 2            | 44         | 10 1/4     | 4.25           | 12.5       | 6.5        | #6               |

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEET 6.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

DETAIL 2 DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
*James J. Ringer*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Buter*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 7 OF 14

BD-678M



CD = CAISSON DIAMETER

3'-0"

STEEL POST, PANEL, AND CAISSON

1/2" CLR. MIN. (TYP.)

1'-10" MIN. LAP (ALTERNATE SPLICE LOCATIONS)

WELDED STUDS (TYP.)

3" CLR.

8-#9 BARS EQUALLY SPACED (BARS MAY BE SLIGHTLY ADJUSTED TO AVOID INTERFERENCE WITH WELDED STUDS)

#4 TIES

CAISSON

STEEL POST

SECTION K-K



## STEEL POST EMBEDDED IN CAISSON DIMENSION TABLE

HEIGHT ZONE=  
WIND PRESSURE =

[illegible]

TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. CAISSON REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DESIGN TABLES REFER TO SHEET 10.
3. FOR CAISSON LENGTHS REFER TO SHEET 14.
4. FOR PANEL SEAT DETAILS REFER TO BC-778M.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

DETAIL 3

RECOMMENDED AUG. 30, 2019  
*Louis J. Russo*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Melvin V. Bata*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 8 OF 14

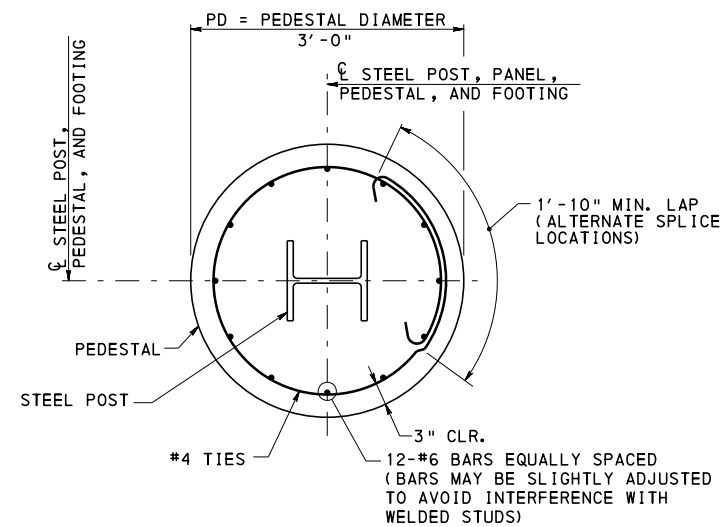
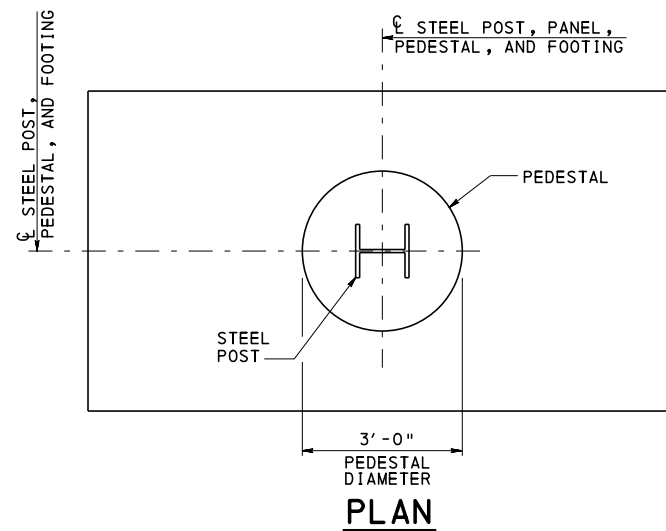
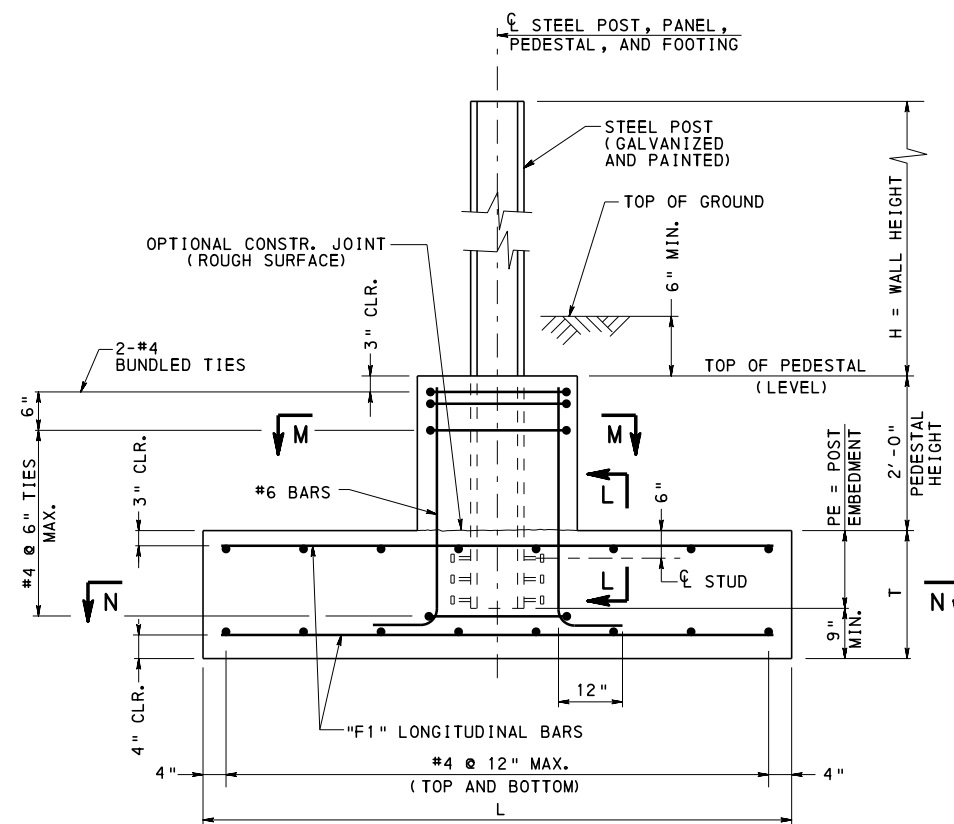
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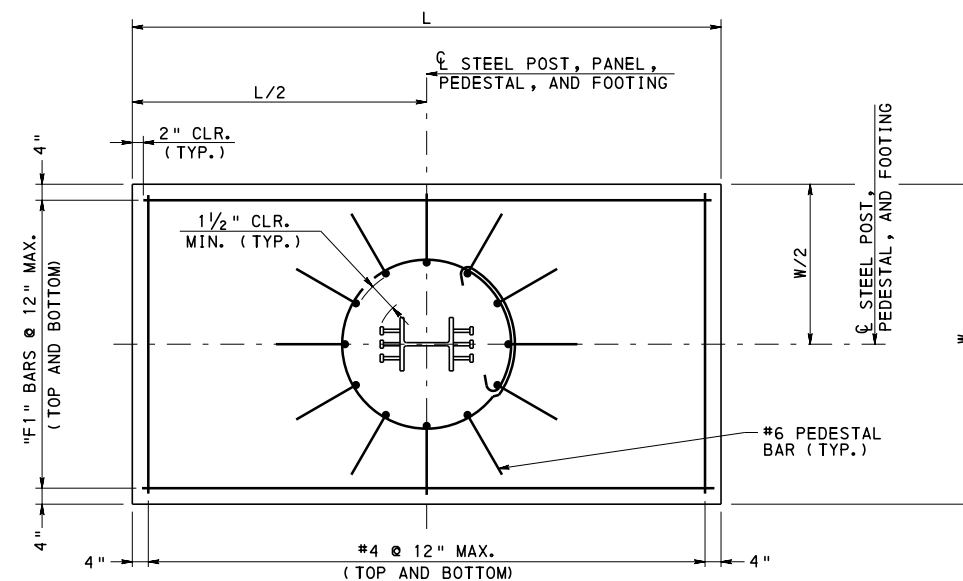
TABLE NOTES:

1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.

ELEVATION

ADJUST FOOTING TOP REINFORCEMENT SPACING TO CLEAR POST.

DETAIL 4  
STEEL POST EMBEDDED IN  
SPREAD FOOTING WITH PEDESTAL



SECTION N-N

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION L-L REFER TO SHEET 8.
3. FOR DESIGN TABLES REFER TO SHEET 10.
4. FOR PANEL SEAT DETAILS REFER TO BC-778M.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

DETAIL 4

RECOMMENDED AUG. 30, 2019  
*Donna J. R...*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Melvin P. Butler*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 9 OF 14

BD-678M



| DETAIL 3                                                                          |                              |               |                              |                                  |
|-----------------------------------------------------------------------------------|------------------------------|---------------|------------------------------|----------------------------------|
| STEEL POST<br>EMBEDDED IN CAISSON<br>HEIGHT ZONE 0'-14'<br>WIND PRESSURE = 20 PSF |                              |               |                              |                                  |
| STEEL POST                                                                        |                              |               |                              |                                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                    | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | NUMBER OF<br>WELDED<br>STUDS | POST<br>EMBEDMENT<br>PE<br>(IN.) |
| 12.0                                                                              | 6.0                          | W8x31         | 4                            | 53                               |
|                                                                                   | 8.0                          | W8x31         | 4                            | 53                               |
|                                                                                   | 10.0                         | W8x31         | 4                            | 53                               |
|                                                                                   | 12.0                         | W8x31         | 6                            | 57                               |
|                                                                                   | 14.0                         | W8x48         | 6                            | 57                               |
|                                                                                   | 16.0                         | W10x49        | 9                            | 57                               |
|                                                                                   | 18.0                         | W10x60        | 9                            | 57                               |
|                                                                                   | 20.0                         | W10x77        | 12                           | 61                               |
|                                                                                   | 22.0                         | W10x100       | 12                           | 61                               |
|                                                                                   | 24.0                         | W12x120       | 12                           | 61                               |
|                                                                                   | 26.0                         | W12x120       | 15                           | 65                               |
|                                                                                   | 28.0                         | W12x136       | 15                           | 65                               |
| 16.0                                                                              | 6.0                          | W8x31         | 4                            | 53                               |
|                                                                                   | 8.0                          | W8x31         | 4                            | 53                               |
|                                                                                   | 10.0                         | W8x31         | 4                            | 53                               |
|                                                                                   | 12.0                         | W8x35         | 6                            | 57                               |
|                                                                                   | 14.0                         | W10x49        | 9                            | 57                               |
|                                                                                   | 16.0                         | W10x54        | 9                            | 57                               |
|                                                                                   | 18.0                         | W10x77        | 12                           | 61                               |
|                                                                                   | 20.0                         | W10x100       | 12                           | 61                               |
|                                                                                   | 22.0                         | W12x120       | 12                           | 61                               |
|                                                                                   | 24.0                         | W12x120       | 15                           | 65                               |
|                                                                                   | 26.0                         | W12x152       | 18                           | 69                               |
|                                                                                   | 28.0                         | W12x170       | 18                           | 69                               |
| 20.0                                                                              | 6.0                          | W8x31         | 4                            | 53                               |
|                                                                                   | 8.0                          | W8x31         | 4                            | 53                               |
|                                                                                   | 10.0                         | W8x31         | 6                            | 57                               |
|                                                                                   | 12.0                         | W8x48         | 8                            | 61                               |
|                                                                                   | 14.0                         | W10x49        | 9                            | 57                               |
|                                                                                   | 16.0                         | W10x68        | 12                           | 61                               |
|                                                                                   | 18.0                         | W10x88        | 12                           | 61                               |
|                                                                                   | 20.0                         | W12x120       | 15                           | 65                               |
|                                                                                   | 22.0                         | W12x120       | 15                           | 65                               |
|                                                                                   | 24.0                         | W12x152       | 18                           | 69                               |
|                                                                                   | 26.0                         | W12x170       | 21                           | 73                               |

| DETAIL 3                                                                             |                              |               |                              |                                  |
|--------------------------------------------------------------------------------------|------------------------------|---------------|------------------------------|----------------------------------|
| STEEL POST<br>EMBEDDED IN CAISSON<br>HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF |                              |               |                              |                                  |
| STEEL POST                                                                           |                              |               |                              |                                  |
| POST<br>SPACING<br>PS<br>(FT.)                                                       | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | NUMBER OF<br>WELDED<br>STUDS | POST<br>EMBEDMENT<br>PE<br>(IN.) |
| 12.0                                                                                 | 6.0                          | W8x31         | 4                            | 53                               |
|                                                                                      | 8.0                          | W8x31         | 4                            | 53                               |
|                                                                                      | 10.0                         | W8x31         | 6                            | 57                               |
|                                                                                      | 12.0                         | W8x40         | 6                            | 57                               |
|                                                                                      | 14.0                         | W10x49        | 9                            | 57                               |
|                                                                                      | 16.0                         | W10x60        | 9                            | 57                               |
|                                                                                      | 18.0                         | W10x77        | 12                           | 61                               |
|                                                                                      | 20.0                         | W10x100       | 15                           | 65                               |
|                                                                                      | 22.0                         | W12x120       | 15                           | 65                               |
|                                                                                      | 24.0                         | W12x120       | 15                           | 65                               |
|                                                                                      | 26.0                         | W12x152       | 18                           | 69                               |
|                                                                                      | 28.0                         | W12x190       | 21                           | 73                               |
| 16.0                                                                                 | 6.0                          | W8x31         | 4                            | 53                               |
|                                                                                      | 8.0                          | W8x31         | 4                            | 53                               |
|                                                                                      | 10.0                         | W8x31         | 6                            | 57                               |
|                                                                                      | 12.0                         | W8x48         | 8                            | 61                               |
|                                                                                      | 14.0                         | W10x54        | 9                            | 57                               |
|                                                                                      | 16.0                         | W10x77        | 12                           | 61                               |
|                                                                                      | 18.0                         | W10x100       | 15                           | 65                               |
|                                                                                      | 20.0                         | W12x120       | 15                           | 65                               |
|                                                                                      | 22.0                         | W12x120       | 18                           | 69                               |
|                                                                                      | 24.0                         | W12x152       | 21                           | 73                               |
| 20.0                                                                                 | 6.0                          | W8x31         | 4                            | 53                               |
|                                                                                      | 8.0                          | W8x31         | 6                            | 57                               |
|                                                                                      | 10.0                         | W8x35         | 8                            | 61                               |
|                                                                                      | 12.0                         | W10x49        | 9                            | 57                               |
|                                                                                      | 14.0                         | W10x68        | 12                           | 61                               |
|                                                                                      | 16.0                         | W10x88        | 15                           | 65                               |
|                                                                                      | 18.0                         | W12x120       | 15                           | 65                               |
|                                                                                      | 20.0                         | W12x136       | 18                           | 69                               |
|                                                                                      | 22.0                         | W12x170       | 21                           | 73                               |

| DETAIL 4                                                                                             |                              |               |                              |                                  |                |            |            |                     |
|------------------------------------------------------------------------------------------------------|------------------------------|---------------|------------------------------|----------------------------------|----------------|------------|------------|---------------------|
| STEEL POST<br>EMBEDDED IN SPREAD FOOTING WITH PEDESTAL<br>HEIGHT ZONE 0'-14'<br>WIND PRESSURE 20 PSF |                              |               |                              |                                  |                |            |            |                     |
| STEEL POST                                                                                           |                              |               |                              |                                  | SPREAD FOOTING |            |            |                     |
| POST<br>SPACING<br>PS<br>(FT.)                                                                       | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | NUMBER OF<br>WELDED<br>STUDS | POST<br>EMBEDMENT<br>PE<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR<br>SIZE) |
| 12.0                                                                                                 | 6.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.0        | 5.0        | #4                  |
|                                                                                                      | 8.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.0        | 5.0        | #4                  |
|                                                                                                      | 10.0                         | W8x31         | 4                            | 12                               | 1.75           | 5.5        | 5.0        | #4                  |
|                                                                                                      | 12.0                         | W8x31         | 6                            | 16                               | 2.25           | 6.5        | 5.0        | #4                  |
|                                                                                                      | 14.0                         | W8x48         | 6                            | 16                               | 2.25           | 7.0        | 5.0        | #4                  |
|                                                                                                      | 16.0                         | W10x49        | 9                            | 16                               | 2.25           | 8.0        | 5.0        | #4                  |
|                                                                                                      | 18.0                         | W10x60        | 9                            | 16                               | 2.25           | 8.5        | 5.0        | #5                  |
|                                                                                                      | 20.0                         | W10x77        | 12                           | 20                               | 2.5            | 9.0        | 5.0        | #5                  |
|                                                                                                      | 22.0                         | W10x100       | 12                           | 20                               | 2.5            | 9.5        | 5.0        | #5                  |
|                                                                                                      | 24.0                         | W12x120       | 12                           | 20                               | 2.5            | 10.0       | 5.0        | #5                  |
|                                                                                                      | 26.0                         | W12x120       | 15                           | 24                               | 2.75           | 10.5       | 5.5        | #5                  |
|                                                                                                      | 28.0                         | W12x136       | 15                           | 24                               | 2.75           | 11.0       | 5.5        | #6                  |
| 16.0                                                                                                 | 6.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.0        | 5.0        | #4                  |
|                                                                                                      | 8.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.5        | 5.0        | #4                  |
|                                                                                                      | 10.0                         | W8x31         | 4                            | 12                               | 1.75           | 6.5        | 5.0        | #4                  |
|                                                                                                      | 12.0                         | W8x35         | 6                            | 16                               | 2.25           | 7.0        | 5.0        | #4                  |
|                                                                                                      | 14.0                         | W10x49        | 9                            | 16                               | 2.25           | 8.0        | 5.0        | #4                  |
|                                                                                                      | 16.0                         | W10x54        | 9                            | 16                               | 2.25           | 8.5        | 5.0        | #5                  |
|                                                                                                      | 18.0                         | W10x77        | 12                           | 20                               | 2.5            | 9.0        | 5.0        | #5                  |
|                                                                                                      | 20.0                         | W10x100       | 12                           | 20                               | 2.5            | 10.0       | 5.0        | #5                  |
|                                                                                                      | 22.0                         | W12x120       | 12                           | 20                               | 2.5            | 10.0       | 5.5        | #6                  |
|                                                                                                      | 24.0                         | W12x120       | 15                           | 24                               | 2.75           | 11.0       | 5.5        | #6                  |
|                                                                                                      | 26.0                         | W12x152       | 18                           | 28                               | 3.25           | 11.0       | 6.0        | #6                  |
|                                                                                                      | 28.0                         | W12x170       | 18                           | 28                               | 3.25           | 11.5       | 6.0        | #6                  |
| 20.0                                                                                                 | 6.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.0        | 5.0        | #4                  |
|                                                                                                      | 8.0                          | W8x31         | 4                            | 12                               | 1.75           | 6.0        | 5.0        | #4                  |
|                                                                                                      | 10.0                         | W8x31         | 6                            | 16                               | 2.25           | 7.0        | 5.0        | #4                  |
|                                                                                                      | 12.0                         | W8x48         | 8                            | 20                               | 2.5            | 7.5        | 5.0        | #4                  |
|                                                                                                      | 14.0                         | W10x49        | 9                            | 16                               | 2.5            | 8.5        | 5.0        | #5                  |
|                                                                                                      | 16.0                         | W10x68        | 12                           | 20                               | 2.5            | 9.0        | 5.0        | #5                  |
|                                                                                                      | 18.0                         | W10x88        | 12                           | 20                               | 2.5            | 10.0       | 5.0        | #6                  |
|                                                                                                      | 20.0                         | W12x120       | 15                           | 24                               | 2.75           | 10.5       | 5.5        | #6                  |
|                                                                                                      | 22.0                         | W12x120       | 15                           | 24                               | 2.75           | 11.0       | 5.5        | #6                  |
|                                                                                                      | 24.0                         | W12x152       | 18                           | 28                               | 3.25           | 11.0       | 6.0        | #6                  |
|                                                                                                      | 26.0                         | W12x170       | 21                           | 32                               | 3.5            | 12.0       | 6.0        | #6                  |

| DETAIL 4                                                                                                |                              |               |                              |                                  |                |            |            |                     |
|---------------------------------------------------------------------------------------------------------|------------------------------|---------------|------------------------------|----------------------------------|----------------|------------|------------|---------------------|
| STEEL POST<br>EMBEDDED IN SPREAD FOOTING WITH PEDESTAL<br>HEIGHT ZONES OVER 14'<br>WIND PRESSURE 28 PSF |                              |               |                              |                                  |                |            |            |                     |
| STEEL POST                                                                                              |                              |               |                              |                                  | SPREAD FOOTING |            |            |                     |
| POST<br>SPACING<br>PS<br>(FT.)                                                                          | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | NUMBER OF<br>WELDED<br>STUDS | POST<br>EMBEDMENT<br>PE<br>(IN.) | T<br>(FT.)     | L<br>(FT.) | W<br>(FT.) | F1<br>(BAR<br>SIZE) |
| 12.0                                                                                                    | 6.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.0        | 5.0        | #4                  |
|                                                                                                         | 8.0                          | W8x31         | 4                            | 12                               | 1.75           | 6.0        | 5.0        | #4                  |
|                                                                                                         | 10.0                         | W8x31         | 6                            | 16                               | 2.25           | 7.0        | 5.0        | #4                  |
|                                                                                                         | 12.0                         | W8x40         | 6                            | 16                               | 2.25           | 8.0        | 5.0        | #4                  |
|                                                                                                         | 14.0                         | W10x49        | 9                            | 16                               | 2.25           | 9.0        | 5.0        | #4                  |
|                                                                                                         | 16.0                         | W10x60        | 9                            | 16                               | 2.25           | 9.5        | 5.0        | #5                  |
|                                                                                                         | 18.0                         | W10x77        | 12                           | 20                               | 2.5            | 10.0       | 5.0        | #5                  |
|                                                                                                         | 20.0                         | W10x100       | 15                           | 24                               | 2.75           | 10.5       | 5.5        | #5                  |
|                                                                                                         | 22.0                         | W12x120       | 15                           | 24                               | 2.75           | 11.0       | 5.5        | #5                  |
|                                                                                                         | 24.0                         | W12x120       | 15                           | 24                               | 2.75           | 11.5       | 6.0        | #6                  |
|                                                                                                         | 26.0                         | W12x152       | 18                           | 28                               | 3.25           | 12.0       | 6.0        | #6                  |
|                                                                                                         | 28.0                         | W12x190       | 21                           | 32                               | 3.5            | 12.0       | 6.5        | #6                  |
| 16.0                                                                                                    | 6.0                          | W8x31         | 4                            | 12                               | 1.75           | 5.5        | 5.0        | #4                  |
|                                                                                                         | 8.0                          | W8x31         | 4                            | 12                               | 1.75           | 6.5        | 5.0        | #4                  |
|                                                                                                         | 10.0                         | W8x31         | 6                            | 16                               | 2.25           | 7.5        | 5.0        | #4                  |
|                                                                                                         | 12.0                         | W8x48         | 8                            | 20                               | 2.5            | 8.5        | 5.0        | #4                  |
|                                                                                                         | 14.0                         | W10x54        | 9                            | 16                               | 2.5            | 9.5        | 5.0        | #5                  |
|                                                                                                         | 16.0                         | W10x77        | 12                           | 20                               | 2.5            | 10.0       | 5.5        | #5                  |
|                                                                                                         | 18.0                         | W10x100       | 15                           | 24                               | 2.75           | 10.5       | 5.5        | #5                  |
|                                                                                                         | 20.0                         | W12x120       | 15                           | 24                               | 2.75           | 11.0       | 6.0        | #6                  |
|                                                                                                         | 22.0                         | W12x120       | 18                           | 28                               | 3.25           | 12.0       | 6.0        | #6                  |
|                                                                                                         | 24.0                         | W12x152       | 21                           | 32                               | 3.5            | 12.0       | 6.5        | #6                  |
| 20.0                                                                                                    | 6.0                          | W8x31         | 4                            | 12                               | 1.75           | 6.0        | 5.0        | #4                  |
|                                                                                                         | 8.0                          | W8x31         | 6                            | 16                               | 2.25           | 7.0        | 5.0        | #4                  |
|                                                                                                         | 10.0                         | W8x35         | 8                            | 20                               | 2.5            | 8.5        | 5.0        | #4                  |
|                                                                                                         | 12.0                         | W10x49        | 9                            | 16                               | 2.5            | 9.0        | 5.0        | #5                  |
|                                                                                                         | 14.0                         | W10x68        | 12                           | 20                               | 2.5            | 10.0       | 5.0        | #5                  |
|                                                                                                         | 16.0                         | W10x88        | 15                           | 24                               | 2.75           | 10.5       | 5.5        | #6                  |
|                                                                                                         | 18.0                         | W12x120       | 15                           | 24                               | 2.75           | 11.5       | 6.0        | #6                  |
|                                                                                                         | 20.0                         | W12x136       | 18                           | 28                               | 3.25           | 12.0       | 6.0        | #6                  |
|                                                                                                         | 22.0                         | W12x170       | 21                           | 32                               | 3.5            | 12.5       | 6.5        | #6                  |

NOTES:

1. FOR ADDITIONAL INFORMATION REFER  
TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAILS, REFER TO SHEETS 8 AND 9.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

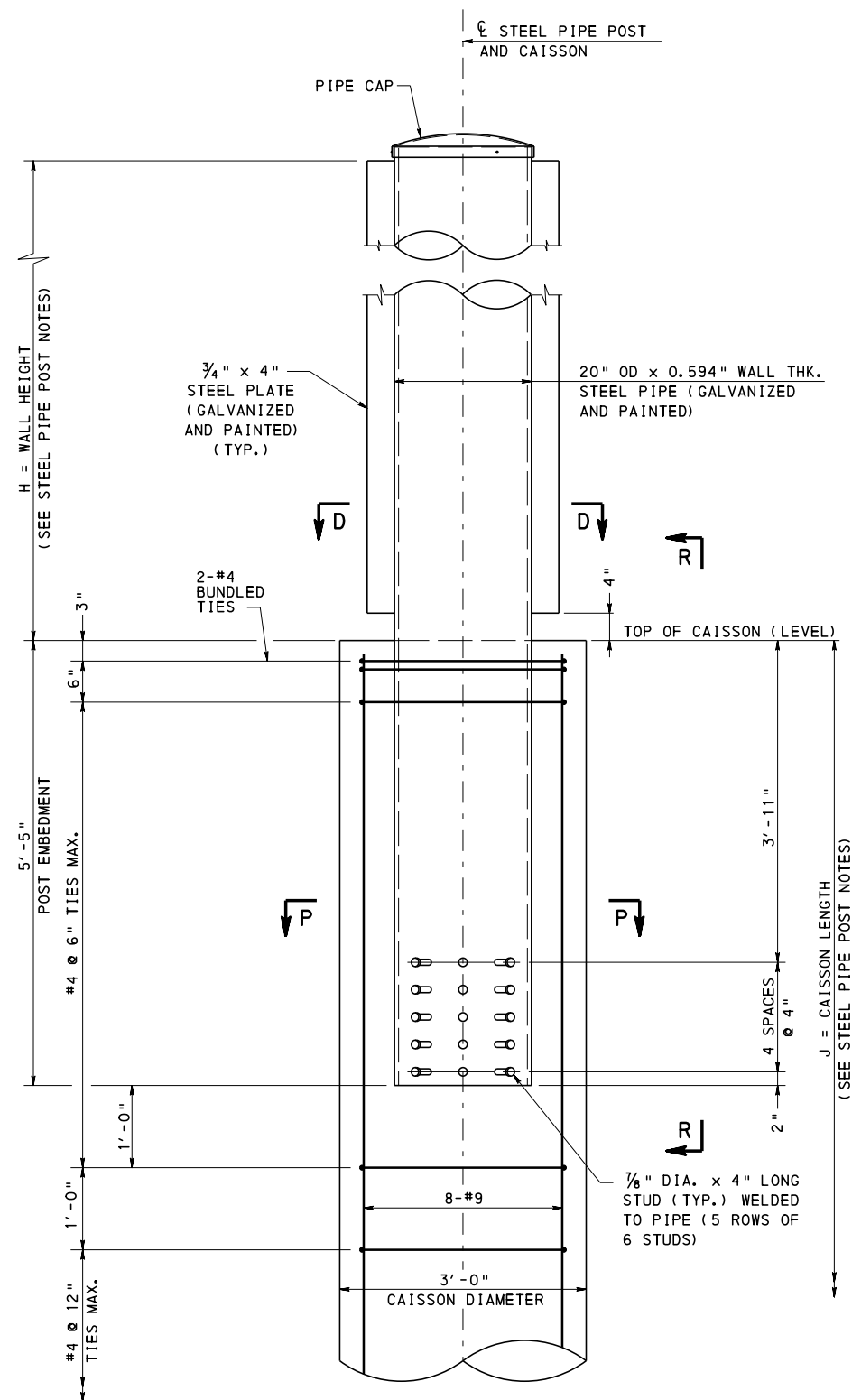
DETAIL 3 AND DETAIL 4 DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
*James J. Rizzo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. Bate*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 10 OF 14

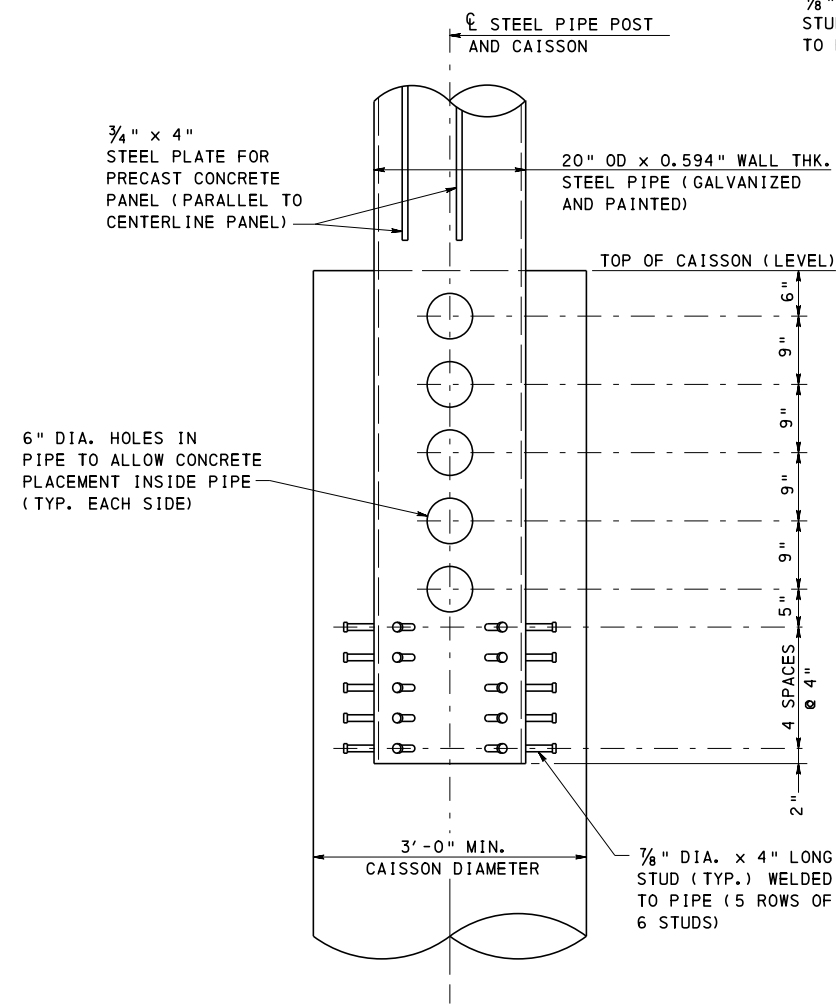
BD-678M



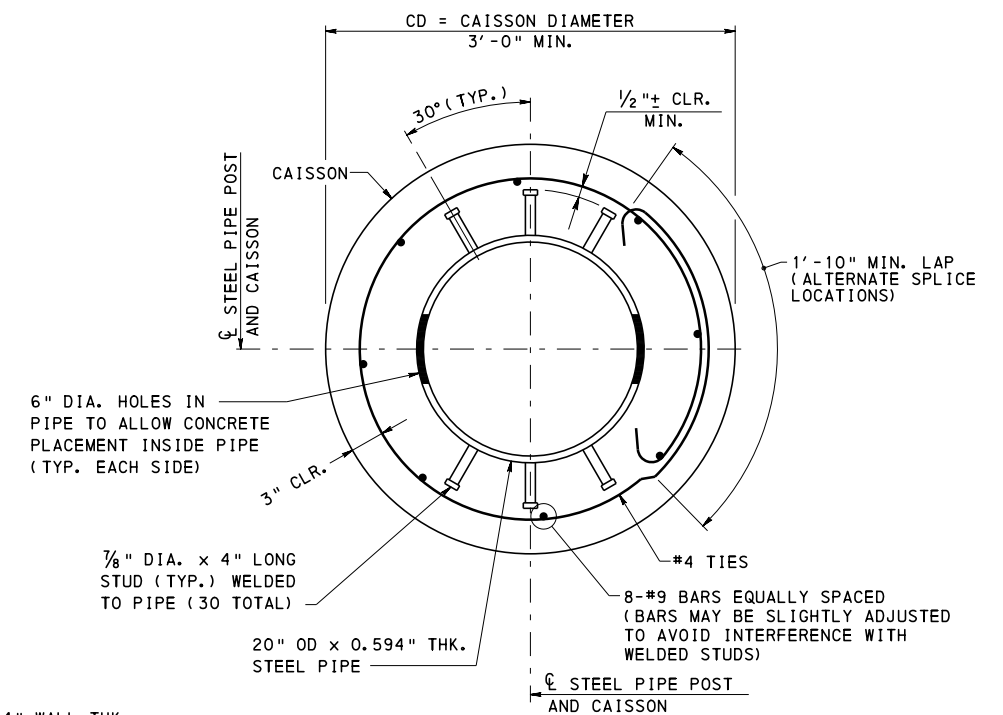
ELEVATION

DETAIL 5

CORNER/ANGLED STEEL PIPE POST  
EMBEDDED IN CAISSON



SECTION R-R



SECTION P-P

NOTES:


1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION D-D REFER TO SHEET 13.
3. FOR STEEL PIPE POST NOTES REFER TO SHEET 13.
4. FOR PIPE CAP DETAIL REFER TO BC-778M.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

