



<div>OS-299 (7-08)</div> <div></div>	TRANSMITTAL LETTER	<div>PUBLICATION: Publication 218M September 2010 Edition Change No. 3</div> <div>DATE: December 15, 2014</div>
<div>SUBJECT:</div> <div>Change No. 3 to Standards for Bridge Design, BD-600M Series September 2010 Edition</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div>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 January 26, 2015 should incorporate these new standards.</div> <div>The Standard Drawings included in this release along with a description of the changes are listed in the attached multi-sheet Table.</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 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 - www.dot.state.pa.us Click on Forms, Publications & Maps</div><div><input checked="" type="checkbox"/> DGS warehouse (PennDOT employees ONLY)</div></div> <div>APPROVED FOR ISSUANCE BY:</div> <div>Barry J. Schoch, P.E. – Secretary of Transportation By: </div> <div>Brian G. Thompson, P.E., Director of Bureau of Project Delivery, Highway Administration</div>	


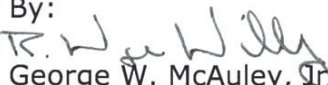
STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-600M	1	Added new Bridge Design Standards BD-605M (6 sheets) and BD-619M (5 sheets). Approval dates for 32 existing BD Standards were updated.
BD-601M	1 of 10	Note 2: Inserted "AND INTEGRAL SIDEWALKS" after "DECK SLABS" and "RAISED OR ALTERNATE" after "BARRIERS AND"
	4 of 10	LEGEND #8: Replaced "EACH SIDE" with "FRONT SIDE OF BARRIER".
	8 of 10	Added provision for haunch reinforcement when haunch depth is 5" or greater and SIP forms are present for PS Conc. PA I-Beam & Bulb-Tee Beams
	9 of 10	DEFINITION OF So(OVERHANG LENGTH): Deleted note for location of "L" dimension for centerline of web/stem/beam within barrier width.
	10 of 10	Shifted rear face of barrier in SECTION A-A toward CL Lighting Pole to be consistent with location in PLAN VIEW.
BD-604M	2 of 4	TYPICAL EXPANSION/RELIEF JOINT: Fillet weld replaced by groove weld to allow strip seal extrusion to be positioned flush with top of bridge deck.
BD-605M	6 shts	New Standard: FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PA BULB-TEE PRESTRESSED I-BEAM AND STEEL I-BEAM BRIDGES
BD-610M	13 of 17	VERTICAL REINFORCEMENT Detail: Added "DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK" to end of existing note.
	17 of 17	ELEVATION & SECTION R-R: Added 4 - 3" long min. COUPLINGS for light pole anchor bolts with reference to Section 1101.04.
BD-611M	1 of 3	Note 16: Revised "BD-656M" to "BC-788M".
		SECTIONS (POT BEARINGS AND ELASTOMERIC BEARINGS): Revised WATERPROOFING reference from BD-656M to BC-788M.
		SECTIONS (POT BEARINGS AND ELASTOMERIC BEARINGS): Revised ADDITIONAL DRAINAGE reference from BD-656M to BC-751M.
		Added "BC-751M BRIDGE DRAINAGE" to Reference Drawings.
	3 of 3	SECTIONS (POT BEARINGS AND ELASTOMERIC BEARINGS): Revised WATERPROOFING reference from BD-656M to BC-788M.
BD-612M		SECTIONS (POT BEARINGS AND ELASTOMERIC BEARINGS): Revised ADDITIONAL DRAINAGE reference from BD-656M to BC-751M.
		Removed "TELEPHONE OR CABLE TV CONDUIT" from "UTILITY TELEPHONE OR CABLE TV CONDUIT SUPPORT DETAIL" title.
		SECTION X-X (AT PIER): Added slab reinforcement and "SLAB REINFORCEMENT" callout.
		Added a "SLEEVE" callout in the "PIPELINE UTILITY-FULL DEPTH DIAPHRAGM" detail.
	2 of 3	SECTION X-X (AT ABUTMENT): Revised "DECK" to "SLAB",
		Added a coupling to sleeve behind abutment,
		Added "COUPLING" and "SLEEVE" callouts.
		LEGEND: Revised "STYROFOAM" to "PREFORMED CELLULAR POLYSTYRENE".
	3 of 3	SECTION Y-Y: Added slab reinforcement and "SLAB REINFORCEMENT" callout,
		Revised "TELEPHONE AND/OR CABLE TV" to "UTILITY" in "CONDUITS" callout.
		SECTION V-V: Revised "DECK" to "SLAB",
		Revised "TELEPHONE AND/OR CABLE TV" to "UTILITY" in "CONDUITS" callout.
		LEGEND: Revised "STYROFOAM" to "PREFORMED CELLULAR POLYSTYRENE".
		Revised "TELEPHONE AND/OR CABLE TV" to "UTILITY" in "SLEEVE" callout in END DIAPHRAGM detail.
BD-615M	1 of 3	Removed metric from all 3 sheets.
	3 of 3	ELEVATION & SECTION A-A: Added 4 - 3" long min. COUPLINGS for light pole anchor bolts with reference to Section 1101.04.
BD-617M	1 of 17	SECTION A-A: Removed "MAY BE USED" (for Type B anchor bolts) from anchor bolt callout.
	13 of 17	VERTICAL REINFORCEMENT Detail: Added "DIMENSIONS MAY ALSO BE MODIFIED BY

STANDARD	SHEET	DESCRIPTION OF CHANGES
		PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK" to end of existing note.
BD-617M (cont.)	15 of 17	Added "OPTIONAL" to title of "ANCHOR BOLT DETAIL".
	17 of 17	ELEVATION & SECTION Q-Q: Added 4 - 3" long min. COUPLINGS for light pole anchor bolts with reference to Section 1101.04.
BD-618M	1 of 12	Removed metric dimensions from all sheets.
	11 of 12	VERTICAL REINFORCEMENT Detail: Added "DIMENSIONS MAY ALSO BE MODIFIED BY PRESTRESS FABRICATOR TO AVOID INTERFERENCE WITH BEAM FORM WORK" to end of existing note.
	12 of 12	Revised lighting pole support reference to Note 9. ELEVATION & SECTION A-A: Added 4 - 3" long min. COUPLINGS for light pole anchor bolts with reference to Section 1101.04.
BD-619M	5 shts	New Standard: CROSS FRAME AND SOLID PLATE DIAPHRAGMS FOR STEEL BEAM/GIRDER BRIDGES DESIGNED WITH REFINED METHODS OF ANALYSIS
BD-620M	1 of 6	Revised LATERAL STABILITY BRACING DESIGN CRITERIA REFERENCES R5, R6, and R8-R11.
		Revised the minimum wind pressure for lateral bracing design.
BD-621M	1 of 3	Removed one rear face stem reinforcing bar in the "TYPICAL SECTION WITHOUT BACKWALL" detail.
BD-622M	1 of 5	REFERENCE DRAWINGS: ADDED BC-751M BRIDGE DRAINAGE to table.
		SECTION A-A: Added dimension "DEVELOPMENT LENGTH FOR STRAIGHT REBAR OPTION".
BD-627M	5 of 8	MOMENT SLAB (BURIED) WITH TOE WALL AND TYP C.I.P BARRIER: Removed gutterline to approx. finished ground line dimension, Removed bottom of moment slab to top of barrier dimension string.
		TOE WALL ELEVATION TRANSITION: Added "6'-0" MAX" dimension from gutterline to bottom of toe wall, Removed "3'-0" MAX" dimension from gutterline to approx. finished ground line.
		MOMENT SLAB (BURIED) WITH TOE WALL AND TYP C.I.P BARRIER: Revised "5'-0" MAX TOE WALL" to "6'-0" MAX" from gutterline to bottom of toe wall, Revised top of barrier to gutterline dimension to "AS REQ'D".
		MOMENT SLAB (AT-GRADE) WITH TOE WALL AND TYP C.I.P BARRIER: Removed gutterline to approx. finished ground line dimension, Removed bottom of moment slab to top of barrier dimension string.
		MOMENT SLAB (AT-GRADE) WITH TOE WALL AND TYP C.I.P BARRIER: Revised "5'-0" MAX TOE WALL" to "6'-0" MAX" from gutterline to bottom of toe wall.
	8 of 8	PLAN-SHOULDER DETAILS AT INLET: Revised clear distance between inlet and #5 bar from 4" to 2".
BD-629M	4 of 15	SECTION C-C and SECTION D-D: Added "(PLASTIC HINGE ZONE)" under titles and 8" MAX. CENTER TO CENTER bar spacing for round columns
		NOTES: Added "BOTH VERTICALLY AND HORIZONTALLY" to Note 4 and added Note 5 concerning "non-continuous ties"
		SECTION A-A: Added 48" MAX. BETWEEN RESTRAINED VERTICAL BARS on square column detail
		SECTION C-C: Added 6" MAX. CLEAR SPACING WHEN ALTERNATE BARS ARE TIED on square column details
	5 of 15	SECTION A-A: Revised 24" MAX. TIE SPACING to 48" MAX. BETWEEN RESTRAINED VERTICAL BARS
		NOTES: Added "BOTH HORIZONTALLY AND VERTICALLY" to existing Note 6
	7 of 15	SECTION A-A: Revised 24" MAX. TIE SPACING to 48" MAX. BETWEEN RESTRAINED VERTICAL BARS and added "TIES REQUIRED WHEN DISTANCE BETWEEN LONGITUDINALLY SUPPORTED BARS EXCEED 48"
	SECTION C-C: Added "(PLASTIC HINGE ZONE)" under titles and 6" MAX. CLEAR SPACING	

STANDARD	SHEET	DESCRIPTION OF CHANGES
		WHEN ALTERNATE BARS ARE TIED
BD-629M Cont.	7 of 15	NOTES: Added "BOTH VERTICALLY AND HORIZONTALLY" to existing Note 6 and added Note 7 concerning "non-continuous ties"
	8 of 15	SECTION A-A: Revised 24" MAX. TIE SPACING to 48" MAX. BETWEEN RESTRAINED VERTICAL BARS and revised 24" to 48"
		NOTES: Added "BOTH VERTICALLY AND HORIZONTALLY" to existing Note 5 and added Note 6 concerning "non-continuous ties"
		SECTION C-C: Added "(PLASTIC HINGE ZONE)" under titles and 6" MAX. CLEAR SPACING WHEN ALTERNATE BARS ARE TIED
	10 of 15	SECTION C-C: Added "(PLASTIC HINGE ZONE)" under titles and 8" MAX. CENTER TO CENTER bar spacing
BD-632M	10 of 13	Added NOTE 11: BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.
	11 of 13	Added APRON BAFFLE OPENING detail.
		Added NOTE 11: BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.
	12 of 13	Revised WEIR DETAIL and added 1'-6" height dimension to PROFILE.
BD-641M	1 of 8	Revised "Column" to "Design" in fourth bullet under INFORMATION CONTAINED IN THE DESIGN TABLES
	4 of 8	SIDE VIEW: Added separate "Column Height" dimension to top of column (2 locations)
BD-642M	1 of 6	Revised "Column" to "Design" in fourth bullet under INFORMATION CONTAINED IN THE DESIGN TABLES
	4 of 6	END VIEW: Extended column A & B height dimensions to top of columns.
BD-643M	1 of 6	Revised "Column" to "Design" in fourth bullet under INFORMATION CONTAINED IN THE DESIGN TABLES
	4 of 6	END VIEW: Extended column A & B height dimensions to top of columns.
BD-644M	1 of 13	Revised "Column" to "Design" in fourth bullet under INFORMATION CONTAINED IN THE DESIGN TABLES
	4 of 13	END VIEW: Extended column A & B height dimensions to top of columns.
	8 of 13	END VIEW: Added "Design Height (H)" dimension
		END VIEW: Extended column A & B height dimensions to top of columns.
	9 of 13	ELEVATION and SIDE VIEW: Removed footing dimensions "FW" (Elevation) and "FL" (Side View)
BD-645M	1 of 7	Revised "Column" to "Design" in fourth bullet under INFORMATION CONTAINED IN THE DESIGN TABLES
	4 of 7	END VIEW: Extended column A & B height dimensions to top of columns.
BD-647M	1 of 5	NOTES TO DESIGNER, 3rd bullet point: revise 2 1/4" to 2"
	2 of 5	NOTES TO DESIGNER, General Note 4: Revised 1/2" to 1/4"
	3 of 5	NOTES TO DESIGNER, General Note 4: Revised 1/2" TO 1/4"
BD-649M	3 of 6	SIDE ELEVATION: Replaced erroneous footing thickness with 2'-0".
		SIDE ELEVATION: Added separate "Column Height" dimension to top of column
	4 of 6	TABLE 1, PEDESTAL SIZE (E): Revised two entries to be 4'-3" and 3'-9".
BD-650M	3 of 4	END VIEW: Extended column A & B height dimensions to top of columns
BD-651M	2 of 2	SKEW LIMITATIONS FOR INTEGRAL ABUTMENT BRIDGES: Corrected SPAN LENGTH (L) criteria.
BD-653M	2 of 2	Sheet Title: Revised sheet title to be "BEARING DETAILS FOR P/S CONCRETE BEAM BRIDGES"
		ELASTOMERIC BEARING PAD ARRANGEMENT: Revised dimension from centerline bearings to end of beam to be 6" MIN. for adjacent beams and 9" MIN. for spread beam
BD-656M	1 of 7	FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-656M (cont.)	2 of 7	FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.
	3 of 7	Moved WATERPROOFING DETAIL AT ABUTMENT WITHOUT BACKWALL to Sheet 12 of BC-788M.
		ABUTMENT WITHOUT BACKWALL: Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.
	4 of 7	TYPICAL LONGITUDINAL SECTION FOR ADJACENT BOX BEAMS (COMPOSITE): Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.
		TYPICAL LONGITUDINAL SECTION FOR I-BEAMS: Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.
		Moved ADDITIONAL DRAINAGE DETAIL AT ABUTMENT WITHOUT BACKWALL to Sheet 7 of BC-751M.
		TYPICAL LONGITUDINAL SECTION FOR SPREAD BOX BEAMS: Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.
		TYPICAL LONGITUDINAL SECTION FOR PLANK BEAMS: Revised references for WATERPROOFING and ADDITIONAL DRAINAGE.
BD-658M	1 of 1	PIER PLAN (90): Revise distance from end of beam to face of pier cap to be 1'-6" instead of 1'-3"
		SECTION F-F: Revised slope of cheek wall from 1V:25H to 4%
		PIER PLAN (90 & Skewed): Added note to permit a single (full width) shear block for I-beams and revised slope of cheek wall from 1V:25H to 4%
		SECTION E-E, SECTION F-F & PIER SHEAR BLOCK DETAIL A: Revised General Note reference numbers accordingly.
		GENERAL NOTES: Removed metric references and renumbered notes.
BD-660M	1 of 2	ALTERNATE DECK PALCEMENT SEQUENCE SCHEMES FOR CONTINUOUS BRIDGES: Removed Step 4 regarding barrier casting sequence
		DECK PALCEMENT SEQUENCE SCHEMES FOR CONTINUOUS BRIDGES: Removed Step 5 regarding barrier casting sequence
BD-661M	2 of 8	ADJACENT BOX BEAM SECTION: Added shear keys and call-out SHEAR KEY (TYP.) (OMIT ON FASICA SIDE)
		ADJACENT BOX BEAM SECTION: Repositioned three dot bars in top slab to be on top of the transverse reinforcement.
	4 of 8	36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER & TYPICAL SIDEWALK: Repositioned three dot bars in top slab to be on top of the transverse reinforcement.
	5 of 8	36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: Repositioned dot bars in top slab to be on top of the transverse reinforcement.
BD-666M	1 of 1	DESIGN NOTE 3: Revised note, design of repair now in accordance with AASHTO LRFD Guide Specification.
BD-667M	1 of 9	TYPICAL ELEVATION: Added limits for Class A and Class AAAP concrete in Cap Beam and Diaphragm. Added Minimum Edge Distance criteria from Appendix G to *** note.
		TYPICAL PLAN: Revised orientation of 1'-0" haunch dimension on left side of plan and removed 1'-0" haunch dimesions on right side of plan
	4 of 9	SCOUR PROTECTION DETAIL: Added detail and notes for placement of Coarse Aggregate in Geotextile Class 4, Type A layers under abutment cap.
	5 of 9	MINIMUM ATTACHED WINGWALL LENGTH (L) table: Updated table dimensions to be consistent with Rectangular and Tappeded Wingwall Elevations.
		SECTION J-J, SECTION L-L & SECTION M-M: Added call-out for Minimum and Maximum Edge Distance to centerline of pile, Skew Angle designation and 10 degree flare angle.
BD-678M	2 of 14	DESIGN PARAMETER 4 - SPREAD FOOTINGS: Deleted bullet PROVIDE A MINIMUM FOOTING THICKNESS OF 1'-9".
	3 of 14	SECTION A-A: Deleted extraneous horizontal line segment to the right side of the footing.
BD-697M	1 of 4	Added "(P.C.P.)" to General Note 11 and Construction Methodology Note 6. Revised date of

STANDARD	SHEET	DESCRIPTION OF CHANGES
		FHWA-HRT-11-026 guide from January 2011 to June 2012 under Design Methodology Note 2
BD-697M (cont.)	2 of 4	TYPICAL BEAM SEAT (ISOMETRIC VIEW): Added "BEAM SEAT REINFORCEMENT" to detail and clarified foam material under Solid CMU
	3 of 4	SECTION A-A: Removed the "1H : 1V" slope call-out on the EXCAVATION LIMITS line and revised the description of Circle Note 6 for the excavation slope.
		SECTION A-A: Added 6'-0" MIN dimension from Stream Bed to Bottom of RSF MINIMUM BEARING ELEVATION and added Bearing Bed Reinforcement under beam seat area.
		BEAM SEAT & INTEGRATED APPROACH DETAIL: Revised Aluminum Flashing Detail to extend 6" below Foam Board. Added P.C.P. to Foam Board call-out.
	4 of 4	FACING REQUIREMENTS & DETAILS: Revised Aluminum Flashing Detail to extend 6" below Foam Board. Added P.C.P. to Foam Board call-out.
		Renamed TYPICAL BEAM SEAT DETAIL to CONCRETE BEAM SEAT DETAIL and added GRS facing and reinforcement layers to detail.

<div>OS-299 (7-08)</div> <div></div>	TRANSMITTAL LETTER	<div>PUBLICATION:</div> <div>Publication 218M September 2010 Edition Change No. 2</div> <div>DATE:</div> <div>November 26, 2013</div>
<div>SUBJECT:</div> <div>Change No. 2 to Standards for Bridge Design, BD-600M Series September 2010 Edition</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div>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 January 3, 2014 should incorporate these new standards.</div> <div>The Standard Drawings included in this release along with a description of the changes are listed in the attached multi-sheet Table.</div>		
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STANDARD	SHEET	DESCRIPTION OF CHANGES
INDEX (BD-600M)	-	Added BD-649M, BD-650M and BD-697M. Updated approval dates of 16 existing standards.
BD-601M	1 of 10	Added BC-706M & BC-722M to list of Reference Drawings.
	5 of 10	Show bolt-head on TS behind rubrail.
	8 of 10	DESIGN SECTIONS: added section for NEXT BEAMS
	9 of 10	Definition of So (OVERHANG LENGTH): added typical section for NEXT BEAMS. Combined steel I-beam section with P/S I-beam & bulb-tee section. Design Note 1: added NEXT BEAMS and spacing calculation method.
	10 of 10	ELEVATION & SECTION A-A: added 3" long COUPLINGS to light pole anchor bolts. NOTE 4: permitted anchor angles to be galvanized. Added NOTE 10 which requires lighting poles within a span to be evaluated for dynamic effects.
BD-609M	1	Removed Sheet 2 from this Standard to create BC-706M.
		SECTION A-A: added callout for BOLT FOR RUBRAIL. Added bolt head and callout for BOLT FOR TS. Added references to BD-601M OR BD-632M for reinf. bar detail. Added PIPE to 1" OD SLEEVE callout. Dimensioned rail bolt pattern from top of post. Added indication for "h" for wearing course. Changed callout from R.C. DECK OR TOP SLAB to R.C. DECK OF BOX CULVERT TOP SLAB.
		PLAN & ELEVATION: added RAIL AT END OF BRIDGE. Added BC-706M to REFERENCE DRAWINGS list. Changed dimension "...DECK, SLAB OR R.C. BOX TOP SLAB..." to "...DECK SLAB OR BOX CULVERT TOP SLAB...". NOTE 9: replaced SHEET 2 with BC-706M. NOTE 10: replaced MASS with WEIGHT. NOTE 11: replaced A36 with ASTM A709, GRADE 36.
		Added dimensions to post and notes to Elevation and Section A-A.
BD-613M	7 shts	Removed 6 Sheets from this Standard to create new BC-756M.
	1 of 7	Revised DESIGN METHODOLOGY Notes 1 and 2. Revised INSTRUCTIONS FOR USING DESIGN TABLES Notes 2 & 11. Revised Index of Sheets. Added BC-756M to Reference Drawings.
	3 of 7	Added New Sheet: Example Bearing Location Plan and Load Table.
	4 of 7	Added note clarifying sole plate dimensions for prestressed concrete beams with tapped screw connection. Similar Sheets 5, 6 & 7.
	7 of 7	Added "*" to BEARING HEIGHT column heading. Changed the "CC" guide bar dimension from 26.625" to 25.625" (typo correction).
BD-629M	1 of 15	Added General Note 14 to require EPOXY RESIN COATING to pier column/wall if it is within SPLASH ZONE.
	3 of 15	Lap length revised to match AASHTO latest criteria Added two PERMITTED SPLICE LOCATION details.
	5 of 15	SECTION A-A: revised maximum tie spacing from 24" to 4'-0". Similar revision made to Sheets 7 and 8.
	13 of 15	Added new Note 3 to include reference to DM-4, SECTION 5.11.1.2.1 for reinforcement hook reinforcement on pile foundations.
BD-632M	13 shts	Removed Design Table information (formerly Shts. 9, 10 & 11) due to issue with haunch sizes and slab/wall thicknesses. Sheet numbering, total sheets, and sheet references changed throughout.
	1 of 13	Labeled "1'-6" HEADWALL" on left and "1'-6" barrier curb" on right of SECTION ALONG CL OF CULVERT. Previously both called headwall (with and without railing) with no width dimension.


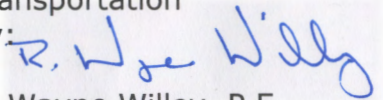
STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-632M		DETAIL B: Replaced "2'-0" MAX" with "MAXIMUM HEIGHT BASED ON BARRIER/GUIDE RAIL TYPE". Replaced FOR PA STRUCTURE MOUNTED GUIDE RAIL SEE BD-609M with FOR REINFORCEMENT AND GUIDE RAIL DETAILS, SEE BD-609M, BD-610M OR BD-617M BASED ON BARRIER/GUIDE RAIL TYPE. Changed barrier bar callout from "#5 @ 9"" to "#5 or #4". Added WEARING COURSE (h). Revised the welded wire fabric callout on the Apron Section to bring the wire size directly behind the wire spacing (standard industry labeling). Added BC-706M, BD-610M and BD-617M to list of Reference Drawings.
	2 of 13	Added RAIL END to PLAN & ELEVATION in upper left corner of sheet. SECTION A-A: added BOLTS for Rubrail and TS attachment to post. Added 1'-7" MAX. for height of curb. SLAB TO CURB REINF. BAR DETAILS: revised vertical leg length to be T-3"+h+6". TYPICAL HEADWALL SECTIONS: Flow direction added.
	4 of 13	Revised Notes: 18. Removed haunch = wall thickness provision and reverted back to the AASHTO M273M provision that allows any haunch size for custom designs. 24. Added "HAUNCH SIZE MUST MATCH THAT OF BOX CULVERT SEGMENTS." 25. Changed "HAUNCH DUCT MUST BE TIED TO INSIDE REINFORCEMENT" to "HAUNCH DUCT MUST BE SECURED TO INSIDE REINFORCEMENT" to satisfy fabricator comments about other methods to affix duct location and straightness. 28 Specified a 4'-0" min. segment length. Removed sht 9 previously had 4' min. segment lengths and a 6' min. for spans > 16'. This produced unnecessarily heavy box segments that were difficult to transport & assemble. DECK CONNECTION DETAILS: added deck slab reinforcement, changed top callout from "REINFORCED CONCRETE BOX" to "BOX SLAB" to be consistent with lower callout, and revised sections to "Longitudinal" & "Transverse". SECTION T-T: replaced 1'-6" dimension with "VARIES WITH SKEW AND COLLAR LOCATION". Added 9" MIN. dimension. Dimensioned collar. SECTION X-X: added END OF CULVERT and * Note regarding reduction of edge distance. Changed minimum wall/slab thickness to 13" for culverts with S > 12'. This conforms with Sht. 9, which requires a 13" min. to allow for post-tensioning ducts (required in walls and slabs for culverts with S > 12').
	5 of 13	CULVERT WITH PRECAST END SECTION: Added "PRECAST" to beginning of detail title. Revised sheet references and added wording permitting alternative cutoff wall with grouted rock. Changed indication of "OUT COLLAR TO OUT BOX" to "PRECAST END SECTION". Corrected that the 1'-6" collar begins after the 6" offset. SECTION P-P: replaced APRON SLAB with PRECAST CULVERT/END SECTION. PRECAST END SECTION: Removed dashed lines indicating footing in plan view. Added note that the 6" culvert-collar offset may be reduced. Added Note to require tensioning of bottom slab prior to installation of cutoff wall. PRECAST WINGWALL CONNECTION DETAILS: Revised dimensioning breakpoint for "T" from 14" to 15". SHIP LAP JOINT: revised edge distance to insert from 6" MIN. to 9" MIN. KEYED JOINT: revised edge distance to insert from 6"MIN. to 9" MIN.
	6 of 13	New Sheet: Added ALTERNATIVE CUTOFF WALL WITH GROUTED ROCK detail and relocated [PRECAST] CULVERT WITH CAST-IN-PLACE WINGWALLS elevation and related details moved from Sheet 5. Added note that the 6" culvert-collar offset may be reduced. Clarified that the collar or barrier curb is not shown on the plan view detail. Previous Section P-P was relocated from sheet 5 and renamed Section Q-Q.
	7 of 13	Clarified strand location callout on TYP. BOX END SECTION and changed "sections" to "segments" in POST-TENSIONING Note 3.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-632M		POST-TENSIONING NOTES: 3. Changed "POST-TENSION BOX SECTIONS FIRST, THEN PROVIDE EITHER:" to "POST-TENSION BOX SEGMENTS FIRST, THEN PROVIDE:" Changed Note 3, bullet 2 from "-OR- STRAPS ON SIDES OF END SECTION AS SHOWN ON BC-798M" to "STRAPS ON SIDES OF END SECTION AS SHOWN ON BC-798M OR STRANDS IN WALLS, IF APPLICABLE (SPANS ≥12' AND 90° WINGWALL)." Revised haunch dimension to be "Haunch to match box" on Section D-D and Section E-E. Revised POST-TENSIONED END SECTIONS to show post tensioning strands. Post tensioning strand in wall or galvanized straps added to either Post-Tension End Section details.
	8 of 13	Vertical leg dimensions of slab and anchor bolt bar change required to allow barrier/anchor bars to avoid primary culvert reinforcement. LEGEND: T < 11": T-3" and T ≥ 10" to T ≥ 11" PLAN & ELEVATION: added RAIL AT END and reference to BC-706M. SECTION F-F: Corrected leader line location for 1'-9.25" dimension to match outer edge of curb instead of steel post. Replace triangle symbol with 1'-7" MAX. for height of headwall/curb. Added callout for BOLT FOR RUBRAIL. Added bolt head and callout for BOLT FOR TS. Notes: Clarified that "h" (the 11" max fill height) includes the 5" min reinforced concrete deck if present.
	9 of 13	Clarified diameter callouts for post-tensioning ducts. Removed "@ 12"" from diagonal bar callout on TYPICAL HAUNCH SECTION DETAIL ELEVATION. Removed JOINT DETAIL since already included on BC-798M and moved DETAIL D to BC-798M. CONFIGURATION FOR SLAB/WALL WITH POST-TENSIONING: Clarified "T" & "F" callouts and added note for post tensioning duct placement. Set 13" Min "T". Changed breakpoint for "H" from 14" to 15", and replaced "OR" with "AND" so that "H" is the same in wall/slab corners. Changed callout to "SEE DETAIL E FOR MINIMUM REINFORCEMENT CLEARANCES" on Typical Haunch Section Detail and changed dimensions to "1" MIN. CLR." on Detail E to clarify that the concern is clearance to the recess, not additional longitudinal reinforcement.
	10 of 13	Added two missing apron baffles to SECTION J-J and revised reference to Sheet 12 on Plan View of TWIN CELL BOX CULVERTS.
	11 of 13	Modified apron baffle heights and placement. Revised reference to Sheet 13 on TYPICAL INTERIOR BAFFLE detail.
	13 of 13	Revised reference to Sheet 10 on Note 11 and revised reference to Sheet 12 on Plan View of TWIN CELL BOX CULVERTS. Added OPPOSING BAFFLES LESS THAN 1'-0" and LESS THAN 2'-0" details and notes.
	10 shts	Removed metric dimensions and tables (Standard reduced from 18 sheets to 10 sheets).
	3 of 10	Removed Design Example 3.
	7 of 10	Note 5 from previous Sht. 8 which describes meaning for *** was moved to this sheet and is listed as Note 11.
	1 of 8	DRILLED SHAFTS (CAISSONS) DM-4 referenced changed from D10.8.3.8 to D4.6 and "33/64" typo changed to "°". Changed column and pipe struts' material specifications to SEE PUBLICATION 408, SECTION 948.2. ALTERNATE PRESS-BREAK MEMBERS note: replaced CHORDS with STRUTS. Removed General Note 17.
	4 of 8	Post now installed vertically plumb in initial position. 2 nd note below changed to remove back rake from strut camber dimension. Replaced Grout between base plate and foundation with Galvanized Rodent Screen.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-641M	5 of 8	Post now installed vertically plumb in initial position. Eliminated example beneath Camber Diagram.
	6 of 8	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500"). Removed "CC" column deflection info from Table.
	7 of 8	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500"). Removed "CC" column deflection info from Table. Column size increased for seven design selections to reduce column deflection.
	8 of 8	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
BD-642M	1 of 6	Changed "MUST" to "SHOULD" in Information Contained in the Design Tables bullet 2. Removed General Note 17. DRILLED SHAFTS (CAISSONS) DM-4 referenced changed from D10.8.3.8 to D4.6. Changed column and pipe struts' material specifications to SEE PUBLICATION 408, SECTION 948.2.
	4 of 6	Replaced Grout between base plate and foundation with Galvanized Rodent Screen.
	5 of 6	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
BD-643M	1 of 6	Removed General Note 17. DRILLED SHAFTS (CAISSONS) DM-4 referenced changed from D10.8.3.8 to D4.6. Changed column and pipe struts' material specifications to SEE PUBLICATION 408, SECTION 948.2.
	4 of 6	Replaced Grout between base plate and foundation with Galvanized Rodent Screen.
	5 of 6	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
BD-644M	1 of 13	Changed "MUST" to "SHOULD" in Information Contained in the Design Tables bullet 2. Removed General Note 17. DRILLED SHAFTS (CAISSONS) DM-4 referenced changed from D10.8.3.8 to D4.6. Changed column and pipe struts' material specifications to SEE PUBLICATION 408, SECTION 948.2.
	4 of 13	Removed sign panel from rear face of 2 post Tri-chord truss, showed sign panel on front face in View B-B, and replaced grout between base plate and foundation with Galvanized Rodent Screen.
	5 of 13	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
	6 of 13	Added Note: FOR DESIGN TABLE NOTES, SEE SHEET 5.
	8 of 13	Replaced Grout between base plate and foundation with Galvanized Rodent Screen. Added front and rear face sign panels to View B-B.
	9 of 13	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
	10 of 13	Added Note: FOR DESIGN TABLE NOTES, SEE SHEET 9.
	11 of 13	Added Note: FOR DESIGN TABLE NOTES, SEE SHEET 9.
	13 of 13	Added Note: FOR DESIGN TABLE NOTES, SEE SHEET 9.
BD-645M	1 of 7	Removed General Note 17. DRILLED SHAFTS (CAISSONS) DM-4 referenced changed from D10.8.3.8 to D4.6. Changed column and pipe struts' material specifications to SEE PUBLICATION 408, SECTION 948.2.
	4 of 7	Replaced Grout between base plate and foundation with Galvanized Rodent Screen.
	5 of 7	Added Note: CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
	6 of 7	Added Note: FOR DESIGN TABLE NOTES, SEE SHEET 5.