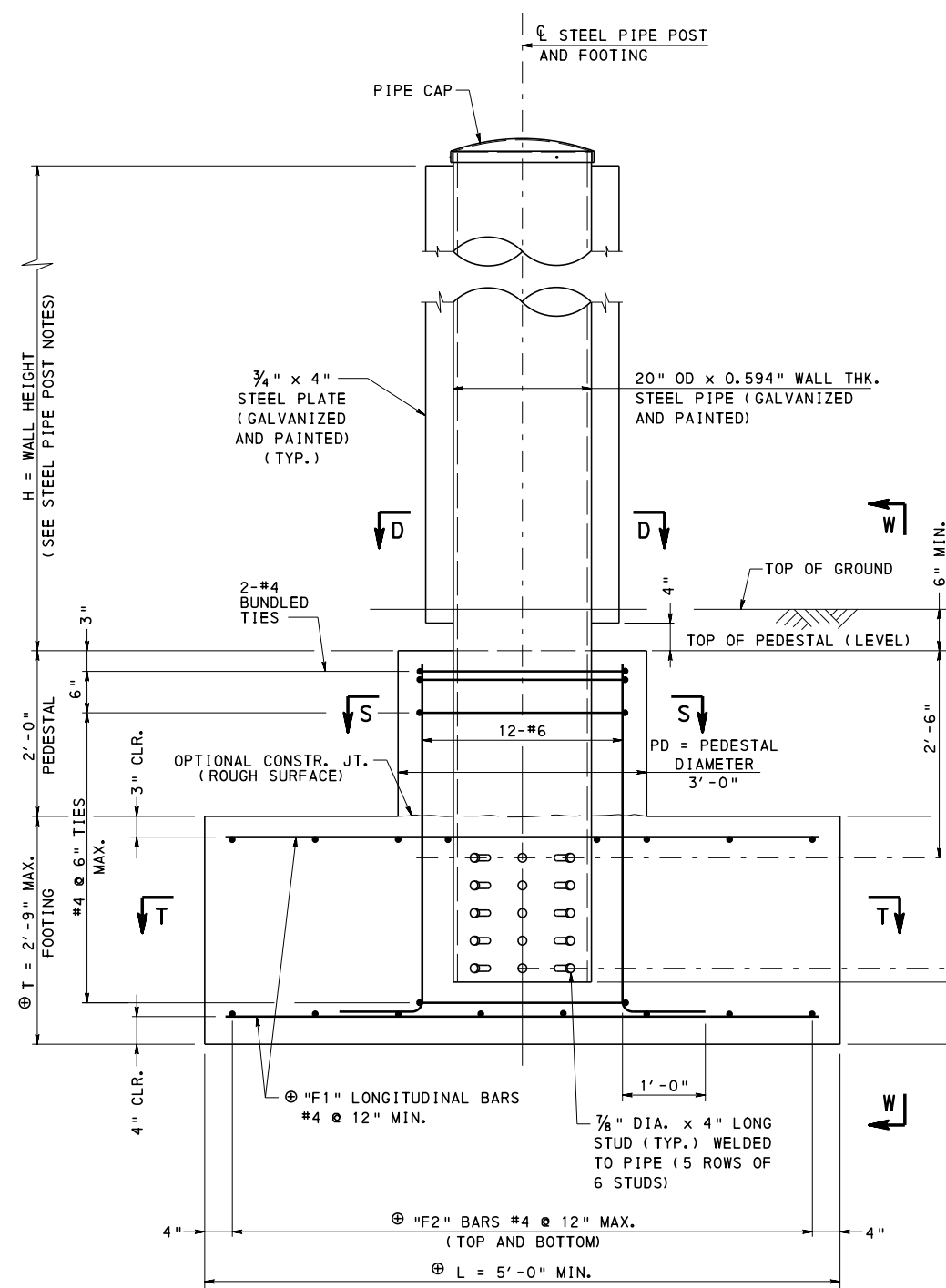
STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

DETAIL 5

RECOMMENDED AUG. 30, 2019  
*Joris J. Runyon*  
 ACTING CHIEF BRIDGE ENGINEER

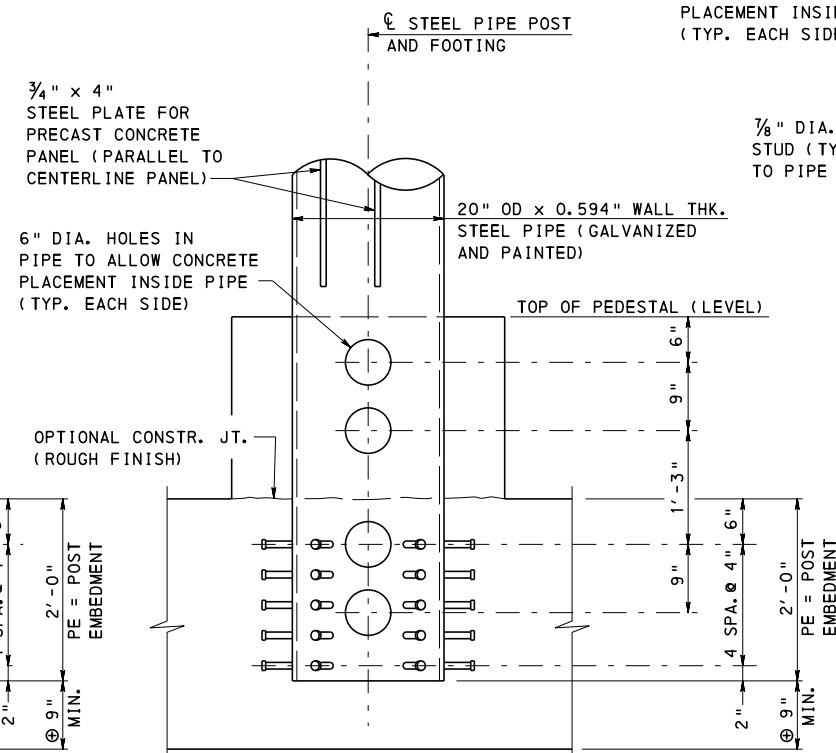
RECOMMENDED AUG. 30, 2019  
  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 11 OF 14  
BD-678M

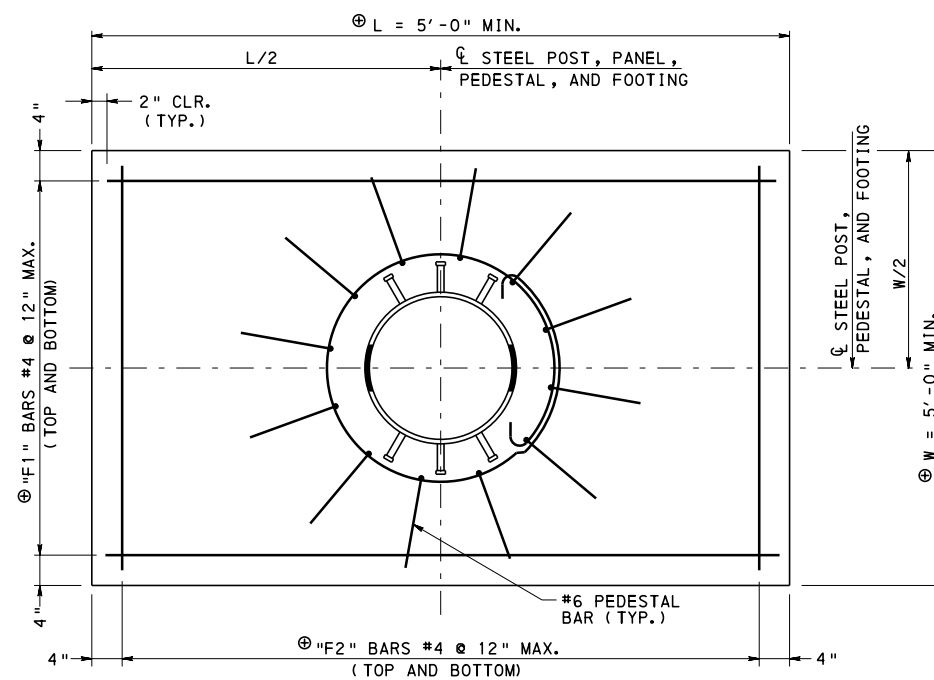
ELEVATION

ADJUST FOOTING TOP REINFORCEMENT SPACING TO CLEAR POST.

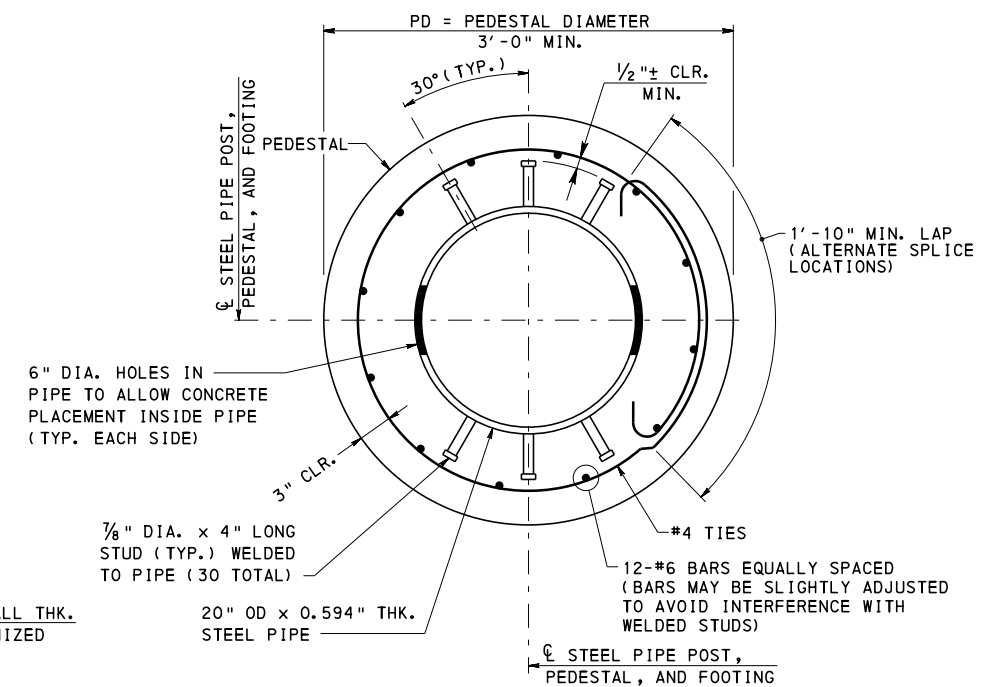
**DETAIL 6**  
**CORNER/ANGLED STEEL PIPE POST EMBEDDED**  
**IN SPREAD FOOTING WITH PEDESTAL**



## SECTION W-W



SECTION T-T



SECTION S-S

LEGEND:

⊕ MIN. SIZE SHOWN,  
PROVIDE SIZE REQUIRED PER DESIGN

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION D-D REFER TO SHEET 13.
3. FOR STEEL PIPE POST NOTES REFER TO SHEET 13.
4. FOR PIPE CAP DETAIL REFER TO BC-778M.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

DETAIL 6

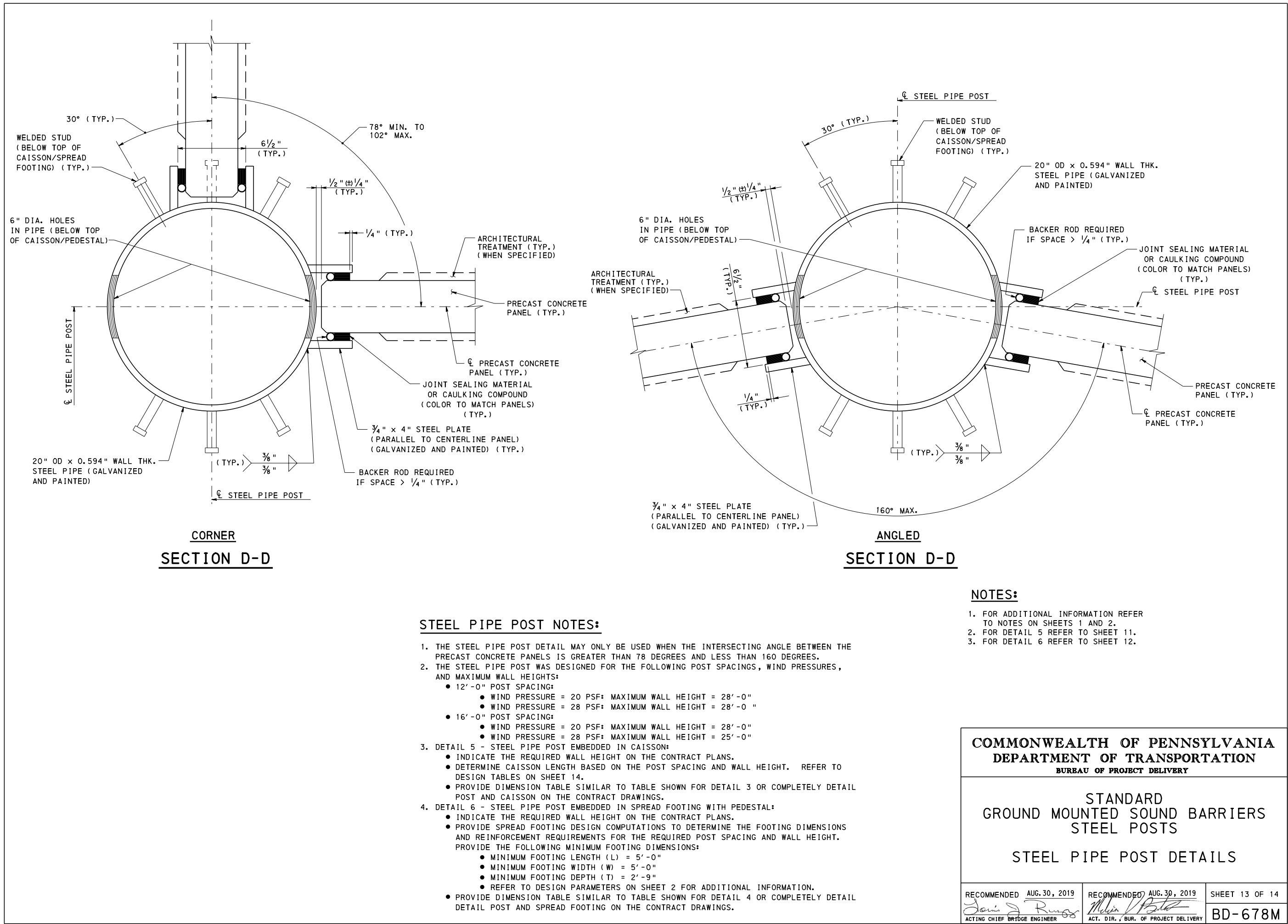
RECOMMENDED AUG. 30, 2019  
*Louis J. Ruz*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Melvin J. Banta*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 12 OF 14

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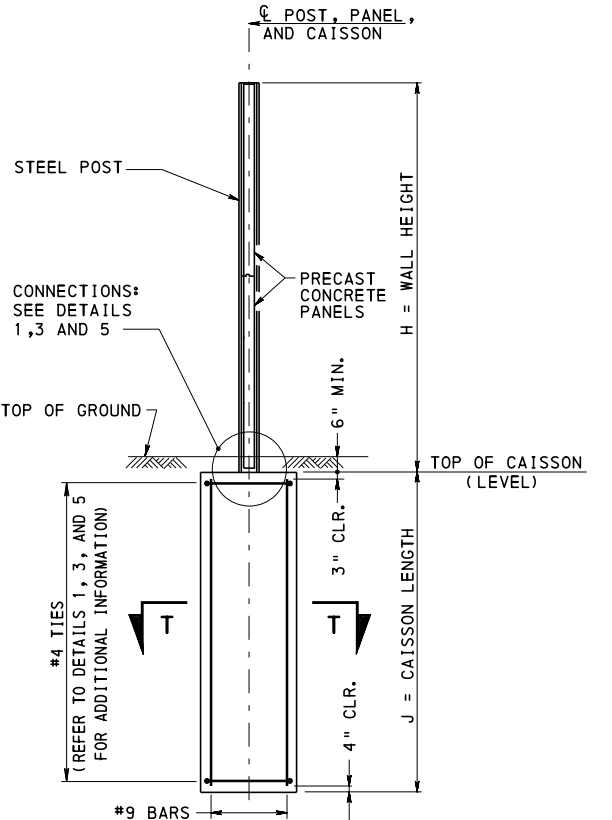
BD-678M



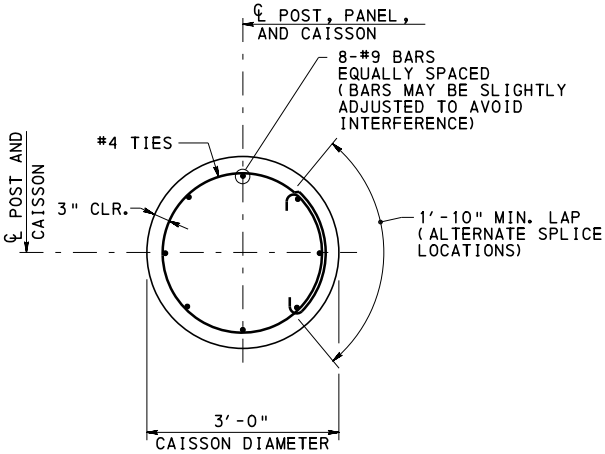
| CAISSON LENGTH<br>WIND PRESSURE = 28 PSF                                                                                               |                     |         |                                                                                                                                          |                     |         |                                                                                                                                          |                     |         |                                                                                                                                           |                     |         |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------|
| TYPE 1 SOIL<br>SATURATED LOOSE SAND                                                                                                    |                     |         | TYPE 2 SOIL<br>DRY MEDIUM DENSE SAND                                                                                                     |                     |         | TYPE 3 SOIL<br>SATURATED SOFT CLAY                                                                                                       |                     |         | TYPE 4 SOIL<br>DRY MEDIUM STIFF CLAY                                                                                                      |                     |         |
| SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 30°<br>2. C = 0 LB./SQ. FT.<br>3. UNIT WEIGHT = 100 LB./CU. FT.<br>4. K = 20 LB./CU. IN. |                     |         | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 34°<br>2. C = 0.0 LB./SQ. FT.<br>3. UNIT WEIGHT = 120 LB./CU. FT.<br>4. K = 90 LB./CU. IN. |                     |         | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 0°<br>2. C = 500 LB./SQ. FT.<br>3. UNIT WEIGHT = 100 LB./CU. FT.<br>4. K = 100 LB./CU. IN. |                     |         | SOIL PROPERTIES:<br>1. ANGLE OF INT. FRICT. = 0°<br>2. C = 1000 LB./SQ. FT.<br>3. UNIT WEIGHT = 120 LB./CU. FT.<br>4. K = 200 LB./CU. IN. |                     |         |
| POST SPACING PS (FT.)                                                                                                                  | WALL HEIGHT H (FT.) | J (FT.) | POST SPACING PS (FT.)                                                                                                                    | WALL HEIGHT H (FT.) | J (FT.) | POST SPACING PS (FT.)                                                                                                                    | WALL HEIGHT H (FT.) | J (FT.) | POST SPACING PS (FT.)                                                                                                                     | WALL HEIGHT H (FT.) | J (FT.) |
| 12.0                                                                                                                                   | 6.0                 | 12.0    | 12.0                                                                                                                                     | 6.0                 | 9.0     | 12.0                                                                                                                                     | 6.0                 | 9.5     | 12.0                                                                                                                                      | 6.0                 | 9.0     |
|                                                                                                                                        | 8.0                 | 13.0    |                                                                                                                                          | 8.0                 | 9.0     |                                                                                                                                          | 8.0                 | 11.0    |                                                                                                                                           | 8.0                 | 9.0     |
|                                                                                                                                        | 10.0                | 14.5    |                                                                                                                                          | 10.0                | 10.0    |                                                                                                                                          | 10.0                | 13.0    |                                                                                                                                           | 10.0                | 9.0     |
|                                                                                                                                        | 12.0                | 15.5    |                                                                                                                                          | 12.0                | 10.5    |                                                                                                                                          | 12.0                | 14.5    |                                                                                                                                           | 12.0                | 10.0    |
|                                                                                                                                        | 14.0                | 16.5    |                                                                                                                                          | 14.0                | 11.0    |                                                                                                                                          | 14.0                | 16.0    |                                                                                                                                           | 14.0                | 10.5    |
|                                                                                                                                        | 16.0                | 17.5    |                                                                                                                                          | 16.0                | 11.5    |                                                                                                                                          | 16.0                | 18.0    |                                                                                                                                           | 16.0                | 11.5    |
|                                                                                                                                        | 18.0                | 18.5    |                                                                                                                                          | 18.0                | 12.0    |                                                                                                                                          | 18.0                | 19.5    |                                                                                                                                           | 18.0                | 12.5    |
|                                                                                                                                        | 20.0                | 19.0    |                                                                                                                                          | 20.0                | 12.5    |                                                                                                                                          | 20.0                | 21.0    |                                                                                                                                           | 20.0                | 13.5    |
|                                                                                                                                        | 22.0                | 20.0    |                                                                                                                                          | 22.0                | 13.0    |                                                                                                                                          | 22.0                | 22.5    |                                                                                                                                           | 22.0                | 14.5    |
|                                                                                                                                        | 24.0                | 21.0    |                                                                                                                                          | 24.0                | 13.5    |                                                                                                                                          | 24.0                | 24.0    |                                                                                                                                           | 24.0                | 15.0    |
| 16.0                                                                                                                                   | 26.0                | 22.0    | 16.0                                                                                                                                     | 26.0                | 14.0    | 16.0                                                                                                                                     | 26.0                | 25.5    | 16.0                                                                                                                                      | 26.0                | 16.0    |
|                                                                                                                                        | 28.0                | 23.0    |                                                                                                                                          | 28.0                | 14.5    |                                                                                                                                          | 28.0                | 27.0    |                                                                                                                                           | 28.0                | 17.0    |
|                                                                                                                                        | 6.0                 | 13.0    |                                                                                                                                          | 6.0                 | 9.0     |                                                                                                                                          | 6.0                 | 10.5    |                                                                                                                                           | 6.0                 | 9.0     |
|                                                                                                                                        | 8.0                 | 14.0    |                                                                                                                                          | 8.0                 | 9.5     |                                                                                                                                          | 8.0                 | 13.0    |                                                                                                                                           | 8.0                 | 9.0     |
|                                                                                                                                        | 10.0                | 15.5    |                                                                                                                                          | 10.0                | 10.5    |                                                                                                                                          | 10.0                | 15.0    |                                                                                                                                           | 10.0                | 10.0    |
|                                                                                                                                        | 12.0                | 17.0    |                                                                                                                                          | 12.0                | 11.0    |                                                                                                                                          | 12.0                | 17.0    |                                                                                                                                           | 12.0                | 11.0    |
|                                                                                                                                        | 14.0                | 18.0    |                                                                                                                                          | 14.0                | 12.0    |                                                                                                                                          | 14.0                | 18.5    |                                                                                                                                           | 14.0                | 12.0    |
|                                                                                                                                        | 16.0                | 19.0    |                                                                                                                                          | 16.0                | 12.5    |                                                                                                                                          | 16.0                | 20.5    |                                                                                                                                           | 16.0                | 13.0    |
|                                                                                                                                        | 18.0                | 20.0    |                                                                                                                                          | 18.0                | 13.0    |                                                                                                                                          | 18.0                | 22.0    |                                                                                                                                           | 18.0                | 14.0    |
|                                                                                                                                        | 20.0                | 21.0    |                                                                                                                                          | 20.0                | 13.5    |                                                                                                                                          | 20.0                | 24.0    |                                                                                                                                           | 20.0                | 15.0    |
| 20.0                                                                                                                                   | 22.0                | 22.0    | 20.0                                                                                                                                     | 22.0                | 14.5    | 20.0                                                                                                                                     | 22.0                | 26.0    | 20.0                                                                                                                                      | 22.0                | 16.0    |
|                                                                                                                                        | 24.0                | 23.5    |                                                                                                                                          | 24.0                | 15.0    |                                                                                                                                          | 24.0                | 28.0    |                                                                                                                                           | 24.0                | 17.0    |
|                                                                                                                                        | 26.0                | 24.5    |                                                                                                                                          | 26.0                | 15.5    |                                                                                                                                          | 26.0                | 29.5    |                                                                                                                                           | 26.0                | 18.0    |
|                                                                                                                                        | 28.0                | 25.5    |                                                                                                                                          | 28.0                | 16.0    |                                                                                                                                          | 28.0                | 31.5    |                                                                                                                                           | 28.0                | 19.0    |
|                                                                                                                                        | 6.0                 | 13.5    |                                                                                                                                          | 6.0                 | 9.5     |                                                                                                                                          | 6.0                 | 12.0    |                                                                                                                                           | 6.0                 | 9.0     |
|                                                                                                                                        | 8.0                 | 15.5    |                                                                                                                                          | 8.0                 | 10.5    |                                                                                                                                          | 8.0                 | 14.0    |                                                                                                                                           | 8.0                 | 9.5     |
|                                                                                                                                        | 10.0                | 17.0    |                                                                                                                                          | 10.0                | 11.0    |                                                                                                                                          | 10.0                | 16.5    |                                                                                                                                           | 10.0                | 10.5    |
|                                                                                                                                        | 12.0                | 18.0    |                                                                                                                                          | 12.0                | 12.0    |                                                                                                                                          | 12.0                | 18.5    |                                                                                                                                           | 12.0                | 12.0    |
|                                                                                                                                        | 14.0                | 19.0    |                                                                                                                                          | 14.0                | 12.5    |                                                                                                                                          | 14.0                | 21.0    |                                                                                                                                           | 14.0                | 13.0    |
|                                                                                                                                        | 16.0                | 20.5    |                                                                                                                                          | 16.0                | 13.5    |                                                                                                                                          | 16.0                | 23.0    |                                                                                                                                           | 16.0                | 14.5    |
| 20.0                                                                                                                                   | 18.0                | 22.0    | 20.0                                                                                                                                     | 18.0                | 14.0    | 20.0                                                                                                                                     | 18.0                | 25.0    | 20.0                                                                                                                                      | 18.0                | 15.5    |
|                                                                                                                                        | 20.0                | 23.5    |                                                                                                                                          | 20.0                | 14.5    |                                                                                                                                          | 20.0                | 27.0    |                                                                                                                                           | 20.0                | 17.0    |
|                                                                                                                                        | 22.0                | 25.0    |                                                                                                                                          | 22.0                | 15.5    |                                                                                                                                          | 22.0                | 29.5    |                                                                                                                                           | 22.0                | 18.0    |
|                                                                                                                                        | 24.0                | 26.5    |                                                                                                                                          | 24.0                | 16.0    |                                                                                                                                          | 24.0                | 32.0    |                                                                                                                                           | 24.0                | 19.0    |
|                                                                                                                                        | 26.0                | 28.0    |                                                                                                                                          | 26.0                | 16.5    |                                                                                                                                          | 26.0                | 34.5    |                                                                                                                                           | 26.0                | 20.0    |
|                                                                                                                                        |                     |         |                                                                                                                                          |                     |         |                                                                                                                                          |                     |         |                                                                                                                                           |                     |         |

INSTRUCTIONS FOR DETERMINING CAISSON LENGTHS:

1. DETERMINE REQUIRED POST SPACING AND WALL HEIGHT.
2. DETERMINE SOIL TYPE BASED ON THE INFORMATION SHOWN IN THE ACCEPTED STRUCTURE FOUNDATION GEOTECHNICAL REPORT. SELECT THE SOIL TYPE WHICH HAS A STRENGTH LESS THAN OR EQUAL TO THE ACTUAL SOIL STRENGTH. ALTERNATE CAISSON DESIGNS ARE PERMITTED IF SOIL PROPERTIES DIFFER FROM THOSE INDICATED FOR THE FOUR SOIL TYPES.
3. DETERMINE GROUND WATER LEVEL. IF GROUND WATER IS WITHIN THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 AND TYPE 4 SOILS, USE THE CAISSON LENGTH IN THE TABLES FOR TYPE 1 OR TYPE 3 SOILS. IF GROUND WATER IS NOT WITHIN CAISSON LENGTH, USE THE CAISSON LENGTH INDICATED IN THE TABLES FOR TYPE 2 OR TYPE 4 SOILS.
4. MINIMUM CAISSON LENGTH IN SOIL = 9'-0".



ELEVATION



SECTION T-T  
CAISSON

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL 1 REFER TO SHEET 4.
3. FOR DETAIL 3 REFER TO SHEET 8.
4. FOR DETAIL 5 REFER TO SHEET 11.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
GROUND MOUNTED SOUND BARRIERS  
STEEL POSTS

CAISSON DESIGN TABLES

RECOMMENDED AUG. 30, 2019  
[Signature]  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
[Signature]  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 14 OF 14  
BD-678M

GENERAL NOTES

- CHANGE 2
- CHANGE 3
1. DESIGN SPECIFICATIONS:

● PENNDOT DESIGN MANUAL, PART 4, STRUCTURES APRIL 2015 EDITION.

● 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.

● 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION,

● 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERMINS THROUGH 2006.

● DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS.)
2. CONSTRUCTION SPECIFICATIONS AND WORK QUALITY:

● PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5)
3. DESIGN LOADS:

● WIND LOAD:

● THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.

● STRUCTURE MOUNTED SOUND BARRIERS ARE DESIGNED FOR A WIND PRESSURE OF 37 PSF.

● ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL AND POST.

● SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
5. PANEL HEIGHTS:

● BARRIERS MOUNTED ON BRIDGES:

● 2'-0" MINIMUM TO 10'-0" MAXIMUM

● PROVIDE A MAXIMUM POST SPACING OF 8'-0" WHEN PANEL HEIGHT IS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0"

● STACKED PANELS ARE NOT PERMITTED

● BARRIERS MOUNTED ON RETAINING WALLS AND MOMENT SLABS:

● 2'-0" MINIMUM TO 9'-0" MAXIMUM

● PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 9'-0"
6. PANEL JOINTS:

● PROVIDE FULL HEIGHT PANELS ON BARRIERS MOUNTED ON BRIDGES.

● MINIMIZE THE NUMBER OF PANEL JOINTS.

● PROVIDE UNIFORM STEPS.

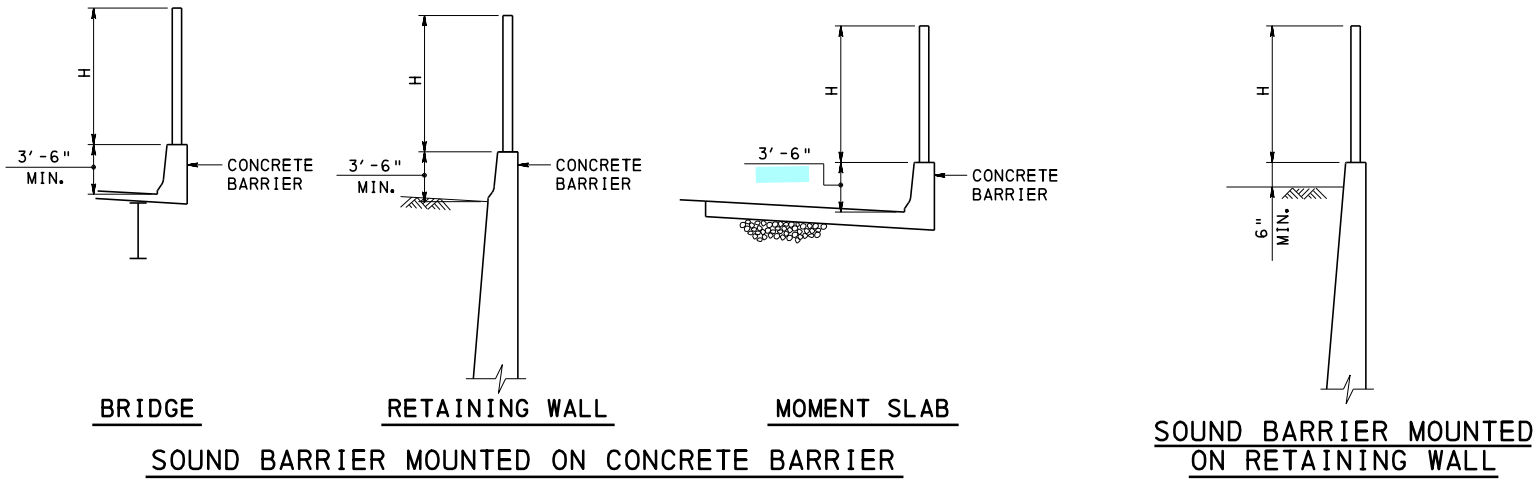
● IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0" AND MAY NOT OCCUR MORE FREQUENTLY THAN ONCE EVERY 50'-0" OF WALL LENGTH.
7. PRECAST CONCRETE POSTS ARE NOT PERMITTED FOR STRUCTURE MOUNTED SOUND BARRIERS, PROVIDE STEEL POSTS.
8. STEEL CABLES ARE REQUIRED IN ALL STRUCTURE MOUNTED PRECAST CONCRETE PANELS UNLESS BOTH SIDES OF THE PANEL ARE LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT. STEEL CABLES ARE ALWAYS REQUIRED IN THE BRIDGE MOUNTED PRECAST CONCRETE PANELS.
9. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PANELS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAFFIC LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.
10. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
11. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.
12. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
13. FOR ADDITIONAL INFORMATION REFER TO BC-779M.

MATERIAL NOTES

1. REFER TO BC-779M FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS AND STEEL POSTS ARE DEVELOPED FOR A WIND PRESSURE OF 37 PSF.
2. THE INFORMATION SHOWN IN THE TABLES MUST BE USED FOR ALL HEIGHT ZONES.
3. THE DESIGN POST SPACING (CENTER-TO-CENTER POSTS) IS TO BE THE ACTUAL POST SPACING ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF POST SPACING SHOWN ON THE DESIGN TABLES.
4. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.
5. THE DESIGN PANEL HEIGHT IS TO BE THE ACTUAL PANEL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF PANEL HEIGHT SHOWN ON THE DESIGN TABLES.



STRUCTURE MOUNTED SOUND BARRIERS

| INDEX OF SHEETS |                                                                     |
|-----------------|---------------------------------------------------------------------|
| SHT. NO.        | SHEET TITLE                                                         |
| 1               | GENERAL NOTES - 1                                                   |
| 2               | GENERAL NOTES - 2                                                   |
| 3               | GEOMETRY AND LAYOUT                                                 |
| 4               | MISCELLANEOUS DETAILS                                               |
| 5               | PRECAST CONCRETE PANEL DETAILS - 1                                  |
| 6               | PRECAST CONCRETE PANEL DETAILS - 2                                  |
| 7               | BARRIER MOUNTED ON BRIDGES DESIGN TABLES AND DETAILS                |
| 8               | BARRIER MOUNTED ON WALLS AND MOMENT SLABS DESIGN TABLES AND DETAILS |
| 9               | WALL MOUNTED DESIGN TABLES AND DETAILS                              |
| 10              | STRUCTURE MOUNTED TO GROUND MOUNTED DETAILS                         |
| 11              | EXPANSION PANEL DETAILS                                             |

|         |                                                                         |
|---------|-------------------------------------------------------------------------|
| BD-601M | CONCRETE DECK SLAB                                                      |
| BD-618M | VERTICAL WALL CONCRETE BARRIER                                          |
| BD-622M | R. C. ABUTMENTS WITH BACKWALL                                           |
| BD-624M | R. C. ABUTMENTS WITHOUT BACKWALL                                        |
| BD-677M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS                    |
| BD-678M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS                               |
| BC-734M | ANCHOR SYSTEMS                                                          |
| BC-735M | WALL CONSTRUCTION & EXPANSION JOINT DETAILS                             |
| BC-736M | REINFORCEMENT BAR FABRICATION DETAILS                                   |
| BC-752M | CONCRETE DECK SLAB DETAILS                                              |
| BC-762M | TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES       |
| BC-766M | PREFORMED NEOPRENE COMPRESSION SEAL JOINT FOR APPROACH SLABS            |
| BC-767M | NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES |
| BC-776M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS                   |
| BC-777M | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE POSTS                    |
| BC-778M | GROUND MOUNTED SOUND BARRIERS STEEL POSTS                               |
| BC-779M | STRUCTURE MOUNTED SOUND BARRIER WALLS                                   |
| BC-799M | MECHANICALLY STABILIZED EARTH RETAINING WALLS                           |
| RC-20M  | CONCRETE PAVEMENT JOINTS                                                |
| RC-24M  | PAVEMENT RELIEF JOINTS                                                  |
| RC-25M  | SHOULDERS                                                               |

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
STRUCTURE MOUNTED SOUND BARRIER WALLS  
GENERAL NOTES - 1

|                                            |               |                                                          |               |               |
|--------------------------------------------|---------------|----------------------------------------------------------|---------------|---------------|
| RECOMMENDED                                | FEB. 19, 2021 | RECOMMENDED                                              | FEB. 19, 2021 | SHEET 1 OF 11 |
| Thomas P. Maciore<br>CHIEF BRIDGE ENGINEER |               | Brenda L. Thompson<br>DIRECTOR, BUR. OF PROJECT DELIVERY |               | BD-679M       |



NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4 AND THESE STANDARDS.
2. THE FOLLOWING NOTE MUST BE PLACED ON THE PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE PLANS HAVE BEEN REVIEWED AND ACCEPTED:
- THE DISTRICT ENVIRONMENTAL MANAGER HAS REVIEWED AND ACCEPTED THE ACOUSTIC REQUIREMENTS OF THE PROPOSED WALL.

DISTRICT ENVIRONMENTAL MANAGER
3. SPECIFY IF THE REINFORCEMENT BARS ARE UNCOATED, EPOXY COATED, OR GALVANIZED.
4. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED, OR GALVANIZED.
5. PROVIDE A CONSTANT POST SPACING FOR THE ENTIRE LENGTH OF WALL. THE CONSTANT POST SPACING MAY BE INTERRUPTED TO MISS EXPANSION JOINTS, CONSTRUCTION JOINTS, AND/OR ANY OTHER PHYSICAL FEATURES. VARIATIONS MUST BE ACCEPTED BY THE DISTRICT BRIDGE ENGINEER.
6. INDICATE IF STEEL CABLES ARE REQUIRED IN THE PRECAST CONCRETE PANELS. (SEE GENERAL NOTE 8, ON SHEET 1) REFER TO BC-779M FOR DETAILS.
7. INDICATE IF LOW-DENSITY (LIGHTWEIGHT) CONCRETE IS REQUIRED IN THE PRECAST CONCRETE PANELS.
8. INDICATE IF THE TOP OF PANELS ARE STEPPED OR SLOPED. SLOPED PANELS ARE THE PREFERRED OPTION FOR MOST ARCHITECTURAL SURFACE TREATMENTS.
9. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS IF APPLICABLE:
- OVERALL WALL LENGTH
  - HORIZONTAL GEOMETRY
  - VERTICAL GEOMETRY
  - ACOUSTIC PROFILE ELEVATIONS
  - EXISTING GROUND LINE ELEVATIONS
  - FINISHED GROUND ELEVATIONS
  - TOP OF BARRIER / WALL ELEVATIONS
  - POST SPACINGS
  - GENERAL NOTES
  - DETAILS
  - REINFORCEMENT BAR SCHEDULE FOR ALL CAST-IN-PLACE CONCRETE
  - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL
10. PROVIDE FIRE HYDRANT OPENINGS OR OTHER HIGHWAY ACCESS AS REQUIRED IN THE PRECAST CONCRETE PANELS. PROVIDE REINFORCEMENT AROUND OPENINGS IN ACCORDANCE WITH DETAILS SHOWN ON BC-776M TO PRECLUDE CRACKING.
11. INDICATE IF THE ARCHITECTURAL SURFACE TREATMENT TOLERANCES AS SPECIFIED IN PUBLICATION 408, SECTION 1086.3 ARE APPLICABLE.
12. THE FOLLOWING INFORMATION MUST BE SPECIFIED ON THE CONTRACT DRAWINGS OR INDICATED IN THE CONTRACT SPECIAL PROVISIONS:
- ARCHITECTURAL SURFACE TREATMENTS ON THE RESIDENTIAL AND ROADWAY SIDES OF THE PRECAST CONCRETE SOUND BARRIER PANELS. INDICATE THE MINIMUM, MAXIMUM, AND AVERAGE DEPTHS.
  - COLOR OF THE INTEGRAL PIGMENTATION FOR PRECAST CONCRETE SOUND BARRIER PANELS.
  - COLOR OF JOINT SEALANT AND/OR CAULKING COMPOUND, NON-SHRINK GROUT, AND ANTIGRAFFITI COATING.
  - LIMITS OF ANTIGRAFFITI COATING.
  - PAINT COLOR OF STEEL COMPONENTS.
13. PROVIDE FEDERAL COLOR NUMBERS IN ACCORDANCE WITH FEDERAL STANDARD NUMBER 595A OR 595B.
14. PREPARE DESIGN CALCULATIONS CONSIDERING THE ADDITIONAL LOADS ON THE BEAMS/GIRDERS DUE TO THE BRIDGE MOUNTED SOUND BARRIER.
15. PREPARE DESIGN CALCULATIONS CONSIDERING THE ADDITIONAL LOADS ON THE MOMENT SLAB DUE TO THE MOMENT SLAB MOUNTED SOUND BARRIER.
16. PREPARE DESIGN CALCULATIONS CONSIDERING THE ADDITIONAL LOADS ON THE RETAINING WALL DUE TO THE RETAINING WALL MOUNTED SOUND BARRIER.
17. PROVIDE COMPLETE DETAILS AND DESIGN WHERE AN EXPANSION PANEL IS REQUIRED.
18. PROVIDE COMPLETE DETAILS WHERE A GROUND MOUNTED SOUND BARRIER IS CONNECTED TO A STRUCTURE MOUNTED SOUND BARRIER.
19. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THIS STANDARD.
20. SPECIFY IF A SOUND ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED, PRIOR TO BIDDING, BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE SUPPORTING COMPONENTS DUE TO THE INCREASED PANEL WEIGHT.
21. IF NEEDED DETAILS ARE NOT FOUND IN THE SOUND BARRIER STANDARDS A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

DESIGN PARAMETERS

1. PRECAST CONCRETE PANELS:
- PANELS ARE DESIGNED FOR NORMAL DENSITY (WEIGHT) CONCRETE AND LOW-DENSITY (LIGHTWEIGHT) CONCRETE AS INDICATED IN THE PANEL REINFORCEMENT TABLES.
  - USE LOW-DENSITY (LIGHTWEIGHT) CONCRETE PANELS FOR SOUND BARRIERS MOUNTED ON BRIDGES WHEN REQUIRED IN ACCORDANCE WITH BD-601M, SHEET 1, NOTE 25.
  - DESIGNER TO INDICATE IF LOW-DENSITY (LIGHTWEIGHT) CONCRETE IS REQUIRED ON THE CONTRACT DRAWINGS.
  - PANELS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 37 PSF.
  - PANELS ARE DESIGNED USING A 5 INCH STRUCTURAL THICKNESS.
  - PANELS ARE DESIGNED FOR THE ADDITIONAL CONCRETE WEIGHT OF 1½" TO ACCOUNT FOR ARCHITECTURAL SURFACE TREATMENTS.
  - THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½" BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½".
  - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 1½".
  - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING BETWEEN POSTS.
  - PANELS ARE DESIGNED USING A 1'-0" STRIP WIDTH.
  - PANELS ARE DESIGNED FOR THE FOLLOWING IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, 5TH EDITION, 1999.
  - PANELS ARE DESIGNED FOR STRIPPING FORCES CAUSED BY FORM SUCTION AND IMPACT WHEN THE PANELS ARE STRIPPED FROM THE FORMS IN ACCORDANCE WITH SECTION 5.2.3 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
  - PROVIDE A MINIMUM CONCRETE STRENGTH, AT TIME OF STRIPPING, EQUAL TO 4,000 PSI.
  - PANEL THICKNESS AND REINFORCING, FOR PANELS LESS THAN OR EQUAL TO 9'-0", IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OF PANEL USING A TWO-POINT PICKUP OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
  - PANEL THICKNESS AND REINFORCING, FOR PANELS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0", IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OR SIDE OF PANEL USING A TWO-POINT OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
  - PANELS ARE DESIGNED FOR TRANSPORTATION IN ACCORDANCE WITH SECTION 5.2.11 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
  - THE FLEXURAL TENSILE STRESSES IN THE CONCRETE ARE CALCULATED USING THE UNCRACKED GROSS SECTION BASED ON THE STRUCTURAL THICKNESS. THE STRESSES ARE COMPARED AGAINST THE MODULUS OF RUPTURE REDUCED BY A SAFETY FACTOR OF 1.50 IN ACCORDANCE WITH SECTION 5.2.4.1.
  - PANELS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.
2. STEEL SOUND BARRIER POSTS:
- POSTS ARE DESIGNED AS VERTICAL CANTILEVER BEAMS.
  - POSTS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 37 PSF.
  - MAXIMUM PERMITTED POST DEFLECTION EQUALS POST HEIGHT (H) IN INCHES DIVIDED BY 360.
  - POSTS AND CONNECTIONS ARE NOT DESIGNED FOR TRAFFIC IMPACT LOADING.
3. ANCHOR BOLTS:
- ANCHOR BOLTS ARE DESIGNED IN ACCORDANCE WITH SECTION 5.17 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.
  - MINIMUM ANCHOR BOLT EMBEDMENT LENGTH IS CALCULATED BASED ON THE DEVELOPMENT LENGTH OF A HOOKED BAR IN TENSION (WITHOUT ANY MODIFICATION FACTORS). REFER TO SECTION 8.29 IN THE 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.
  - THE ANCHOR BOLT EMBEDMENT LENGTH MUST EXTEND TO A DEPTH WHERE THE BARRIER/WALL REINFORCEMENT IS FULLY DEVELOPED. DESIGNER MUST INCREASE EMBEDMENT LENGTH AS REQUIRED.
4. BASE PLATES:
- BASE PLATES ARE DESIGNED FOR BENDING DUE TO APPLIED BOLTS FORCES, COMPRESSION AND TENSION.
  - BASE PLATES ARE NOT DESIGNED TO SUPPORT THE VERTICAL LOAD OF THE PRECAST CONCRETE PANELS EVEN THOUGH THE PANEL RESTS ON THE BASE PLATE. THE REASON FOR THIS IS THAT THE PANEL IS CONTINUOUSLY SUPPORTED ON TOP OF THE BARRIER OR RETAINING WALL, THUS THE BASE PLATE IS NOT INDUCED TO ANY ADDITIONAL LOADING.
  - BASE PLATE THICKNESS IS DETERMINED USING THE ALLOWABLE BENDING STRESS IN ACCORDANCE WITH SECTION 5.8 OF THE 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
  - BASE PLATE IS SUPPORTED ON THE LEVELING NUTS. THE NON-SHRINK GROUT IS NOT CONSIDERED AS A LOAD-CARRYING ELEMENT.
  - EDGE DISTANCE OF ANCHOR BOLTS:
  - THE CLEAR DISTANCE BETWEEN THE EDGE OF HOLES AND EDGES OF THE BASE PLATE SHALL NOT BE LESS THAN THE DIAMETER OF THE ANCHOR BOLT WHEN OVER SIZE OR SLOTTED HOLES ARE SPECIFIED.

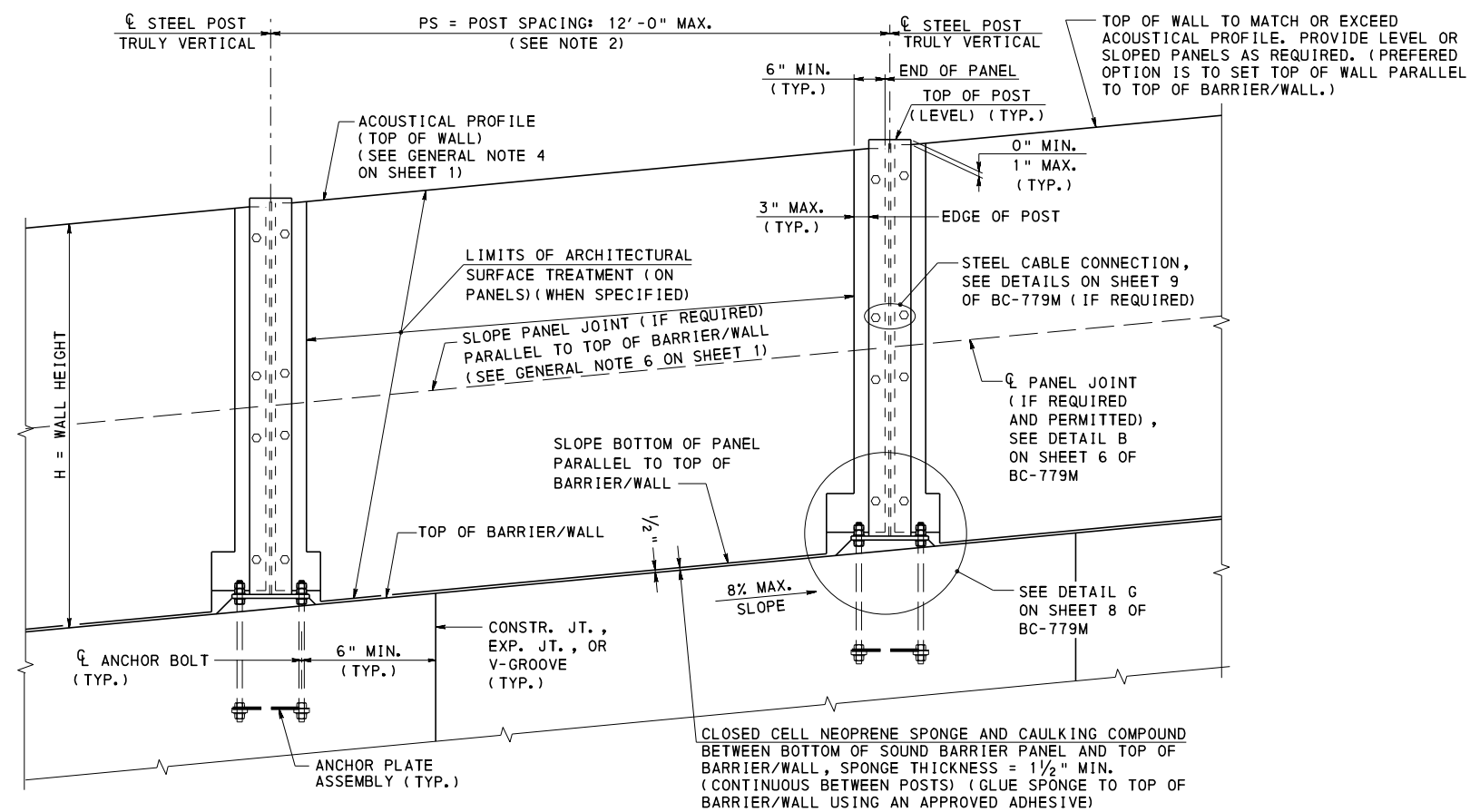
ARCHITECTURAL SURFACE TREATMENTS

1. THE FOLLOWING ARCHITECTURAL SURFACE TREATMENTS ARE PERMITTED ON THE FACE OF THE PRECAST CONCRETE PANELS AND ARE TO BE INDICATED ON THE CONTRACT DRAWINGS AND/OR IN THE CONTRACT SPECIAL PROVISIONS IF REQUIRED:
- NON-FORM LINER FINISHES:
  - SMOOTH FINISH
  - BROOMED FINISH
  - FUZZY OR RAKED FINISH (PERMITTED ON ONE SIDE ONLY)
  - EXPOSED AGGREGATE
  - FORM LINER FINISHES:
  - ASHLAR STONE
  - CUT STONE
  - FRACTURE FIN
  - GRAPE STAKE
  - SHIP LAP
  - ANY OTHER TREATMENT PERMITTED BY THE DEPARTMENT
2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0" TO 1½", BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½" UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.
3. AVOID USING FORM LINER FINISHES ON BOTH SIDES OF THE PRECAST CONCRETE PANELS. A FORM LINER FINISH, ON ONE SIDE OF THE PANEL, ALONG WITH A STAMPED FINISH, ON THE OTHER SIDE OF THE PANEL, IS PERMITTED.

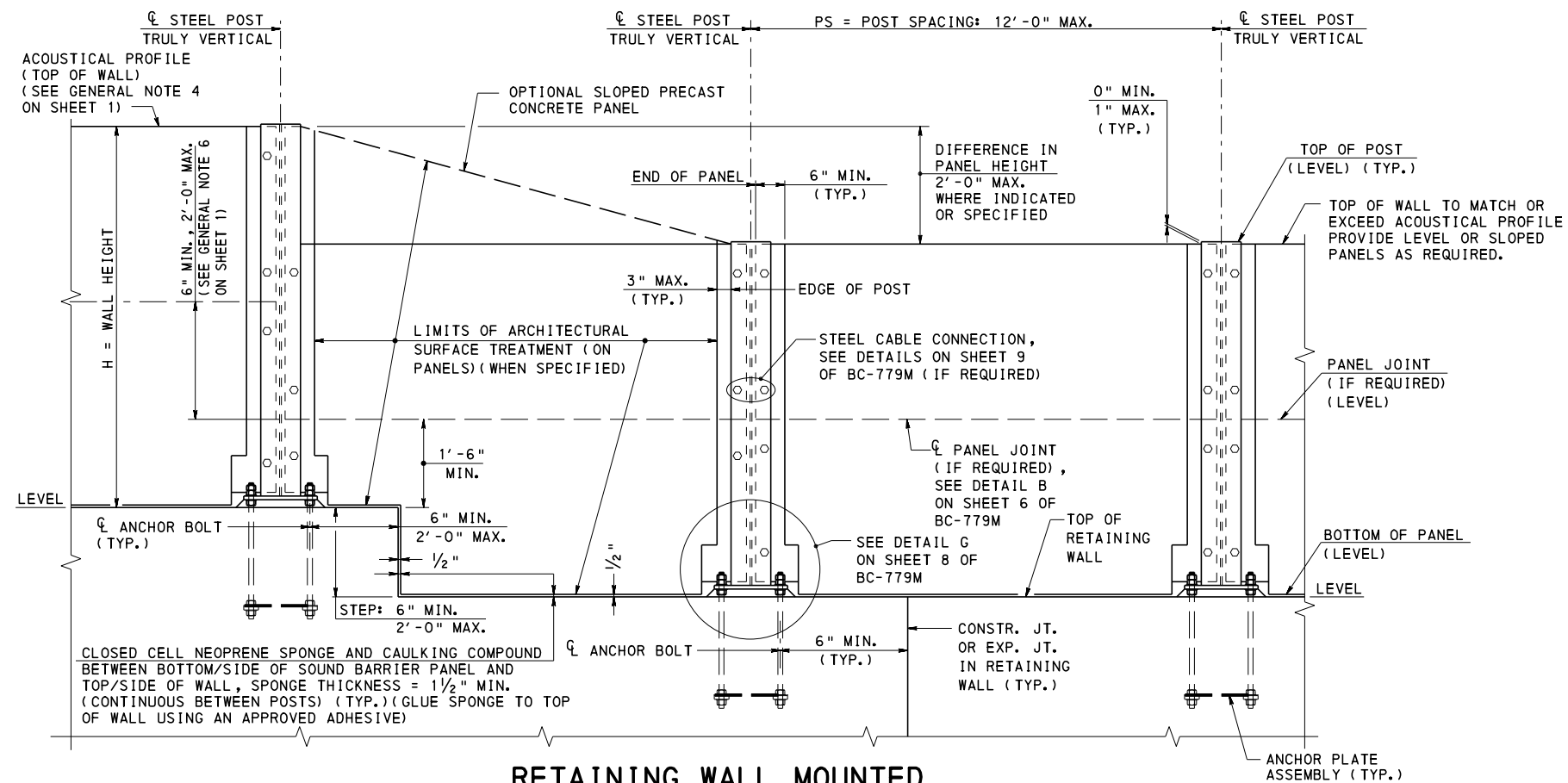
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
STRUCTURE MOUNTED SOUND BARRIER WALLS  
GENERAL NOTES - 2

|                                            |               |                                                       |               |               |
|--------------------------------------------|---------------|-------------------------------------------------------|---------------|---------------|
| RECOMMENDED                                | FEB. 19, 2021 | RECOMMENDED                                           | FEB. 19, 2021 | SHEET 2 OF 11 |
| Thomas P. Mociore<br>CHIEF BRIDGE ENGINEER |               | Brenda Thompson<br>DIRECTOR, BUR. OF PROJECT DELIVERY |               | BD-679M       |



## BARRIER MOUNTED/RETAINING WALL MOUNTED SOUND BARRIER ELEVATION ( TOP OF BARRIER/WALL SLOPED)



- NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. MAXIMUM POST SPACING IS 8'-0" FOR BRIDGE MOUNTED SOUND BARRIER WHEN PANEL HEIGHT IS GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0".

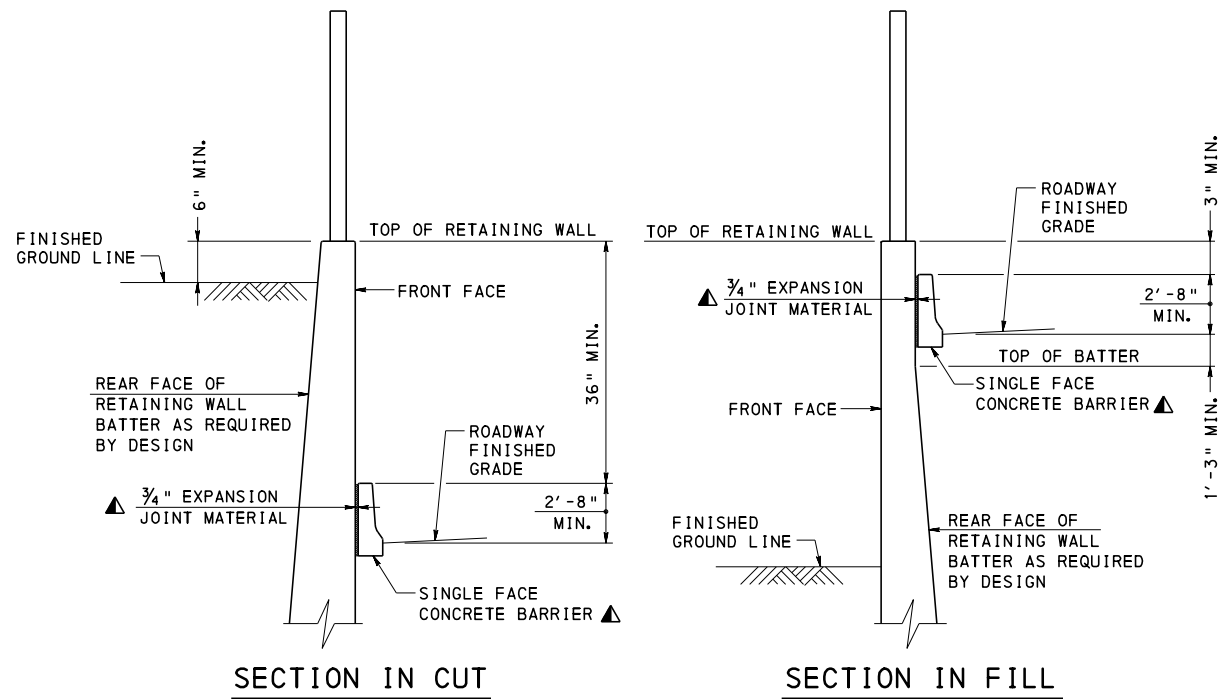
COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

# STANDARD STRUCTURE MOUNTED SOUND BARRIER WALLS GEOMETRY AND LAYOUT

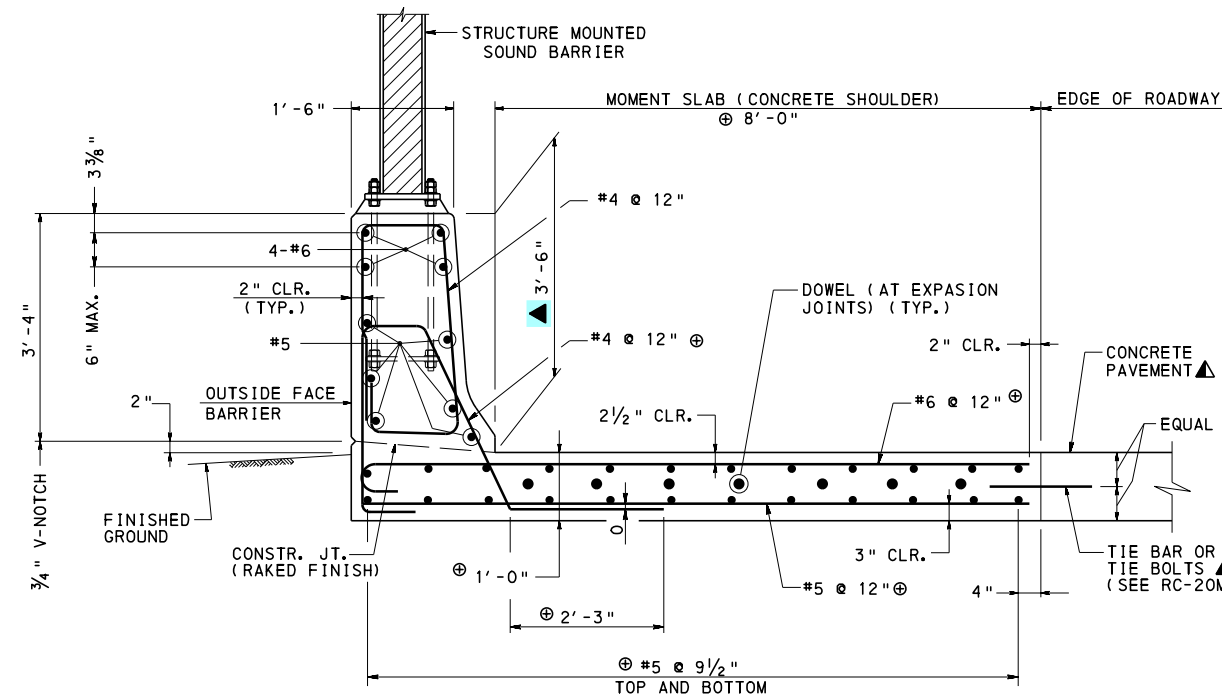
RECOMMENDED FEB. 19, 2021  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021  
*Brian B. Thompson*  
 DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 3 OF 11  
BD-679M



PROTECTION OF RETAINING WALLS WITH ROADWAY BARRIER



TYPICAL C.I.P. MOMENT SLAB AND BARRIER SECTION

| STRUCTURE MOUNTED SOUND BARRIER<br>DIMENSION TABLE |                                    |                                   |                       |                                |                         |                      |                     |              |                        |                                   |                       |             |                  |
|----------------------------------------------------|------------------------------------|-----------------------------------|-----------------------|--------------------------------|-------------------------|----------------------|---------------------|--------------|------------------------|-----------------------------------|-----------------------|-------------|------------------|
| WIND PRESSURE =                                    |                                    |                                   |                       |                                |                         |                      |                     |              |                        |                                   |                       |             |                  |
| POST                                               |                                    |                                   |                       | BASE PLATE                     |                         |                      |                     | ANCHOR BOLTS |                        | ANCHOR PLATES                     |                       |             |                  |
| POST<br>NUMBER                                     | DESIGN<br>POST<br>SPACING<br>(FT.) | DESIGN<br>WALL<br>HEIGHT<br>(FT.) | STEEL<br>POST<br>SIZE | POST<br>HEIGHT<br>PH1<br>(FT.) | THICKNESS<br>↑<br>(IN.) | LENGTH<br>↓<br>(IN.) | WIDTH<br>W<br>(IN.) | F<br>(IN.)   | DIAMETER<br>D<br>(IN.) | EMBEDMENT<br>LENGTH<br>S<br>(IN.) | LENGTH<br>Q1<br>(IN.) | F1<br>(IN.) | SLOPE<br>AT POST |
|                                                    |                                    |                                   |                       |                                |                         |                      |                     |              |                        |                                   |                       |             |                  |
|                                                    |                                    |                                   |                       |                                |                         |                      |                     |              |                        |                                   |                       |             |                  |
|                                                    |                                    |                                   |                       |                                |                         |                      |                     |              |                        |                                   |                       |             |                  |

**DIMENSION TABLE NOTES:**  
1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.  
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.

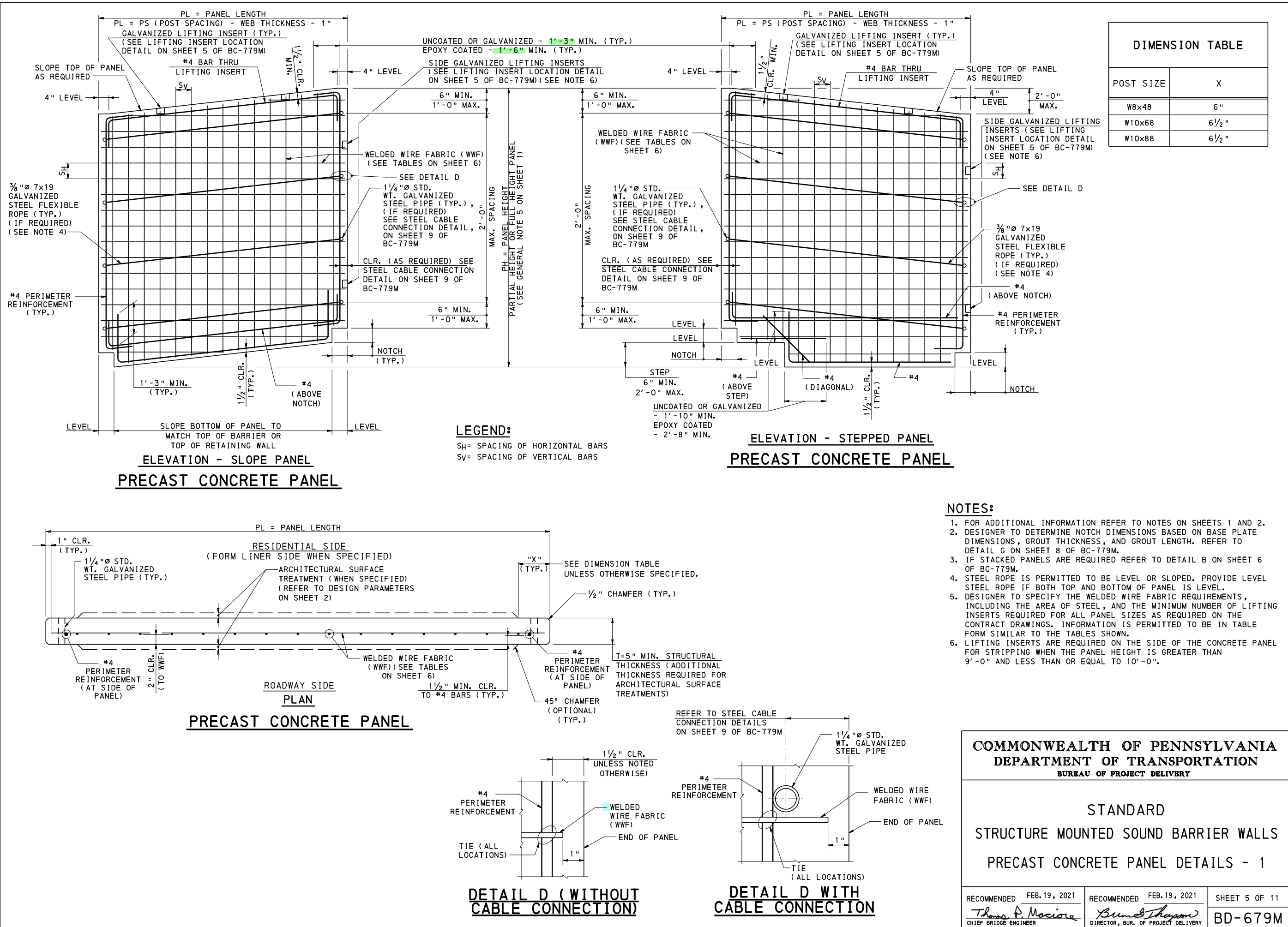
- LEGEND:**
- ▲ ROADWAY ITEM
  - ⊕ MIN. SIZE SHOWN, PROVIDE SIZE REQUIRED PER DESIGN
  - ▲ 45" F-SHAPE CONCRETE BARRIER NOT PERMITTED ON MOMENT SLAB.