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-647M	1 of 5	MATERIAL NOTE 3: replaced steel pipe specification with reference to PUBLICATION 408, SECTION 948.2(a). TITLE: replaced 160 with 200.
	2 of 5	Revised Notes to Designer to clarify the information that must be placed on the contract documents. Removed old General Notes 3 and 4. Revised Note 5 (old Note 7) to clarify galvanized steel screen. Added NOTE TO DESIGNER requiring designer to provide mast arm camber. CAMBER DIAGRAM: Post now installed vertically plumb in initial position. Removed back-rake callouts. Added notes to define this change. Added Galvanized Rodent Screen callout to Side View.
	3 of 5	CAMBER DIAGRAM: replaced note to clarify the diagram's information. Revised Notes to Designer to clarify the information that must be placed on the contract documents. Removed old Notes 3 and 4. Revised Note 5 (old Note 7) to clarify galvanized steel screen. Added NOTE TO DESIGNER requiring designer to provide mast arm camber. Added Galvanized Rodent Screen callout to Side View.
	4 of 5	CAMBER TABLE: added values for 180' and 200' spans and adjusted previous values. MAST ARM SEGMENT ARRANGEMENTS E & F revised in Table.
		FRAME STRUCTURE: added callouts for connections, differentiating between "BASE", "END", and "SPLICE" connections. Added 4'-0" MIN. for sign panel to centerline mast distance, and 6'-0" MAX. for sign panel overhang past mast arm connection. Added OPTIONAL SHOP CONNECTION (TYP.) to mast at 2' below bend. Added Splice Connection at midspan of Mast Arm. Identified CL of MAST ARM & SIGN PANEL.
		MAST & MAST ARM SELECTION TABLE: added rows for 1000 S.F. PANEL AREAS. Added 180' & 200' span selection rows to Table.
		5 of 5
BD-649M	6 shts	New sheet added to display Cantilever Structure detail previously contained on Sht. 4.
		CANTILEVER STRUCTURES: added callouts for connections, differentiating between "BASE" and "END" connections. Added 4'-0" MIN. for sign panel to centerline mast distance, and 6'-0" MAX. for sign panel overhang past mast arm connection. Added OPTIONAL SHOP CONNECTION (TYP.) to mast at 2' below bend. Identified CL of MAST ARM & SIGN PANEL. MAST & MAST ARM SELECTION Table updated to include additional Panel Areas (460, 540 & 680 S.F.).
BD-649M	6 shts	Initial Release - DMS Center-mount Sign Structures for PennDOT and PTC. Previously contained in ITS-1000M Series standards maintained by BHSTE
BD-650M	4 shts	Initial Release - DMS Overhead Truss Sign Structures for PennDOT and PTC. Previously contained in ITS-1000M Series standards maintained by BHSTE
BD-651M	2 of 2	Interior diaphragm location schematic clarified and callout changed from 1/3 Point to At The Drape Point.
		Revised TENDON AND DIAPHRAGM REQUIREMENTS FOR ADJACENT BOX BEAM BRIDGES and updated SKEW LIMITATIONS FOR INTEGRAL ABUTMENT BRIDGES.
BD-653M	1 of 2	Note 1 (on dual units) removed, other 3 notes renumbered.
	2 of 2	Added 1" min. edge clearance to SKEW EXCEEDING BEAM LIMITS detail and ELASTOMERIC BEARING PAD ARRANGEMENTS (BOX BEAMS) detail.
BD-667M	1 of 9	TYPICAL ELEVATION: revised Max. and Min. edge distance to piles with *** Note. TYPICAL PLAN: Added skew angle θ dimension.
	5 of 9	Girder Depth (d) labeled on 3 elevations.
		Added MINIMUM WINGWALL LENGTH (L) TABLE and revised girder depth from 5'-6" (66") to 5'-0" (60") on elevations and Table 1.
	7 of 9	Dimension of "BEAM" changed to "GIRDER DEPTH (d)" on 4 details to match table headings.

STANDARD	SHEET	DESCRIPTION OF CHANGES
		Added MINIMUM APPROACH SLAB LENGTH TABLE.
BD-667M	8 of 9	Note on concrete pile's rebar hooks added. Clarified concrete placement sequence.
	9 of 9	Changed existing abutment exposure from 1' MAX. on F.F. to 1'-6" Typical, 4'-0" MAX. Rear face limit now set at 6" MIN. to 12" MAX.
BD-677M	20 shts	Removed metric dimensions and design tables (8 sheets removed from standard).
	1 of 20	GENERAL NOTES: Removed Note 1 (dual units) and renumbered subsequent notes. Removed old Notes 15 & 16 (referencing BD-676M & BC-777M respectively).
	2 of 20	DESIGN PARAMETERS: Clarified that spread footings are designed for WIND pressures of 20 & 28 psf. Removed minimum footing thickness of 2'-0" from Note 4 (Spread Footings).
	4 of 20	Added NOTES 3 & 4 which permit additional lap splices to create closed stirrups.
	5 of 20	Added NOTE 7 regarding the galvanizing of the hardware for connection of the precast concrete posts to the steel base plates. Added two NOTE 7 callouts on ELEVATION detail.
	8 of 20	Added Note 5, "5. FOR PANEL SEAT DETAILS REFER TO BC-777M." Added two references to Note 7 on Sheet 5 on the DETAIL 2 Elevation. Added "=" to PH1 dimension on DETAIL 2 Elevation.
	12 of 20	Added Post Types "C & D" to sheet title.
BD-679M	1 of 11	GENERAL NOTES: Removed Note 1 (dual units) and renumbered subsequent notes.
	11 shts	Replaced the vertical elastomeric pads between the steel posts and sound barrier wall panel with closed cell neoprene sponge strip, Shts. 7, 8, 9, & 11.
BD-697M	4 shts	Initial Release of Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS).

<div>OS-299 (7-08)</div> <div></div>	TRANSMITTAL LETTER	<div>PUBLICATION:</div> <div>Publication 218M September 2010 Edition Change No. 1</div> <div>DATE:</div> <div>August 31, 2012</div>
<div>SUBJECT:</div> <div>Change No. 1 to Standards for Bridge Design, BD-600M Series September 2010 Edition</div>		
<div>INFORMATION AND SPECIAL INSTRUCTIONS:</div> <div>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 October 5, 2012 should incorporate these new standards.</div> <div>The Standard Drawings included in this release along with a description of the changes are listed in the attached multi-sheet Table.</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 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 - www.dot.state.pa.us Click on Forms, Publications & Maps</div><div><input checked="" type="checkbox"/> DGS warehouse (PennDOT employees ONLY)</div></div> <div>APPROVED FOR ISSUANCE BY:</div> <div>Barry J. Schoch, P.E. – Secretary of Transportation</div> <div>By:  R. Wayne Willey, P.F., Acting Director of Bureau of Project Delivery, Highway Administration</div>	

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-600M	1	Revised for issuance of Change No. 1. Added BD-626M and BD-666M plus revised date for 23 updated standards
BD-601M	1 of 10	NOTES: Revised notes and numbering NOTE 3: Replaced CLASS AAA CONCRETE with CLASS AAAP CONCRETE SHEET 9 eliminated due to removal of metric.
		NOTE 13: Article 5.14.1.2.7 changed to 5.14.1.4, Article 6.10.3.7 changed to 6.10.1.7, Section D5.14.1.2.7 changed to D5.14.14 , Section D6.10.37P changed to D6.10.17
		LEGEND: No. 3 - Article D5.14.1.2.7 change to D5.14.1.4 LEGEND: No. 5 - DECK SLAB added to LAP SPLICE LENGTH LEGEND: No. 6 - S3 AND input before both S3' BARS
	2 of 10	LEGEND: No. 4 - S3 AND input before S3' BARS NOTES: added No. 2 BARRIER LAP SPLICE LENGTH : 3' - 7" #5 BARS 4' - 4" #6 BARS
		SPLIT CONCRETE GLARE SCREEN: Added 3'- 5½" dimension ALTERNATE SPLIT CONCRETE MEDIAN: Added 3'- 5½" dimension
	3 of 10	NOTES: added NO. 3 BARRIER LAP SPLICE LENGTH: 3' - 7" #5 BARS 4' - 4" #6 BARS
		LEGEND: No. 4 - S3 AND input before S3' BARS No. 7 - DECK SLAB added before LAP SLPICE LENGTH
		NOTES: added NO. 3 BARRIER LAP SPLICE LENGTH: 3' - 7" #5 BARS
	4 of 10	TYPICAL SIDEWALK DETAIL changed to INTEGRAL SIDEWALK DETAIL LEGEND: No. 4 - S3 AND input before S3' BARS No. 5 - DECK SLAB added before LAP SLPICE LENGTH
		PROTECTED SIDEWALKS definition added NOTES: added NO. 3 BARRIER LAP SPLICE LENGTH: 3' - 7" #5 BARS 4' - 4" #6 BARS
		INTEGRAL SIDEWALK DETAIL: Changed 2%, SLOPED.. to 1.5%, SLOPED.. ALTERNATE SIDEWALK DETAIL: Replaced 2% with 1.5% RAISED SIDEWALK DETAIL: Removed 2% for sidewalk slope Changed 2%, SLOPED.. to 1.5%, SLOPED..
		CONCRETE BARRIER WITH STRUCTURE: Added 2'- 2¼" dimension INTEGRAL SIDEWALK DETAIL: Added 3'- 6" dimension
		Added to ALTERNATE SIDEWALK DETAIL: PERMITTED FOR BRIDGES WITH A POSTED VEHICLUAR 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).
	5 of 10	SECTION A-A: Revised reinforcement on drawing
	6 of 10	REINFORCEMENT DETAILS TABLE 2: Changed title to BARRIER DIMENSIONS
	10 of 10	NOTES: Revised notes and numbering
BD-609M	1 of 2	SECTION A-A: Added thickness of curb and spacing of post's anchor bolts NOTES: Revised numbering REFERENCE DRAWINGS: Added RC-52M: TYPE 2 STRONG POST GUIDE RAIL
	2 of 2	RAIL AT END OF BRIDGE: Changed A325 BOLT to ¾" A325 GALV. BOLT BASE PLATE DETAIL: Added 1/4" continuous fillet weld. Added dimensions of 12 inch square base plate.
BD-611M	1 of 3	POT BEARINGS and ELASTOMERIC BEARINGS (ELEVATION): Increased concrete cover dimension from 2" to 3" for the #4 L-bar at the end of the deck slab on both sections Increased concrete cover dimension from 3" to 4" for the beam notch on both sections
		POT & ELASTOMERIC BEARINGS: Changed WATERPROOFING MEMBRANE to MEMBRANE WATERPROOFING
		POT BEARINGS and ELASTOMERIC BEARINGS (ELEVATION): Changed SEE NOTE numbering according to revised numbering
		PLAN (SKEWED STRUCTURES): Increased the dimension from 1'-0" to 1'-1" to be consistent with the 4" dimension on the sections.
		NOTES: Revised notes and numbering

STANDARD	SHEET	DESCRIPTION OF CHANGES
		NOTE 6: Replaced CLASS AAA with CLASS AA Revised Notes 16 and 17
		ELASTOMERIC BEARINGS: Revised STYROFOAM to PREFORMED CELLULAR POLYSTYRENE POT BEARINGS and ELASTOMERIC BEARINGS (FULL DEPTH DIAPHRAGM): Changed SEE NOTE numbering Revised dimensions
BD-611M	2 of 3	DIAPHRAGM AT ABUTMENT WITH BACKWALL: Revised STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Changed SEE NOTE numbering Increased clear cover dimension from 1" to 2" on the #6 @ 9" bars projecting from the end diaphragm into the approach slab.
		POT and ELASTOMERIC BEARING (ELEVATION): Changed SEE NOTE numbering Added MIN to 4"
		Extended BEARING ASSEMBLY TYPICAL lines
		PLAN (SKEWED STRUCTURES): Increased the dimension for the beam notch from 1'-0" to 1'-1" to be consistent with the 4" dimension on the detail.
		DIAPHRAGM AT ABUTMENT WITH BACKWALL: Added 0" MIN., 6" MAX. dimension between bottom flange of steel beam and bottom of concrete end diaphragm.
		DIAPHRAGM AT ABUTMENT WITH BACKWALL: Increased concrete cover dimension from 3" to 4" for the beam notch Increased concrete cover dimension from 2" to 3" for the #4 L-bar at the end of the deck slab
	3 of 3	Changed SEE NOTE numbering according to revised numbering SECTION (ELASTOMERIC BEARINGS): Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE ALTERNATE REBAR DETAIL: Revised joint detailing to be consistent with the revisions made to BD-628M Added EXPANSION WATERSTOP, SEE BC-735M Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE
BD-621M	1 of 3	NOTES: Revised notes and numbering Added Note 1: PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS PILE FOOTING: Added extra reinforcing bars
	2 of 3	TYPICAL SECTION WITH BACKWALL: Changed SEE NOTES numbering TYPICAL SECTION WITHOUT BACKWALL: Revised to be consistent with the revisions made to BD-628M - DETAILS 10, 11, and 12.
	3 of 3	ANCHOR BOLT PLAN (INSTRUCTIONS): Changed SECTION 1001.3(f) and 1001.3(k) 8 to SECTION 1001.3(k) 9 and 1001.3 (f)
BD-626M	9 shts	Initial Release of ANCHORED WALLS
BD-627M	1 of 8	REFERENCE DRAWINGS: Revised titles for BC-709M, BC-713M, and BC-739M
	2 of 8	MOMENT SLAB (BURIED) WITH TYPICAL C.I.P. BARRIER: Changed ASPHALT JOINT SEALANT (AC-20) to ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]
	3 of 8	NOTES: NOTE 3: Changed MEMBRANE WATERPROOFING to WATERPROOFING MEMBRANE
		MOMENT SLAB (BURIED) WITH TYPICAL PRECAST CONCRETE BARRIER: Changed ASPHALT JOINT SEALANT (AC-20) to ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)] Changed MEMBRANE WATERPROOFING to WATERPROOFING MEMBRANE
	4 of 8	MOMENT SLAB WITH ASPHALT OVERLAY ADJACENT TO TYPE 2: Replaced ASPHALT JOINT SEALANT (AC-20) with ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]
	5 of 8	MOMENT SLAB (BURIED) WITH TOE WALL: Changed ASPHALT JOINT SEALANT (AC-20) to ASPHALT RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]
	6 of 8	TYPE 1 AND TYPE 2 OPEN JOINT: Replaced SEALANT with SEALER JOINT NOTES: Revised NOTE 1
	8 of 8	PAVEMENT RELIEF JOINT DETAILS: Replaced STYROFORM with PREFORMED CELLULAR

STANDARD	SHEET	DESCRIPTION OF CHANGES
		POLYSTYRENE (3 places) Changed AC-2.5 IN ACCORDANCE WITH PUB 408M to PG 46-40 IN ACCORDANCE WITH PUB 408
BD-628M	1 of 35	MATERIAL NOTES: NOTES 1: Included Class A Cement Concrete in support pedestals and eliminated reference to header slabs.
		GENERAL NOTES: Revised notes and numbering INDEX OF SHEETS: Revised sheet titles and numbering APPROACH SLAB TYPES: Revised TYPE 4
	2 of 35	APPROACH SLAB GUIDELINE NOTES: Revised NOTES 2 & 3 NOTE 4: Changed TYPE 2 to TYPE 3 Added NOTE 4 NOTE 7: Replaced TYPE 3, 4 AND 5 with TYPE 3 AND 5
		INSTRUCTIONS TO DESIGNER NOTES: Revised NOTE 13 to eliminate reference to HEADER SLAB INSTRUCTIONS TO DESIGNER NOTES: Renumbered NOTE 14 to NOTE 15 and NOTE 15 to NOTE 14 Revised NOTE 14
		INSTRUCTIONS TO DESIGNER NOTES: NOTE 15: Added ROADWAY INLETS LIMIT comment Added NOTE 16: OPENINGS IN BARRIERS AT THE BRIDGE/APPROACH SLAB INTERFACE Revised numbering
		INSTRUCTIONS TO DESIGNER NOTES: Revised NOTE 9 to include INVERTED V JOINT SEAL, and WATERSTOP and eliminated references to CLASS 3 EXCAVATION Added STAINLESS STEEL PLATES comments NOTE 10: Added SUBBASE THICKNESS comments
	3 of 35	DESCRIPTION OF PLANS & DESCRIPTION OF DETAILS: Revised descriptions and sheet numbers
		Added PAVING NOTCH FORMING DETAILS & JOINT PREPARATION NOTES Eliminated PLAN 1 for TYPE 1 AND TYPE 2 APPROACH SLABS SECTION A-A: Increased concrete cover dimension from 2" to 3" for the #5 U-bar at the end of the approach slab (2 places)
	4 of 35	PLAN 1 TYPE 1 & TYPE 2: Increased concrete cover dimension from 3" to 5" for the transverse reinforcement in the approach slab Added JOINT SEAL AND WATERSTOP TERMINATION DETAIL
		PLAN 1 TYPE 1 & TYPE 2: Changed title from PLAN 3 to PLAN 1 Added notes for 1/2" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL and WATERSTOP
		Old Sheet 5 of 35 renumbered to Sheet 4 of 35 due to elimination of Old PLAN 2 for TYPE 1 and TYPE 2 Approach Slabs set to the Curb-to-Curb Width NOTES: NOTE 5: Revised PAVING NOTCH OUT TO OUT NOTE 6: Changed GUIDE RAIL to APPROACH END
	5 of 35	Old Sheet 6 of 35 renumbered to Sheet 5 of 35 due to elimination of old PLAN 2 for TYPE 1 and TYPE 2 Approach Slabs set to the Curb-to-Curb Width
		PLAN 2 TYPE 1 & TYPE 2: Revised title from PLAN 4 to PLAN 2 Increased concrete cover dimension from 3" to 5" for the transverse reinforcement in the approach sla
		Moved SECTION C-C and NOTE 3 from old SHEET 4 to new SHEET 5 Revised NOTE 3 to NOTE 6 NOTES: Eliminated old NOTE 3 reference to SECTION C-C and revised numbering NOTE 4: Changed GUIDE RAIL to APPROACH END
		PLAN 2 TYPE 1 & TYPE 2: Added notes for ½" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL AND WATERSTOP Changed SEE NOTE numbering
	6 of 35	PLAN 3 TYPE 1 & TYPE 2: Revised title from PLAN 5 to PLAN 3 Added notes for ½" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL AND WATERSTOP
		PLAN 3 TYPE 1 & TYPE 2: Increased concrete cover dimension from 3" to 5" for the transverse

STANDARD	SHEET	DESCRIPTION OF CHANGES
		reinforcement in the approach slab.
		Old Sheet 7 of 35 renumbered to Sheet 6 of 35 due to elimination of old PLAN 2 for TYPE 1 and TYPE 2 APPROACH SLABS set to the Curb-to-Curb Width SECTION F-F: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE
BD-628M	7 of 35	Old Sheet 8 of 35 renumbered to Sheet 7 of 35 due to elimination of old PLAN 2 for TYPE 1 and TYPE 2 APPROACH SLABS set NOTES: NOTE 6: Changed GUIDE RAIL to APPROACH END SECTION G-G: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE
		PLAN 4 TYPE 1 & TYPE 2: Changed title from PLAN 6 to PLAN 4 Added notes for ½" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL AND WATERSTOP
		PLAN 4 TYPE 1 AND TYPE 2: Increased concrete cover dimension from 3" to 5" for the transverse reinforcement in the approach slab
	8 of 35	TYPE 2- CONCRETE APPROACH: Revised barrier note to DESIGNER MUST FULLY DETAIL THE APPROPRIATE BARRIER TYPE, LENGTH, AND TRANSITION ON THE CONTRACT DRAWINGS
		DETAIL D (WITH WINGWALL): Changed STYROFOAM to CLOSED CELL NEOPRENE SPONGE Added criteria to PROVIDE 1'-0" GAP IN THE POLYETHYLENE SHEETING ALONG REAR FACE OF U-WING TO ALLOW FOR DRAINAGE (3 places)
		TYPE 1, TYPE 3 OR TYPE 4: Revised reinforcement and thickness due to revised location of the drain trough. Added criteria to PROVIDE 1'-0" GAP IN THE POLYETHYLENE SHEETING ALONG REAR FACE OF U-WING TO ALLOW FOR DRAINAGE
		Old Sheet 9 of 35 renumbered to Sheet 8 of 35 DETAIL E: Changed JOINT SEALANT (AC-20) to RUBBER SEALING COMPOUND [PUB. 408, SECTION 705.4(g)]
	9 of 35	Old Sheet 10 of 35 renumbered to Sheet 9 of 35 DETAIL 1, 2 & 3: Added 3" CLR. Revised title of DETAIL 1, 2, and 3 and SHEET TITLE to include TYPE 4
	10 of 35	Old Sheet 11 of 35 renumbered to Sheet 10 of 35 NOTES: Added NOTES 3 and 4
		DETAIL 4 (WITHOUT OVERLAY): Revised thickness of CLOSED CELL NEOPRENE SPONGE from ⅜" to ½" and dimension from rear face of backwall from 8⅝" to 8½"
		DETAIL 4 (WITH OVERLAY): Revised dimensions
		DETAIL H: Revised to eliminate ⅝" JOINT with JOINT SEALING MATERIAL to be a saw cut joint with either a NEOPRENE COMPRESSION SEAL or INVERTED V JOINT SEAL Added DETAIL H NOTES
	11 of 35	DETAIL 5: Revised thickness of CLOSED CELL NEOPRENE SPONGE from ⅜" to ½" and dimension from rear face of backwall from 8⅝" to 8½"
		Added DETAIL J (INVERTED V JOINT SEAL) & DETAIL J NOTES
	12 of 35	Old Sheet 12 of 35 renumbered to Sheet 11 of 35 DETAIL J: Revised to eliminate ⅝" JOINT with JOINT SEALING MATERIAL to be a saw cut joint with either a NEOPRENE COMPRESSION SEAL or INVERTED V JOINT SEAL NOTES: Added Notes 2 and 3.
		DETAIL 6: Eliminated ⅝" joint dimension on TYPE 1 Revised thickness of CLOSED CELL NEOPRENE SPONGE from ⅜" to ½" and dimension from end of beam from 8⅝" to 8½"
		Added WATERSTOP Changed 9" to 9¼" on TYPE 2
		Old Sheet 13 of 35 renumbered to Sheet 12 of 35 NOTES: Added NOTE 4 Revised drawing details
	13 of 35	DETAIL 7: Eliminated ⅝" joint dimension on TYPE 1 Revised thickness of CLOSED CELL NEOPRENE SPONGE from ⅜" to ½" and dimension from end of beam from 8⅝" to 8½"
		Added WATERSTOP

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M		Changed 9" to 9¼" on TYPE 2
		Old Sheet 14 of 35 renumbered to Sheet 13 of 35 NOTES: Added NOTE 4
	14 of 35	Old Sheet 15 of 35 renumbered to Sheet 14 of 35 NOTES: Added NOTE 3
		DETAIL 8: Eliminated ¾" joint dimension on TYPE 1 Revised thickness of CLOSED CELL NEOPRENE SPONGE from ¾" to ½" and dimension from end of beam from 8⅝" to 8½" Added WATERSTOP Changed 9" to 9¼" on TYPE 2
	15 of 35	DETAIL 9: Eliminated ¾" joint dimension on TYPE 1 Revised thickness of CLOSED CELL NEOPRENE SPONGE from ¾" to ½" and dimension from end of beam from 8⅝" to 8½" Added WATERSTOP Changed 9" to 9¼" on TYPE 2
		Old Sheet 16 of 35 renumbered to Sheet 15 of 35 NOTES: Added NOTE 3
	16 of 35	Old Sheet17 of 35 renumbered to Sheet 16 of 35 DETAIL 10: Revised width of abutment corbel from 9" to 1'-4" Added WATERSTOP Added ABUTMENT CORBEL REINFORCEMENT DETAIL NOTES: Revised NOTE 2 Revised drawing details
		DETAIL 10: Eliminated ¾" joint dimension for both TYPE 1 and TYPE 2 and revised thickness of CLOSED CELL NEOPRENE SPONGE from ¾" to ½" Revised method of APPROACH SLAB SUPPORT to eliminate joint leakage being directed onto bridge seat
	17 of 35	Old Sheet 18 of 35 renumbered to Sheet 17 of 35 DETAIL 11: Revised width of abutment corbel from 9" to 1'-4" Added WATERSTOP NOTES: Revised NOTE 2 and added NOTE 3
		DETAIL 11: Eliminated ¾" joint dimension for both TYPE 1 and TYPE 2 and revised thickness of CLOSED CELL NEOPRENE SPONGE from ¾" to ½" Revised method of APPROACH SLAB SUPPORT to eliminate joint leakage being directed onto bridge seat
	18 of 35	Old Sheet 19 of 35 renumbered to Sheet 18 of 35 DETAIL 12: Revised width of abutment corbel from 9" to 1'-4" Added WATERSTOP NOTES: Revised NOTE 2 and added NOTE 3
		DETAIL 12: Eliminated ¾" joint dimension for both TYPE 1 and TYPE 2 and revised thickness of CLOSED CELL NEOPRENE SPONGE from ¾" to ½" Revised method of APPROACH SLAB SUPPORT to eliminate joint leakage being directed onto bridge seat
	19 of 35	PLAN 1 TYPE 3: Increased concrete cover dimensions from 3" to 5" for the transverse reinforcement in the APPROACH SLAB
		Old Sheet 20 of 35 renumbered to Sheet 19 of 35 SECTION K-K: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE SECTION J-J: Increased concrete cover dimension from 2" to 3" for the #5 U-bar at the end of the APPROACH SLAB
		DESCRIPTION OF PLANS & DETAILS TABLES: Revised sheet numbers PLAN 1 TYPE 3: Added notes for ½" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL AND WATERSTOP
	20 of 35	Old Sheet 21 of 35 renumbered to Sheet 20 of 35 NOTES: NOTE 6: Changed GUIDE RAIL to be APPROACH END
		PLAN 2 TYPE 3: Increased concrete cover dimension from 3" to 5" for the transverse reinforcement in the APPROACH SLAB

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M		Added notes for ½" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL and WATERSTOP
		Old Sheet 22 of 35 renumbered to Sheet 21 of 35 DETAIL R: Changed dimensions 2'-1½" to 2'-1" and 3" to 2½" NOTES: Changed sheet numbers
	21 of 35	PLAN 3 TYPE 3: Increased concrete cover dimension from 3" to 5" for the transverse reinforcement in the APPROACH SLAB Added notes for ½" OPRN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL and WATERSTOP
		Old Sheet 23 of 35 renumbered to Sheet 22 of 35 DETAIL 13, 14 & 15: Replaced CLASS AAA with CLASS AAAP Changed 2" to 3" CLR.
	22 of 35	Old Sheet 27 of 35 renumbered to Sheet 23 of 35 Removed TYPE 4 AND from the sheet title DETAIL 16, 17 & 18: Removed TYPE 4 AND from the detail titles Replaced CONCRETE HEADER SLAB-TYPE 4 with CONCRETE APPROACH SLAB Replaced CLASS AAA with CLASS AAAP
		Added PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS, SEE ALTERNATE REBER DETAIL, THIS SHEET DETAIL 19: Revised drawing details
	24 of 35	Added DETAIL 20 and ALTERNATE REBAR DETAIL from old Sheet 29 ALTERNATE REBAR DETAIL: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE and thickness of CLOSED CELL NEOPRENE SPONGE 1" to ½" Added EXPANSION WATERSTOP DETAIL 19: Added WATERSTOP
		DETAIL 19 & 20: Added criteria to provide a 2'-0" GAP IN THE POLYETHYLENE SHEETING ALONG THE REAR FACE OF BACKWALL TO ALLOW FOR DRAINAGE Increased CLR. dimension from 1" to 2" on the #6 @9" bars Changed PAVING NOTCH dimensions
		Old Sheet 28 of 35 renumbered to Sheet 24 of 35 Eliminated ALTERNATE (3/8" Joint) DETAIL NOTES: Eliminated NOTES 2, 3, 4 & 5 Added NOTES 4 & 5 Revised numbering
		DETAIL 19 & 20: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE and thickness of CLOSED CELL NEOPRENE SPONGE 1" to ½" Removed TYPE 4 from detail titles Changed CLASS AAA to CLASS AAAP
	25 of 35	Old Sheet 30 of 35 renumbered to Sheet 25 of 35 NOTES: Eliminated NOTES 2-5 Revised numbering Added NOTES 4-6 DETAIL 21: Revised P/S CONCRETE I-BEAM note
		Added DETAIL 22 from old Sheet 31 of 35 DETAIL 22: Added 0" MIN., 6" MAX dimension between bottom flange of steel beam and bottom of concrete end diaphragm Changed ADJACENT TO STEEL I-BEAMS to STEEL I-BEAMS AND
		DETAILS 21 & 22: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE and thickness of CLOSED CELL NEOPRENE SPONGE from 1" to ½" Increased CLR. dimension from 1" to 2" on the #6 @9" bars projecting from the end diaphragm into the approach slab
		DETAIL 21 & 22: Added criteria to provide a 2'-0" GAP IN THE POLYETHYLENE SHEETING ALONG THE REAR FACE OF BACKWALL TO ALLOW FOR DRAINAGE Removed TYPE 4 from detail titles Added "A" @ 68°F to JOINT OPENING
	26 of 35	PLAN 1 TYPE 4: Revised reinforcement and thickness of Type 4 Approach Slabs to match Type 1 Approach Slabs due to revised location of the drain trough

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M		Old Sheet 24 of 35 renumbered to Sheet 26 of 35 PLAN 1 TYPE 4: Revised location of drain trough for Type 4 to be integral and attached to the abutment Revised Plan to add support pedestals and eliminate header slab
		SECTION P-P: Revised to eliminate drain trough and references to header slab Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE NOTES: Added Note 3 Revised section references and sheet numbers Renumbered notes
		SECTION O-O:Revised to move drain trough to be integral and attached to the abutment Increased concrete cover dimension from 2" to 3" for the #5 U-bar at the end of the approach slab and from 3" to 5" for the transverse reinforcement in the approach slab
		DESCRIPTION OF PLANS & DESCRIPTION OF DETAILS TABLES: Revised sheet numbers and descriptions Added DESCRIPTIONS FOR DETAILS 23, 24, 25 and 26 (Type 4).
		PLAN 1 TYPE 4: Added notes for 1/2" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL and WATERSTOP
	27 of 35	PLAN 2 TYPE 4: Revised location of drain trough for Type 4 to be integral and attached to the abutment Added notes for 1/2" OPEN JOINT IN BARRIER AT THE BRIDGE/APPROACH SLAB interface and end treatment of JOINT SEAL and WATERSTOP
		PLAN 2 TYPE 4: Revised reinforcement of Type 4 Approach Slabs to match Type 1 Approach Slabs due to revised location of the drain trough Increased concrete cover dimension from 3" to 5" for the transverse reinforcement in the approach slab
		PLAN 2 TYPE 4: Revised Plan to add support pedestals and eliminate header slab. SECTION S-S: Revised to change references from header slab to approach slab.
		Old Sheet 25 of 35 renumbered to Sheet 27 fo 35 NOTES: Revised notes and numbering Revised sheet numbers and sections in NOTES New NOTE 6: Changed GUIDE RAIL to APPROCH END
	28 of 35	Eliminated BEARING ASSEMBLY, Added Rubberized trough material lining with Termination Bars Added 3"x3" Non Shrink Grout Chamfers Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Added Section U-U
		SECTION T-T: Revised to eliminate references to header slab and approach slab. Added TOOTH EXPANSION DAM ANCHORAGE DETAIL from old Sheet 34
		PLAN 3 TYPE 4: Revised Plan to add support pedestals and eliminate header slab. Eliminated Approach Slab illustrate alternate details for new integral drain trough with adjacent flexible pavement.
		Old Sheet 26 of 35 renumbered to Sheet 28 of 35 NOTES: Revised numbering PLAN 3 TYPE 4: Revised location of drain trough for TYPE 4 to be integral and attached to the abutment
	29 of 35	Old Sheet 28 fo 35 renumbered to Sheet 29 of 35 Old DETAIL 19 revised to DETAIL 23 for TYPE 4 with integral drain trough attached to abutment NOTES: Revised notes and numbering Added new NOTES 4 & 5
		TYPE 4 APPROACH SLAB-DETAIL 23: Revised deck slab to be continuous over end of beam and abutment backwall to the tooth dam assembly Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Added SECTION and ELEVATION for PEDESTAL REINFORCEMENT
	30 of 35	Old Sheet 29 of 35 renumbered to Sheet 30 of 35 NOTES: Revised notes and numbering Added new NOTES 4 & 5
		Added DECK SLAB REINFORCEMENT DETAIL and DRAIN TROUGH REINFORCEMENT