**NOTES:**  
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.

**MOMENT SLAB NOTES:**  
1. DESIGNER MUST INCLUDE ALL DETAILS REQUIRED FOR THE MOMENT SLAB AND BARRIER ON THE CONTRACT DRAWINGS.  
2. FOR ADDITIONAL MOMENT SLAB DETAILS, REFER TO BC-799M.  
3. CONCRETE SHOULDER SHOWN, ASPHALT-PAVED SHOULDER SIMILAR, REFER TO BD-627M AND BC-799M FOR ADDITIONAL DETAILS.  
4. FOR CONCRETE SHOULDER AT GRADE, CONSTRUCT ROADWAY PAVEMENT PRIOR TO THE MOMENT SLAB, BARRIER, AND SOUND BARRIER WALL.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
STRUCTURE MOUNTED SOUND BARRIER WALLS  
MISCELLANEOUS DETAILS



| PRECAST CONCRETE<br>PANEL REINFORCEMENT<br>FOR LIGHT WEIGHT CONCRETE ( 115 LB./CU.FT.) |                                |                                       |                                                  |          |                                      |
|----------------------------------------------------------------------------------------|--------------------------------|---------------------------------------|--------------------------------------------------|----------|--------------------------------------|
| WIND PRESSURE = 37 PSF                                                                 |                                |                                       |                                                  |          |                                      |
| POST<br>SPACING<br>PS<br>(FT.)                                                         | PANEL<br>HEIGHT<br>PH<br>(FT.) | WELDED WIRE FABRIC<br>** WWF AxB-WCxD | WELDED WIRE STEEL<br>AREA ( IN <sup>2</sup> /FT) |          | MIN. NUMBER<br>OF LIFTING<br>INSERTS |
|                                                                                        |                                |                                       | HORIZONTAL                                       | VERTICAL |                                      |
| 6.0                                                                                    | 2.0                            | WWF 6x6-W4xW4                         | 0.08                                             | 0.08     | 2                                    |
|                                                                                        | 4.0                            | WWF 6x6-W4xW4                         | 0.08                                             | 0.08     | 2                                    |
|                                                                                        | 6.0                            | WWF 6x6-W4xW8                         | 0.08                                             | 0.16     | 2                                    |
|                                                                                        | 8.0                            | WWF 6x4-W4xW8                         | 0.08                                             | 0.24     | 2                                    |
|                                                                                        | 9.0                            | WWF 6x4-W4xW12                        | 0.08                                             | 0.36     | 2                                    |
| 8.0                                                                                    | 2.0                            | WWF 6x6-W4xW4                         | 0.08                                             | 0.08     | 2                                    |
|                                                                                        | 4.0                            | WWF 6x6-W4xW4                         | 0.08                                             | 0.08     | 2                                    |
|                                                                                        | 6.0                            | WWF 6x6-W4xW8                         | 0.08                                             | 0.16     | 2                                    |
|                                                                                        | 8.0                            | WWF 6x4-W4xW8                         | 0.08                                             | 0.24     | 2                                    |
|                                                                                        | 9.0                            | WWF 6x4-W4xW12                        | 0.08                                             | 0.36     | 2                                    |
| 10.0                                                                                   | 2.0                            | WWF 4x6-W4xW4                         | 0.12                                             | 0.08     | 2                                    |
|                                                                                        | 4.0                            | WWF 4x6-W4xW4                         | 0.12                                             | 0.08     | 2                                    |
|                                                                                        | 6.0                            | WWF 4x6-W4xW8                         | 0.12                                             | 0.16     | 2                                    |
|                                                                                        | 8.0                            | WWF 4x4-W4xW8                         | 0.12                                             | 0.24     | 2                                    |
|                                                                                        | 9.0                            | WWF 4x4-W4xW12                        | 0.12                                             | 0.36     | 2                                    |
| 12.0                                                                                   | 2.0                            | WWF 4x6-W8xW4                         | 0.24                                             | 0.08     | 2                                    |
|                                                                                        | 4.0                            | WWF 4x6-W8xW4                         | 0.24                                             | 0.08     | 2                                    |
|                                                                                        | 6.0                            | WWF 4x6-W8xW8                         | 0.24                                             | 0.16     | 2                                    |
|                                                                                        | 8.0                            | WWF 4x4-W8xW8                         | 0.24                                             | 0.24     | 2                                    |
|                                                                                        | 9.0                            | WWF 4x4-W8xW12                        | 0.24                                             | 0.36     | 2                                    |

\*\* WWF AxB-WCxD

WHERE A = SPACING OF HORIZONTAL BARS (SH)  
B = SPACING OF VERTICAL BARS (SV)  
C = HORIZONTAL WIRE SIZE  
D = VERTICAL WIRE SIZE  
WWF = WELDED WIRE FABRIC

| PRECAST CONCRETE<br>PANEL REINFORCEMENT<br>FOR NORMAL WEIGHT CONCRETE ( 150 LB./CU.FT.) |                                |                                       |                                                  |          |                                      |
|-----------------------------------------------------------------------------------------|--------------------------------|---------------------------------------|--------------------------------------------------|----------|--------------------------------------|
| WIND PRESSURE = 37 PSF                                                                  |                                |                                       |                                                  |          |                                      |
| POST<br>SPACING<br>PS<br>(FT.)                                                          | PANEL<br>HEIGHT<br>PH<br>(FT.) | WELDED WIRE FABRIC<br>** WWF AxB-WCxD | WELDED WIRE STEEL<br>AREA ( IN <sup>2</sup> /FT) |          | MIN. NUMBER<br>OF LIFTING<br>INSERTS |
|                                                                                         |                                |                                       | HORIZONTAL                                       | VERTICAL |                                      |
| 6.0                                                                                     | 2.0                            | WWF 6x6-W4xW4                         | 0.08                                             | 0.08     | 2                                    |
|                                                                                         | 4.0                            | WWF 6x6-W4xW4                         | 0.08                                             | 0.08     | 2                                    |
|                                                                                         | 6.0                            | WWF 6x6-W4xW8                         | 0.08                                             | 0.16     | 2                                    |
|                                                                                         | 8.0                            | WWF 6x4-W4xW12                        | 0.08                                             | 0.36     | 2                                    |
|                                                                                         | 9.0                            | WWF 6x4-W4xW12                        | 0.08                                             | 0.36     | 2                                    |
| 8.0                                                                                     | 2.0                            | WWF 4x6-W4xW4                         | 0.12                                             | 0.08     | 2                                    |
|                                                                                         | 4.0                            | WWF 4x6-W4xW4                         | 0.12                                             | 0.08     | 2                                    |
|                                                                                         | 6.0                            | WWF 4x6-W4xW8                         | 0.12                                             | 0.16     | 2                                    |
|                                                                                         | 8.0                            | WWF 4x4-W4xW12                        | 0.12                                             | 0.36     | 2                                    |
|                                                                                         | 9.0                            | WWF 4x4-W4xW12                        | 0.12                                             | 0.36     | 2                                    |
| 10.0                                                                                    | 2.0                            | WWF 6x6-W8xW4                         | 0.16                                             | 0.08     | 2                                    |
|                                                                                         | 4.0                            | WWF 6x6-W8xW4                         | 0.16                                             | 0.08     | 2                                    |
|                                                                                         | 6.0                            | WWF 6x6-W8xW8                         | 0.16                                             | 0.16     | 2                                    |
|                                                                                         | 8.0                            | WWF 6x4-W8xW12                        | 0.16                                             | 0.36     | 2                                    |
|                                                                                         | 9.0                            | WWF 6x4-W8xW12                        | 0.16                                             | 0.36     | 2                                    |
| 12.0                                                                                    | 2.0                            | WWF 4x6-W8xW4                         | 0.24                                             | 0.08     | 2                                    |
|                                                                                         | 4.0                            | WWF 4x6-W8xW4                         | 0.24                                             | 0.08     | 2                                    |
|                                                                                         | 6.0                            | WWF 4x6-W8xW8                         | 0.24                                             | 0.16     | 2                                    |
|                                                                                         | 8.0                            | WWF 4x4-W8xW12                        | 0.24                                             | 0.36     | 2                                    |
|                                                                                         | 9.0                            | WWF 4x4-W8xW12                        | 0.24                                             | 0.36     | 4                                    |

BRIDGE MOUNTED PRECAST CONCRETE PANELS  
PANEL HEIGHT GREATER THAN 9'-0"  
AND LESS THAN OR EQUAL TO 10'-0"

1. IN ORDER TO PROVIDE A SINGLE PANEL HEIGHT GREATER THAN 9'-0" AND LESS THAN OR EQUAL TO 10'-0" THE POST SPACING MUST NOT EXCEED 8'-0" FOR THE BRIDGE MOUNTED BARRIER. (STACKED PANELS ARE NOT PERMITTED.)
2. PRECAST CONCRETE PANEL REINFORCEMENT:
- PROVIDE THE FOLLOWING WELDED WIRE FABRIC IN THE PRECAST CONCRETE PANEL FOR NORMAL DENSITY (WEIGHT) AND LOW-DENSITY (LIGHTWEIGHT) CONCRETE WITH A POST SPACING LESS THAN OR EQUAL TO 8'-0":
    - WWF 4x4-W12xW12
    - AREA OF STEEL:
      - HORIZONTAL = 0.36 IN<sup>2</sup>/FT
      - VERTICAL = 0.36 IN<sup>2</sup>/FT
3. LIFTING INSERTS:
- PROVIDE A MINIMUM OF TWO LIFTING INSERTS ON THE SIDE OF THE PANEL FOR STRIPPING.
  - PROVIDE A MINIMUM OF TWO LIFTING INSERTS ON THE TOP OF THE PANEL FOR ERECTION.
  - REFER TO SHEET 5 OF BC-779M FOR LOCATIONS.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
STRUCTURE MOUNTED SOUND BARRIER WALLS  
PRECAST CONCRETE PANEL DETAILS - 2

RECOMMENDED FEB. 19, 2021  
Thomas P. Mociore  
CHIEF BRIDGE ENGINEER

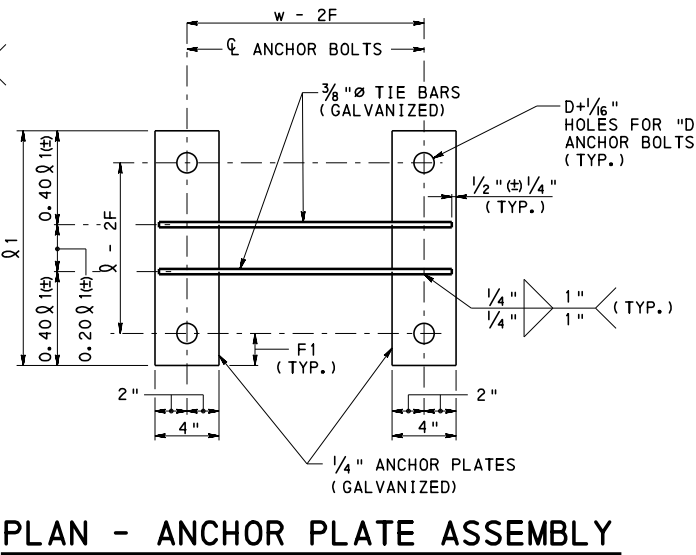
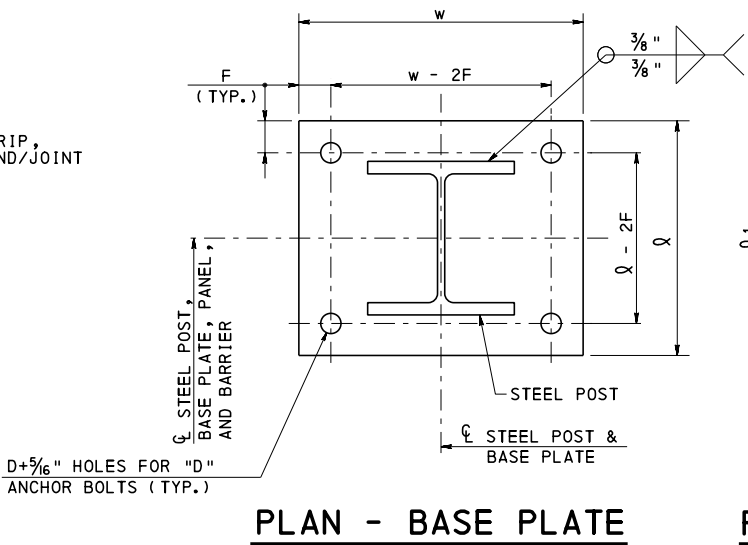
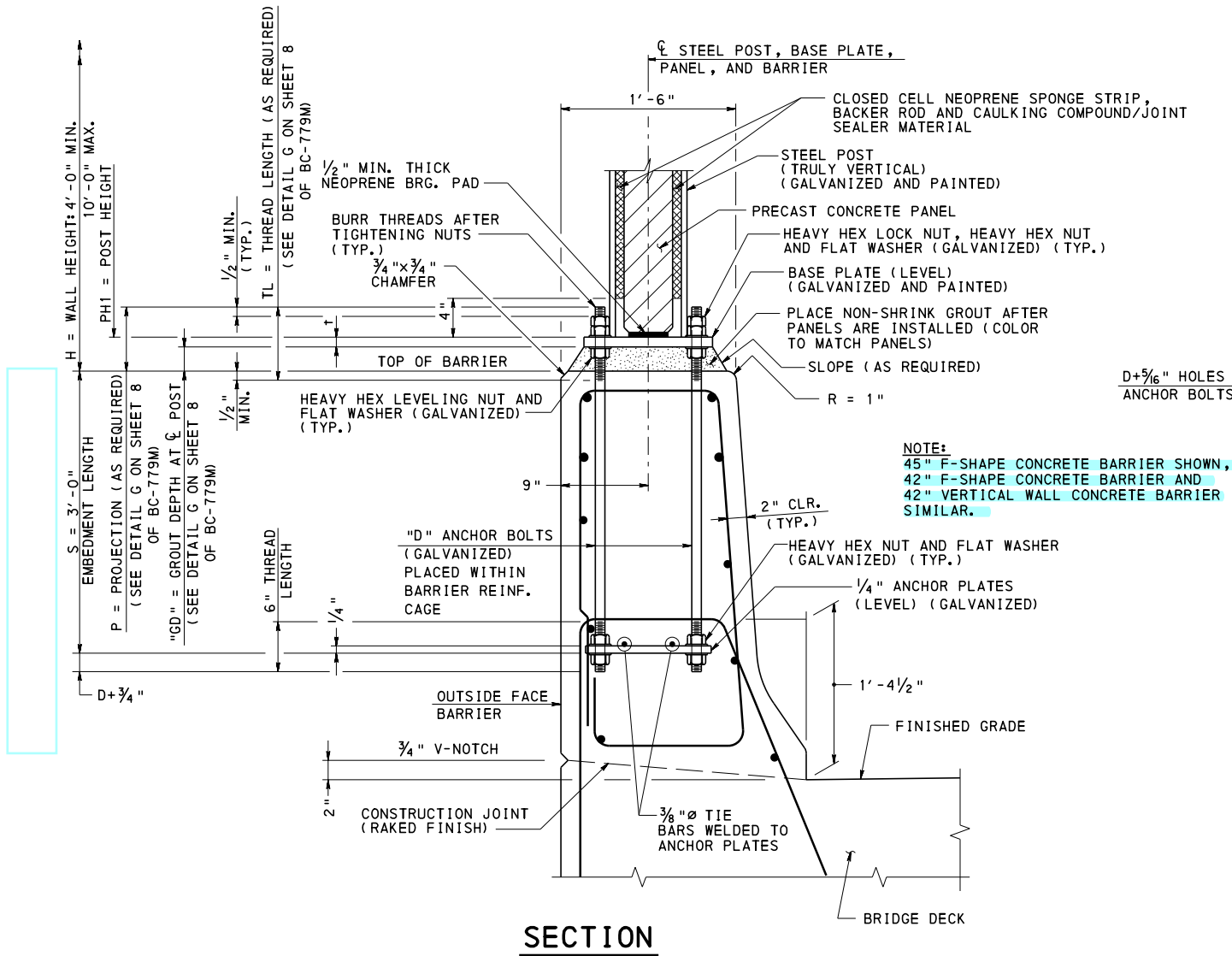
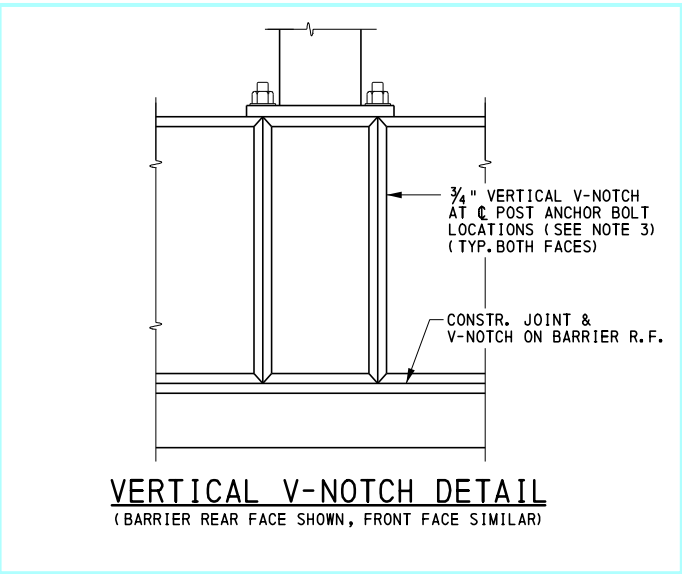
RECOMMENDED FEB. 19, 2021  
Burt S. Thompson  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 6 OF 11

BD-679M



| BARRIER MOUNTED SOUND BARRIER ON BRIDGES                                                 |                     |            |            |         |         |         |              |               |          |
|------------------------------------------------------------------------------------------|---------------------|------------|------------|---------|---------|---------|--------------|---------------|----------|
| STEEL POST, BASE PLATE, ANCHOR BOLT, AND ANCHOR PLATE GEOMETRY<br>WIND PRESSURE = 37 PSF |                     |            |            |         |         |         |              |               |          |
| POST SPACING PS (FT.)                                                                    | WALL HEIGHT H (FT.) | STEEL POST | BASE PLATE |         |         |         | ANCHOR BOLTS | ANCHOR PLATES |          |
|                                                                                          |                     |            | t (IN.)    | Q (IN.) | w (IN.) | F (IN.) | D (IN.)      | Q1 (IN.)      | F1 (IN.) |
| 6.0                                                                                      | 6.0                 | W8x48      | 1          | 13 1/2  | 16      | 2 1/8   | 1 1/4        | 11 3/4        | 1 1/4    |
|                                                                                          | 8.0                 | W8x48      | 1 1/8      | 14      | 18      | 2 1/2   | 1 1/2        | 12            | 1 1/2    |
|                                                                                          | 10.0                | W8x48      | 1 3/8      | 14      | 18      | 2 1/2   | 1 1/2        | 12            | 1 1/2    |
| 8.0                                                                                      | 6.0                 | W8x48      | 1          | 13 1/2  | 16      | 2 1/8   | 1 1/4        | 11 3/4        | 1 1/4    |
|                                                                                          | 8.0                 | W8x48      | 1 1/4      | 14      | 18      | 2 1/2   | 1 1/2        | 12            | 1 1/2    |
|                                                                                          | 10.0                | W8x48      | 1 5/8      | 14 1/2  | 19      | 2 7/8   | 1 3/4        | 12 1/4        | 1 3/4    |
| 10.0                                                                                     | 6.0                 | W8x48      | 1 1/8      | 14      | 18      | 2 1/2   | 1 1/2        | 12            | 1 1/2    |
|                                                                                          | 8.0                 | W8x48      | 1 1/2      | 14 1/2  | 19      | 2 7/8   | 1 3/4        | 12 1/4        | 1 3/4    |
|                                                                                          | 9.0                 | W8x48      | 1 3/4      | 14 1/2  | 19      | 2 7/8   | 1 3/4        | 12 1/4        | 1 3/4    |
| 12.0                                                                                     | 6.0                 | W8x48      | 1 1/8      | 14      | 18      | 2 1/2   | 1 1/2        | 12            | 1 1/2    |
|                                                                                          | 8.0                 | W8x48      | 1 1/2      | 14 1/2  | 19      | 2 7/8   | 1 3/4        | 12 1/4        | 1 3/4    |



- NOTES:**
- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
  - REFER TO SHEET 4 FOR DIMENSION TABLE TO BE SHOWN ON THE CONTRACT DRAWINGS.
  - PROVIDE VERTICAL V-NOTCHES ON BARRIER WALL FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL THIS SHEET.



STEEL POST, BASE PLATE, ANCHOR BOLT,  
AND ANCHOR PLATE GEOMETRY  
WIND PRESSURE = 37 PSF

**Dimensions and Projections:**

- $H$  = WALL HEIGHT: 4'-0" MIN. 15'-0" MAX.
- $S$  = 3'-0" EMBEDMENT LENGTH
- $P$  = PROJECTION (AS REQUIRED) (SEE DETAIL G ON SHEET 8 OF BC-779M)
- "GD" = GROUT DEPTH AT  $\phi$  POST (SEE DETAIL G ON SHEET 8 OF BC-779M)
- $D + \frac{3}{4}"$
- 6" THREAD LENGTH
- $\frac{1}{4}"$
- 2"
- $\frac{3}{4}"$  V-NOTCH
- CONSTRUCTION JOINT (RAKED FINISH)
- RETAINING WALL OR MOMENT SLAB

**Materials and Components:**

- $\frac{1}{8}"$  MIN. THICK NEOPRENE BRG. PAD
- BURR THREADS AFTER TIGHTENING NUTS (TYP.)
- $\frac{3}{4}" \times \frac{3}{4}"$  CHAMFER
- HEAVY HEX LEVELING NUT AND FLAT WASHER (GALVANIZED) (TYP.)
- "D" ANCHOR BOLTS (GALVANIZED) PLACED WITHIN BARRIER REINF. CAGE
- $\frac{3}{8}" \phi$  TIE BARS WELDED TO ANCHOR PLATES
- STEEL POST, BASE PLATE, PANEL, AND BARRIER
- 1'-6"
- CLOSED CELL NEOPRENE SPONGE STRIP, BACKER ROD AND CAULKING COMPOUND/JOINT SEALER MATERIAL
- STEEL POST (TRULY VERTICAL) (GALVANIZED AND PAINTED)
- PRECAST CONCRETE PANEL
- HEAVY HEX LOCK NUT, HEAVY HEX NUT AND FLAT WASHER (GALVANIZED) (TYP.)
- BASE PLATE (LEVEL) (GALVANIZED AND PAINTED)
- PLACE NON-SHRINK GROUT AFTER PANELS ARE INSTALLED (COLOR TO MATCH PANELS)
- SLOPE (AS REQUIRED)
- $R = 1"$
- HEAVY HEX NUT AND FLAT WASHER (GALVANIZED) (TYP.)
- $\frac{1}{4}"$  ANCHOR PLATES
- 1'-4 $\frac{1}{2}"$
- FINISHED GRADE

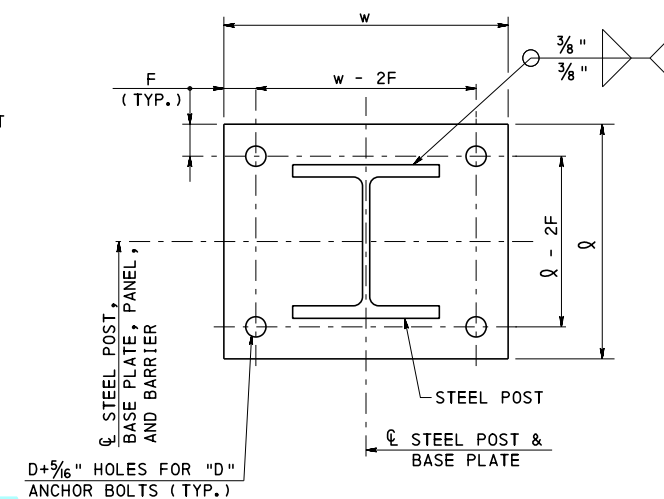
**Notes:**

- NOTE: 45" F-SHAPE CONCRETE BARRIER SHOWN, 42" F-SHAPE CONCRETE BARRIER AND 42" VERTICAL WALL CONCRETE BARRIER SIMILAR. 45" F-SHAPE CONCRETE BARRIER NOT PERMITTED FOR SOUND BARRIERS ON MOMENT SLAB.

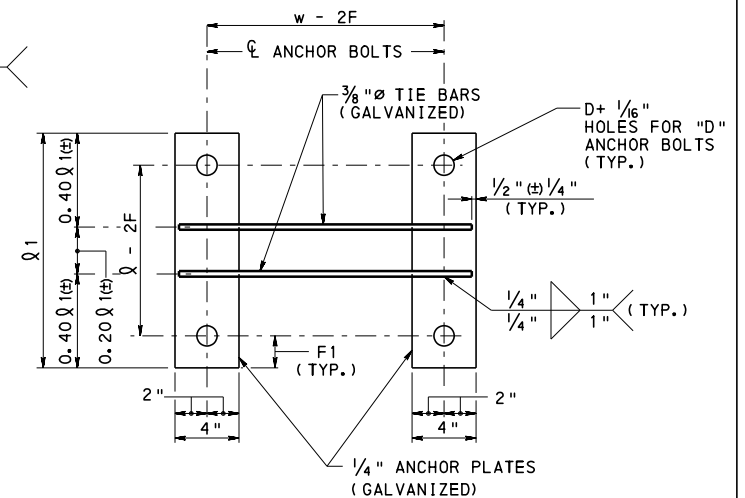
**Other Labels:**

- PH1 = POST HEIGHT
- TL = THREAD LENGTH (AS REQUIRED) (SEE DETAIL G ON SHEET 8 OF BC-779M)
- TOP OF BARRIER
- 4"
- 9"
- 2" CLR. (TYP.)
- OUTSIDE FACE BARRIER

SECTION



PLAN - BASE PLATE



### PLAN - ANCHOR PLATE ASSEMBLY

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. REFER TO SHEET 4 FOR DIMENSION TABLE TO BE SHOWN ON THE CONTRACT DRAWINGS.
3. PROVIDE VERTICAL V-NOTCHES ON BARRIER FRONT AND REAR FACES AT ALL POST ANCHOR BOLT LOCATIONS. SEE DETAIL SHEET 7.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

# STANDARD STRUCTURE MOUNTED SOUND BARRIER WALLS BARRIER MOUNTED ON WALLS AND MOMENT SLABS DESIGN TABLE AND DETAILS

RECOMMENDED FEB. 19, 2021  
Thomas P. Maciore  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021  
*Bruce Thompson*  
 DIRECTOR, BUR. OF PROJECT DELIVERY

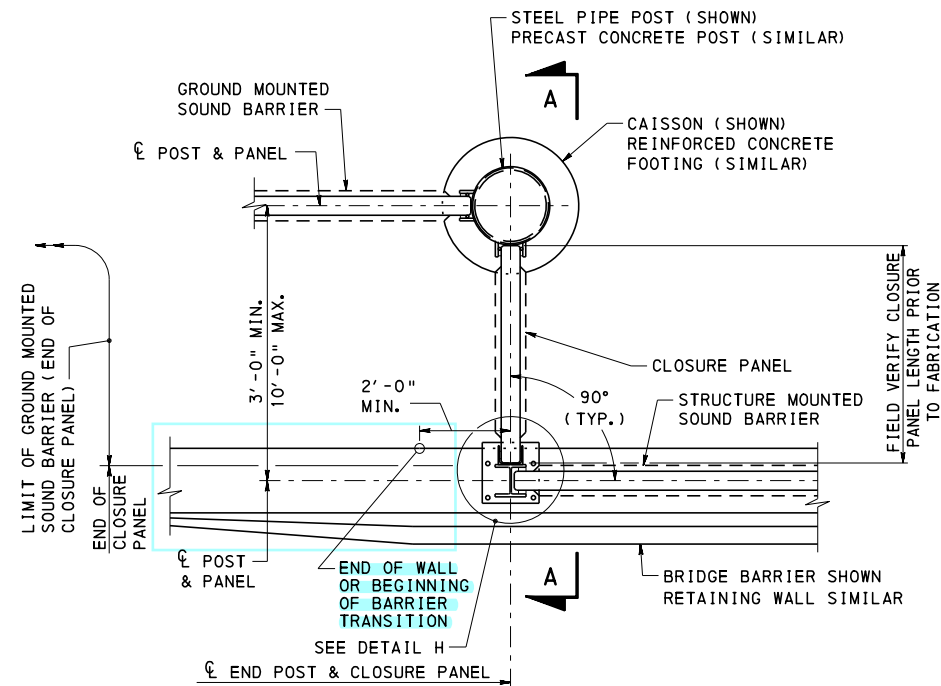
SHEET 8 OF 11  
BD-679M

| WALL MOUNTED SOUND BARRIER                                                                  |                              |               |            |            |            |            |              |            |               |             |
|---------------------------------------------------------------------------------------------|------------------------------|---------------|------------|------------|------------|------------|--------------|------------|---------------|-------------|
| STEEL POST, BASE PLATE, ANCHOR BOLT,<br>AND ANCHOR PLATE GEOMETRY<br>WIND PRESSURE = 37 PSF |                              |               |            |            |            |            |              |            |               |             |
| POST<br>SPACING<br>PS<br>(FT.)                                                              | WALL<br>HEIGHT<br>H<br>(FT.) | STEEL<br>POST | BASE PLATE |            |            |            | ANCHOR BOLTS |            | ANCHOR PLATES |             |
|                                                                                             |                              |               | T<br>(IN.) | Q<br>(IN.) | W<br>(IN.) | F<br>(IN.) | D<br>(IN.)   | S<br>(IN.) | Q1<br>(IN.)   | F1<br>(IN.) |
| 6.0                                                                                         | 6.0                          | W8x48         | 3/4        | 15 1/4     | 15         | 1 5/8      | 1            | 24         | 14            | 1           |
|                                                                                             | 8.0                          | W8x48         | 7/8        | 16         | 16         | 2 1/8      | 1 1/4        | 30         | 14 1/4        | 1 1/4       |
|                                                                                             | 10.0                         | W8x48         | 1          | 16         | 16         | 2 1/8      | 1 1/4        | 30         | 14 1/4        | 1 1/4       |
|                                                                                             | 12.0                         | W8x48         | 1 1/8      | 16 1/2     | 18         | 2 1/2      | 1 1/2        | 33         | 14 1/2        | 1 1/2       |
|                                                                                             | 14.0                         | W8x48         | 1 3/8      | 16 1/2     | 18         | 2 1/2      | 1 1/2        | 33         | 14 1/2        | 1 1/2       |
|                                                                                             | 16.0                         | W10x68        | 1 5/8      | 17         | 21         | 2 7/8      | 1 3/4        | 39         | 14 3/4        | 1 3/4       |
|                                                                                             | 18.0                         | W10x68        | 1 3/4      | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |
|                                                                                             | 20.0                         | W10x88        | 2          | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |
| 8.0                                                                                         | 6.0                          | W8x48         | 3/4        | 15 1/4     | 15         | 1 5/8      | 1            | 24         | 14            | 1           |
|                                                                                             | 8.0                          | W8x48         | 7/8        | 16         | 16         | 2 1/8      | 1 1/4        | 30         | 14 1/4        | 1 1/4       |
|                                                                                             | 10.0                         | W8x48         | 1 1/8      | 16 1/2     | 18         | 2 1/2      | 1 1/2        | 33         | 14 1/2        | 1 1/2       |
|                                                                                             | 12.0                         | W8x48         | 1 3/8      | 16 1/2     | 18         | 2 1/2      | 1 1/2        | 33         | 14 1/2        | 1 1/2       |
|                                                                                             | 14.0                         | W8x48         | 1 5/8      | 17         | 19         | 2 7/8      | 1 3/4        | 39         | 14 3/4        | 1 3/4       |
|                                                                                             | 16.0                         | W10x68        | 1 7/8      | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |
|                                                                                             | 17.0                         | W10x68        | 2          | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |
| 10.0                                                                                        | 6.0                          | W8x48         | 3/4        | 16         | 16         | 2 1/8      | 1 1/4        | 30         | 14 1/4        | 1 1/4       |
|                                                                                             | 8.0                          | W8x48         | 1          | 16         | 16         | 2 1/8      | 1 1/4        | 30         | 14 1/4        | 1 1/4       |
|                                                                                             | 10.0                         | W8x48         | 1 1/4      | 16 1/2     | 18         | 2 1/2      | 1 1/2        | 33         | 14 1/2        | 1 1/2       |
|                                                                                             | 12.0                         | W8x48         | 1 1/2      | 17         | 19         | 2 7/8      | 1 3/4        | 39         | 14 3/4        | 1 3/4       |
|                                                                                             | 14.0                         | W10x68        | 1 3/4      | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |
|                                                                                             | 15.0                         | W10x68        | 2          | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |
| 12.0                                                                                        | 6.0                          | W8x48         | 7/8        | 16         | 16         | 2 1/8      | 1 1/4        | 30         | 14 1/4        | 1 1/4       |
|                                                                                             | 8.0                          | W8x48         | 1 1/8      | 16 1/2     | 18         | 2 1/2      | 1 1/2        | 33         | 14 1/2        | 1 1/2       |
|                                                                                             | 10.0                         | W8x48         | 1 3/8      | 17         | 19         | 2 7/8      | 1 3/4        | 39         | 14 3/4        | 1 3/4       |
|                                                                                             | 12.0                         | W8x48         | 1 5/8      | 17         | 22         | 2 7/8      | 1 3/4        | 39         | 14 3/4        | 1 3/4       |
|                                                                                             | 14.0                         | W10x68        | 1 7/8      | 17 1/2     | 22         | 3 1/4      | 2            | 45         | 14 3/4        | 1 7/8       |