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-628M		DETAIL with Approach Slab Support / Paving Notch. Deleted ALTERNATE REBAR DETAIL
		Old DETAIL 20 revised to DETAIL 24 for TYPE 4 with integral drain trough attached to abutment Revised deck slab to be continuous over end diaphragm and abutment backwall to the tooth dam assembly Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE
	31 of 35	Old Sheet 30 of 35 renumbered to Sheet 31 of 35 Old DETAIL 21 revised to DETAIL 25 for TYPE 4 with integral drain trough attached to abutment DETAIL 25: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE
		Added DRAIN TOUGH REINFORCEMENT DETAIL (WITHOUT APPROACH SLAB SUPPORT/PAVING NOTCH) NOTES: Revised notes and numbering Added new NOTE 4
		TYPE 4 APPROACH SLAB-DETAIL 25: Revised deck slab to be continuous over end diaphragm and abutment backwall to the tooth dam assembly.
	32 of 35	Old Sheet 31 of 35 renumbered to Sheet 32 of 35 Old DETAIL 22 revised to DETAIL 26 for TYPE 4 with integral drain trough attached to abutment NOTES: Revised notes and numbering Added new NOTES 3 & 4
		SECTION V-V: Changed 1'-6" WALL to 1'-3" BACKWALL Replaced 1'-6" WALL with 2'-3" TROUGH WALL SECTION W-W: Changed 1'-6" WALL dimension to 1'-3" BACKWALL Revised 1'-6" WALL to be 1'-6" TROUGH WALL
		TYPE 4 APPROACH SLAB-DETAIL 26: Added SEE DETAIL H, SHEET 10 AND NOTE 4 Added INTEGRAL CONCRETE DRAIN TROUGH WITH TOOTH DAM
		TYPE 4 APPROACH SLAB-DETAIL 26: Revised deck slab to be continuous over end diaphragm and abutment backwall to the tooth dam assembly Added DETAIL M & N and SECTION V-V & W-W from old Sheet 33 and updated misc dimensions
		TYPE 4 APPRAOCH SLAB-DETAIL 26: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Added 0" MIN., 6" MAX. dimension between bottom flange of steel beam and bottom of concrete end diaphragm Changed dimensions
	33 of 35	Eliminated DETAIL L, SECTION Q-Q & SECTION U-U based on the revised location of the drain trough and elimination of the bearing assembly Added TOOTH DAM SUPPORT PLAN SECTION R-R: Revised drawing & misc dimensions Added STRUCTURE BACKFILL MATERIAL
		Old Sheet 32 of 35 renumbered to Sheet 33 of 35 NOTES: Revised notes and numbering
	34 of 35	Eliminated BEARING DETAILS & EXCAVATION PAY LIMITS due to revised location of the drain trough Added CONCEPTUAL INSTALLATION SCHEME and JOINT INSTALLATION NOTES Added details for integral drain trough intersection with barrier transition wing
		Deleted TOOTH EXPANSION DAM DETAIL & PLAN - BEARING PLATE WITH MASONRY PLATE Added SAFETY WING PLAN, SECTION Q-Q, & SECTION A'-A'
	35 of 35	Added SECTION B-B & DETAIL A DESCRIPTION OF DETAILS FOR TYPE 5 APPROACH SLAB TABLE: SHEET NO.: Changed 23 to 22 (3 places); 27 to 23 (3 places)
		NOTES: Added new NOTE 3 New Note 5: Changed GUIDE RAIL to APPROACH END Added new NOTE 7
		SECTION X-X: Increased concrete cover dimension from 2" to 3" for the #5 U-bar at the end of APPROACH SLAB and the transverse reinforcement dimension from 3" to 5"
		PLAN TYPE 5: Added BOND END JOINT SEAL TO INTEGRAL ABUTMENT (TYP.) (SEAL ENDS

STANDARD	SHEET	DESCRIPTION OF CHANGES
		OF NEOPRENE COMPRESSION SEAL PER DETAILS ON BC-766M, PRIOR TO INSTALLATION) Added dimensions
BD-628M		PLAN TYPE 5: Added 5" dimensions (2 places) Added BOND END OF JOINT SEAL TO INTEGRAL ABUTMENT (TYP.) (SEAL ENDS OF NEOPRENE COMPRESSION SEAL PER DETAILS ON BC-766M, PRIOR TO INSTALLATION)
BD-629M	1 of 15	DESIGN DATA: Replaced FIXED PIERS WITH CONTINUOUS DECK DESIGN, with FIXED PIERS WITH CONTINUOUS DECK DESIGN FOR STEEL BRIDGES,
	3 of 15	SEISMIC ZONE 1 replaced with RESPONSE ACCELERATION COEFFICIENT, SD1, LESS THAN 0.10 SEISMIC ZONE 2 replaced with SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, SD1, GREATER THAN OR EQUAL TO 0.10 ROUND CLOUMN (ALTERNATE): added 1/2 TIE SPA., 3" MAX.
	5 of 15	Removed SYMMETRICAL ABOUT CENTERLINE COLUMN from two details. SECTIONS A-A & B-B: added FULLY DEVELOPED IN WALL OR FOOTING to column reinforcement callout. SEISMIC ZONE 1 replaced with RESPONSE ACCELERATION COEFFICIENT, SD1, LESS THAN 0.10 SEISMIC ZONE 2 replaced with SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, SD1, GREATER THAN OR EQUAL TO 0.10
	7 of 15	SEISMIC ZONE 1 replaced with RESPONSE ACCELERATION COEFFICIENT, SD1, LESS THAN 0.10 SEISMIC ZONE 2 replaced with SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, SD1, GREATER THAN OR EQUAL TO 0.10
	8 of 15	SEISMIC ZONE 1 replaced with RESPONSE ACCELERATION COEFFICIENT, SD1, LESS THAN 0.10 SEISMIC ZONE 2 replaced with SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, SD1, GREATER THAN OR EQUAL TO 0.10
	10 of 15	SEISMIC ZONE 1 replaced with RESPONSE ACCELERATION COEFFICIENT, SD1, LESS THAN 0.10 SEISMIC ZONE 2 replaced with SITE CLASS E, F OR RESPONSE ACCELERATION COEFFICIENT, SD1, GREATER THAN OR EQUAL TO 0.10
	12 of 15	SECTION C-C: added (SECTION D-D SIMILAR).
	14 of 15	PIER CAP SECTION: DIMENSION "S" revised to be 5" and 5 1/2" instead of 4 1/2" and 5" for #4 and #5 rebar sizes, respectively.
	BD-632M	1 of 15
	2 of 15	LEGEND: Changed SEE NOTE 14, SHEET 1 to SEE NOTE 12, SHEET 1 NOTES: changed No. 1 - WEARING COURSE THICKNESS (h), (COMBINATION FILL AND OVERLAY) SECTION A-A: Added 1'-9¼" dimension PAVEMENT NOTCH DETAIL: Changed 9" PAVEMENT NOTCH(CAST-IN-FIELD

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-632M		OR PRECAST SECONDARY CASTING) to PAVING NOTCH DEPTH (REFER TO BD-628M) AT GRADE: Added S7 REBAR PER BD-601M ALONG TOP SLAB OF CULVERT: NOTE: Changed DECK to TOP SLAB
		UNDER FILL: Deleted FOR FILL 2'-0" OR LESS, INSTALL MEMBRANE WATERPROOFING AND OPTIONAL PROTECTIVE BOARDS SEE BC-788M PA STRUCTURE MOUNTED GUIDE RAIL ELEVATION, changed MEMBRANE WATERPROFING to WATERPROOFING MEMBRANE
	3 of 15	FLARED WING/SAFETY WING: Added & BD-624M after REFER TO BC-739M Changed BC-739M to BD-624M SECTION B-B: Changed BC-739M to BD-624M
	4 of 15	NOTE 13: Changed PROVIDE 2'-0" WIDTH + MEMBRANE ... FOR FILLS > 2'-0" to PROVIDE 2'- 0" MIN. WIDTH ... REFER TO BC-788M CORNER REINFORCEMENT DETAILS: changed SEE No. 25 to SEE No. 24
		BOX DETAILS – WELDED WIRE FABRIC: Changed SEE NOTE 18 to SEE NOTE 17 (2 places), changed SEE NOTE 19 to SEE NOTE 18, changed SEE NOTE 20 to SEE NOTE 19 (2 places) SECTION T-T: changed SEE NOTE 21 to SEE NOTE 20
		NOTES: Deleted previous No. 1, added new No. 1, Revised numbering Revised No. 18: changed IS BASED ON to TO MATCH THE WALL THICKNESS AS PER NO. 27: Changed SEE No. 21 & SEE NO. 12 to SEE No. 19 & SEE No. 11 Added No. 28
	5 of 15	CULVERT WITH PRECAST END SECTION: PROFILE: NOTES: Changed SEE No. 25 to SEE No. 24 Changed SEE NOTE 14 to SEE NOTE 12 Changed SEE NOTE 21 to SEE NOTE 20 PREFORMED DRAIN DETAIL: Changed SEE NOTE 12 to SEE NOTE 11
		CULVERT WITH CAST IN PLACE WINGWALLS: PROFILE: Changed SEE NOTE 21 to SEE NOTE 20 Deleted MIN before 5'-0" Changed SEE NOTE 9 ON SHEET 9 to SEE NOTE 9 ON SHEET 12
		6 of 15
	7 of 15	PA STRUCTURE MOUNTED GUIDE RAIL: PLAN: Added 2 – 6" MAX. Dimensions to drawing SECTION F-F: Added 1' – 9¼" and 6"* dimensions NOTE: No.1 - Changed COMBINATION FILL AND OVERLAY to WEARING COURSE THICKNESS (h)
LEGEND: Added * REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND CURB REINFORCEMENT.		
LEGEND: SLAB REINFORCEMENT BAR DETAILS and ANCHOR BOLT BAR DETAILS: Changed T MINUS 2" to FOR T < 10": T – 2", FOR T ≥ 10": 8" MIN., added (T=TOP SLAB THICKNESS OF BOX CULVERT)		
8 of 15	JOINT DETAIL: Changed MEMBRANE WATERPROOFING to WATERPROOFING MEMBRANE Changed PROTECTIVE BOARD to PROTECTIVE BOARD [PUBLICATION 408, SECTION 680.2(c)] Changed ** to * Changed * and ** to *{	
	JOINT DETAIL: NOTE: Changed PROVIDE 2'-0" WIDTH... FOR FILLS > 2'-0" to PROVIDE 2'-0" MIN. WIDTH... FOR ADDITIONAL DETAILS REFER TO BC-788M DETAIL D: Changed ** to * Removed 2" x 1" before CLOSED CELL	
	DESIGN ASSUMPTIONS: No.6 - Changed IS BASED ON to TO MATCH THE WALL THICKNESS AS PER	
	BOX CULVERTS: PLAN VIEW: Changed APRON (TYP.) to APRON, EACH END OF CULVERT Changed ALTERNATING BAFFLES 1'-0" x 8"H to ALTERNATING INTERIOR BAFFLE, 8" HEIGHT, (TYP.) changes to drawings	
	BOX CULVERTS: SECTION J-J: Added SEE NOTE 7	

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-632M		Moved WING WALL + arrow Changes to drawing BOX CULVERTS: ELEVATION: Added CUTOFF WALL, SEE NOTE 7 (TYP.) TWIN CELL BOX CULVERTS: ELEVATION: Added CUTOFF WALL, SEE NOTE 7 (TYP.) Deleted 1'-6" dimension
		TWIN CELL BOX CULVERTS: PLAN VIEW: Added WEIR 1'-6" HEIGHT, SEE DETAILS ON SHEET 14 Changed ALTERNATING BAFFLES to ALTERNATING INTERIOR BAFFLE & Added (TYP.) Added OPPOSING APRON BAFFLES 8" HEIGHT, SEE NOTE 2 (TYP.) Added EXIST & ELEV. around STREAMBED
		TWIN CELL BOX CULVERTS: SECTION K-K: Moved WEIR (BEYOND) + arrow Moved WING WALL +arrow Added 1'-6" dimensions Added 1'-0"/ CUTOFF WALL, SEE NOTE 7 (TYP.) Changes to drawing, deleted SEE NOTE 8
	13 of 15	BOX CULVERTS: PLAN VIEW: Added OPPOSING APRON BAFFLES 8" HEIGHT, (TYP.) SEE NOTE 2 + arrows Added * = 6 " BAFFLE HEIGHT AT OPENING, & ** = 1'-0" BAFFLE HEIGHT Added INTERIOR between ALTERNATING BAFFLES and APRON, EACH END OF CULVERT Added * & ** dimens
		TYPICAL INTERIOR BAFFLE: PLAN: Added INTERIOR between TYPICAL BAFFLE Changed ON SHT. 9 to ON SHT. 12 PRECAST BOX CULVERT TYPICAL BAFFLE DETAIL: Added H = 1'-0" INTERIOR BAFFLE HEIGHT 6" INTERIOR BAFFLE HEIGHT AT OPENING 8" APRON BAFFLE HEIGHT
		TYPICAL INTERIOR BAFFLE: PROFILE: Added BAFFLE OPENING SEE NOTE 3 Added HEIGHT OF BAFFLE IS EQUAL TO ROCK LINING DEPRESSION DEPTH. Added HEIGHT OF BAFFLE OPENING IS EQUAL TO ½ OF ROCK LINING DEPRESSION DEPTH. Added 1'-3" MIN. misc dimension
		TWIN CELL BOX CULVERTS: SECTION M-M: Added WEIR (BEYOND) + arrow Added misc. 1'-6" and 1'-0" dimensions Added CUTOFF WALL, SEE NOTE 7 (TYP.) Changes to drawing Moved WING WALL + arrow
		TWIN CELL BOX CULVERTS: PLAN VIEW: Added WEIR 1'-6" HEIGHT, SEE DETAILS ON SHEET 14 Added INTERIOR between ALTERNATING BAFFLES Added OPPOSING APRON ... SEE NOTE 2 Added APRON, EACH END OF CULVERT Changes to drawing
		TYP. PRECAST SECTION (NORMAL): Changed NOTE 20 to NOTE 19 (2 places) PRECAST BOX CULVERT TYPICAL WEIR DETAIL: Changed BAFFLE to WEIR PROFILE-TYPICAL WEIR: Added misc dimensions Added ½" DIA. THREADED INSERT (TYP.) PLAN-TYPICAL WEIR: Changed 9 to 12
BD-634M	1 sht.	GENERAL NOTES: Deleted previous GENERAL NOTE 1 Revised numbering Changed CLASS 2, TYPE B to CLASS 4, TYPE A (5 places)
BD-641M	1 of 8	INFORMATION CONTAINED IN THE DESIGN TABLES: 2nd Bullet: Changed CATEGORY III to CATEGORY II. Deleted OR II from SPECIFIED TO BE I Deleted SHOULD between TABLE & MEET
		CONSTRUCTION GENERAL NOTES: MATERIALS AND WORKMANSHIP: Changed D1.5-95 to D1.5 Replaced D1.1-98 to D1.1 Changed D1.5-95 to D1.5
		INFORMATION CONATINED IN THE DESIGN TABLES: 1st Bullet: Deleted EXCEPT, THE

STANDARD	SHEET	DESCRIPTION OF CHANGES
		MEMBER SIZES INDICATED DO NOT INCLUDE THE FATIGUE REQUIREMENTS INDICATED IN THE DESIGN CRITERIA.
		DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES: DRILLED SHAFTS Bullet: Changed DM4 SEC. 4.6P to DM4 SEC. D10.8.3.8 Added P to end of COM624
		NOTES TO DESIGNER: Changed PUBLICAITON 408/2000 to PUBLICATION 408 Changed WELDING CODE 1995 AND CONTRACT to WELDING CODE AND CONTRACT Changed D1.1-98 to D1.1 Changed D1.5-95 TO D1.5
BD-641M	6 of 8	COLUMN AND FOOTING DATA: Changes to values in columns: SC (in.), CC (in.), & PEDESTAL "P" BARS NOTES: Added STRUT AND COLUMN DESIGN BASED ON MAXIMUM SIGN HEIGHT...AND LESS THAN 18'6" FOR DOUBLE STRUT STRUCTURES.
	7 of 8	COLUMN AND FOOTING DATA: Changes to values in columns: COLUMN**, SC (in.), CC (in.), PEDESTAL "P" BARS SINGLE STRUT DATA**: Changes in values DOUBLE STRUT DATA**: Changes in values NOTES: Added bullet note STRUT AND COLUMN...DOUBLE STRUT STRUCTURES.
	8 of 8	Revised SINGLE STRUT DATA, DOUBLE STRUT DATA, & FOOTING TYPE NOTES: Added bullet note STRUT AND COLUMN...DOUBLE STRUT STRUCTURES.
BD-642M	1 of 6	CONSTRUCTION GENERAL NOTES: MATERIAL AND WORMANSHIP: Deleted 95 from D1.5 95 (2 places) Deleted 98 from D1.1 98 NOTES TO DESIGNER: 1ST bullet: Deleted /2000 from PUBLICATION 408/2000 Deleted 95 from D1.5 95 (2 places) Deleted 98 from D1.1 98 Deleted 1995 from between CODE and AND CONTRACT
		INFORMATION CONTAINED IN THE DESIGN TABLES: Deleted SHOULD between TABLES and MEETDESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES: DRILLED SHAFTS (CAISSONS): Changed SEC. 4.6P to D10.8.3.8, Added P to the end of COM624
	2 of 6	Revised POSITIONING OF SIGN PANELS AND SIGN STRUCTURE notes per SOL 431-11-04
BD-643M	1 of 6	INFORMATION CONTAINED IN THE DESING TABLES: 1ST BULLET: Deleted EXCEPT, THE MEMBER SIZES INDICATED...IN THE DESIGN CRITERIA. 2ND BULLET: Deleted SHOULD Between TABLES and MEET, Changed CATEGORY III to II, Deleted OR II from IS SPECIDIFIED TO BE I or II DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES: DRILLED SHAFTS (CAISSONS): Changed SEC. 4.6P to SEC. D10.8.3.8 Added P to end of COM624
		CONSTRUCTION GENERAL NOTES: MATERIALS AND WORKMANSHIP: Changed D1.5-95 to D1.5 (2 places) Changed D1.1-98 to D1.1
		NOTES TO DESIGNER: Changed PUBLICAITON 408/2000 to PUBLICATION 408 Changed WELDING CODE 1995 AND CONTRACT to WELDING CODE AND CONTRACT Changed D1.1-98 to D1.1 Changed D1.5-95 TO D1.5 (2 places)
		HOW TO USE THE DESIGN TABLES: 4th bullet changed and sub-bullets 1-3 changed 5th bullet added
		ELEVATION: Changes to drawing - Redraw with only 12 panels to match Sht. 5 Elevation and Sign program manual Fig. 3.3.2
		LOADING TYPE 1 TABLE: To be updated/ Changed Values
	6 of 6	LOADING TYPE 1 (CONTINUED) TABLE: To be updated/ Changed Values LOADING TYPE 2 TABLE: To be updated/ Changed Values
	1 of 13	CONSTRUCTION GENERAL NOTES: MATERIALS AND WORKMANSHIP: Changed D1.5-95 to D1.5 (2 places)


STANDARD	SHEET	DESCRIPTION OF CHANGES
		Changed D1.1-98 to D1.1
		INFORMATION CONTAINED IN THE DESIGN TABLES: 2ND BULLET: Deleted SHOULD Between TABLES and MEET DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES: DRILLED SHAFTS (CAISSONS): Changed SEC. 4.6P to SEC. D10.8.3.8 Added P to end of COM624
		NOTES TO DESIGNER: Changed PUBLICAITON 408/2000 to PUBLICATION 408 Changed WELDING CODE 1995 AND CONTRACT to WELDING CODE AND CONTRACT Changed D1.1-98 to D1.1 Changed D1.5-95 TO D1.5 (2 places)
BD-644M	2 of 13	Revised POSITIONING OF SIGN PANELS AND SIGN STRUCTURE notes per SOL 431-11-04
BD-645M	1 of 7	INFORMATION CONTAINED IN THE DESIGN TABLES: 2ND BULLET: Deleted SHOULD Between TABLES and MEET DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES: DRILLED SHAFTS (CAISSONS): Changed SEC. 4.6P to SEC. D10.8.3.8 Added P to end of COM624
		CONSTRUCTION GENERAL NOTES: MATERIALS AND WORKMANSHIP: Changed D1.5-95 to D1.5 (2 places) Changed D1.1-98 to D1.1
		NOTES TO DESIGNER: Changed PUBLICAITON 408/2000 to PUBLICATION 408 Changed WELDING CODE 1995 AND CONTRACT to WELDING CODE AND CONTRACT Changed D1.1-98 to D1.1 Changed D1.5-95 TO D1.5 (2 places)
	2 of 7	Revised POSITIONING OF SIGN PANELS AND SIGN STRUCTURE notes per SOL 431-11-04
BD-647M	1 of 4	GENERAL NOTES: Deleted Note 1, Renumbered DESIGN: Changed No.4 DESIGN TABLES MEMBER...CATEGORY II IS MET to THE MEMBER SIZES INDICATED IN THE DESIGN TAB;ES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY I. Revised DESIGN notes per SOL 431-11-04
		MATERIAL: Changed No.1 PROVIDE MATERIALS... AASHTO/AWS/D1.5M/D1.5:2002. to PROVIDE MATERIALS AND WORKMANSHIP...USE ANS I / AWS D1.1 FOR WELDING NOT COVERED IN ANS I/ AASHTO/ AWS D1.5 FABRICATION: Changed ANSI/AWS D1.1 (D4...) to ANSI/AWS D1.1.
BD-652M	3 of 3	Added 18 NEW BULB-TEE BEAM SIZES.
BD-655M	1 of 2	Changed SEE GENERAL NOTE 7 to SEE GENERAL NOTE 6 (4 places) Changed SEE GENERAL NOTE 8 to SEE GENERAL NOTE 7 (3 places) Changed SEE GENERAL NOTE 9 to SEE GENERAL NOTE 8
		GENERAL NOTES: Deleted previous NOTE 1 Renumbered previous NOTES 2-10 as 1-9 P/S I-BEAM NOTES: NOTE 2: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE
		INTERMEDIATE DIAPHRAGM: Changed VERTICAL CLEARANCE ≥ 4880 (16' - 0") to TYPICAL Changed VERTICAL CLEARANCE < 4880 (16' - 0") to EXTERNAL BAYS EXTERNAL BAYS: Added FOR SPANS WITH VERTICAL CLEARNCE LESS THAN 16'-0" OVER VEHICULAR TRAFFIC ONLY
		FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: Added IN THE WEB AREA ABOVE STRANDS to * Note SECTION A-A: Changed ⅞" I.D. to 1" NOMINAL DIA REFERENCE DRAWINGS: Added BD-657M: I-BEAM AND BOX BEAM BRIDGES
	2 of 2	P/S BOX BEAM NOTE: NOTE 2: Changed STYROFOAM to THE PREFORMED CELLULAR POLYSTYRENE
		Changed SEE GENERAL NOTE 7 to SEE GENERAL NOTE 6 (4 places) Changed SEE GENERAL NOTE 8 to SEE GENERAL NOTE 7 (2 places) Changed SEE GENERAL NOTE 9 to SEE GENERAL NOTE 8
BD-656M	General	Added waterproofing and additional drainage to details without backwall throughout with reference to new waterproofing and additional drainage details on sheets 3 and 4

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-656M	1 of 7	FULL DEPTH PIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: Increased dimension to transverse deck reinforcement from 3" to 4" Increased concrete cover dimension from 2" to 3" for the #4 L-bar at the end of deck slab Added REARFACE DIAPHRAGM AND END OF BEAM Added 9" MIN. dimension from CL bearings and dowel to rear face of abutment stem
		FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER: removed (TYP.) from all 9" MIN. dimensions from CL Bearings to pier cap face and end or end of beams and added additional 9" MIN. call-out
		GENERAL NOTE 5: Changed BD-622M to BD- 621M
	2 of 7	FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL: Increased dimension to transverse deck reinforcement from 3" to 4" Increased concrete cover dimension from 2" to 3" for the #4 L-bar at the end of deck slab Added REAR FACE DIAPHRAGM call-out Added 9" MIN. dimension from CL bearings and dowel to rear face of abutment stem
		FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER: removed (TYP.) from all 9" MIN. dimensions from CL Bearings to pier cap face and end or end of beams and added additional 9" MIN. call-out
		Added INTERMEDIATE DIAPHRAGM for EXTERNAL BAYS detail from Sheet 3; added subtitle TYPICAL to diaphragm for internal bays
	3 of 7	ABUTMENT WITHOUT BLACKWALL: Added dimensions to SAW CUT call-out and changed APPROVED SEALER to ASPHALT RUBBER SEALING COMPOUND [PUB. 408 SECTION 705.4(g)] (2 places)
		PIER: Changed STYROFOAM CAP to PREFORMED CELLULAR POLYSTYRENE
		Moved INTERMEDIATE DIAPHRAGM AT FASCIA BEAM (EXTERNAL BAY) detail to Sheet 2
		Added WATERPROOFING DETAIL AT ABUTMENT WITHOUT BACKWALL ADJACENT BOX BEAM NOTES: removed NOTE 4 (specification added to call-outs in details)
	4 of 7	FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL (in details for all three beam types): Removed (TYP.) from 9" MIN. call-out for CL of bearings to front and rear face of abutment stem and added second 9" MIN. call-out Added dimensions to SAW CUT call-out and changed APPROVED SEALER to ASPHALT RUBBER SEALING COMPOUND [PUB. 408 SECTION 705.4(g)]
		ABUTMENT WITHOUT BACKWALL – SPREAD BOX BEAMS: removed "2-#6 BARS PLACED PARALLEL TO SKEW" call-out and added REAR FACE DIAPHRAGM AND END OF BEAM call-out
		ABUTMENT WITHOUT BACKWALL – I-BEAMS: removed "2-#6 BARS PLACED PARALLEL TO SKEW" call-out and added REAR FACE DIAPHRAGM call-out
		Added ADDITIONAL DRAINAGE DETAIL AT ABUTMENT WITHOUT BACKWALL
	5 of 7	In all three LONGITUDINAL SECTIONS on this sheet: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Increased dimension from end of slab to transverse deck reinforcement from 3" to 4" Increased concrete cover from 2" to 3" for the #4 L-bar at the end of the deck slab For the #4 bars projecting from the end diaphragm into the approach slab, increased the distance of its exit from the diaphragm top corner from 1" to 2"
		NOTES: NOTE 3: Revised BD-628M sheet reference from 29 to 24
	6 of 7	In both LONGITUDINAL SECTIONS on this sheet: Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Increased dimension from end of slab to transverse deck reinforcement from 3" to 4" Increased concrete cover from 2" to 3" for the #4 L-bar at the end of the deck slab For the #4 bars projecting from the end diaphragm into the approach slab, increased the distance of its exit from the diaphragm top corner from 1" to 2"
		NOTES: NOTE 3: Revised BD-628M sheet reference from 29 to 24
	7 of 7	Removed AND 4 (for Type 4) from TYPICAL LONGITUDINAL SECTION FOR ADJACENT BOX BEAMS WITH TYPE 3 APPROACH SLABS Changed STYROFOAM to PREFORMED CELLULAR POLYSTYRENE Increased dimension from end of slab to transverse deck reinforcement from 3" to 4" Increased concrete cover from 2" to 3" for the #4 L-bar at the end of the deck slab For the #4 bars projecting from the end diaphragm into the approach slab, increased the distance

STANDARD	SHEET	DESCRIPTION OF CHANGES
		of its exit from the diaphragm top corner from 1" to 2"
		Added TYPICAL LONGITUDINAL SECTION FOR PLANK BEAMS
BD-657M	1 sht	SECTION A-A: Revised SHEAR BLOCK HEIGHT call-out ABUTMENT PLAN-WITH BACKWALL: Added 9" MIN. dimension
BD-661M	General	Numerous cosmetic and presentation changes throughout for fit, clarity, and consistency between details.
		Numbering of Legend Notes revised to included added notes.
	1 of 8	GENERAL NOTES: Deleted previous GENERAL NOTE 1 Renumbered GENERAL NOTES
		PLAN: Corrected orientation of View B-B call-out
		ELEVATION A-A: revised dimension of #4 looped bar to be 4" MIN., 5" MAX. Changes to drawing
		VIEW B-B WITH BEAM NOTCH (COMPOSITE): Revised dimension from bottom of beam to horizontal #4 (END) bar to be 1" ABOVE CL BOTTOM ROW OF STRANDS and revised spacing of the horizontal #4 (END) bars to 3" MIN. in the case of 17" deep beams. VIEW B-B WITHOUT BEAM NOTCH (COMPOSITE): Revised dimension from bottom of beam to horizontal #4 (END) to be 1" ABOVE CL BOTTOM ROW OF STRANDS
		LEGEND: added note to allow #4 looped rebar to be rotated parallel to beam end along CL of bearings. LEGEND: included termination instructions for #5 (TOP) BARS in note regarding termination of #4 looped bar.
	2 of 8	TYPICAL REINFORCEMENT, ADJACENT BOX BEAM DETAIL changed to ADJACENT BOX BEAM SECTION: revised dimension of #4 – A1 bar to be 4" MIN., 5" MAX., and revised embedment of its short leg to be 1".
		END BLOCK REINFORCEMENT DETAILS: revised drawing of stirrups to reflect the #4 A1 pairs of looped bars, revised the dimensioning of the stirrup spacing for clarity, added call-out for distance from end of beam to start of splayed stirrups
		ADJACENT BOX BEAM NOTES: NOTE 5: revised wording and changed AASHTO 5.10.10.1 LRFD ARTICLE to DM-4 DC5.14.1.4.8
		LEGEND: Added two notes to clarify the stirrup spacing and arrangement to satisfy the splitting resistance reinforcement requirements of DM-4 D5.10.10.1.
	3 of 8	BEAM DAP NOTES: Revised reference in NOTE 4 to 14.7.6.3.9dp, and added NOTE 10 BEAM DAP DETAILS: revised end of beam to be shown vertical with call-out revised to END OF BEAM TO BE VERTICAL IN ERECTED POSITION.
		36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING TYPICAL SIDEWALK: Changed 2% slope to 1.5% (2 places)
	4 of 8	ADJACENT BOX BEAM SUPPORTING BARRIER: Added BAR BEND MAY BE MODIFIED BY PRESTRESS BEAM FABRICATOR TO CLEAR STEEL FORM WORK Added dashed lines for barrier #4 rebar which is embedded in fascia box beam.
		LEGENDS: NOTE 12 (previously NOTE 8): revised wording and changed AASHTO 5.10.10.1 LRFD ARTICLE to DM-4 DC5.14.1.4.8
		36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK: Changed 2% slope to 1.5%
	5 of 8	LEGENDS: NOTE 12 (previously NOTE 8): revised reference to DM-4 DC5.14.1.4.8
		6 of 8
	6 of 8	PLAN: Corrected orientation of View E-E call-out, and revised call-outs of end block reinforcement and typical reinforcement for clarity and accuracy.
		SPREAD BOX BEAM NOTES: NOTE 4: revised to reference DM-4 D5.10.10.1 instead of AASHTO
		END BLOCK REINFORCEMENT DETAILS: revised the dimensioning of the stirrup spacing for clarity, added call-out for distance from end of beam to start of splayed stirrups
		VIEW E-E WITH BEAM NOTCH: added 4" MIN., 5" MAX. dimension to #4 looped bar
		VIEW F-F WITH BEAM NOTCH: added note that horizontal #4 (END) bars may be spaced at 3" MIN. in the case of 17" deep beams

STANDARD	SHEET	DESCRIPTION OF CHANGES
		SPREAD BOX BEAM SECTION: revised dimension of #4 – A1 bar to be 4" MIN., 5" MAX., and revised embedment of its short leg to be 1".
	7 of 8	PLANK BEAM NOTE: revised wording and changed AASHTO 5.10.10.1 LRFD ARTICLE to DM-4 DC5.14.1.4.8
		PLAN: revised the dimensioning of the stirrup spacing for clarity
		VIEW H-H: revised dimension from bottom of beam to horizontal #4 (END) bar to be 1" ABOVE CL BOTTOM ROW OF STRANDS
	8 of 8	ADJACENT BOX BEAM: Added MAY BE ROTATED PARALLEL TO BEAM END ALONG CL OF BEARIUNGS to looped #4 bar call-out, and revised the clear cover of reinforcement bars at end face of beam to 2"
	BD-662M	1 of 4
		STANDARD PA I-BEAM-ELEVATION: Changed SEE NOTE 17 to SEE NOTE 16 Added MIN. to PRESTRESS ZONE GENERAL NOTES: Deleted previous GENERAL NOTE 1 Revised numbering ADDITIONAL NOTCH REINF. END VIEW: Added AASHTO I-BEAM, Added STANDARD PA I-BEAM
		AASHTO I-BEAM-ELEVATION: Replaced horizontal dimension from 1.5 x BEAM DEPTH to be either **A = 1.5x or A = 2.0 x Beam Depth Added MIN. to PRESTRESS ZONE AASHTO I-BEAM TYPICAL SECTION: Change SEE NOTE 15 to SEE NOTE 16
	2 of 4	PA BULB-TEE BEAM - ELEVATION: Changed 1.5 to **A Added ** FOR VALUES OF "A", SEE SHEET 1 Added MIN. to PRESTRESS ZONE Changed SEE NOTE 17 to SEE NOTE 16 ADDITIONAL NOTCH REINF. END VIEW: Added PA BULB-TEE
	3 of 4	BEAM DAP DETAILS: SECTION B-B AT LOW END OF BEAM and SECTION B-B AT HIGH END OF BEAM: Added END OF BEAM TO BE VERTICAL IN ERECTED POSTION + ARROW: Added solid vertical line for end of beam Changed existing solid line to dashed line
	BD-666M	1 sht
	BD-667M	Initial Release of STANDARD CFRP STRENGTHENING - PRESTRESSED CONCRETE BEAMS
		1 of 9
		GENERAL NOTES: GENERAL NOTE 4: Changed CLASS AAA CONCRETE to CLASS AAAP CONCRETE
		2 of 9
		SECTION G-G: Changed 1" THICK STYROFOAM SHEET to WATERPROOFING Changes to drawing
	3 of 9	SECTION B-B NO GIRDER, NO PILE: Changed 1" THICK STYROFOAM SHEET (TYP.) to WATERPROOFING (TYP.) Corrected dimensions
	4 of 9	DETAIL H changed to SCOUR PROTECTION DETAIL: changed 1" THICK STYROFOAM SHEET to WATERPROOFING (TYP.). Changed CLASS 2, TYPE B to CLASS 4, TYPE A SECTION E-E: Changed 1" THICK STYROFOAM SHEET to WATERPROOFING Changes to drawing
	5 of 9	SECTION K-K and SECTION N-N: added construction joints.
	BD-667M	9 of 9
	BD-668M	DETAIL FOR USING EXISTING SUBSTRUCTURE UNIT FOR SLOPE PROTECTION: Changed CLASS 2 to CLASS 4, TYPE A
		1 of 3
		NOTE10: Changed 1001.3 (k) 8 to 1001.3(k) 9 TYPICAL PRECAST CHANNEL SECTIONS: added 2" CLR to reinforcement of channel beam. Revised deck slab reinforcement callouts. CHANNEL BEAM FABRICATION NOTE NO. 1: clarified beam reinforcement cover amounts.
	2 of 3	TIEBOLT LOCATION DETAILS: TYPICAL SECTION: Deleted 1" RUBBERIZED JOINT SEALING MATERIAL PARTIAL PLAN: Added ½" OPEN JOINT (BELOW SHEAR KEY) SECTION F-F: Deleted 1" THICK STYROFOAM Changed EXPOSED FACE OF ABUTMENT to FF ABUTMENT

STANDARD	SHEET	DESCRIPTION OF CHANGES
BD-668M		Added 1'-6" MIN. and 9" dimensions Deleted 1½" x ½" from SAW CUT JOINT Changed SEALER to SEALING COMPOUND, REFER TO BC-788M
	3 of 3	TYPICAL SECTIONS: added 2" MIN. STIRRUP PROTECTION INTO BEAM SLAB (TYP.). Beam leg stirrup rebar lap length increased from 1'-0" to 1'-2".
		VERTICAL BARRIER BAR DETAIL: revised symbol for inside radius.