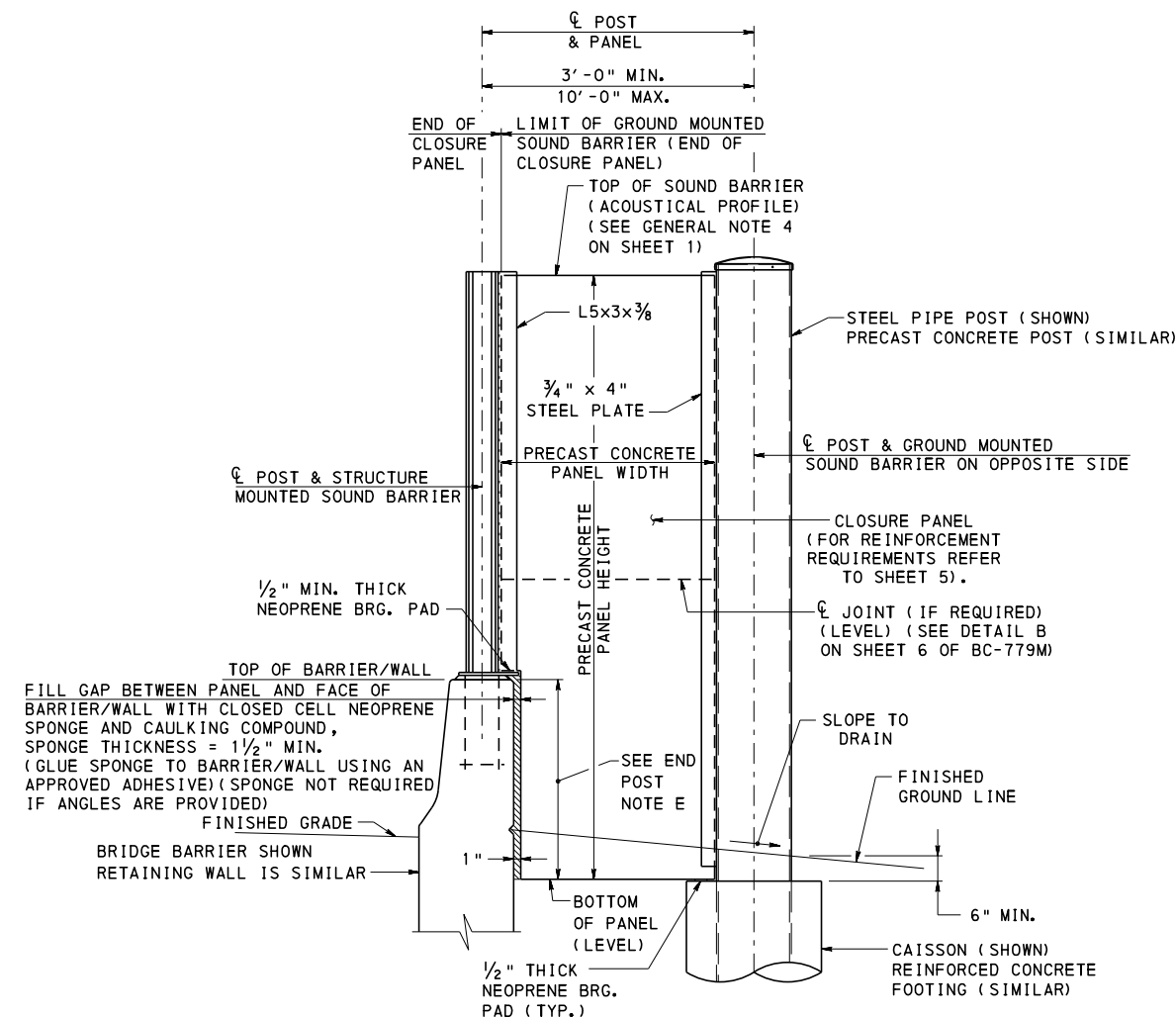


STANDARD  
STRUCTURE MOUNTED SOUND BARRIER WALLS  
WALL MOUNTED  
DESIGN TABLE AND DETAILS

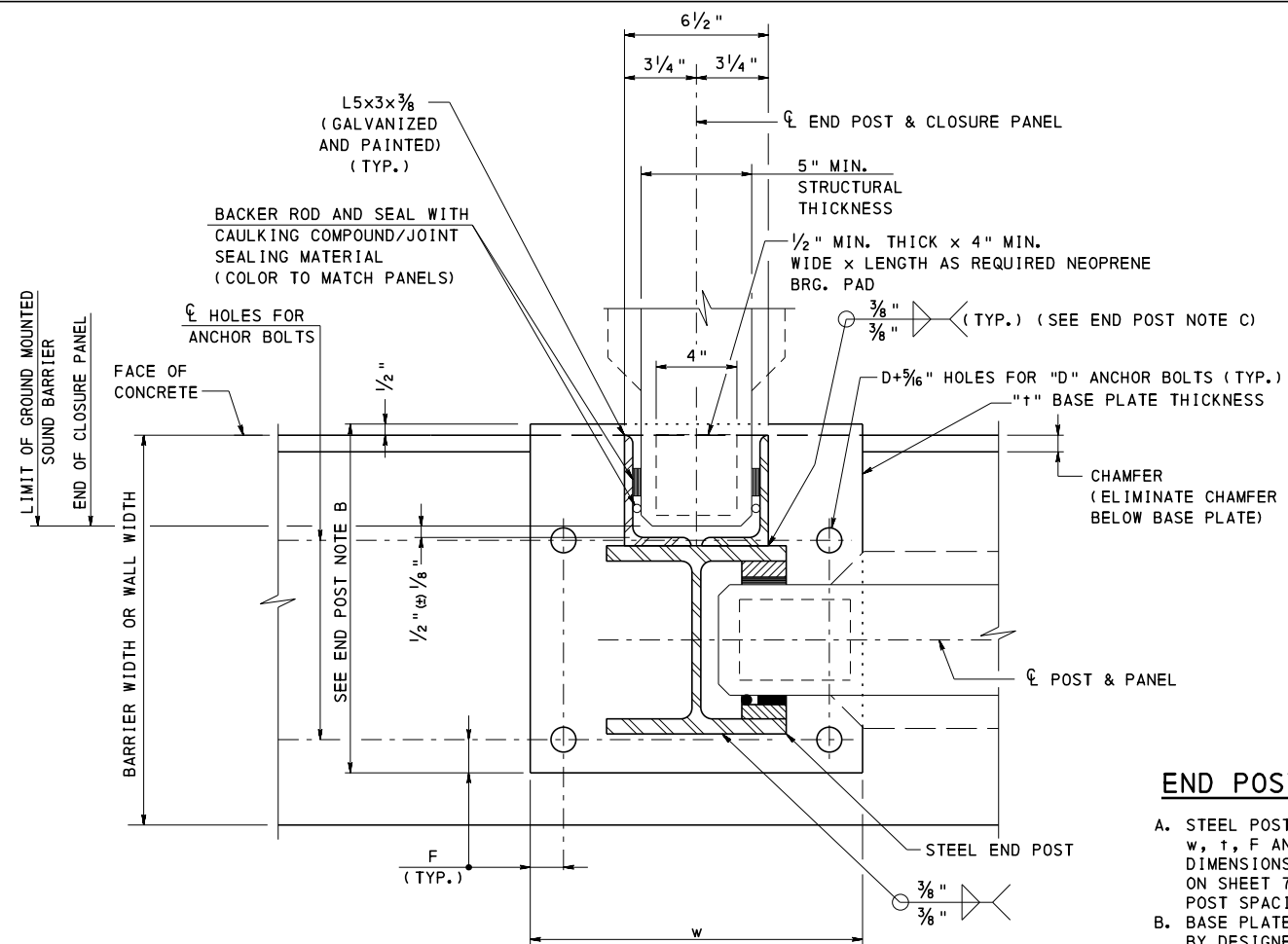
SHEET 9 OF 11  
BD-679M



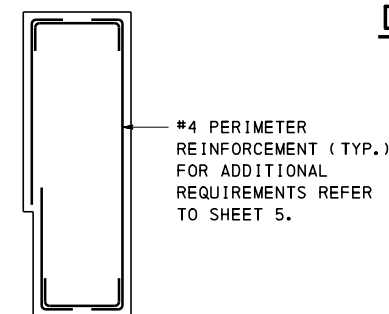
**PLAN - STRUCTURE MOUNTED SOUND BARRIER  
TO GROUND MOUNTED SOUND BARRIER  
(BARRIER/RETAINING WALL WITH BARRIER TRANSITION)**



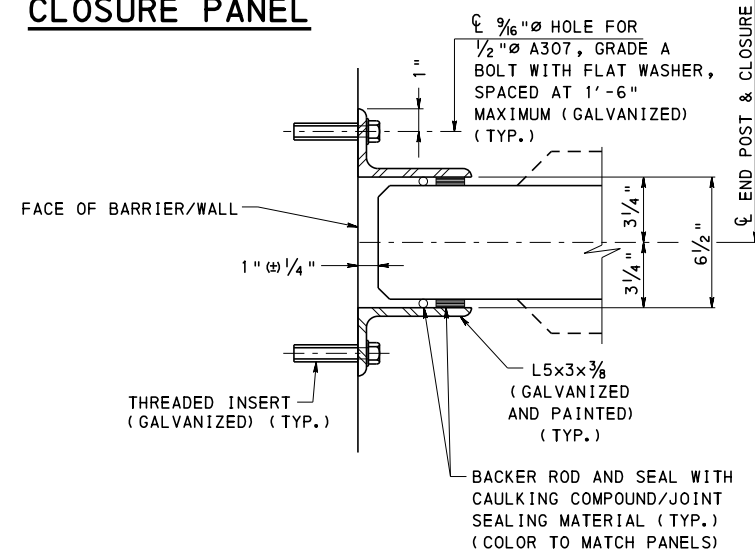
**SECTION A-A**



**DETAIL H**



**CLOSURE PANEL**



**DETAIL J**

**END POST NOTES:**

- STEEL POST SIZE AND DIMENSIONS FOR W, T, F AND D IS TO BE BASED ON THE DIMENSIONS SHOWN IN THE DESIGN TABLES ON SHEET 7, 8 AND 9 FOR THE REQUIRED POST SPACING AND ALL HEIGHTS.
- BASE PLATE DIMENSION TO BE DETERMINED BY DESIGNER.
- FILL GAP BETWEEN ANGLES WITH WELD MATERIAL.
- ELIMINATE THRU BOLTS FOR STEEL CABLES IN END POST. STEEL CABLES ARE STILL REQUIRED IN THE PANEL.
- IF HEIGHT BETWEEN TOP OF BARRIER/WALL AND BOTTOM OF PANEL IS GREATER THAN 4'-0" PROVIDE ANGLES, REFER TO DETAIL J.

**NOTES:**

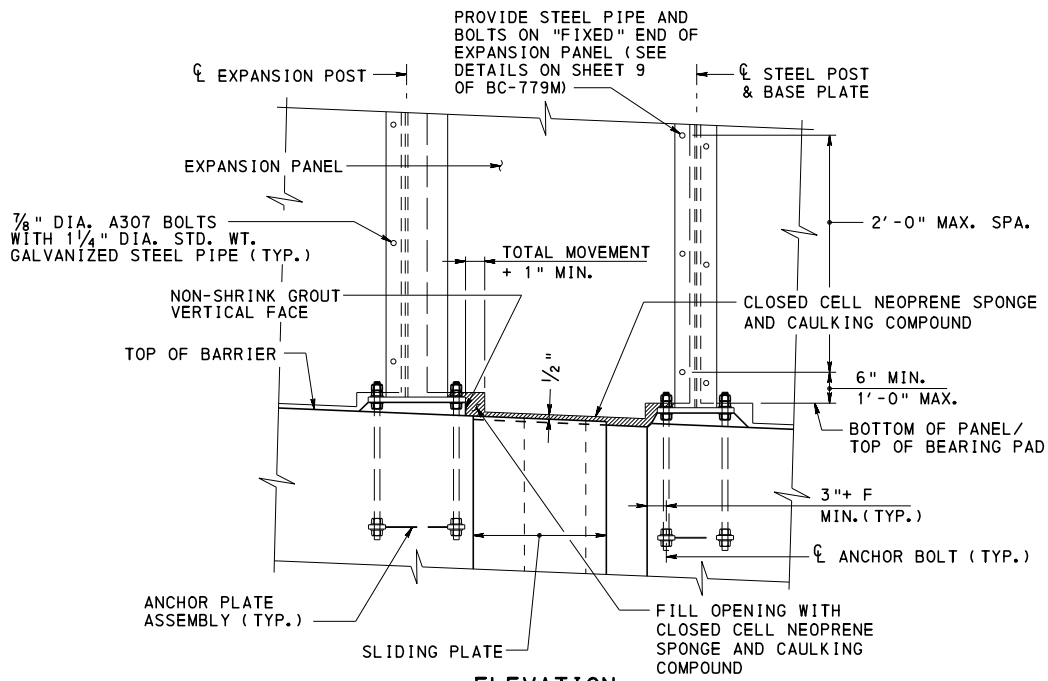
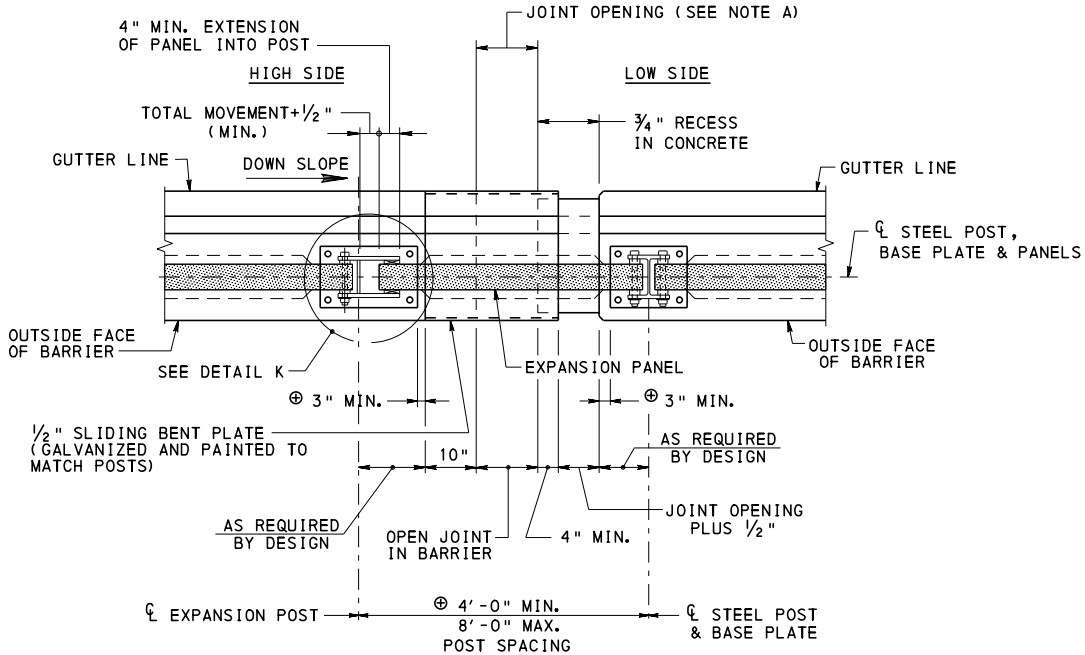
- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- DETAILS SHOWN ARE FOR INFORMATION AND REFERENCE ONLY. ALTERNATE DETAILS ARE PERMITTED AND MUST BE APPROVED BY THE CHIEF BRIDGE ENGINEER.
- DESIGNER MUST PROVIDE DESIGN CALCULATIONS FOR COMPONENTS NOT DESIGNED IN THE STANDARDS.
- DESIGNER MUST INCLUDE ALL DETAILS REQUIRED ON THE CONTRACT DRAWINGS.
- FOR GROUND MOUNTED CORNER POST DETAILS REFER TO BD-677M AND BD-678M.
- DESIGNER MUST CONSIDER HOW INSPECTION ACCESS IS OBTAINED FOR THE ADJACENT STRUCTURE.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

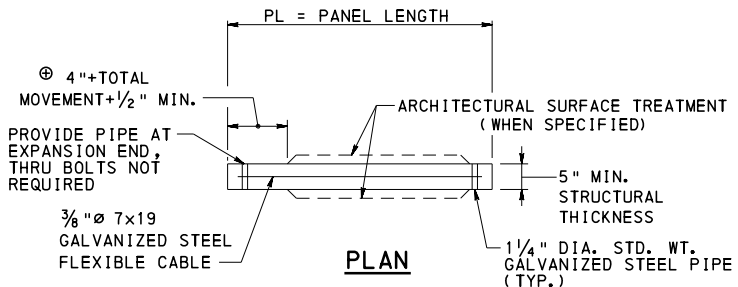
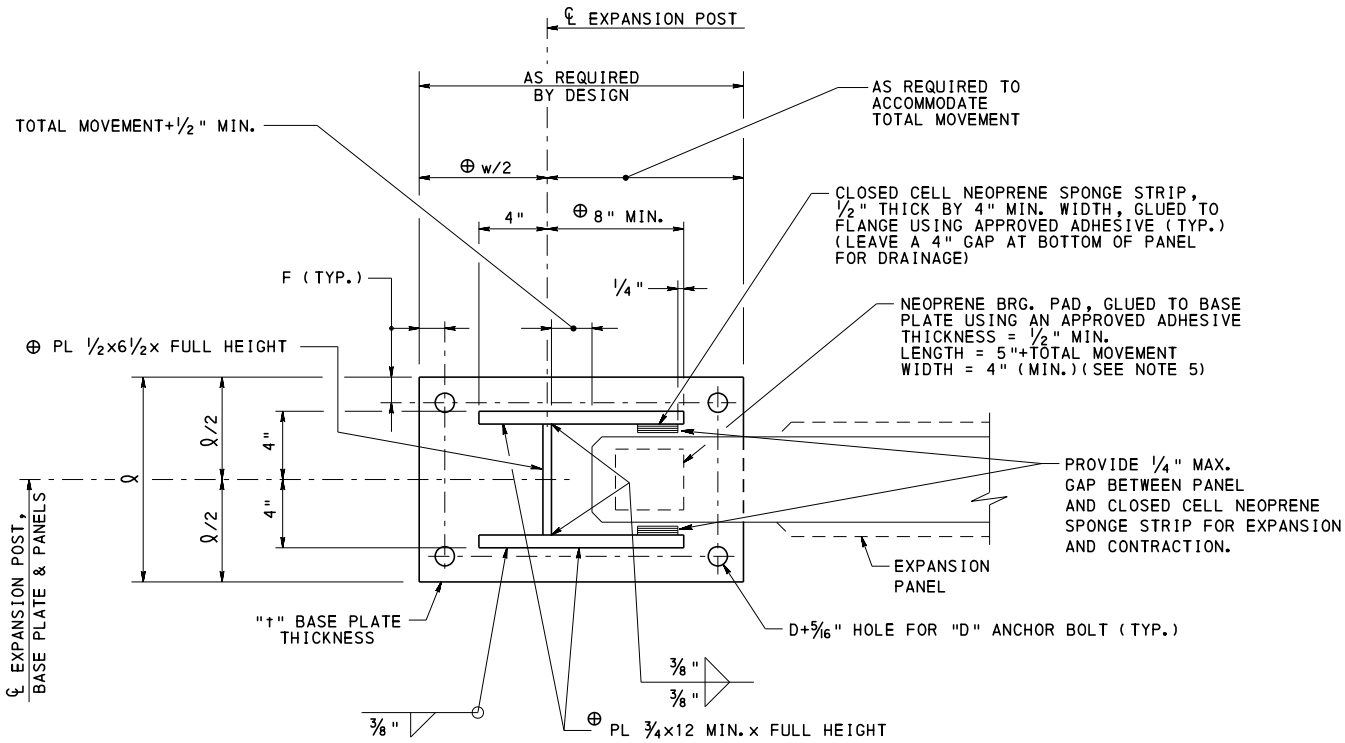
**STANDARD  
STRUCTURE MOUNTED SOUND BARRIER WALLS  
STRUCTURE MOUNTED TO GROUND MOUNTED  
DETAILS**

|                                                                                |                                                                                             |                                  |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------|
| RECOMMENDED FEB. 19, 2021<br><i>Thomas P. Mociore</i><br>CHIEF BRIDGE ENGINEER | RECOMMENDED FEB. 19, 2021<br><i>Brian J. Thompson</i><br>DIRECTOR, BUR. OF PROJECT DELIVERY | SHEET 10 OF 11<br><b>BD-679M</b> |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------|

- NOTE A:
- JOINT OPENING AS REQUIRED FOR BRIDGE EXPANSION AND CONTRACTION AT 68 DEGREES F.
  - JOINT OPENING FOR SHOULDER OR PAVEMENT RELIEF JOINT = 1'-0" (REFER TO RC-20M AND RC-24M).



**EXPANSION PANEL DETAILS**



**PRECAST CONCRETE EXPANSION PANEL**

(FOR ADDITIONAL PANEL DETAILS SEE SHEET 5)

**FABRICATED POST, BASE PLATE AND ANCHOR BOLT SIZES:**

- A. DIMENSIONS FOR Q, t, F AND D IS TO BE BASED ON THE DIMENSIONS SHOWN IN THE DESIGN TABLES ON SHEETS 7, 8 AND 9 FOR THE REQUIRED POST SPACING AND WALL HEIGHT.
- B. DIMENSION w/2 IS TO BE BASED ON ONE-HALF THE w DIMENSION SHOWN IN THE DESIGN TABLES ON SHEETS 7, 8 AND 9 FOR THE REQUIRED POST SPACING AND WALL HEIGHT.
- C. REMAINING DIMENSIONS TO BE DETERMINED BY THE ENGINEER.

**LEGEND:**

⊕ MIN. SIZE SHOWN, PROVIDE SIZE REQUIRED PER DESIGN

**NOTES:**

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. DETAILS SHOWN ARE FOR INFORMATION AND REFERENCE ONLY. ALTERNATE DETAILS ARE PERMITTED AND MUST BE APPROVED BY THE CHIEF BRIDGE ENGINEER.
3. DESIGNER TO DETERMINE TOTAL MOVEMENT REQUIRED.
4. DESIGNER MUST INCLUDE ALL DETAILS REQUIRED ON THE CONTRACT DRAWINGS.
5. DESIGNER TO DESIGN NEOPRENE BEARING PAD TO ACCOMMODATE MOVEMENT OF EXPANSION PANEL.
6. GALVANIZE AND PAINT ALL FABRICATED STRUCTURAL STEEL.
7. IF STRUCTURE MOUNTED SOUND BARRIER ENDS AT THE EXPANSION POST AND CONNECTS TO A GROUND MOUNTED BARRIER PROVIDE ADDITIONAL DETAILS AS REQUIRED IN ACCORDANCE WITH THESE STANDARDS.

**COMMONWEALTH OF PENNSYLVANIA**  
**DEPARTMENT OF TRANSPORTATION**  
**BUREAU OF PROJECT DELIVERY**

**STANDARD**  
**STRUCTURE MOUNTED SOUND BARRIER WALLS**  
**EXPANSION PANEL DETAILS**

RECOMMENDED FEB. 19, 2021  
*Thomas P. Mociore*  
CHIEF BRIDGE ENGINEER

RECOMMENDED FEB. 19, 2021  
*Bruce S. Thayer*  
DIRECTOR, BUR. OF PROJECT DELIVERY

SHEET 11 OF 11  
**BD-679M**

GENERAL NOTES

1. DESIGN SPECIFICATIONS:

● PENNDOT DESIGN MANUAL, PART 4, STRUCTURES, APRIL 2015 EDITION.

● 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.

● 2002 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 17TH EDITION.

● 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING INTERIMS THROUGH 2006.

● DESIGN IS IN ACCORDANCE WITH THE WORKING STRESS DESIGN METHOD. (NO INCREASE IN ALLOWABLE UNIT STRESSES ARE PERMITTED EXCEPT FOR GROUP III LOADINGS WHICH PERMITS A 33% OVERSTRESS).
2. CONSTRUCTION SPECIFICATIONS AND **WORK QUALITY:**

● PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AASHTO/AWS D1.1 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5).
3. DESIGN LOADS:

● WIND LOAD:

● THE WIND LOAD INCLUDES A GUST FACTOR OF 1.3 AND A DRAG FACTOR OF 1.2 AND IS BASED ON A MAXIMUM 50-YEAR MEAN WIND VELOCITY AT 30'-0" ABOVE THE GROUND SURFACE OF 80 MPH.

● OFFSET SOUND BARRIER WALLS (GROUND MOUNTED):  
HEIGHT ZONE: 0' TO 14'-0" = 20 PSF  
HEIGHT ZONE: OVER 14'-0" = 28 PSF

● ICE LOAD: 3 PSF APPLIED TO ONE SIDE OF PANEL

● SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
4. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.

5. STANDARD PANEL HEIGHTS:

● 4'-0" MINIMUM TO 12'-0" MAXIMUM.

● PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 12'-0".

6. END PANEL HEIGHTS:

● 6'-0" MINIMUM TO 22'-0" MAXIMUM.

● PROVIDE SINGLE END PANELS, STACKED PANELS ARE NOT PERMITTED.

● IF WALL HEIGHT IS GREATER THAN 22'-0", ADJUST WALL LENGTH AS REQUIRED SO THE MAXIMUM END PANEL HEIGHT IS 22'-0" OR LESS.

7. HORIZONTAL PANELS JOINT:

● MINIMIZE THE NUMBER OF HORIZONTAL PANEL JOINTS.

● PROVIDE UNIFORM STEPS.

● IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0".

8. PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL-TO-PANEL CONNECTION.

9. OFFSET SOUND BARRIER WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.

10. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING.

11. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN PANELS WHERE THE WALL IS WITHIN 14'-0" OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.

12. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.

13. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 68 DEGREES F.

14. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.

15. FOR ADDITIONAL INFORMATION, REFER TO BC-780M.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE WALL SYSTEM ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 20 PSF AND 28 PSF.

2. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS (STANDARD AND END PANELS) ARE DEVELOPED FOR A WIND PRESSURE OF 28 PSF. USE THE INFORMATION SHOWN IN THE TABLES FOR ALL HEIGHT ZONES.

3. THE DESIGN WALL HEIGHT IS TO BE THE ACTUAL WALL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF WALL HEIGHT SHOWN ON THE DESIGN TABLES.

4. THE DESIGN PANEL HEIGHT IS TO BE THE ACTUAL PANEL HEIGHT ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF PANEL HEIGHT SHOWN ON THE DESIGN TABLES.

5. STANDARD PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 4'-0" OR GREATER THAN 12'-0".

6. END PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 6'-0" OR GREATER THAN 22'-0".

| INDEX OF SHEETS |                                            |
|-----------------|--------------------------------------------|
| SHT.NO.         | SHEET TITLE                                |
| 1               | GENERAL NOTES - 1                          |
| 2               | GENERAL NOTES - 2                          |
| 3               | GEOMETRY AND LAYOUT - 1                    |
| 4               | GEOMETRY AND LAYOUT - 2                    |
| 5               | PRECAST CONCRETE STANDARD PANEL DETAILS    |
| 6               | PRECAST CONCRETE END PANEL DETAILS         |
| 7               | SPREAD FOOTING DETAILS FOR STANDARD PANELS |
| 8               | SPREAD FOOTING DETAILS FOR END PANELS      |

SECTION

ELEVATION

| HEIGHT ZONE (FEET) | WIND PRESSURE (PSF) |
|--------------------|---------------------|
| 0-14               | 20                  |
| OVER 14            | 28                  |

HEIGHT ZONES FOR  
OFFSET SOUND BARRIERS (GROUND MOUNTED)

MATERIAL NOTES

1. REFER TO BC-780M FOR MATERIAL NOTES.

|                    |                                                       |
|--------------------|-------------------------------------------------------|
| BC-734M            | ANCHOR SYSTEMS                                        |
| BC-735M            | WALL CONSTRUCTION AND EXPANSION JOINT DETAILS         |
| BC-736M            | REINFORCEMENT BAR FABRICATION DETAILS                 |
| BC-776M            | GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS |
| BC-780M            | OFFSET SOUND BARRIER WALLS                            |
| BD-679M            | STRUCTURE MOUNTED SOUND BARRIER WALLS                 |
| REFERENCE DRAWINGS |                                                       |

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
OFFSET SOUND BARRIER WALLS  
GENERAL NOTES - 1

RECOMMENDED AUG. 30, 2019  
*John J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. [Signature]*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 8  
BD-680M

CHANGE 2

DESIGN PARAMETERS

1. GENERAL:
- THE WALL SYSTEM IS DESIGNED BASED ON A 4 PANEL UNIT LENGTH (WHICH MAY INCLUDE THE END PANEL) WITH A 2'-0" MINIMUM WALL EMBEDMENT FOR WIND PRESSURES EQUAL TO 20 PSF AND 28 PSF.
  - THE STABILITY OF THE WALL IS CHECKED AT THE TOP OF THE FOOTING.
2. STANDARD PRECAST CONCRETE PANELS:
- PANELS ARE DESIGNED FOR A WIND PRESSURE EQUAL TO 28 PSF.
  - PANELS ARE DESIGNED USING A 10 INCH STRUCTURAL THICKNESS.
  - PANELS ARE DESIGNED FOR AN ADDITIONAL CONCRETE WEIGHT OF 1½ INCH TO ACCOUNT FOR ARCHITECTURAL SURFACE TREATMENTS.
    - THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½ INCH BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 1½ INCH.
    - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 1½ INCH.
  - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING 15'-0".
  - PANELS ARE DESIGNED ON A 1'-0" STRIP WIDTH.
  - BOTTOM PANELS ARE DESIGNED FOR AN EARTH LOAD ON ONE SIDE OF PANEL ONLY. MAXIMUM FILL DIFFERENTIAL BETWEEN SIDES OF PANEL WAS SET AT 2'-0" FOR DESIGN.
  - PANELS ARE DESIGNED FOR THE FOLLOWING IN ACCORDANCE WITH THE PCI DESIGN HANDBOOK, 5TH EDITION, 1999:
    - PANELS ARE DESIGNED FOR STRIPPING FORCES CAUSED BY FORM SUCTION AND IMPACT WHEN THE PANELS ARE STRIPPED FROM THE FORMS IN ACCORDANCE WITH SECTION 5.2.3 AND TABLE 5.2.1. USING AN EQUIVALENT STATIC LOAD MULTIPLIER OF 1.50.
      - PROVIDE A MINIMUM CONCRETE STRENGTH AT TIME OF STRIPPING EQUAL TO 4,000 PSI.
    - PANEL THICKNESS AND REINFORCING, FOR STANDARD PANELS, IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OF PANEL USING A TWO-POINT PICKUP OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
    - PANEL THICKNESS AND REINFORCING, FOR END PANELS, IS DESIGNED FOR STRIPPING AND LIFTING AT TOP OR SIDE OF PANEL USING A TWO-POINT PICKUP OR FOUR-POINT PICKUP IN ACCORDANCE WITH FIGURE 5.2.4.
    - PANELS ARE DESIGNED FOR TRANSPORTATION IN ACCORDANCE WITH SECTION 5.2.11 AND TABLE 5.2.1 USING AN EQUIVALENT STATIC LOAD MULTIPLIER EQUAL TO 1.50.
    - THE FLEXURAL TENSILE STRESSES IN THE CONCRETE ARE CALCULATED USING THE UNCRACKED GROSS SECTION BASED ON THE STRUCTURAL THICKNESS. THE STRESSES ARE COMPARED AGAINST THE MODULUS OF RUPTURE REDUCED BY A SAFETY FACTOR OF 1.50 IN ACCORDANCE WITH SECTION 5.2.4.1.
  - PANELS ARE NOT DESIGNED FOR A TRAFFIC IMPACT LOAD.
3. END PRECAST CONCRETE PANELS:
- END PANEL LENGTH SET AT 10'-0" (WORKING POINT TO END OF PANEL)
  - FOR ADDITIONAL REQUIREMENTS REFER TO ABOVE PARAMETERS FOR THE STANDARD PRECAST CONCRETE SOUND BARRIER PANELS.
4. PANEL CONNECTIONS:
- CABLE CONNECTION IS DESIGNED FOR WIND, EARTH, AND SEISMIC LOADS IN CONJUNCTION WITH 2 DEGREE WALL TILT.
5. SPREAD FOOTINGS:
- SPREAD FOOTINGS ARE DESIGNED BEARING ON SOIL WITH AN ALLOWABLE BEARING PRESSURE EQUAL TO 1.50 TONS/SQ. FT. AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
  - MAXIMUM ALLOWABLE BEARING PRESSURE ON CONCRETE = 0.900 KSI
  - COEFFICIENT OF FRICTION BETWEEN PANEL AND FOOTING = 0.45
  - FACTOR OF SAFETY AGAINST SLIDING = 1.50 MINIMUM
  - FACTOR OF SAFETY AGAINST SLIDING FOR SEISMIC LOADING = 1.125 MINIMUM
  - FACTOR OF SAFETY AGAINST OVERTURNING = 2.00 MINIMUM
  - FACTOR OF SAFETY AGAINST OVERTURNING FOR SEISMIC LOADING = 1.50 MINIMUM
  - WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.
  - PROVIDE A MINIMUM SOIL DEPTH OF 2'-0" ABOVE THE TOP OF FOOTING.
  - PROVIDE A MINIMUM FOOTING THICKNESS OF 1'-0".
  - PROVIDE A MINIMUM FOOTING WIDTH OF 3'-0".
  - SPREAD FOOTINGS ARE DESIGNED FOR NO UPLIFT.
  - SPREAD FOOTINGS ARE DESIGNED FOR LEVEL GROUND. A SITE SPECIFIC DESIGN IS REQUIRED IF GROUND IS SLOPED.
  - SPREAD FOOTINGS ARE DESIGNED WITHOUT LIVE LOAD SURCHARGE. REDESIGN FOOTINGS IF LIVE LOAD SURCHARGE IS REQUIRED.

ARCHITECTURAL SURFACE TREATMENTS

1. THE FOLLOWING ARCHITECTURAL SURFACE TREATMENTS ARE PERMITTED ON THE FACE OF THE PRECAST CONCRETE PANELS AND ARE TO BE INDICATED ON THE CONTRACT DRAWINGS AND/OR IN THE CONTRACT SPECIAL PROVISIONS (IF REQUIRED):
- NON-FORM LINER FINISHES:
    - SMOOTH FINISH
    - BROOMED FINISH
    - FUZZY OR RAKED FINISH (PERMITTED ON ONE SIDE ONLY)
    - EXPOSED AGGREGATE
  - FORM LINER FINISHES:
    - ASHLER STONE
    - CUT STONE
    - FRACTURE FIN
    - GRAPE STAKE
    - SHIP LAP
    - ANY OTHER TREATMENT PERMITTED BY THE DEPARTMENT
2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 1½", BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT ON BOTH SIDES OF THE PANEL MUST NOT BE GREATER THAN 1½ INCH UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.
3. AVOID USING FORM LINER FINISHES ON BOTH SIDES OF THE PRECAST CONCRETE PANELS. A FORM LINER FINISH ON ONE SIDE OF THE PANEL, ALONG WITH A STAMPED FINISH ON THE OTHER SIDE OF PANEL, IS PERMITTED.

NOTES TO DESIGNER

1. PREPARE CONTRACT DRAWINGS IN ACCORDANCE WITH THE DESIGN MANUAL, PART 4 AND THESE STANDARDS.
2. THE FOLLOWING NOTE MUST BE PLACED ON THE PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE PLANS HAVE BEEN REVIEWED AND ACCEPTED:

THE DISTRICT ENVIRONMENTAL MANAGER HAS REVIEWED AND ACCEPTED THE ACOUSTIC REQUIREMENTS OF THE PROPOSED WALL.

DISTRICT ENVIRONMENTAL MANAGER

3. DETERMINE HEIGHT ZONE AND WIND PRESSURE REQUIRED FOR WALL DESIGN AND INDICATE ON THE CONTRACT DRAWINGS.
4. SPECIFY IF THE REINFORCEMENT BARS ARE UNCOATED, EPOXY COATED OR GALVANIZED.
5. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED OR GALVANIZED.
6. OFFSET SOUND BARRIER WALLS MUST BE PROTECTED BY CONCRETE BARRIERS UNLESS THE WALL IS LOCATED BEYOND THE HORIZONTAL CLEAR ZONE OR IF THE BOTTOM OF PANELS ARE A MINIMUM OF 5'-0" ABOVE THE EDGE OF PAVEMENT.
7. PROVIDE SLOPED TOP PANELS. STEPPED PANELS ARE NOT PERMITTED.
8. THE FOLLOWING INFORMATION MUST BE SHOWN ON THE CONTRACT DRAWINGS (IF APPLICABLE):
- OVERALL WALL LENGTH
  - HORIZONTAL GEOMETRY
  - VERTICAL GEOMETRY
  - SOUND BARRIER CONTROL LINE
  - WALL OFFSET "D"
  - LENGTH OF 4-PANEL UNITS - "L"
  - ACOUSTIC PROFILE ELEVATIONS
  - TOP OF WALL ELEVATIONS
  - HORIZONTAL JOINT LOCATIONS (IF PERMITTED)
  - PANEL CONNECTION LOCATIONS
  - PANEL DETAILS
  - BERM WIDTH
  - EXISTING GROUND LINE ELEVATIONS
  - FINISHED GROUND LINE ELEVATIONS
  - TOP AND BOTTOM OF FOOTING ELEVATIONS
  - FOOTING PLAN
  - FOOTING DETAILS
  - FOOTING STEP LOCATIONS
  - GENERAL NOTES
  - FOUNDATION NOTES
  - STAKE-OUT PLAN
  - DETAILS
  - REINFORCEMENT BAR SCHEDULE FOR ALL CAST-IN-PLACE CONCRETE
  - ANY OTHER INFORMATION REQUIRED TO CONSTRUCT THE SOUND BARRIER WALL
9. PROVIDE FIRE HYDRANT OPENINGS OR OTHER HIGHWAY ACCESS AS REQUIRED IN THE PRECAST CONCRETE PANELS. PROVIDE REINFORCEMENT AROUND OPENINGS IN ACCORDANCE WITH DETAILS SHOWN ON BC-776M TO PRECLUDE CRACKING.
10. SLOPE THE FINISHED GROUND LINE AWAY FROM THE SOUND BARRIER WALL.
11. INDICATE IF THE ARCHITECTURAL SURFACE TREATMENT TOLERANCES, AS PROVIDED IN PUBLICATION 408, SECTION 1086.3, ARE APPLICABLE.
12. THE FOLLOWING INFORMATION MUST BE SPECIFIED ON THE CONTRACT DRAWINGS OR INDICATED IN THE CONTRACT SPECIAL PROVISIONS:
- ARCHITECTURAL SURFACE TREATMENTS ON THE RESIDENTIAL AND ROADWAY SIDES OF THE PRECAST CONCRETE SOUND BARRIER PANELS. INDICATE THE MINIMUM, MAXIMUM AND AVERAGE DEPTHS.
  - COLOR OF THE INTEGRAL PIGMENTATION FOR PRECAST CONCRETE SOUND BARRIER PANELS.
  - COLOR OF JOINT SEALANT AND/OR CAULKING COMPOUND, NON-SHRINK GROUT, AND ANTI-GRAFFITI COATING.
  - LIMITS OF ANTIGRAFFITI COATING.
13. PROVIDE FEDERAL COLOR NUMBERS IN ACCORDANCE WITH FEDERAL STANDARD NUMBER 595A OR 595B.
14. PROVIDE COMPLETE DETAILS AND DESIGN, IF REQUIRED, WHERE A OFFSET SOUND BARRIER IS CONNECTED TO A STRUCTURE MOUNTED SOUND BARRIER OR A LINEAR GROUND MOUNTED SOUND BARRIER. REFER TO BD-679M FOR DETAILS.
15. DESIGN COMPUTATIONS AND DETAILS ARE REQUIRED FOR ANY PORTION OF THE STRUCTURE FOR WHICH THE INFORMATION IS NOT TAKEN DIRECTLY FROM THIS STANDARD.
16. SPECIFY IF A SOUND ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED, PRIOR TO BIDDING, BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE WALL SYSTEM AND SPREAD FOOTING DUE TO THE INCREASED PANEL WEIGHT.
17. IF NEEDED DETAILS ARE NOT FOUND IN THE SOUND BARRIER STANDARDS, A SPECIAL SUBMISSION REQUESTING APPROVAL FOR SPECIFIC DETAILS MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.

COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
OFFSET SOUND BARRIER WALLS  
GENERAL NOTES - 2

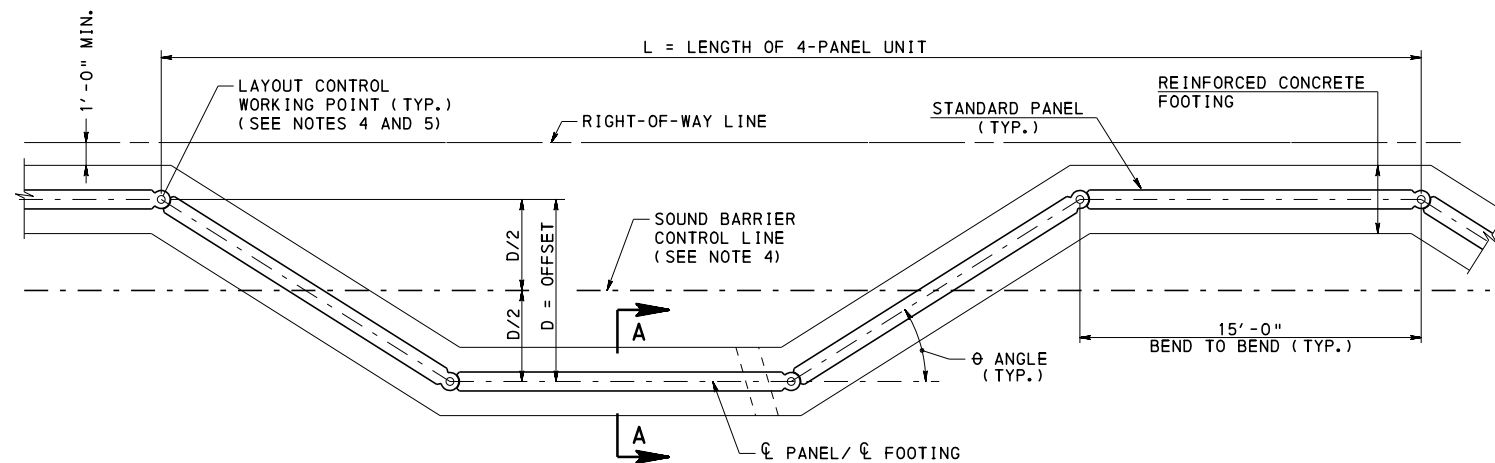
RECOMMENDED AUG. 30, 2019  
*James J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael V. Biele*  
ACT. DIR., BUR. OF PROJECT DELIVERY

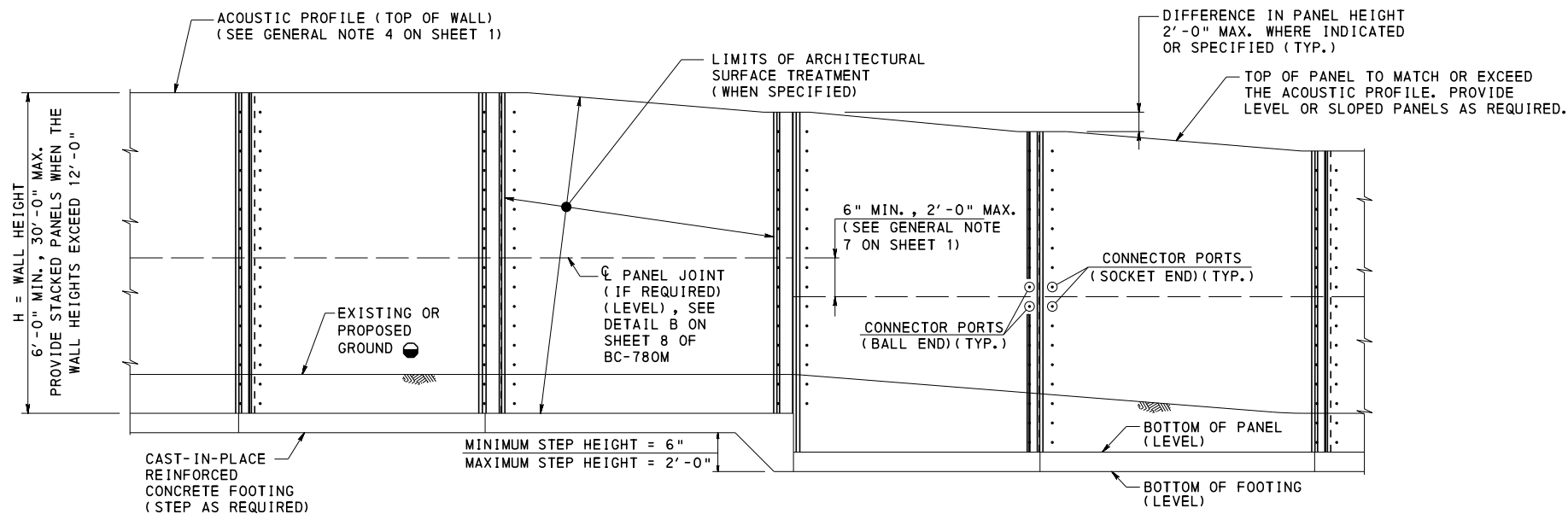
SHEET 2 OF 8

BD-680M

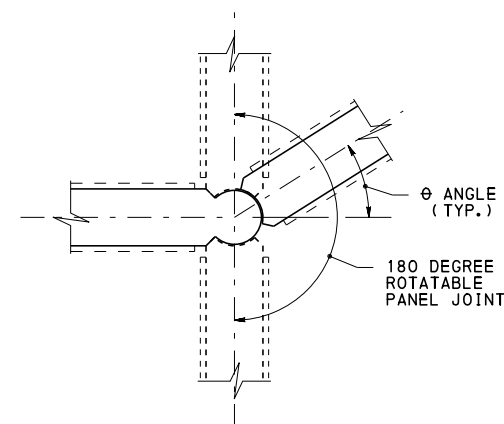




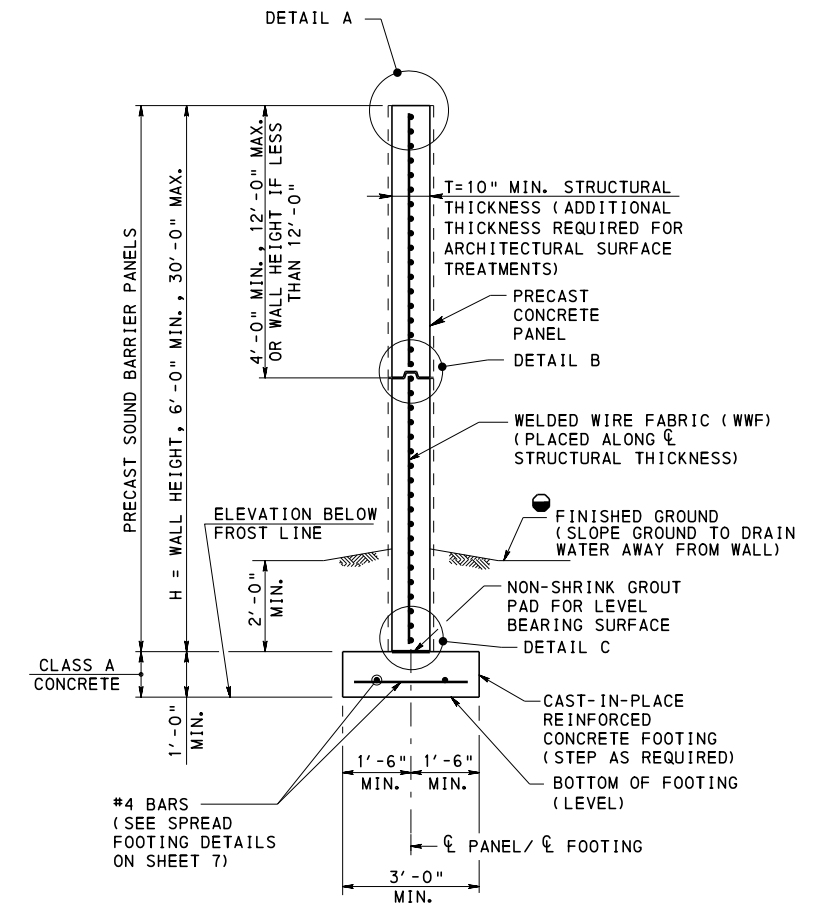
**PLAN - OFFSET SOUND BARRIER**  
(END PANEL NOT SHOWN)



**ELEVATION - OFFSET SOUND BARRIER**  
(END PANEL NOT SHOWN)



**PANEL JOINT**



**SECTION A-A**

**LEGEND:**

- GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

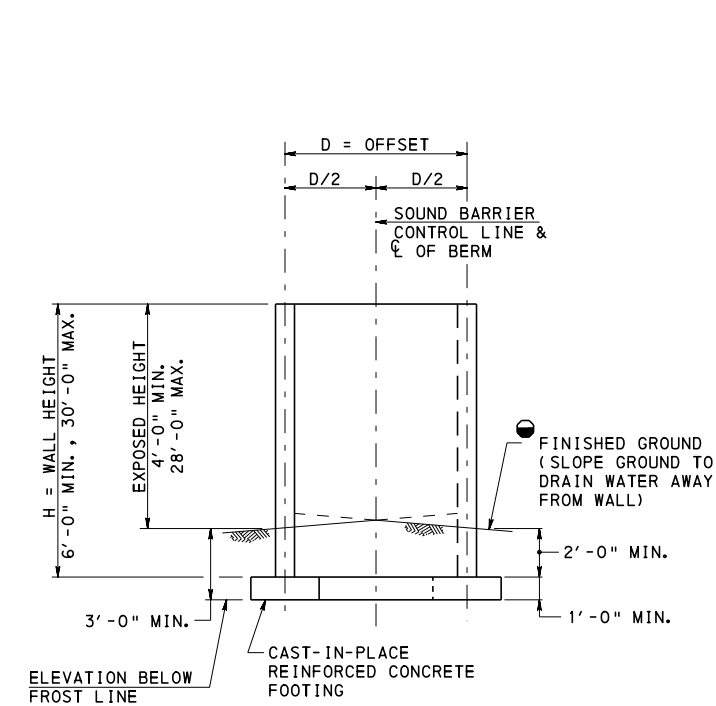
**NOTES:**

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- FOR DESIGN TABLES REFER TO SHEET 4.
- FOR DETAILS A, B, AND C REFER TO BC-780M, SHEET 8.
- LOCATE SOUND BARRIER CONTROL LINE AND WORKING POINTS BASED ON THE ROADWAY GEOMETRY ON THE STAKE-OUT PLAN.
- WALL DIRECTION IS PERMITTED TO CHANGE AT ANY PANEL JOINT AS LONG AS THERE IS A "4 PANEL UNIT" ON BOTH SIDES OF THE PANEL JOINT.
- DESIGNER TO INDICATE THE GEOMETRY OF THE WALL ON THE CONTRACT DRAWINGS.

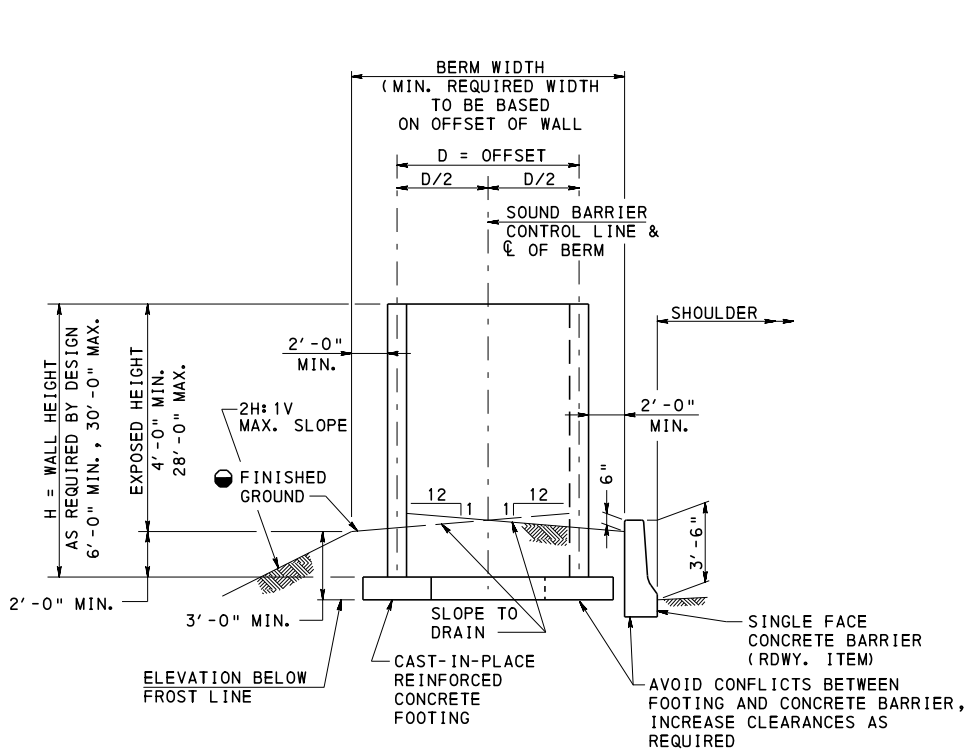
| COMMONWEALTH OF PENNSYLVANIA<br>DEPARTMENT OF TRANSPORTATION<br>BUREAU OF PROJECT DELIVERY |                                                                                                      |                                |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------|
| STANDARD<br>OFFSET SOUND BARRIER WALLS<br>GEOMETRY AND LAYOUT - 1                          |                                                                                                      |                                |
| RECOMMENDED AUG. 30, 2019<br><i>James J. Ringer</i><br>ACTING CHIEF BRIDGE ENGINEER        | RECOMMENDED AUG. 30, 2019<br><i>Michael J. B. [Signature]</i><br>ACT. DIR., BUR. OF PROJECT DELIVERY | SHEET 3 OF 8<br><b>BD-680M</b> |

| OFFSET SOUND BARRIER DESIGN TABLE            |                      |                     |                                      |                                |
|----------------------------------------------|----------------------|---------------------|--------------------------------------|--------------------------------|
| HEIGHT ZONE 0'-14'<br>WIND PRESSURE = 20 PSF |                      |                     |                                      |                                |
| WALL HEIGHT<br>H<br>(FT.)                    | OFFSET<br>D<br>(FT.) | ANGLE<br>θ<br>(DMS) | 4-PANEL<br>UNIT LENGTH<br>L<br>(FT.) | MINIMUM<br>NUMBER<br>OF CABLES |
| 6.0                                          | 2.0                  | 07°39'44.1"         | 59.7321                              | 4                              |
| 8.0                                          | 2.5                  | 09°35'38.6"         | 59.5804                              | 5                              |
| 10.0                                         | 3.0                  | 11°32'13.1"         | 59.3939                              | 5                              |
| 12.0                                         | 3.5                  | 13°29'36.2"         | 59.1719                              | 5                              |
| 14.0                                         | 3.5                  | 13°29'36.2"         | 59.1719                              | 6                              |
| 16.0                                         | 4.0                  | 15°27'57.6"         | 58.9137                              | 6                              |
| 18.0                                         | 4.5                  | 17°27'27.4"         | 58.6182                              | 6                              |
| 20.0                                         | 5.0                  | 19°28'16.4"         | 58.2843                              | 6                              |
| 22.0                                         | 5.5                  | 21°30'36.7"         | 57.9106                              | 6                              |
| 24.0                                         | 6.0                  | 23°34'41.4"         | 57.4955                              | 6                              |
| 26.0                                         | 6.5                  | 25°40'45.4"         | 57.0370                              | 6                              |
| 28.0                                         | 7.0                  | 27°49'05.3"         | 56.5330                              | 6                              |

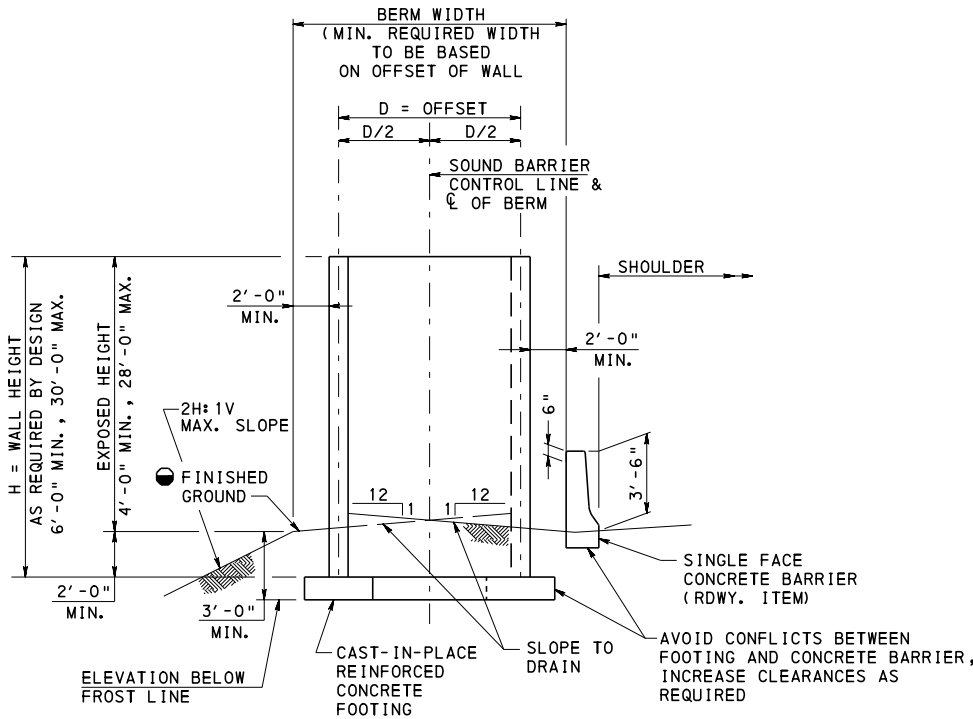
| OFFSET SOUND BARRIER DESIGN TABLE               |                      |                     |                                      |                                |
|-------------------------------------------------|----------------------|---------------------|--------------------------------------|--------------------------------|
| HEIGHT ZONES OVER 14'<br>WIND PRESSURE = 28 PSF |                      |                     |                                      |                                |
| WALL HEIGHT<br>H<br>(FT.)                       | OFFSET<br>D<br>(FT.) | ANGLE<br>θ<br>(DMS) | 4-PANEL<br>UNIT LENGTH<br>L<br>(FT.) | MINIMUM<br>NUMBER<br>OF CABLES |
| 6.0                                             | 2.5                  | 09°35'38.6"         | 59.5804                              | 4                              |
| 8.0                                             | 3.0                  | 11°32'13.1"         | 59.3939                              | 5                              |
| 10.0                                            | 3.5                  | 13°29'36.2"         | 59.1719                              | 5                              |
| 12.0                                            | 4.5                  | 17°27'27.4"         | 58.6182                              | 5                              |
| 14.0                                            | 5.0                  | 19°28'16.4"         | 58.2843                              | 6                              |
| 16.0                                            | 5.5                  | 21°30'36.7"         | 57.9106                              | 6                              |
| 18.0                                            | 6.0                  | 23°34'41.4"         | 57.4955                              | 6                              |
| 20.0                                            | 7.0                  | 27°49'05.3"         | 56.5330                              | 6                              |
| 22.0                                            | 7.5                  | 30°00'00.0"         | 55.9808                              | 6                              |
| 24.0                                            | 8.0                  | 32°13'51.4"         | 55.3772                              | 6                              |
| 26.0                                            | 8.5                  | 34°31'05.2"         | 54.7184                              | 6                              |
| 28.0                                            | 9.0                  | 36°52'11.6"         | 54.0000                              | 7                              |
| 30.0                                            | 10.0                 | 41°48'37.1"         | 52.3607                              | 7                              |



SECTION - OFFSET SOUND BARRIER



SECTION - OFFSET SOUND BARRIER ON BERM  
ADJACENT TO ROADWAY BARRIER  
OPTION 1 (SEE NOTE 2)



SECTION - OFFSET SOUND BARRIER ON BERM  
ADJACENT TO ROADWAY BARRIER  
OPTION 2 (SEE NOTE 2)

**NOTES:**

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- DESIGNER TO SELECT WHICH OPTION IS USED BASED ON ROADWAY GEOMETRICS, RIGHT-OF-WAY REQUIREMENTS AND ALL OTHER CONSTRAINTS. OBTAIN ACCEPTANCE FROM THE DISTRICT BRIDGE ENGINEER. (THE DEPARTMENT PREFERS OPTION 1)

**LEGEND:**

- DMS = DEGREES, MINUTES, AND SECONDS
- ▲ - PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL-TO-PANEL CONNECTION.
  - - GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

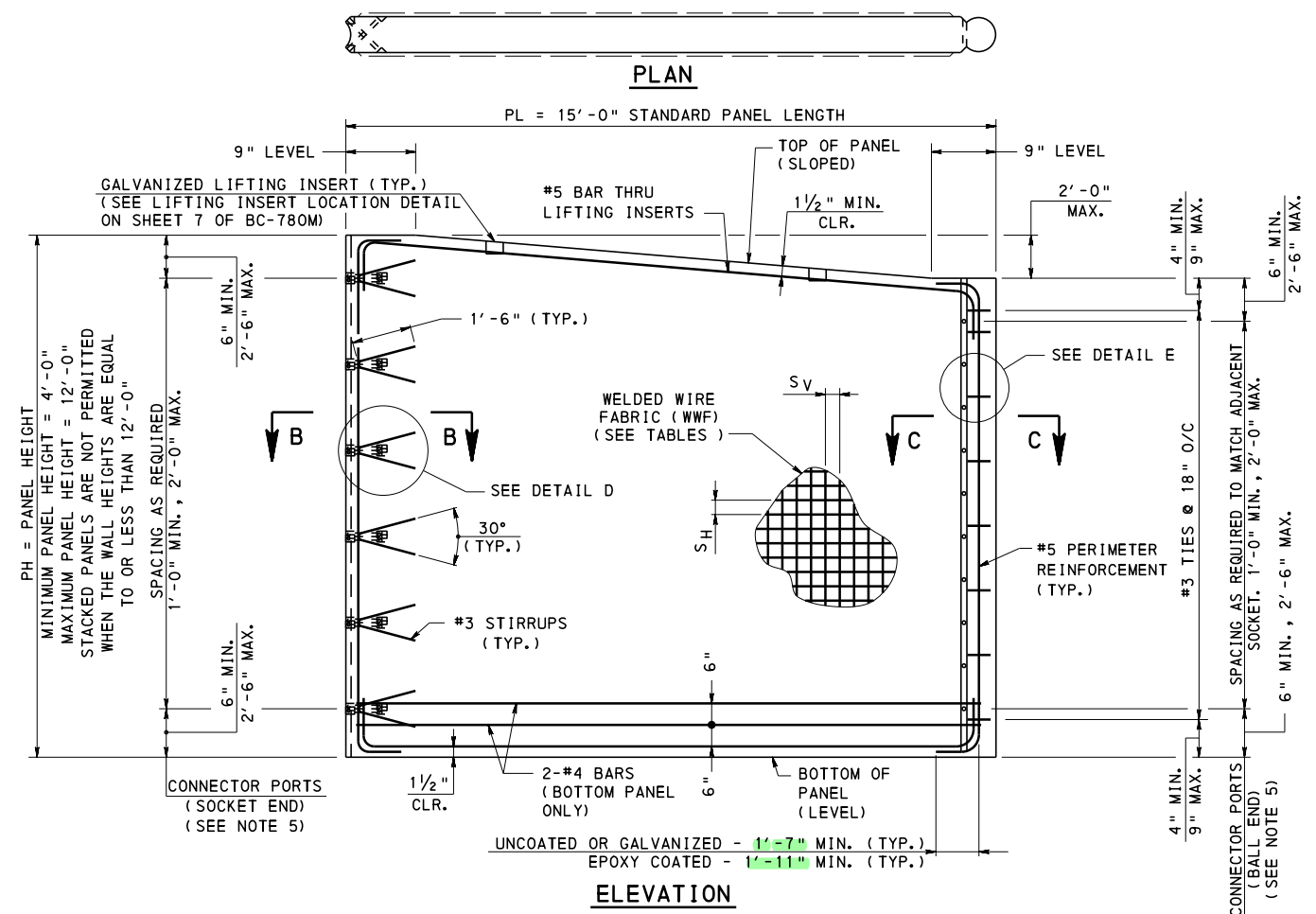
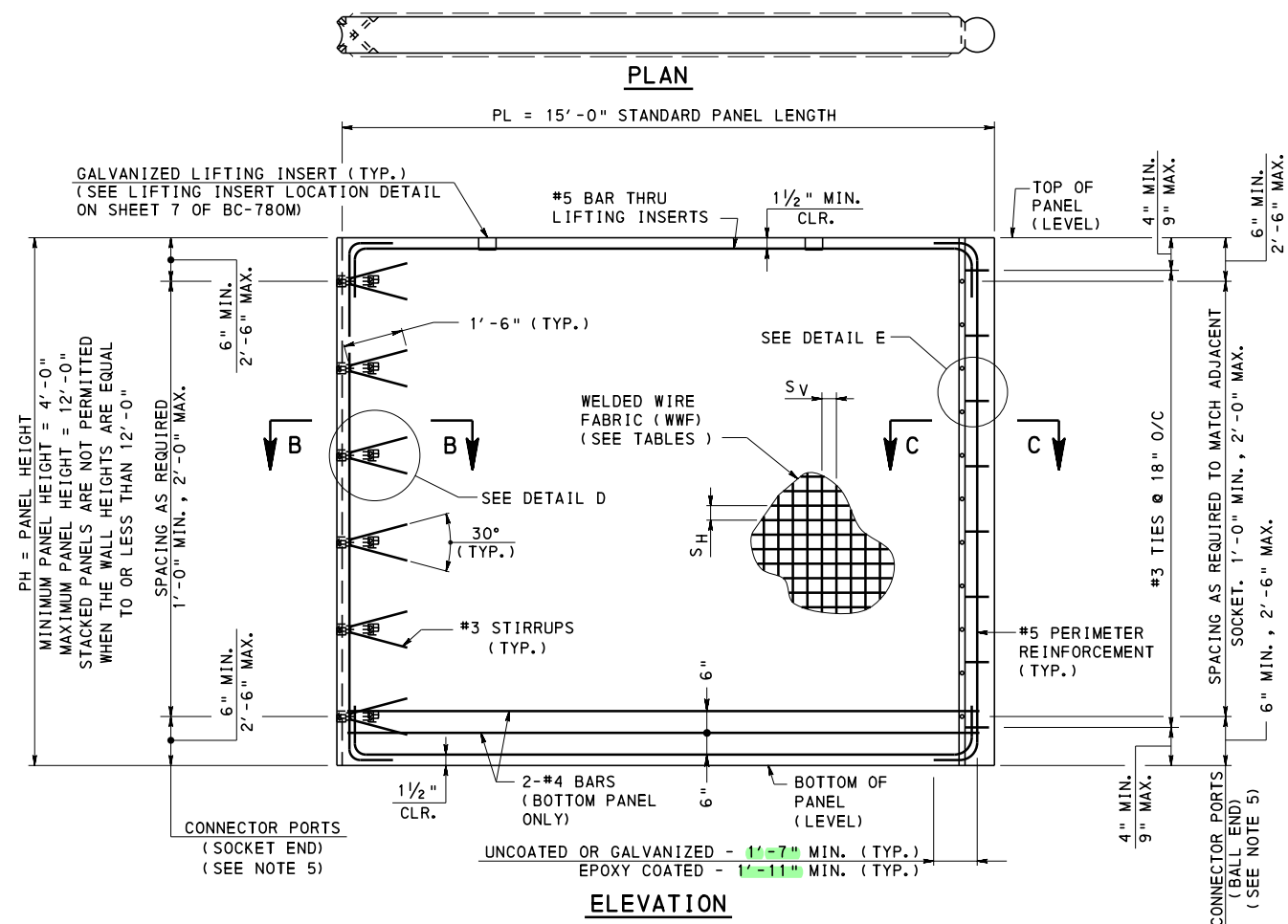
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DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY

STANDARD  
OFFSET SOUND BARRIER WALLS  
GEOMETRY AND LAYOUT - 2

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 8  
BD-680M



LEGEND:

$S_H$  = SPACING OF HORIZONTAL BARS  
 $S_V$  = SPACING OF VERTICAL BARS

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR SECTION B-B AND C-C, REFER TO BC-780M, SHEET 6.
3. FOR DETAILS D AND E, REFER TO BC-780M, SHEET 6.
4. WELDED WIRE FABRIC TO BE PLACED ALONG  $\frac{1}{4}$  STRUCTURAL THICKNESS.
5. LOCATION OF CONNECTOR PORTS MUST BE DETAILED ON THE SHOP DRAWINGS. PORTS LOCATIONS TO MATCH ADJACENT PANELS. PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL TO PANEL CONNECTION (PER SIDE OF PANEL).
6. IF STACKED PANELS ARE REQUIRED REFER TO DETAIL B ON SHEET 8 OF BC-780M.
7. DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN.