<div>OS-299 (7-08)</div> <div></div>	TRANSMITTAL LETTER	PUBLICATION: Publication 218M September 2010 Edition
		DATE: September 29, 2010
SUBJECT: Revisions to Standards for Bridge Design, BD-600M Series September 2010 Edition		
INFORMATION AND SPECIAL INSTRUCTIONS: 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 December 3, 2010 should incorporate these new standards. The Standard Drawings included in this release along with a description of the changes that were made to their 2003 edition version are listed below: STANDARD SHEET DESCRIPTION OF CHANGES BD-601M 1 of 11 NOTE 5: Revise 10 mm to 12 mm for Integral Wearing Surface thickness NOTE 7: Revise '(A616/A616M)' to '(A 996/A 996M)' Updated all sheet number references. REFERENCE DRAWINGS: added "PERMANENT" before "METAL DECK FORMS", added "AND EXPANSION" after "TYPICAL WATERPROOFING", added RC-65M, CONCRETE MOUNTABLE CURBS as a reference. NOTE 5: replaced reference to DETAIL A to read ALTERNATE CONTINUITY REINFORCEMENT DETAIL. NOTE 22: added BD-660M AND before BD-661M. 2 of 11 Added reference to 6 in the legend to all drip notch callouts, Added 6 - FOR DRIP NOTCH DETAILS, SEE BC-775M to Legend, updated all sheet number references 3 of 11 SPLIT CONCRETE DIVISOR DETAIL: Added "SEE NOTE 2" to drip notch callout Added Note: 2. FOR DRIP NOTCH DETAILS, SEE BC-775M, updated sheet number references 4 of 11 CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL: revised BC-702M to BC-779M in barrier width dimension, updated sheet number references RAISED SIDEWALK DETAIL: added 2% slope indication to top of sidewalk LEGEND: revised "BEAM" to "BEAMS ON EACH SIDE" in 8 NOTES: added as note 2 "FOR DRIP NOTCH DETAILS, SEE BC-775M." 5 of 11 SECTION A-A: Added callout to bar "SEE CURB REINFORCEMENT BAR DETAILS ON BD-609M, SHEET 1. SECTION A-A: Added "(SEE NOTE 3)" to drip notch callout Added note: 3. FOR DRIP NOTCH DETAILS, SEE BC-775M. 9 of 11 DEFINITION OF So: Added "GUTTERLINE" callouts, "L" dimension for I-beams, added "L*" dimension for box beam, added asterisk note: 'FOR BOX BEAMS WITH CENTERLINE WEB WITHIN BARRIER WIDTH, "L" IS MEASURED FROM GUTTERLINE.', underlined beam type titles 10 of 11 DEFINITION OF So: Added "GUTTERLINE" callouts, "L" dimension for I-beams, added "L*" dimension for box beam, added asterisk note: 'FOR BOX BEAMS WITH CENTERLINE WEB WITHIN BARRIER WIDTH, "L" IS MEASURED FROM GUTTERLINE.', underlined beam type titles		

	11 of 11	REINFORCEMENT DETAILS & TABLE: revised A, B, & C dimensions to X, Y, & Z Dimension Table for Lighting Pole Anchorage: switched data for dimensions "A" and "B". SECTION A-A: corrected leader-line to point to LEVELING NUT below base plate.
BD-604M	1 of 5	TYPICAL CONCRETE PARAPET DETAIL: replaced PARAPET in title with BARRIER. ALTERNATE CONCRETE PARAPET DETAIL: replaced PARAPET in title with BARRIER. Replaced PARAPET with BARRIER in various call-outs and notes. NOTE 2: replaced A616M, AND with A996M, OR.
	3 of 5	Replaced PARAPET with BARRIER in titles of details and various call-outs. Added Note to Barrier Reinforcement Detail, Dimensions indicated for Typical Barrier height of 1070(3'-6"), adjust dimensions accordingly if Alternate Barrier is approved.
BD-609M	1 of 2	SECTION A-A: changed bolt spec. from A325 to ASTM A449 OR F1554 TITLE: added BARRIER after GUIDE RAIL PRECAST CURB REINFORCEMENT DETAIL: removed "PRECAST" from title, added as a note "MECHANICAL SPLICES PRECAST INTO DECK OR TOP SLAB."
BD-610M	1 of 17	Note 10: revised "A 616" to "A 996M".
BD-611M	1 of 3	SECTION - POT BEARINGS: Added "THK. CLOSED CELL" before "NEOPRENE SPONGE STRIP" SECTION - ELASTOMERIC BEARINGS: Added "THK. CLOSED CELL" before "NEOPRENE SPONGE STRIP" ELEVATION: Added "THK. CLOSED CELL" before "NEOPRENE SPONGE STRIP"
	2 of 3	DIAPHRAGM AT ABUTMENT WITH BACKWALL FOR TYPE 3 AND 4 APPROACH SLABS: added callout to rebar "SEE ALTERNATE REBAR DETAIL ON SHT. 3" BEAM NOTCH NOTES: revised beam depth from 1065 (42") to 1015 (40") in note 4
	3 of 3	Added ALTERNATE REBAR DETAIL SECTION - POT BEARINGS, SECTION - ELASTOMERIC BEARINGS, & ELEVATION: Added "THK. CLOSED CELL" before "NEOPRENE SPONGE STRIP"
BD-612M	3 shts	Reissued with no changes.
BD-613M	4 of 15	Revised 4 1/8" to 3 15/16" and 4 3/8" to 4 3/16" under "L" in the table for POT BEARINGS Revised 3 3/16" for 23 5/8" J under "N" to 3" and 3 3/8" for 24 7/8" J under "N" to 3 3/16"
	14 of 15	MATERIALS Note 11: revised reference for bedding materials from "ASTM D378" to "PUBLICATION 408, SECTION 1113.03(h), TYPE II"
BD-615M	1 of 3	BARRIER ELEVATION: Increased max. post spacing from 10 000 (33'-0") to 10 160 (33'-4"). Decreased min. spacing from 5000 (16'-0") to 4820 (15'-10").
BD-616M	2 shts	Reissued with no changes.
BD-617M	1 of 17	DETAIL A: Added "OR 20X20 (3/4"X3/4") CHAMFER" to "25 (1") R" callout TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION: Revised end of railing angle size to be L 152.4x88.9x7.9 (L 6x3 1/2x5/16")
	5 of 17	TYPICAL ELEVATION: Deleted vertical lines near corners of stem wall
	6 of 17	SECTION F-F: Added "50 (2") CLR." callout at top, Revised "50 (2") CLR." callout to "75 (3") CLR. (TYP. UNLESS OTHERWISE NOTED)" at rear face
	9 of 17	TYPICAL ELEVATION: Deleted vertical lines near corners of stem wall
	10 of 17	SECTION K-K: Added "50 (2") CLR." callout at top, Revised "50 (2") CLR." callout to "75 (3") CLR. (TYP. UNLESS OTHERWISE NOTED)" at rear face
	15 of 18	Eliminated blank sheet no. 15 of 18.
BD-618M	12 shts	Eliminated blank sheet no. 12 of 13.
BD-620M	6 shts	Reissued with no changes.
BD-621M	3 shts	Reissued with no changes.
BD-622M	1 of 5	GENERAL NOTE 2: Revised "A 616M" to "A 996M"
	5 of 5	TYPICAL ELEVATION: Deleted vertical line near left corner of stem wall.
BD-624M	1 of 5	GENERAL NOTE 2: Revised "A 616M" to "A 996M"
BD-625M	1 of 1	Eliminated Metric Units due to AASHTO decision to no longer publish SI Unit Specifications, Added SLOPE DEFINITIONS detail. SCHEME A: Added CUT SLOPE and FILL SLOPE arrows. Replaced alpha with beta and theta with delta symbols.

BD-627M	8 shts	Reissued with no changes.
BD-628M	1 of 35	GENERAL NOTE 3: Added "WITH" after "ACCORDANCE" REFERENCE DRAWINGS: Changed RC-30M title to "SUBSURFACE DRAINS", Changed "GUIDERAIL" to "GUIDE RAIL", Added RC-12M, BACKFILL AT STRUCTURES and RC-50M, GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS.
	2 of 35	APPROACH SLAB GUIDELINE NOTE 4: Revised "A" to "AN" INSTRUCTIONS TO DESIGNER NOTES, No. 9: Added bullet which states TYPE 5 APPROACH SLABS: PROVIDE STRUCTURAL BACKFILL IN ACCORDANCE WITH RC-12M. SUBBASE MATERIAL NOT REQUIRED. 15. GENERAL INFORMATION: Added "APPROACH SLAB HORIZONTAL REACTION FORCES TO BE CARRIED BY EITHER BRIDGE BEARINGS AND/OR DOWELS DIRECTLY INTO ABUTMENT STEM" to 3rd bullet, Revised "1/2 LIVE LOAD" to "MAXIMUM LIVE LOAD" in 4th bullet, Added as 5th bullet "MAXIMUM LIVE LOAD REACTION IS OBTAINED BY TREATING THE BRIDGE APPROACH SLAB AS A SIMPLE BEAM WHICH SPANS FROM ABUTMENT TO SLEEPER SLAB. DESIGNER MUST PLACE TRUCK AXLES AND/OR LANE LOADING TO DETERMINE MAXIMUM REACTION."
	4 of 35	Added NOTE 5: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 6: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION. TYPE 1 OR TYPE 5 APPROACH SLAB DETAILS: Replaced SUBBASE (ROADWAY ITEM) with SEE NOTE 3. Added NOTE 3: TYPE 1 APPROACH SLAB: SUBBASE (ROADWAY ITEM). TYPE 5 APPROACH SLAB: STRUCTURAL BACKFILL, REFER TO RC-12M. PLAN 2 TYPE 1 AND TYPE 2: Added "(SEE NOTE 5)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 6)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at inlet
	5 of 35	Added NOTE 5: PROVIDE PAVING NOTCH FROM CURB TO CURB. Added NOTE 6: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 7: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION. PLAN 3 TYPE 1 AND TYPE 2: Added "(SEE NOTE 6)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 7)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at inlet
	6 of 35	PLAN 4 TYPE 1 AND TYPE 2: Added "(SEE NOTE 5)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 6)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at inlet Added NOTE 5: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 6: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	7 of 35	PLAN 5 TYPE 1 AND TYPE 2: Added outflow pipe at inlet, Added "(SEE NOTE 4)" to callout "3000 (10'-0") MIN." Added NOTE 4: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	8 of 35	PLAN 6 TYPE 1 AND TYPE 2: Added "(SEE NOTE 6)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 7)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at inlet Added NOTE 6: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 7: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	20 of 35	PLAN 1 TYPE 3: Added outflow pipe at inlet, Added "(SEE NOTE 3)" to callout "3000 (10'-0") MIN." Added NOTE 3: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION
	21 of 35	PLAN 2 TYPE 3: Added "(SEE NOTE 6)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 7)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at

		inlet SECTION L-L: Revised "DETAIL J" to "DETAIL K" Added NOTE 6: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 7: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	22 of 35	Added SECTION Z-Z and DETAIL R Added NOTE 5: USE GUIDE RAIL TRANSITION SIMILAR TO DETAIL ON BC-739M. ONCE BEYOND INLET, PROVIDE GUIDE RAIL AND POSTS AS PER RC-50M AND/OR RC-52M. Added NOTE 6: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION. PLAN 3 TYPE 3: Added "(SEE NOTE 5)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 6)" to 3000 (10'-0") MIN. dimension, Added "12 (1/2") SLIDING PLATE" callouts, Added outflow pipe at inlet SECTION N-N: Revised "SEE DETAIL K" to "SEE DETAIL R"
	23 of 35	DETAILS 13, 14, & 15: replaced SUBBASE (ROADWAY ITEM) with SEE NOTE 4. added NOTE 4: TYPE 3 APPROACH SLAB: SUBBASE (ROADWAY ITEM). TYPE 5 APPROACH SLAB: STRUCTURAL BACKFILL, REFER TO RC-12M.
	24 of 35	PLAN 1 TYPE 4: Added outflow pipe at inlet, Added "(SEE NOTE 5)" to callout "3000 (10'-0") MIN." Added NOTE 5: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	25 of 35	PLAN 2 TYPE 4: Added "(SEE NOTE 9)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 10)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at inlet Added NOTE 9: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 10: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	26 of 35	PLAN 3 TYPE 4: Added "(SEE NOTES 7 & 8)" to CURB (ROADWAY ITEM) dimension, Added "(SEE NOTE 9)" to 3000 (10'-0") MIN. dimension, Added "12 (1/2") SLIDING PLATE" callouts, Added "OUTSIDE FACE OF BARRIER AND EDGE OF APPROACH SLAB" callout, Added outflow pipe at inlet Moved 10-Degree Barrier to Guide Rail Transition Flare past Toothed Expansion Dam onto the Header Slab Added NOTE 7: USE GUIDE RAIL TRANSITION SIMILAR TO DETAIL ON BC-739M. ONCE BEYOND INLET, PROVIDE GUIDE RAIL AND POSTS AS PER RC-50M AND/OR RC-52M. Added NOTE 8: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 9: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
	27 of 35	DETAILS 16, 17, & 18: Replaced SUBBASE (ROADWAY ITEM) with SEE NOTE 4. Added NOTE 4: TYPE 4 APPROACH SLAB: SUBBASE (ROADWAY ITEM). TYPE 5 APPROACH SLAB: STRUCTURAL BACKFILL, REFER TO RC-12M.
	28 of 35	TYPE 3 & 4 APPROACH SLAB - DETAIL 19: Added "SEE ALTERNATE REBAR DETAIL ON SHEET 29" TO '#19 @ 225' bar callout
	29 of 35	Added ALTERNATE REBAR DETAIL TYPE 3 AND 4 APPROACH SLAB - DETAIL 20: Added "SEE ALTERNATE REBAR DETAIL, THIS SHEET." to the legend triangle note
	30 of 35	TYPE 3 AND 4 APPROACH SLAB - DETAIL 21: Added "SEE ALTERNATE REBAR DETAIL, SHEET 29" to triangle note in legend
	31 of 35	TYPE 3 AND 4 APPROACH SLAB - DETAIL 22: Added "SEE ALTERNATE REBAR DETAIL, SHEET 29" to triangle note in legend
	35 of 35	PLAN TYPE 5: Added "(SEE NOTE 4)" to CURB (ROADWAY ITEM) dimension, added "(SEE NOTE 5)" to 3000 (10'-0") MIN. dimension, Added outflow pipe at inlet, Removed #16@225 (#5@9") callout from Sleeper Slab SECTION X-X: Replaced "SUBBASE (ROADWAY ITEM)" with "STRUCTURE BACKFILL, REFER TO RC-12M"