| PRECAST CONCRETE<br>PANEL REINFORCEMENT FOR<br>STANDARD UPPER PANELS |                                    |                                                  |          |                                      |
|----------------------------------------------------------------------|------------------------------------|--------------------------------------------------|----------|--------------------------------------|
| WIND PRESSURE = 28 PSF                                               |                                    |                                                  |          |                                      |
| PANEL<br>HEIGHT<br>PH<br>(FT.)                                       | WELDED WIRE FABRIC<br>WWF AxB-WCxD | WELDED WIRE<br>STEEL AREA (IN <sup>2</sup> /FT.) |          | MIN. NUMBER<br>OF LIFTING<br>INSERTS |
|                                                                      |                                    | HORIZONTAL                                       | VERTICAL |                                      |
| 4.0                                                                  | WWF 6x6-W8xW8                      | 0.16                                             | 0.16     | 2                                    |
| 6.0                                                                  | WWF 6x6-W8xW8                      | 0.16                                             | 0.16     | 2                                    |
| 8.0                                                                  | WWF 6x4-W8xW8                      | 0.16                                             | 0.24     | 4                                    |
| 10.0                                                                 | WWF 6x4-W8xW12                     | 0.16                                             | 0.36     | 4                                    |
| 12.0                                                                 | WWF 6x4-W8xW20                     | 0.16                                             | 0.60     | 4                                    |

| <h1 style="text-align: center;">PRECAST CONCRETE<br/>PANEL REINFORCEMENT FOR<br/>STANDARD BOTTOM PANELS</h1> |                                    |                                                  |          |                                      |
|--------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------------|----------|--------------------------------------|
| <h2 style="text-align: center;">WIND PRESSURE = 28 PSF</h2>                                                  |                                    |                                                  |          |                                      |
| PANEL<br>HEIGHT<br>PH<br>(FT.)                                                                               | WELDED WIRE FABRIC<br>WWF AxB-WCxD | WELDED WIRE<br>STEEL AREA (IN <sup>2</sup> /FT.) |          | MIN. NUMBER<br>OF LIFTING<br>INSERTS |
|                                                                                                              |                                    | HORIZONTAL                                       | VERTICAL |                                      |
| 4.0                                                                                                          | WWF 4x6-W8xW8                      | 0.24                                             | 0.16     | 2                                    |
| 6.0                                                                                                          | WWF 4x6-W8xW8                      | 0.24                                             | 0.16     | 2                                    |
| 8.0                                                                                                          | WWF 4x4-W8xW8                      | 0.24                                             | 0.24     | 4                                    |
| 10.0                                                                                                         | WWF 4x4-W8xW12                     | 0.24                                             | 0.36     | 4                                    |
| 12.0                                                                                                         | WWF 4x4-W8xW20                     | 0.24                                             | 0.60     | 4                                    |

WHERE A = SPACING OF HORIZONTAL BARS ( $S_H$ )  
 B = SPACING OF VERTICAL BARS ( $S_V$ )  
 C = HORIZONTAL WIRE SIZE  
 D = VERTICAL WIRE SIZE  
 WWF = WELDED WIRE FABRIC

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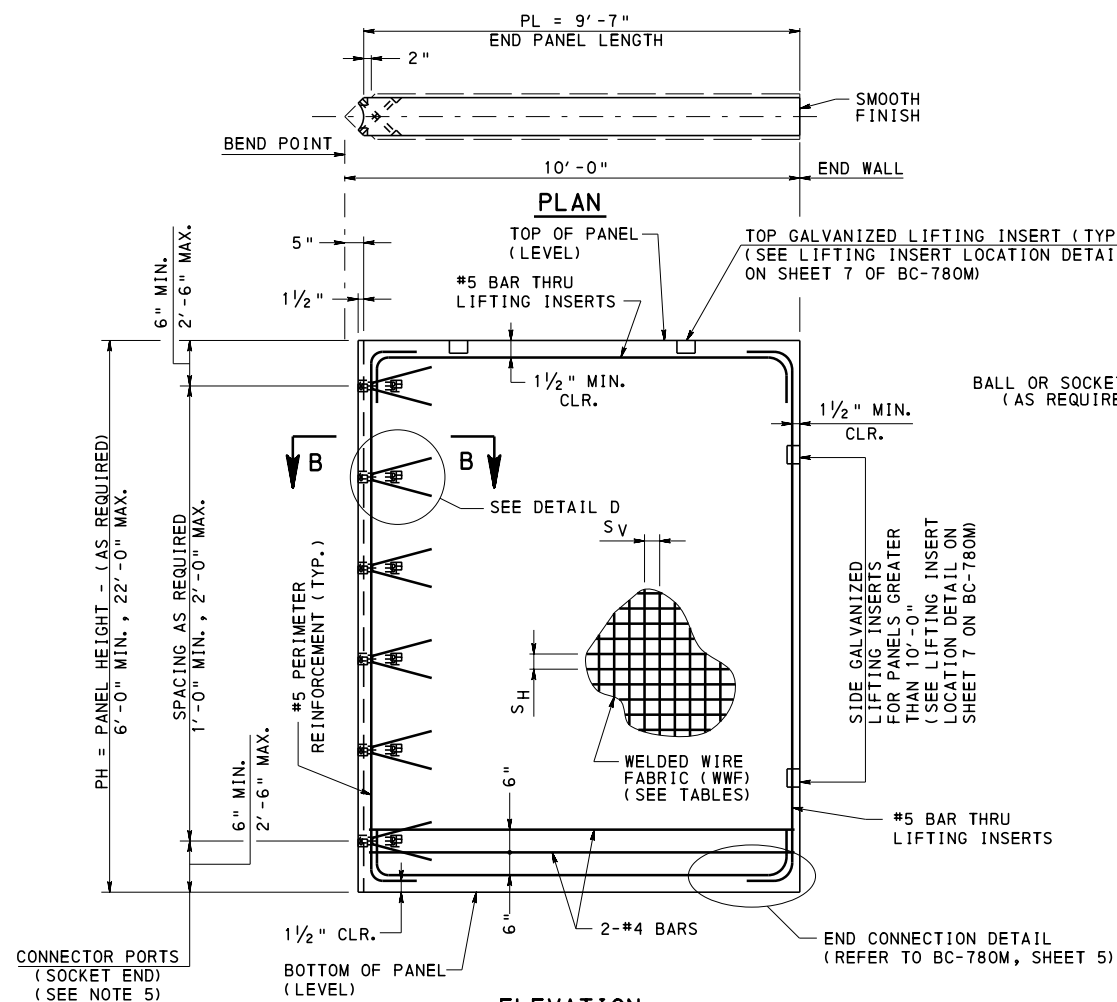
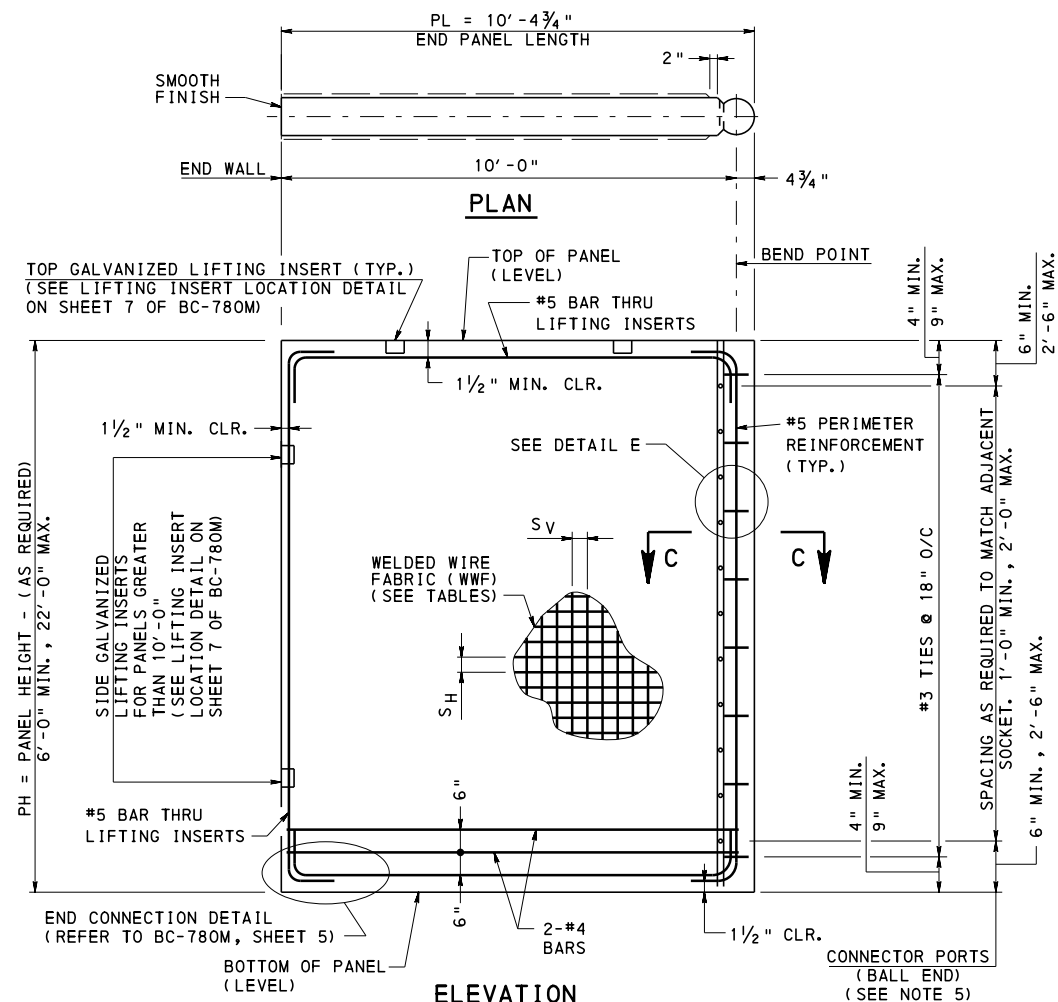
STANDARD  
OFFSET SOUND BARRIER WALLS  
PRECAST CONCRETE STANDARD PANEL DETAILS

RECOMMENDED AUG. 30, 2019  
*Joris J. Runyon*  
 ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Melvin D. Butler*  
 ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 5 OF 8

BD-680M



### ALTERNATE SLOPED END PANEL

(FABRICATOR TO LOCATE LIFTING INSERTS, AS REQUIRED)

#### LEGEND:

S<sub>H</sub> = SPACING OF HORIZONTAL BARS  
S<sub>V</sub> = SPACING OF VERTICAL BARS

#### NOTES:

- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- FOR SECTION B-B AND C-C, REFER TO BC-780M, SHEET 6.
- FOR DETAILS D AND E, REFER TO BC-780M, SHEET 6.
- WELDED WIRE FABRIC TO BE PLACED ALONG  $\phi$  STRUCTURAL THICKNESS.
- LOCATION OF CONNECTOR PORTS MUST BE DETAILED ON THE SHOP DRAWINGS. PORTS LOCATIONS TO MATCH ADJACENT PANELS. PROVIDE A MINIMUM OF THREE CABLE CONNECTIONS FOR THE END PANEL TO ADJACENT PANEL(S) CONNECTION.
- PROVIDE SINGLE END PANELS, STACKED PANELS NOT PERMITTED.
- DESIGNER TO SPECIFY THE WELDED WIRE FABRIC REQUIREMENTS, INCLUDING THE AREA OF STEEL, AND THE MINIMUM NUMBER OF LIFTING INSERTS REQUIRED ON THE CONTRACT DRAWINGS. INFORMATION IS PERMITTED TO BE IN TABLE FORM SIMILAR TO THE TABLES SHOWN.

| PRECAST CONCRETE PANEL REINFORCEMENT FOR END PANELS |                                     |                                               |          |                                |               |
|-----------------------------------------------------|-------------------------------------|-----------------------------------------------|----------|--------------------------------|---------------|
| WIND PRESSURE = 28 PSF                              |                                     |                                               |          |                                |               |
| PANEL HEIGHT PH (FT.)                               | WELDED WIRE FABRIC ** WWF AxB-WCxWD | WELDED WIRE STEEL AREA (IN <sup>2</sup> /FT.) |          | MIN. NUMBER OF LIFTING INSERTS |               |
|                                                     |                                     | HORIZONTAL                                    | VERTICAL | TOP OF PANEL                   | SIDE OF PANEL |
| 6.0                                                 | WWF 6x6-W8xW8                       | 0.16                                          | 0.16     | 2                              | —             |
| 8.0                                                 | WWF 6x4-W8xW8                       | 0.16                                          | 0.24     | 2                              | —             |
| 10.0                                                | WWF 6x4-W8xW12                      | 0.16                                          | 0.36     | 2                              | —             |
| 12.0                                                | WWF 4x4-W12xW12                     | 0.36                                          | 0.36     | 4                              | 4             |
| 14.0                                                | WWF 4x4-W12xW12                     | 0.36                                          | 0.36     | 4                              | 4             |
| 16.0                                                | WWF 4x4-W12xW12                     | 0.36                                          | 0.36     | 4                              | 4             |
| 18.0                                                | WWF 4x4-W12xW12                     | 0.36                                          | 0.36     | 4                              | 4             |
| 20.0                                                | WWF 4x4-W12xW12                     | 0.36                                          | 0.36     | 4                              | 4             |
| 22.0                                                | WWF 4x4-W12xW12                     | 0.36                                          | 0.36     | 4                              | 4             |

WHERE A = SPACING OF HORIZONTAL BARS (S<sub>H</sub>)  
B = SPACING OF VERTICAL BARS (S<sub>V</sub>)  
C = HORIZONTAL WIRE SIZE  
D = VERTICAL WIRE SIZE  
WWF = WELDED WIRE FABRIC

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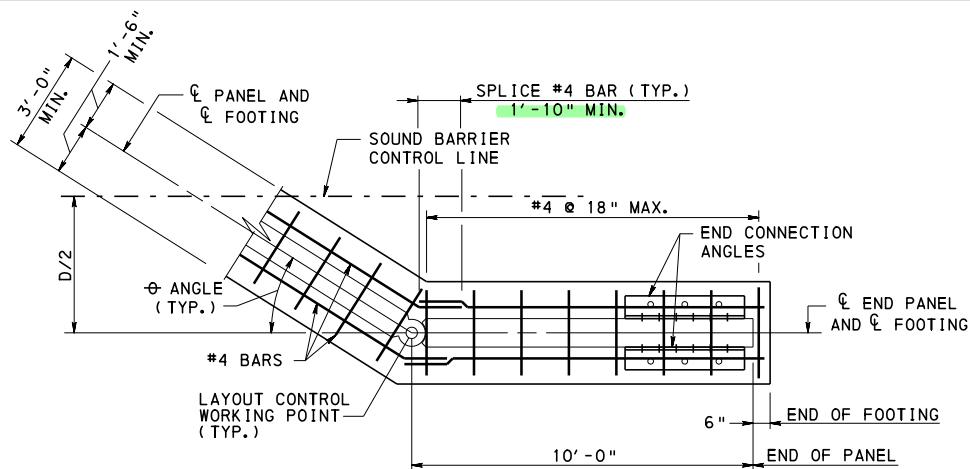
STANDARD  
OFFSET SOUND BARRIER WALLS  
PRECAST CONCRETE END PANEL DETAILS

RECOMMENDED AUG. 30, 2019  
ACTING CHIEF BRIDGE ENGINEER

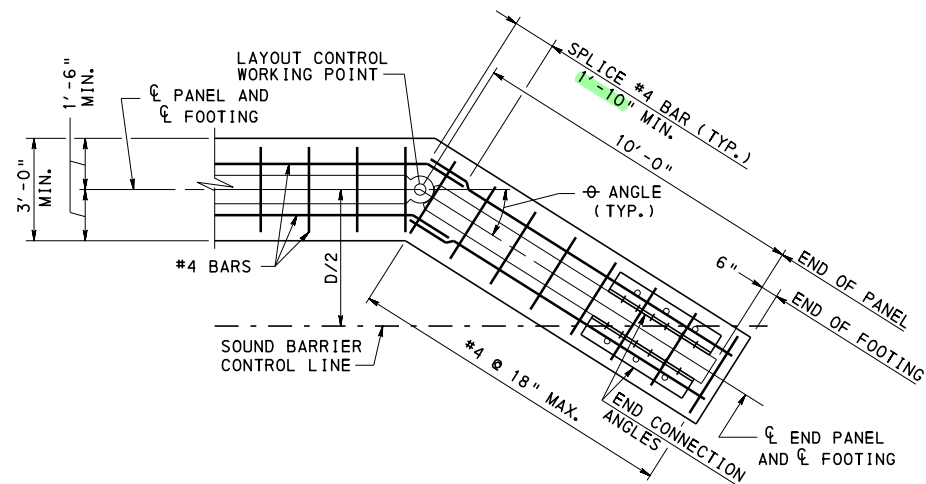
RECOMMENDED AUG. 30, 2019  
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SHEET 6 OF 8  
BD-680M

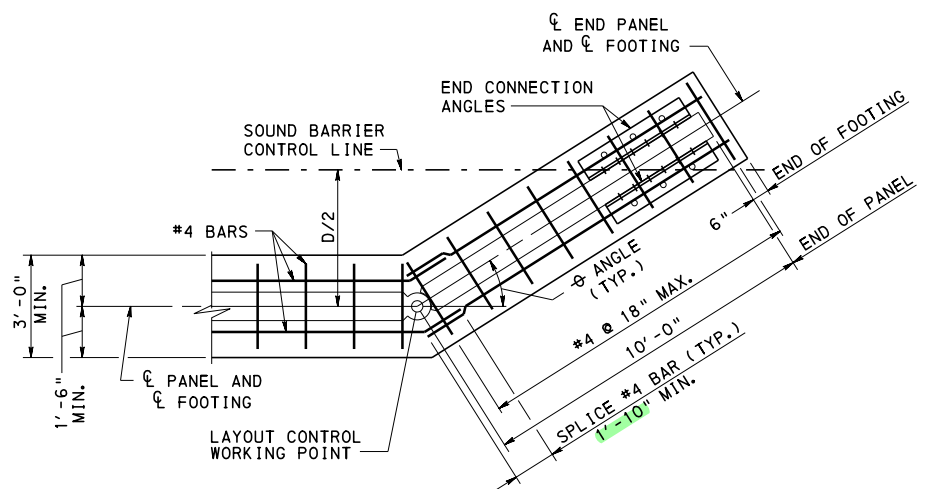




**OPTION 1**



**OPTION 2**



**OPTION 3**

**FOOTING PLANS AT END PANELS**

**NOTES:**

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR END PANEL CONNECTION DETAILS, REFER TO SHEET 5 OF BC-780M.

**COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF PROJECT DELIVERY**

**STANDARD  
OFFSET SOUND BARRIER WALLS  
SPREAD FOOTING DETAILS  
FOR END PANELS**

RECOMMENDED AUG. 30, 2019  
*John J. Russo*  
ACTING CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 30, 2019  
*Michael J. B. [Signature]*  
ACT. DIR., BUR. OF PROJECT DELIVERY

SHEET 8 OF 8  
**BD-680M**



CHANGE 2

CHANGE 5

GENERAL NOTES

1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS PUBLICATION 408, AASHTO/AWS D1.5 BRIDGE WELDING CODE AND THE SPECIAL PROVISIONS.

2. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.

3. USE CLASS A CEMENT CONCRETE FOR CONCRETE MASONRY UNIT FILL AND COPING.

4. PROVIDE GRADE 60 REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706. DO NOT USE RAIL STEEL (A 996) FOR BENT BARS. USE EPOXY COATED OR GALVANIZED BARS IN ACCORDANCE WITH PUBLICATION 408 SECTION 1002.

5. REINFORCED SOIL FOUNDATION (RSF) BACKFILL: PENNDOT 2A COARSE AGGREGATE OR DRIVING SURFACE AGGREGATE (LOCAL JURISDICTION BRIDGES ONLY), WITH ALL AGGREGATES TYPE A.

6. REINFORCED BACKFILL GRADATION: AASHTO #8, #57, #67 OR A COMBINATION THEREOF, WITH ALL AGGREGATES TYPE A.

7. INTEGRATED APPROACH BACKFILL: PENNDOT 2A COARSE AGGREGATE OR DRIVING SURFACE AGGREGATE (LOCAL JURISDICTION BRIDGES ONLY), WITH ALL AGGREGATES TYPE C OR BETTER.

8. GEOSYNTHETIC REINFORCEMENT TO BE IN ACCORDANCE WITH PUBLICATION 408, SECTION 735, CLASS 4, TYPE C, WITH THE FOLLOWING ADDITIONAL PROPERTIES:

• USE BIAXIAL GEOTEXTILE MADE FROM POLYPROPYLENE

• TENSILE PROPERTIES DETERMINED BY ASTM D 4595 WITH ULTIMATE TENSILE STRENGTH GREATER THAN OR EQUAL TO 4,800 LB/FT IN BOTH DIRECTIONS TESTED AT A STRAIN RATE OF 10% PER MINUTE. TENSILE STRENGTH AT 2% STRAIN GREATER THAN OR EQUAL TO TENSILE STRENGTH REQUIRED BY DESIGN.

• PROVIDE CERTIFIED TEST DATA DEMONSTRATING COMPLIANCE WITH THIS STANDARD AND PUBLICATION 408.

9. CONCRETE MASONRY UNITS (CMU):

• CONDUCT FREEZE-THAW TEST IN ACCORDANCE WITH ASTM C1262-10 TO ESTABLISH CONFORMANCE WITH ASTM C1372.

• PREVENT EXPOSURE TO DEICING CHEMICALS. ADDITIVES CAN BE USED TO REDUCE EFFLORESCENCE AT THE FACE OF THE BLOCKS IF THERE IS POTENTIAL EXPOSURE TO DEICING CHEMICALS.

• COMPRESSIVE STRENGTH = 3,000 PSI MINIMUM

• WATER ABSORPTION LIMIT LESS THAN OR EQUAL TO 5% AFTER 24 HOURS

• NOMINAL DIMENSIONS = 8"x8"x16" SMALL CMU, 24"x24"x72" SOLID CONCRETE BLOCKS; ACTUAL DIMENSIONS SHOULD BE USED WHEN DETERMINING ABUTMENT GEOMETRY (SMALL CMU = 7⅞"x7⅞"x15⅝" - TYPICALLY)

• HEIGHT TOLERANCE ±⅛", LENGTH AND WIDTH TOLERANCE ±⅛"

• MINIMUM FACE SHELL THICKNESS 1¼" AND MINIMUM WEB THICKNESS ¾"

• SPECIFY SPLIT FACE CMU IF DESIRED FOR AESTHETICS

10. PREFORMED CELLULAR POLYSTYRENE (P.C.P.) FOAM BOARD: IN ACCORDANCE WITH ASTM C 578; MINIMUM COMPRESSIVE STRENGTH = 10 PSI.

DESIGN METHODOLOGY

1. DESIGN LIMITATIONS:

• LIMIT TO SITES WHERE ADT IS LESS THAN 400 VEHICLES/DAY.

• LIMIT TO SINGLE SPAN BRIDGES WITH SPAN LENGTH LESS THAN OR EQUAL TO 70 FEET.

• LIMIT ABUTMENT HEIGHTS TO 30 FEET MAXIMUM MEASURED FROM TOP OF REINFORCED SOIL FOUNDATION TO TOP OF BEAM SEAT.

• LIMIT TO SITES WITH LOW SCOUR POTENTIAL.

• LIMIT TO SITES WITH MAXIMUM WATER VELOCITIES LESS THAN OR EQUAL TO 7 FPS FOR TYPICAL DETAILS SHOWN (SMALL SOLID, HOLLOW AND FILLED CMU).

• LIMIT TO SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 7 FPS AND LESS THAN OR EQUAL TO 10 FPS, WHEN ALL ROWS OF SMALL HOLLOW CONCRETE MASONRY UNITS ARE USED AND FILLED WITH REBAR AND CONCRETE (SEE SHEET 4 OF 4 FOR DETAIL).

• LIMIT TO SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 10 FPS AND LESS THAN OR EQUAL TO 12 FPS, WHEN SOLID CONCRETE BLOCKS ARE USED (SEE SHEET 4 OF 4 FOR DETAIL).

• LIMIT TO SITES WITH SOIL PH OF 5 TO 9.

• IF A PROJECT REQUIRES A 75 YEAR FACING ELEMENT SERVICE LIFE, IT MAY BE NECESSARY TO UTILIZE A DIFFERENT FACING TYPE. IF HOLLOW OR FILLED CONCRETE MASONRY UNITS ARE USED, HAVE A VIABLE PLAN FOR CONCRETE MASONRY UNIT REPAIR.

2. USE THE METHODOLOGY AND GUIDELINES PROVIDED IN THE GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM INTERIM IMPLEMENTATION GUIDE, FHWA-HRT-11-026, JUNE 2012 AND GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM SYNTHESIS REPORT, FHWA-HRT-11-027, JANUARY 2011.

DESIGN METHODOLOGY (CONTINUED)

3. LOAD & RESISTANCE FACTOR DESIGN METHODOLOGY:

BEARING RESISTANCE FACTOR = 0.65

SLIDING RESISTANCE FACTOR (SOIL ON SOIL) = 1.0

GLOBAL STABILITY RESISTANCE FACTOR = 0.65

INTERNAL STABILITY RESISTANCE FACTOR = 0.45

REINFORCEMENT TENSION RESISTANCE FACTOR = 0.90

REINFORCEMENT STRENGTH REDUCTION FACTOR = 2.25

ALLOWABLE STRESS DESIGN METHODOLOGY:

BEARING FACTOR OF SAFETY = 2.5

SLIDING FACTOR OF SAFETY = 1.5

GLOBAL STABILITY FACTOR OF SAFETY = 1.5

INTERNAL STABILITY FACTOR OF SAFETY = 3.5

REINFORCEMENT TENSION FACTOR OF SAFETY = 3.5

4. PERFORMANCE CRITERIA:

• TOLERABLE VERTICAL STRAIN = 0.5% OF WALL HEIGHT (H)

• TOLERABLE LATERAL STRAIN = 1.0% OF b AND q (BEARING WIDTH AND SETBACK)

5. LIMIT SERVICE 1 BEARING STRESS ON THE BEAM SEAT TO LESS THAN OR EQUAL TO 4,000 PSF.

6. FOR STRUCTURES OVER ROAD OR RAIL, ADD ESTIMATED GRS MASS VERTICAL STRAIN FROM DEAD LOAD AND FOUNDATION SETTLEMENT TO REQUIRED VERTICAL CLEARANCE.

7. DEPENDANT ON SUPERSTRUCTURE TYPE (I.E. STEEL BEAMS, SPREAD CONCRETE BEAMS OR TIMBER BEAMS) AND/OR BEARING STRESSES, A PRECAST OR CAST IN PLACE CONCRETE BEAM SEAT MAY BE REQUIRED, SEE SHEET 4 FOR DETAILS.

8. STEEL OR SPREAD CONCRETE BEAM SUPERSTRUCTURES REQUIRE THE DESIGN OF A CONCRETE END DIAPHRAGM OR BACKWALL.

9. PERFORM CORE BORINGS OR EXPLORATORY EXCAVATIONS AS NECESSARY TO DETERMINE FOUNDATION AND SCOURABILITY OF BEDDING MATERIAL. IF BEDROCK IS ENCOUNTERED, KEY RSF INTO BEDROCK 6"-12" BASED ON ROCK QUALITY AND ERODIBILITY.
- CONSTRUCTION METHODOLOGY
1. SITE LAYOUT/SURVEY: CONSTRUCT THE BASE OF THE GRS ABUTMENT AND WINGWALLS WITHIN 1.0 INCH OF THE STAKED ELEVATIONS. CONSTRUCT THE EXTERNAL GRS ABUTMENT AND WINGWALLS TO WITHIN ±0.5 INCHES OF THE SURVEYED STAKE DIMENSIONS.

2. COMPACTION: COMPACT BACKFILL TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY ACCORDING TO AASHTO T99 AND ±2 PERCENT OPTIMUM MOISTURE CONTENT. IN THE BEARING REINFORCEMENT ZONE, COMPACT TO 100 PERCENT OF THE MAXIMUM DRY DENSITY ACCORDING TO AASHTO T99. THE COMPACTED THICKNESS SHALL BE 8 INCHES PER LIFT IN THE REINFORCED BACKFILL. THE MAXIMUM COMPACTED THICKNESS SHALL BE 6 INCHES PER LIFT IN THE RSF AND INTEGRATED APPROACH. ONLY HAND-OPERATED COMPACTION EQUIPMENT IS ALLOWED WITHIN 3 FEET OF THE WALL FACE. REINFORCEMENT EXTENDS DIRECTLY BENEATH EACH LAYER OF CMU BLOCKS, EXTENDING TO 1 INCH OR LESS FROM THE FRONT FACE OF THE WALL. COMPACT OPEN-GRADED MATERIAL TO OBTAIN A STATE OF NON-MOVEMENT AND A MINIMUM OF 3 PASSES OF VIBRATION EQUIPMENT.

3. GEOSYNTHETIC REINFORCEMENT PLACEMENT: PULL THE GEOSYNTHETIC TAUGHT TO REMOVE ANY WRINKLES AND LAY FLAT PRIOR TO PLACING AND COMPACTING THE BACKFILL MATERIAL. STAGGER SPLICES AT LEAST 24 INCHES APART AND SPLICES ARE NOT ALLOWED IN THE BEARING REINFORCEMENT ZONE. NO EQUIPMENT IS ALLOWED DIRECTLY ON THE GEOSYNTHETIC. PLACE A MINIMUM 6 INCH LAYER OF GRANULAR FILL PRIOR TO OPERATING ONLY RUBBER-TIRED EQUIPMENT OVER THE GEOSYNTHETIC AT SPEEDS LESS THAN 5 MILES PER HOUR WITH NO SUDDEN BRAKING OR SHARP TURNING.

4. REINFORCED SOIL FOUNDATION CONSTRUCTION: ENCAPSULATE THE RSF IN GEOTEXTILE REINFORCEMENT ON ALL SIDES WITH MINIMUM OVERLAPS OF 3.0 FEET TO PREVENT WATER INFILTRATION AND BACKFILL MIGRATION. WRAPPED CORNERS NEED TO BE TIGHT WITHOUT EXPOSED SOIL. COMPACT BACKFILL MATERIAL IN LIFTS THAT RESULT IN 6 INCHES IN COMPACTED HEIGHT. PLACE GEOSYNTHETIC REINFORCEMENT AT 12 INCH SPACING. GRADE AND LEVEL THE TOP OF THE RSF PRIOR TO FINAL ENCAPSULATION, AS THIS WILL SERVE AS THE LEVELING PAD FOR THE CMU BLOCKS OF THE GRS ABUTMENT. ALTHOUGH IT IS NOT PREFERABLE, IF BUILDING GRS WALL ON EXISTING FOUNDATIONS, CONSIDER PROVIDING A VERTICAL CONTROL JOINT TO ALLOW FOR DIFFERENTIAL SETTLEMENT.

5. GRS WALL FACE ALIGNMENT: CHECK FOR LEVEL ALIGNMENT OF THE CMU BLOCK ROW AT LEAST EVERY OTHER LAYER OF THE GRS ABUTMENT. CORRECT ANY ALIGNMENT DEVIATIONS GREATER THAN 0.25 INCHES. WHERE DIFFERENTIAL SETTLEMENT IS ANTICIPATED, OR ENCOUNTERED, PROVIDE A VERTICAL CONTROL JOINT IN THE WALL FACE TO REDUCE OR ELIMINATE CRACKING OF BLOCKS.

6. BEAM SEAT PLACEMENT: FOR FLAT GRADED BEAM SEATS, THE THICKNESS OF THE BEAM SEAT IS APPROXIMATELY 8 TO 12 INCHES AND CONSISTS OF A MINIMUM OF TWO 4 INCH COMPACTED THICKNESSES OF WRAPPED-FACE GRS. PLACE PRECUT 4 INCH THICK P.C.P. FOAM BOARD ON THE TOP OF THE BEARING BED REINFORCEMENT BUTT AGAINST THE BACK FACE OF THE CMU BLOCK. SET HALF HEIGHT OR FULL HEIGHT (DEPENDING ON WALL HEIGHT AND REQUIRED CLEAR SPACE) SOLID CMU BLOCKS ON TOP OF THE P.C.P. FOAM BOARD. WRAP TWO APPROXIMATELY 4 INCH COMPACTED THICKNESSES ACROSS THE BEAM SEAT. BEFORE FOLDING THE FINAL WRAP, IT MAY BE NECESSARY TO GRADE THE SURFACE AGGREGATE OF THE BEAM SEAT SLIGHTLY HIGH, TO ABOUT 0.5 INCHES, TO AID IN SEATING THE SUPERSTRUCTURE AND TO MAXIMIZE CONTACT WITH THE BEARING AREA.

7. SUPERSTRUCTURE PLACEMENT: THE CRANE USED FOR THE PLACEMENT OF THE SUPERSTRUCTURE CAN BE POSITIONED ON THE GRS ABUTMENT PROVIDED THE OUTRIGGER PADS ARE SIZED FOR LESS THAN 4,000 PSF NEAR THE FACE OF THE ABUTMENT WALL. GREATER LOADS COULD BE SUPPORTED WITH INCREASING DISTANCE FROM THE ABUTMENT FACE IF CHECKED BY THE ENGINEER. AN ADDITIONAL LAYOUT OF GEOSYNTHETIC REINFORCEMENT CAN BE PLACED BETWEEN THE BEAM SEAT AND THE CONCRETE OR STEEL BEAMS TO PROVIDE ADDITIONAL PROTECTION OF THE BEAM SEAT. SET BEAMS SQUARE AND LEVEL WITHOUT DRAGGING ACROSS THE BEAM SEAT SURFACE.
- CONSTRUCTION METHODOLOGY (CONTINUED)
8. INTEGRATED APPROACH PLACEMENT: GEOTEXTILE REINFORCEMENT LAYERS ARE PLACED ALONG THE BACK OF THE SUPERSTRUCTURE, BUILT IN COMPACTED THICKNESSES OF 6-INCHES (MAXIMUM VERTICAL SPACING OF REINFORCEMENT IS 6 INCHES). THE TOP OF THE FINAL WRAP SHOULD BE A MINIMUM OF 2 INCHES BELOW THE TOP OF THE SUPERSTRUCTURE TO ALLOW AT LEAST 2 INCHES OF AGGREGATE BASE COVER OVER THE GEOSYNTHETIC TO PROTECT IT FROM HOT MIX ASPHALT.

9. DRIVE STEEL GUIDERAIL POSTS THROUGH GEOTEXTILE.
- ABBREVIATIONS
- q<sub>b</sub> = SETBACK DISTANCE BETWEEN BACK OF FACING ELEMENT AND BEAM SEAT; 8 INCHES MINIMUM

B = BASE LENGTH OF REINFORCEMENT NOT INCLUDING THE WALL FACE; B/H IS GREATER THAN OR EQUAL TO 0.3 AND SATISFY GLOBAL STABILITY

b = BEARING WIDTH FOR BRIDGE, BEAM SEAT; 2.0 FEET MINIMUM FOR SPANS LESS THAN 25 FEET, 2.5 FEET MINIMUM FOR SPANS GREATER THAN OR EQUAL TO 25 FEET.

B<sub>b</sub> = WIDTH OF THE BRIDGE

b<sub>block</sub> = WIDTH OF CMU

b<sub>r</sub> = LENGTH OF BEARING BED REINFORCEMENT; LENGTH = 2q + b

B<sub>RSF</sub> = WIDTH OF RSF

B<sub>total</sub> = TOTAL WIDTH AT BASE OF GRS ABUTMENT INCLUDING THE WALL FACING

CMU = CONCRETE MASONRY UNIT

d<sub>a</sub> = CLEAR SPACE FROM TOP OF WALL TO BOTTOM OF SUPERSTRUCTURE GREATER OF 3 INCHES OR 2 PERCENT OF ABUTMENT HEIGHT (H); ACCOMMODATES VERTICAL DEFORMATION OF REINFORCED BACKFILL AND DIFFERENTIAL SETTLEMENT.

D<sub>RSF</sub> = DEPTH OF RSF BELOW BOTTOM OF WALL ELEVATION; 0.25 x B<sub>total</sub> MINIMUM

GRS = GEOSYNTHETIC REINFORCED SOIL

H = WALL HEIGHT MEASURED FROM TOP OF RSF TO TOP OF BEAM SEAT

H<sub>block</sub> = HEIGHT OF CMU

h<sub>rb</sub> = HEIGHT OF ROAD BASE (EQUALS HEIGHT OF SUPERSTRUCTURE AND PAVEMENT THICKNESS)

IBS = INTEGRATED BRIDGE SYSTEM

L = LENGTH OF GEOSYNTHETIC REINFORCEMENT

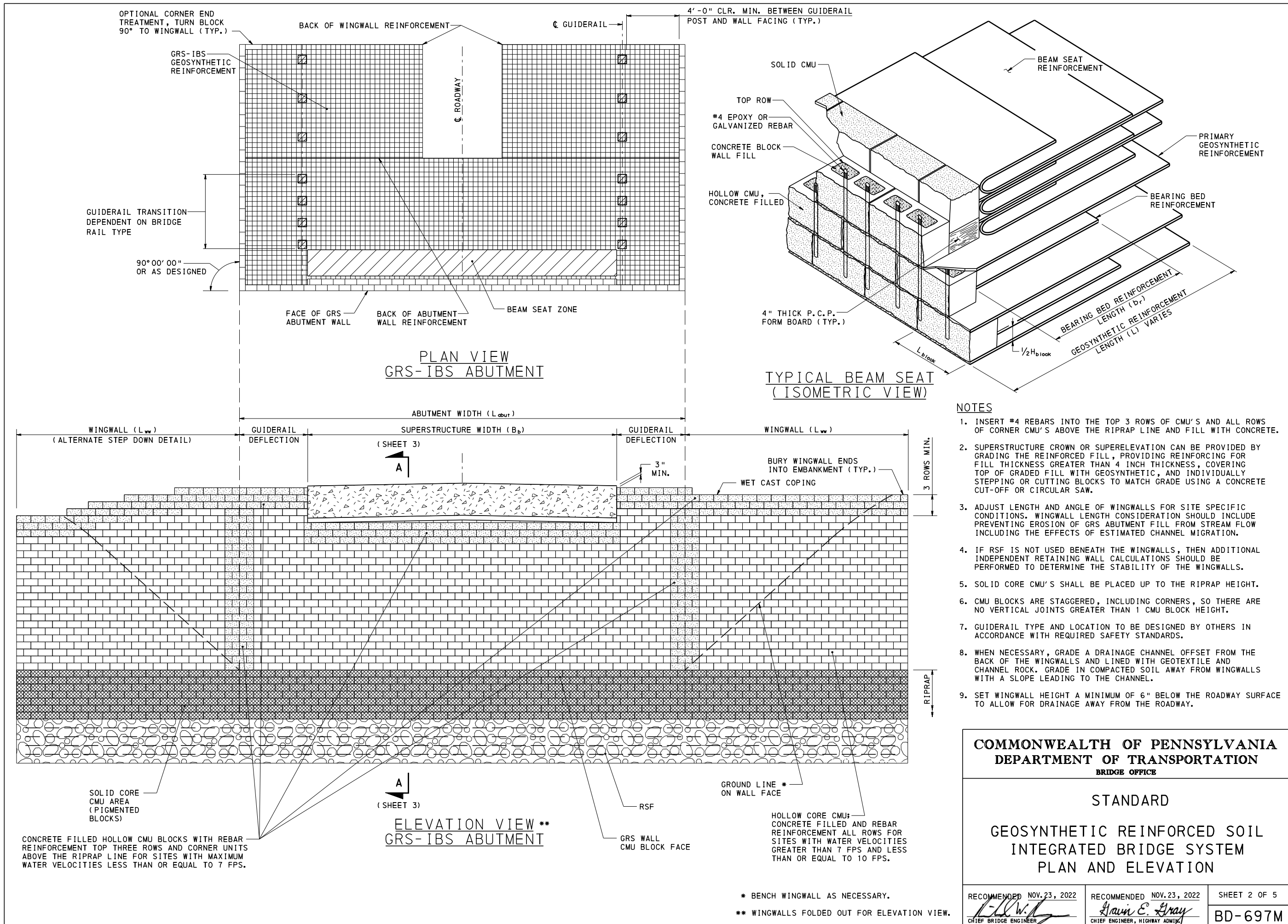
L<sub>abut</sub> = ABUTMENT WIDTH

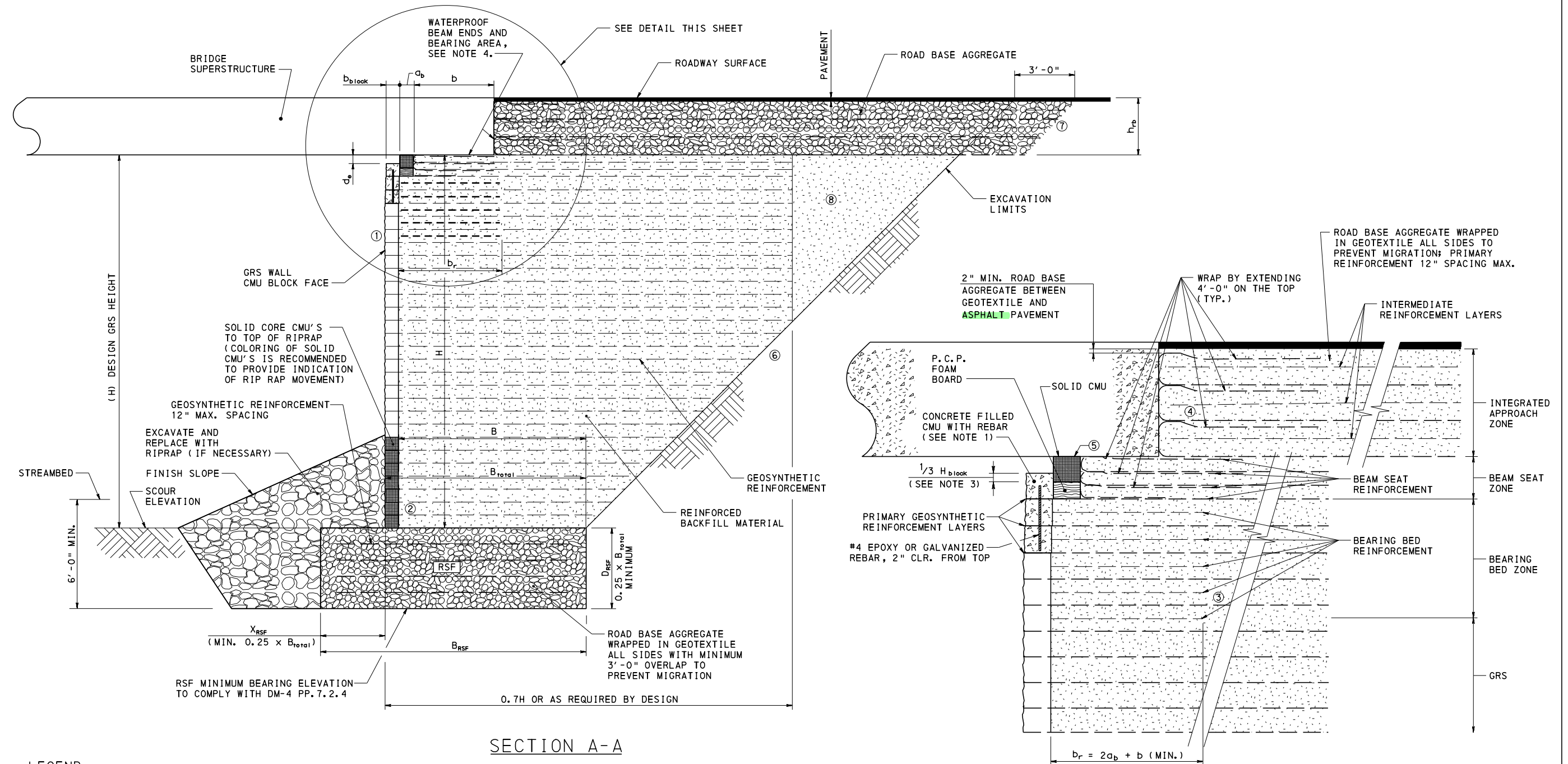
L<sub>block</sub> = LENGTH OF CMU

L<sub>ww</sub> = WINGWALL LENGTH

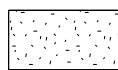
RSF = REINFORCED SOIL FOUNDATION

X<sub>RSF</sub> = LENGTH OF RSF IN FRONT OF THE ABUTMENT WALL FACE; 0.25 x B<sub>total</sub> MINIMUM
- COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF TRANSPORTATION  
BRIDGE OFFICE
- STANDARD  
GEOSYNTHETIC REINFORCED SOIL  
INTEGRATED BRIDGE SYSTEM  
NOTES
- RECOMMENDED NOV. 23, 2022  
*L. L. W. G.*  
CHIEF BRIDGE ENGINEER
- RECOMMENDED NOV. 23, 2022  
*Gavin E. Gray*  
CHIEF ENGINEER, HIGHWAY ADMINISTRATION
- SHEET 1 OF 5  
BD-697M

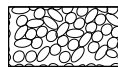




#### LEGEND



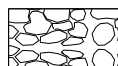
REINFORCED BACKFILL MATERIAL



ROAD BASE AGGREGATE



PAVEMENT



RIPRAP



HOLLOW CONCRETE MASONRY UNIT (CMU)



PIGMENTED SOLID CONCRETE MASONRY UNIT (CMU)



CONCRETE FILLED CONCRETE MASONRY UNIT (CMU)

#### NOTES

1. FINISH CMU CONCRETE FILL AT TOP OF CMU'S UNDER BRIDGE GIRDERS SLOPED TO DRAIN.
2. ON TOP ROW OF CMU'S CREATE A MORTAR CAPPING APPROXIMATELY 1 1/2" THICK. SEE COPING DETAIL ON SHEET 4.
3. THE SOLID CMU IN BEAM SEAT MUST ENGAGE THE UPPER-MOST CONCRETE FILLED CMU FACING BY 1/3 OF THE BLOCK HEIGHT.
4. WATERPROOFING METHODS ARE DEPENDANT ON THE SUPERSTRUCTURE TYPE, BUT CAN INCLUDE **WATERPROOFING MEMBRANES, WATERPROOFING ASPHALT BINDERS**, INCREASED CONCRETE COVER FOR CONCRETE MEMBERS OR A CAST IN PLACE BEAM SEAT AND END DIAPHRAGM (SEE SHEET 4).
- ① VERTICAL WALL FACE BATTER = 0°
- ② SOLID CMU'S BEHIND RIPRAP.
- ③ DEPTH DESIGNED TO SATISFY INTERNAL STABILITY WITH MINIMUM OF 5 LAYERS OF BEARING BED REINFORCEMENT.
- ④ PRIMARY WRAP REINFORCEMENT VERTICAL SPACING FOR THE INTEGRATED APPROACH IS A MAXIMUM OF 12 INCHES.
- ⑤ FULL HEIGHT BLOCK IS TYPICAL IN FRONT OF BEARING SEAT BUT A HALF HEIGHT BLOCK AND A SPECIAL P.C.P. FOAM BOARD THICKNESS MAY BE REQUIRED IN SOME APPLICATIONS. CUT BLOCK TO HALF HEIGHT USING CONCRETE CUT-OFF OR CIRCULAR SAW OR PURCHASE AS HALF HEIGHT.
- ⑥ EXCAVATION SLOPE IN ACCORDANCE WITH RC-11M OR OSHA SAFETY REGULATION (29 CFR, PART 1926, SUBPART P, EXCAVATION). TEMPORARY SUPPORT OF EXCAVATION (SHORING) MAY BE REQUIRED FOR CERTAIN SITE CONDITIONS.
- ⑦ EXTEND INTEGRATED APPROACH ZONE LAYERS PAST CUT SLOPE.
- ⑧ PLACE HIGH QUALITY FILL IN THIS AREA.

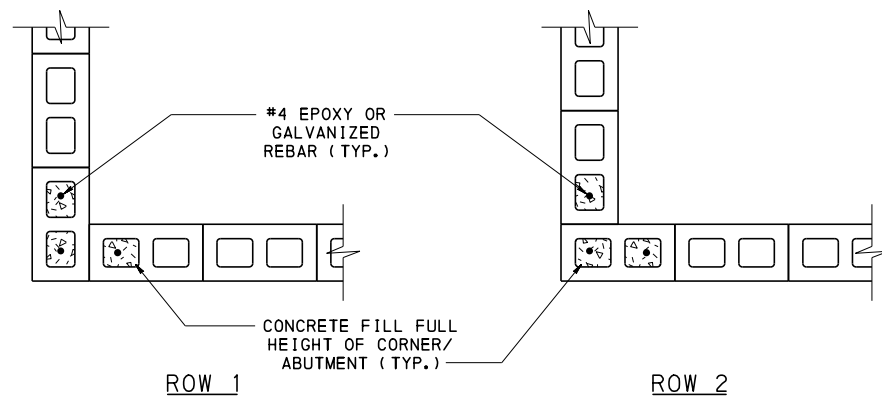
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**DEPARTMENT OF TRANSPORTATION**  
BRIDGE OFFICE

**STANDARD**  
**GEOSYNTHETIC REINFORCED SOIL**  
**INTEGRATED BRIDGE SYSTEM**  
**DETAILS**

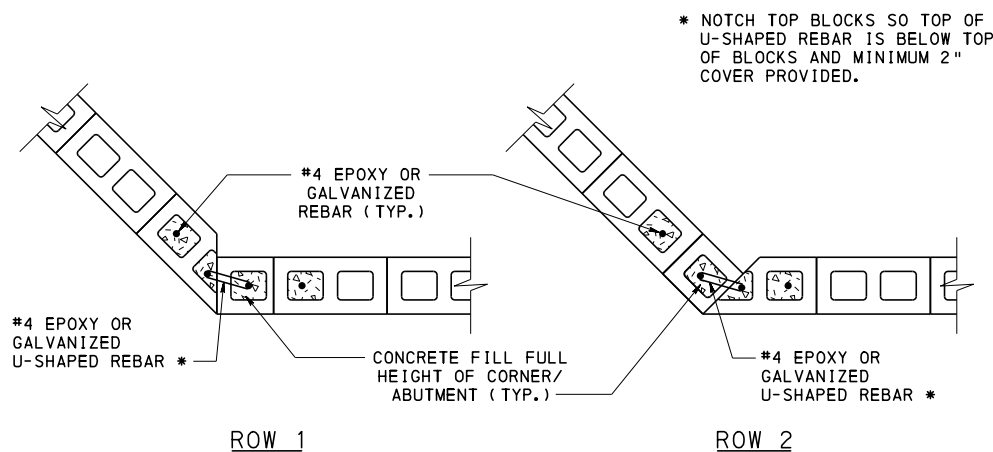
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SHEET 3 OF 5  
BD-697M

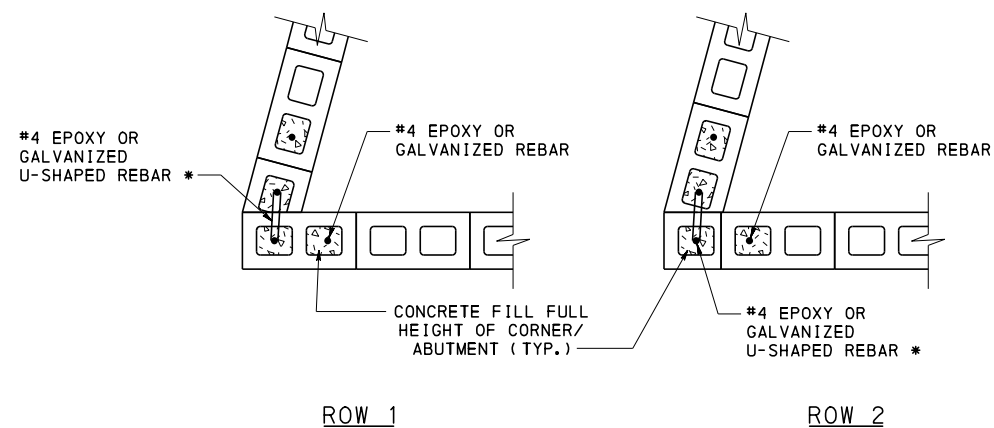


CORNER DETAIL (90°)



CORNER DETAIL (> 90°)

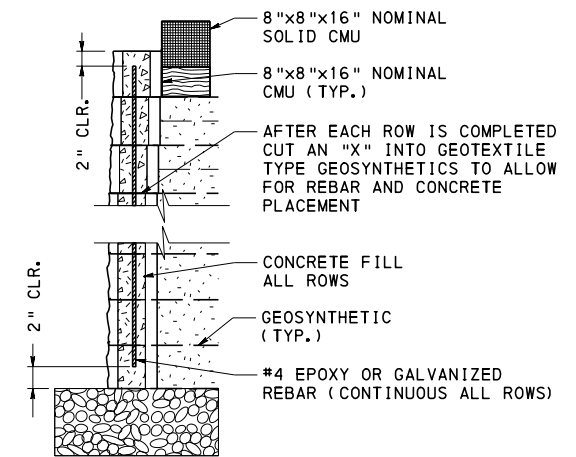
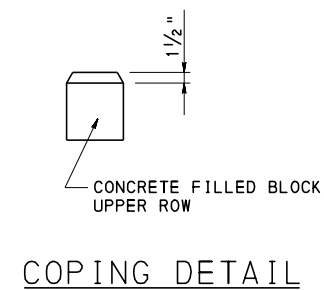
NOTE: MANUFACTURED ANGLED CORNER UNITS ARE ALSO POSSIBLE. CHECK AVAILABILITY BEFORE SPECIFYING.



CORNER DETAIL (< 90°)

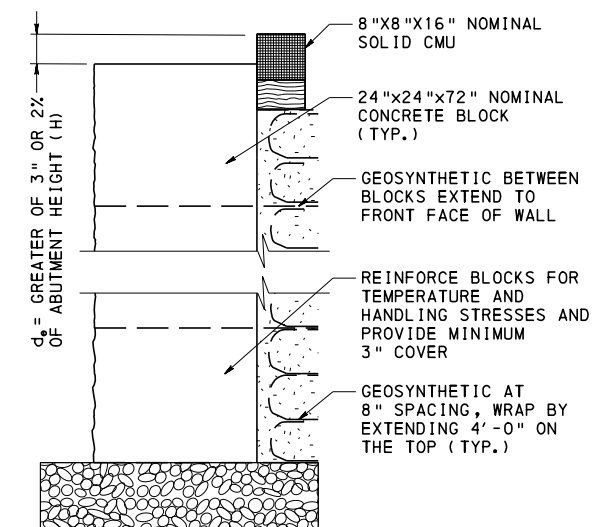
NOTE: MANUFACTURED ANGLED CORNER UNITS ARE ALSO POSSIBLE. CHECK AVAILABILITY BEFORE SPECIFYING.

- NOTES**
1. SELECT AN ABUTMENT WIDTH THAT ACCOMMODATES A WHOLE NUMBER OF BLOCKS.
  2. ALTERNATE ROW 1 AND ROW 2.



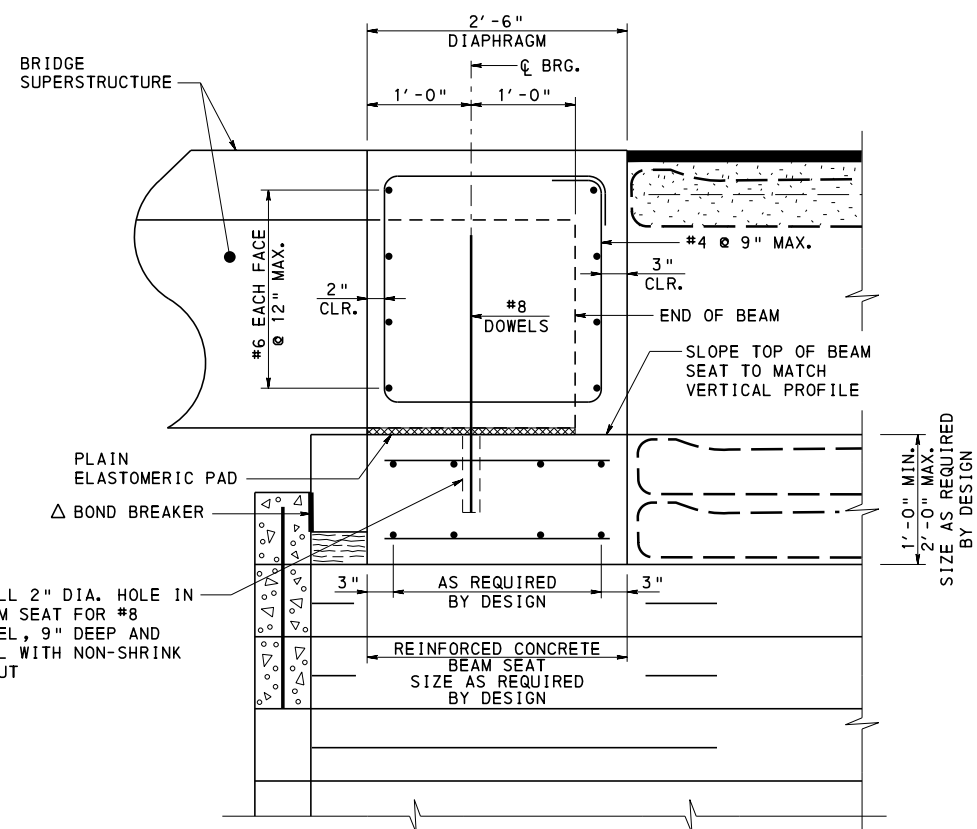
NOTE: FOR SITES WITH MAXIMUM WATER VELOCITIES LESS THAN OR EQUAL TO 7 FPS, ONLY TOP 3 ROWS AND ALL CORNER UNITS MUST CONTAIN REBAR AND BE CONCRETE FILLED.

**8"x8"x16" NOMINAL CMU  
ALL ROWS CONCRETE FILLED**  
(SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 7 FPS AND LESS THAN OR EQUAL TO 10 FPS)



**24"x24"x72" NOMINAL SOLID BLOCK**  
(SITES WITH MAXIMUM WATER VELOCITIES GREATER THAN 10 FPS AND LESS THAN OR EQUAL TO 12 FPS)

FACING REQUIREMENTS & DETAILS



CONCRETE BEAM SEAT DETAIL

Δ CLOSURE POURS MUST PROVIDE BOND BREAKER BETWEEN FACING UNITS AND CONCRETE INTERFACE.

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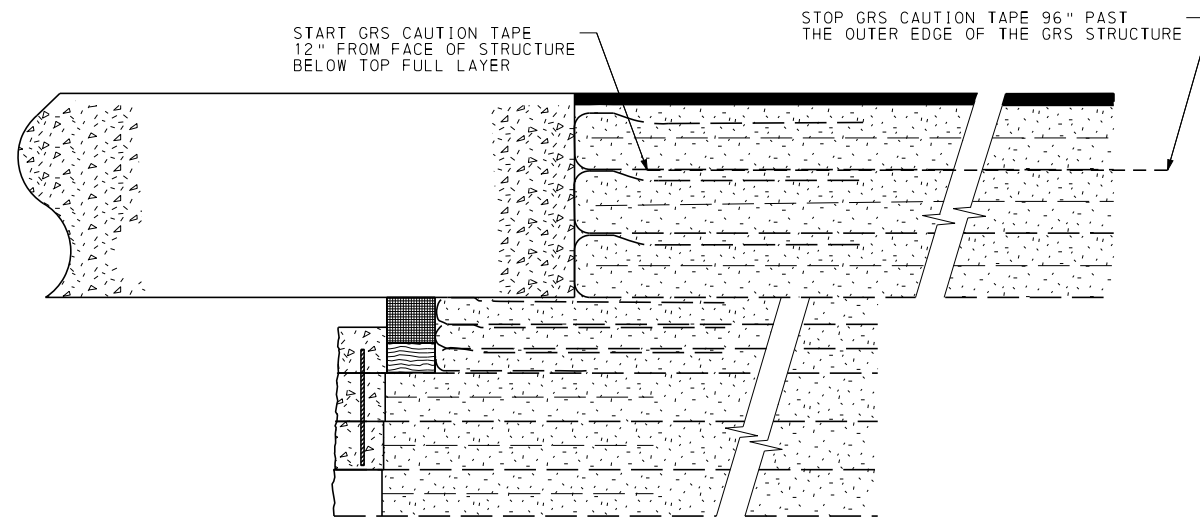
**STANDARD  
GEOSYNTHETIC REINFORCED SOIL  
INTEGRATED BRIDGE SYSTEM  
DETAILS**

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CHIEF BRIDGE ENGINEER

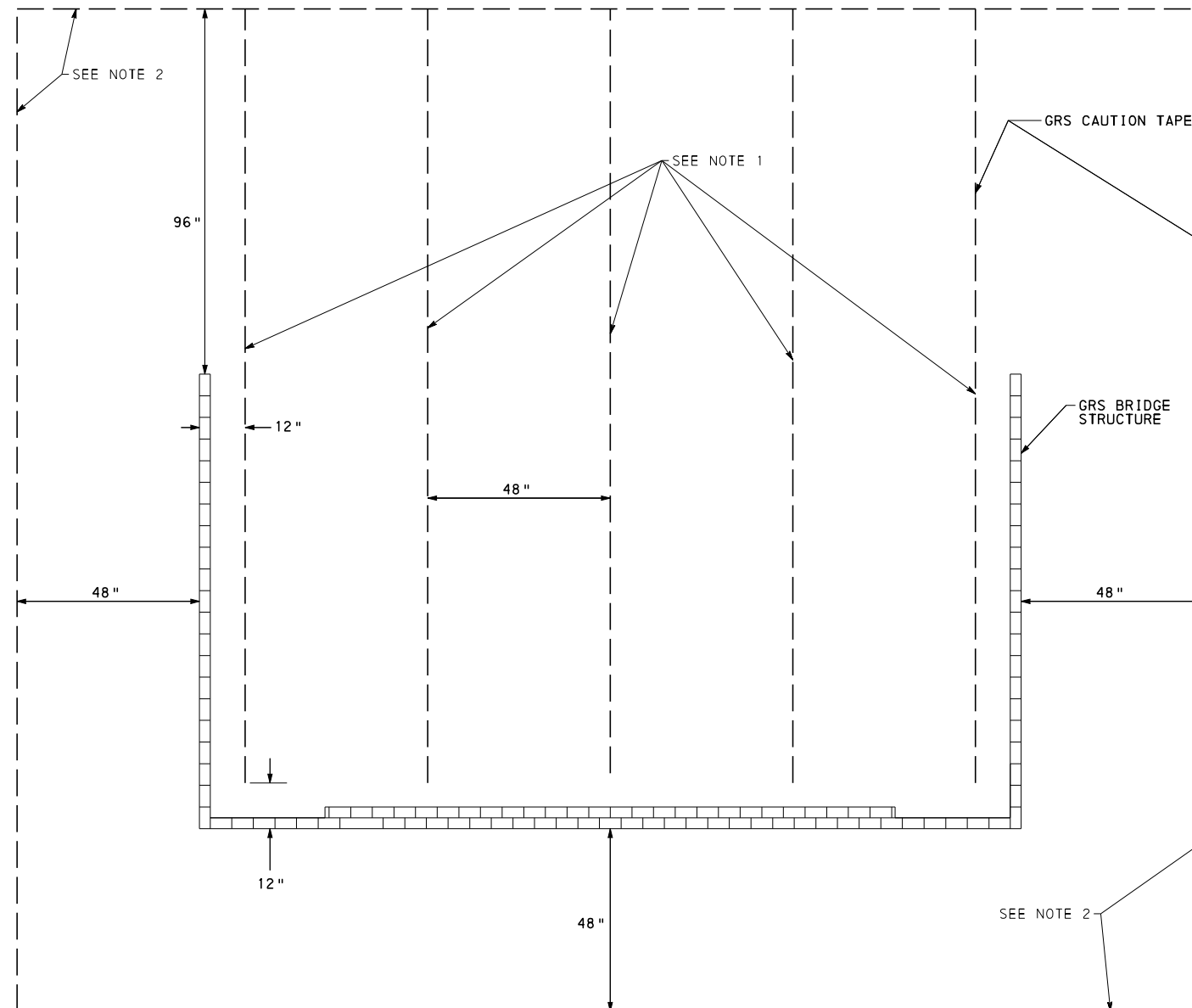
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SHEET 4 OF 5  
BD-697M

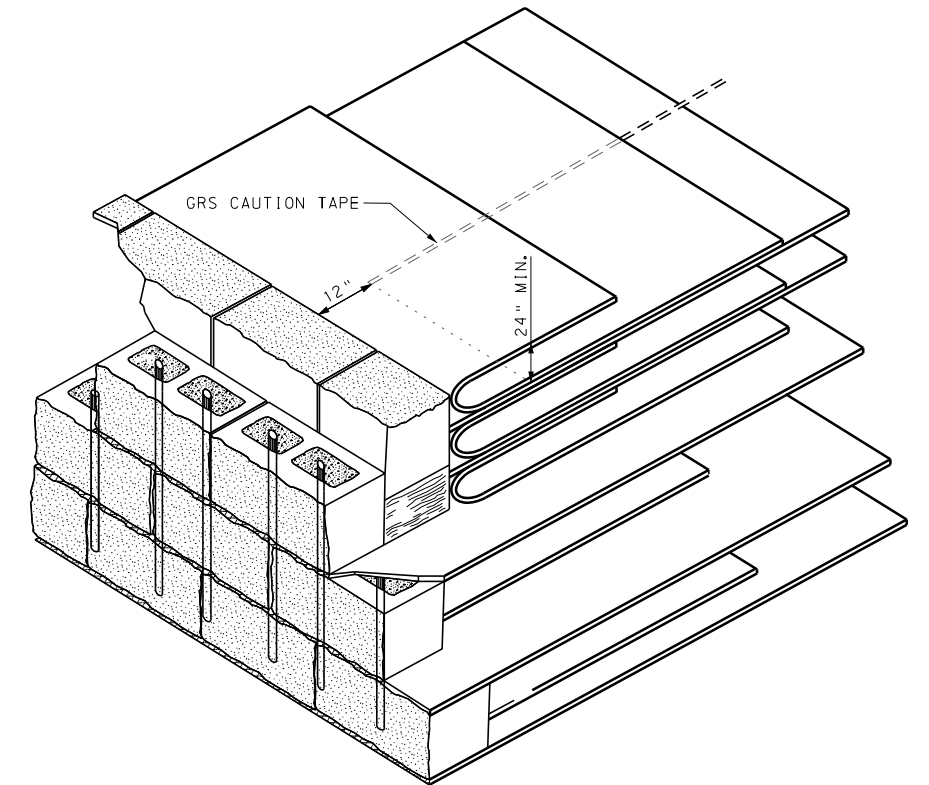




GRS CAUTION TAPE (SIDE VIEW)



GRS CAUTION TAPE  
(PLAN VIEW)



GRS CAUTION TAPE  
(ISOMETRIC VIEW)

- NOTES
1. GRS CAUTION TAPE IS PLACED ON THE TOP LAYER OF INTEGRATED APPROACH (IA) GEOTEXTILE. EXTEND TAPE 96" BEYOND THE END OF THE WINGWALLS AS SHOWN.
  2. FOR GRS CAUTION TAPE OUTSIDE OF THE FRONT FACE OF THE GRS BRIDGE STRUCTURE, EMBED THE CAUTION TAPE 24" BELOW FINISHED GRADE AND IN THE LOCATIONS SHOWN.
  3. GRS CAUTION TAPE IS TO BE CUSTOMIZED DETECTABLE UNDERGROUND WARNING TAPE, 3 INCHES WIDE, WHITE (PREFERRED) OR GREEN IN COLOR WITH SOLID BLACK LETTERING. THE TEXT ON THE TAPE SHALL BE: "STOP DIGGING - GRS ABUTMENT - CALL OWNER"

COMMONWEALTH OF PENNSYLVANIA  
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BRIDGE OFFICE

STANDARD  
GEOSYNTHETIC REINFORCED SOIL  
INTEGRATED BRIDGE SYSTEM  
CAUTION TAPE PLACEMENT

RECOMMENDED NOV. 23, 2022  
*L. W. B.*  
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SHEET 5 OF 5  
BD-697M