BD-629M	1 of 15	Note **: Replaced "AN APPROVED EPOXY BONDING COMPOUND" with "BOND BREAKER" Added NOTE 3: PROVIDE PAVING NOTCH FROM CURB TO CURB. Added NOTE 4: PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 950 (3'-1 1/2") SPA. ALONG CURB AFTER GUIDE RAIL TRANSITION. Added NOTE 5: INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION. NOTE 2: Replaced "AND" with "OR" NOTE 5: Added "75 (3") - SIDE COVER TO STIRRUPS IN PIER CAPS TO PROVIDE CONSTRUCTION TOLERANCE AND LONG TERM SERVICEABILITY" CONSTRUCTABILITY CONSIDERATIONS - COLUMN: Revised first note after MAXIMUM to be "WIDTH VARIANCE. CONSIDER USING COLUMN SEGMENT LENGHTS WITH 300 (1'-0") INCREMENTS FOR ALL BUT TOP COLUMN SEGMENT. SEE ELEVATION ON SHEET 9, FOR GRAPHICAL REPRESENTATION."
		2 of 15 Removed SECTION A-A & B-B with single stirrup, SECTION A-A & B-B: Revised "50(2") CLR. (TYP.)" to be "75 (3") CLR. EA. SIDE", Added "50 (2") CLR. TOP & BOT." dimension for top and bottom concrete cover
		3 of 15 ROUND COLUMN (ALTERNATE): Replaced spiral extending into footing with ties, Added "TIES @ 150 (6") MAX. SPACING" dimension, Replaced "TIES@300(1'-0") with "#13 (#4) SPIRAL WITH 12" MAX. PITCH" dimension in the middle of the column
		4 of 15 SECTION B-B & C-C: Deleted additional ties in round column details, Deleted original Note 4 and rennumbers original Note 5 to Note 4.
		6 of 15 SECTION A-A: Revised 50 (2") callout to 75 (3") for side cover to stirrups dimension, Added "50 (2") CLR." dimension for top and bottom concrete cover
		7 of 15 SECTION C-C: Added "75 (3") CLR." dimension to left side thickness
		8 of 15 Sheet Title: After "SOLID SHAFT" added "(WALL)" SECTION B-B: Revised 50 (2") callout to 75 (3") for side cover to stirrups dimension, Added "50 (2") CLR." dimension for top and bottom concrete cover SECTION C-C: Added "350 (1'-2") MAX. SPA." dimension
		9 of 15 SECTION A-A: Revised 50 (2") callout to 75 (3") for side cover to stirrups dimension, Added "50 (2") CLR." dimension for top and bottom concrete cover ELEVATION: Added Graphical Representation for 300 (1'-0") increments
		10 of 15 Removed Notes 6 & 7, SECTION C-C: Removed additional #13 (#4) cross ties
		12 of 15 Removed Notes 6 & 7, SECTION C-C: Removed additional #13 (#4) cross ties
		13 of 15 SINGLE COLUMN PILE FOOTING: Added 180 degree hook at each end of bottom mat bars, CONTINUOUS PILE FOOTING: Added 180 degree hook at each end of bottom mat bars
		14 of 15 PIER CAP SECTION: Revised 50 (2") callout to 75 (3") for side cover to stirrup dimension, Added 25 (1") to all "S" dimensions in English and Metric tables DETAIL A: Revised 50 (2") callouts to 75 (3") for concrete cover at end of cap ARCHITECTURAL TREATMENT AND TOP OF CAP AT DECK JOINT: Revised 50 (2") callout to 75 (3") for side cover to stirrups dimension, Added "50 (2") CLR. TYP. FOR TOP AND BOTTOM OF PIER CAP" dimension
BD-631M	1 of 2	NOTE 2: Revised "A 616M" with "A 996M".
BD-632M	1 of 11	NOTE 6: Revised 2 FEET to 600 (2'-0") NOTE 19: Revised 8 to 3 e-Notification No. 28 and No. 29 changes incorporated NOTE 18: Revised TOP SLAB to TOP AND BOTTOM SLABS SECTION ALONG CENTERLINE CULVERT: Added Culvert Bedding beneath culvert and 600 (2'-0") MIN. for extension of apron below bedding, Added Callout for Compacted No. 2A Coarse Aggregate or Flowable Backfill limits at Inlet End APRON SECTION: Added "TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER, 1050 (3'-6") MIN." callout NOTE 12: Added FOR WEEP HOLES LOCATED IN THE COMPACTED NO. 2A COARSE AGGREGATE AREAS OR FLOWABLE BACKFILL AREAS, PROVIDE PREFORMED DRAIN CONFORMING TO PUB. 408 SECTION 623.2(a), WHICH IS 50 mm (2") MINIMUM THICK x 1220 (4'-0") WIDE CENTERED HORIZONTALLY ON WEEP HOLE, SEE PREFORMED DRAIN DETAIL ON SHEET 5. Added NOTE 21. PROVIDED COMPACTED NO. 2A COARSE AGGREGATE BACKFILL
		OR TYPE B FLOWABLE BACKFILL AT INLET END OF CULVERTS FOR A MINIMUM LENGTH OF 3050 (10'-0") PLUS WINGWALLS. HEIGHT OF COMPACTED NO. 2A COARSE AGGREGATE OR FLOWABLE BACKFILL IS A MINIMUM OF 600 (2'-0") ABOVE NORMAL STREAM ELEVATION EXTENDING TO THE BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER.
2 of 11		SECTION A-A: Revised "A325" in anchor bolt callout to "ASTM A449 OR F1554"
3 of 11		e-Notification No. 28 changes incorporated TYPICAL HEADWALL ELEVATION: Added "TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER, 1050 (3'-6") MIN." callout
4 of 11		e-Notification No. 29 incorporated, Added new Note 28 NOTE 4: Revised 2 FEET to 600 (2'-0") in the second bullet NOTE 11: Revised OR SEE SHEETS 5 THRU 8 to AND SHEETS 9 AND 10 NOTE 15: Revised 2" to 50 (2") and 1/2" to 10 (1/2") NOTE 16: Revised 5" to 125 (5") NOTE 17: Revised 300 mm (1'-0") to 150 (6") NOTE 26: Revised SHEET 6 to SHEETS 6 AND 8
5 of 11		e-Notification No. 28 and No. 29 incorporated CULVERT WITH PRECAST END SECTION: Added "TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER" to callout CULVERT WITH CAST IN PLACE WINGWALLS: Added "TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICHEVER IS DEEPER" to callouts, Revised "PROTECTION" to "LINING" and "RIPRAP" to "LINING" in ROCK callout Added SECTION P-P and section marks on Plan Views Added PREFORMED DRAIN DETAIL Revised "CULVERT WITH END WALL" title to be "CULVERT WITH CAST IN PLACE WINGWALLS"
7 of 11		SECTION F-F: Revised "A325" in anchor bolt callout to "ASTM A449 OR F1554"
9 of 11		e-Notification No. 28 and No. 29 incorporated DESIGN NOTES: Added to Note 2 "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 2400 mm (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 2400 mm (8'-0") SPACING.", Added Note 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 1050 mm (3'-6") MIN.", Note 8: Revised "PROTECTION" to "LINING", Added "AND APRON" after "ROCK LINING" in third sentence TWIN CELL BOX CULVERTS PLAN VIEW: Added "1500 5'-0" MIN. (TYP.)" dimension, Added "ALTERNATING BAFFLES 300 (1'-0") X 200 (8")H" callout SECTION J-J & K-K: Added "SEE NOTE 4" dimension for baffle spacing BOX CULVERT PLAN VIEWS: Revised rock, Added baffle opening dimension "SEE NOTE 3", Added "SEE NOTE 2" callout with "APRON BAFFLE DIMENSIONED SIMILAR TO SINGLE CELL" for twin cell callout SECTION J-J: Replaced "DEPRESS ROCK 300 (1'-0")..." note with "SEE NOTE 8"
10 of 11		e-Notification No. 28 and No. 29 incorporated SECTION L-L & M-M: Added "SEE NOTE 4" dimension for baffle spacing, Added "SEE NOTE 8" callout TWIN CELL BOX CULVERTS PLAN VIEW: Added "1500 5'-0" MIN. (TYP.)" dimension, Added "ALTERNATING 300 (1'-0") X 150 (6")H" x 1/3W BAFFLES HT. = 1/2 DEPRESSION" callout, Added "ALTERNATING 300 (1'-0") X 300 (1'-0")H" BAFFLES HT. = DEPRESSION (TYP.)" callout BOX CULVERT PLAN VIEWS: Revised rock, Added baffle opening dimension "SEE NOTE 3", Added "SEE NOTE 2" callout with "APRON BAFFLE DIMENSIONED SIMILAR TO SINGLE CELL" for twin cell callout DESIGN NOTES: Added to Note 2 "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 2400 mm (8'-0") LONG, A SECOND SET OF OPPOSING BAFFLES ARE REQUIRED TO BE

		SET AT 1/2 THE DISTANCE FROM THE END BAFFLE TOTHE FACE OF THE BOX. FOR LONGER APRONS, BAFFLES NOT TO EXCEED 2400 mm (8'-0") SPACING.", Added Note 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 1050 (3'-6") MIN.", Note 8: Revised "PROTECTION" to "LINING", Added "AND APRON" after "ROCK LINING" in third sentence
BD-633M	2 shts	Reissued with no changes.
BD-634M	1 sht	Reissued with no changes.
BD-635M	7 shts	Reissued with no changes since June 9, 2010 release via SOL 431-10-06.
BD-636M	18 shts	Reissued with no changes since June 9, 2010 release via SOL 431-10-06.
BD-641M	1 of 8	Deleted old sheets 6, 7, & 10 of 11: Eliminated metric units due to AASHTO decision to no longer publish SI Unit Specifications, Old Sheet 1 of 11 renumbered to Sheet 1 of 8, Removed all metric dimensions and notes GENERAL NOTE 10: Added ", BOLTS, NUTS & WASHERS" after steel, Added "UNLESS STAINLESS STEEL OR OTHERWISE INDICATED" to end. CONSTRUCTION GENERAL NOTES: Added "65 KSI YIELD MAX" to PIPE COLUMNS under the 2nd bullet REFERENCE DRAWINGS: Removed RC-55M Revised notes to refer to Fatigue Category instead of Importance Factor. Revised and expanded note on criteria for use of Press-break members. Revised "VARIABLE MESSAGE SIGNS (VMS)" to "DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS)" CONSTRUCTION GENERAL NOTES, ALTERNATE PRESS-BREAK MEMBERS: "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 CHORDS."
	2 of 8	Old Sheet 2 of 11 renumbered to Sheet 2 of 8, Removed all metric dimensions and notes
	3 of 8	Old Sheet 3 of 11 renumbered to Sheet 3 of 8, Removed all metric dimensions and notes
	4 of 8	Old Sheet 4 of 11 renumbered to Sheet 4 of 8, Removed all metric dimensions and notes NOTES TO DESIGNER: Added "DO NOT CAMBER TYPE B CANTILEVER STRUTS." to the 2nd bullet Added Fatigue Category to Design Criteria box Added 10'-0" fill depth over footing (4 places), Added Note: DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS<10' to the 2'-0" MIN. cover
	5 of 8	Old Sheet 5 of 11 renumbered to Sheet 5 of 8, Removed all metric dimensions and notes
	6 of 8	Old Sheet 8 of 11 renumbered to 6 of 8, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fifth bullet
	7 of 8	Old Sheet 9 of 11 renumbered to Sheet 7 of 8, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fifth bullet
	8 of 8	Old Sheet 11 of 11 renumbered to Sheet 8 of 8, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fifth bullet
BD-642M	1 of 6	Deleted old sheets 5 & 6 of 8: Eliminated metric units due to AASHTO decision to no longer publish SI Unit Specifications, Old Sheet 1 of 8 renumbered to Sheet 1 of 6, Removed all metric dimensions and notes Revised notes to refer to Fatigue Category instead of Importance Factor. Revised and expanded note on criteria for use of Press-break members. Revised "VARIABLE MESSAGE SIGNS (VMS)" to "DYNAMIC/VARIABLE MESSAGE

		SIGNS (DMS/VMS)" GENERAL NOTE 10: Added ", BOLTS, NUTS & WASHERS" after steel, Added "UNLESS STAINLESS STEEL OR OTHERWISE INDICATED" to end. CONSTRUCTION GENERAL NOTES: Added "65 KSI YIELD MAX" to PIPE COLUMNS under the 2nd bullet REFERENCE DRAWINGS: Removed RC-55M CONSTRUCTION GENERAL NOTES, ALTERNATE PRESS-BREAK MEMBERS: "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 CHORDS."
	2 of 6	Old Sheet 2 of 8 renumbered to Sheet 2 of 6, Removed all metric dimensions and notes
	3 of 6	Old Sheet 3 of 8 renumbered to Sheet 3 of 6, Removed all metric dimensions and notes
	4 of 6	Old Sheet 4 of 8 renumbered to Sheet 4 of 6, Removed all metric dimensions and notes ELEVATION: Added 10'-0" fill depth over footings (2 places), Added Note: DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS<10' to the 2'-0" MIN. cover Added Fatigue Category to Design Criteria box
	5 of 6	Old Sheet 7 of 8 renumbered to Sheet 5 of 6, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fourth bullet Increased chord size from 8" to 10" for 1st entry in 'Loading Type 1' table. Increased chord size from 16" to 17" for OVER 50' TO 60' Design Span and 125 SQ. FT. SIGN AREA in LOADING TYPE 1 table. ELEVATION: added "ON DIAMETER" after 0.14"/FT. taper rate
	6 of 6	Old Sheet 8 of 8 renumbered to Sheet 6 of 6, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and Revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the second bullet, Added "FOR DESIGN TABLE NOTES, SEE SHEET 5." as the third bullet
BD-643M	1 of 6	Deleted old sheets 5 & 6 of 8: Eliminated metric units due to AASHTO decision to no longer publish SI Unit Specifications, Old Sheet 1 of 8 renumbered to Sheet 1 of 6, Removed all metric dimensions and notes GENERAL NOTE 10: Added ", BOLTS, NUTS & WASHERS" after steel, Added "UNLESS STAINLESS STEEL OR OTHERWISE INDICATED" to end. CONSTRUCTION NOTES: Added "65 KSI YIELD MAX" under 2nd bullet REFERENCE DRAWINGS: Removed RC-55M Revised notes to refer to Fatigue Category instead of Importance Factor. Revised and expanded note on criteria for use of Press-break members. Revised "VARIABLE MESSAGE SIGNS (VMS)" to "DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS)" CONSTRUCTION GENERAL NOTES, ALTERNATE PRESS-BREAK MEMBERS: "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 CHORDS."
	2 of 6	Old Sheet 2 of 8 renumbered to Sheet 2 of 6, Removed all metric dimensions and notes
	3 of 6	Old Sheet 3 of 8 renumbered to Sheet 3 of 6, Removed all metric dimensions and notes
	4 of 6	Old Sheet 4 of 8 renumbered to Sheet 4 of 6, Removed all metric dimensions and notes ELEVATION: Added 10'-0" fill depth over footings (2 places), Added Note: DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS<10' to the

	2'-0" MIN. cover Added Fatigue Category to Design Criteria box NOTES TO DESIGNER: Added a bullet "DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS."
5 of 6	Old Sheet 7 of 8 renumbered to Sheet 5 of 6, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fourth bullet Added ALTERNATE PANEL POINT CONNECTION DETAIL with variable X dimensions, X = 12.5" FOR VERTICALS LESS THAN 3" DIA., X = 15" FOR VERTICALS 3" TO 4" DIA. AND COLUMNS 20" DIA. OR LARGER, X = 17" FOR VERTICALS 5" DIA. OR LARGER ELEVATION: Revised 11" dimension to "X", Added callout "SEE ALTERNATE PANEL POINT CONNECTION DETAIL", Added "X = 11" FOR STANDARD PIPE TO PIPE CONNECTIONS."
6 of 6	Old Sheet 8 of 8 renumbered to Sheet 6 of 6, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Added "NOTE: FOR DESIGN TABLE NOTES, SEE SHEET 5."
BD-644M 1 of 13	Deleted old sheets 5, 6, 7, 12, 13, 14, 15, & 16 of 21: Eliminated metric units due to AASHTO decision to no longer publish SI Unit Specifications, Old Sheet 1 of 21 renumbered to Sheet 1 of 13, Removed all metric dimensions and notes Revised notes to refer to Fatigue Category instead of Importance Factor. Revised and expanded note on criteria for use of Press-break members. Revised "VARIABLE MESSAGE SIGNS (VMS)" to "DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS)" GENERAL NOTE 10: Added ", BOLTS, NUTS & WASHERS" after steel, Added "UNLESS STAINLESS STEEL OR OTHERWISE INDICATED" to end. CONSTRUCTION NOTES: Added "65 KSI YIELD MAX" under 2nd bullet REFERENCE DRAWINGS: Removed RC-55M CONSTRUCTION GENERAL NOTES, ALTERNATE PRESS-BREAK MEMBERS: "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 CHORDS."
2 of 13	Old Sheet 2 of 21 renumbered to Sheet 2 of 13, Removed all metric dimensions and notes
3 of 13	Old Sheet 3 of 21 renumbered to Sheet 3 of 13, Removed all metric dimensions and notes
4 of 13	Old Sheet 4 of 21 renumbered to Sheet 4 of 13, Removed all metric dimensions and notes ELEVATION: Added 10'-0" fill depth over footings (2 places), Added Note: DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS<10' to the 2'-0" MIN. cover Added Fatigue Category to Design Criteria box NOTES TO DESIGNER: Added a bullet "DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS."
5 of 13	Old Sheet 8 of 21 renumbered to Sheet 5 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fifth bullet, Revised sheet number from 3 to 2 in the eighth bullet
6 of 13	Old Sheet 9 of 21 renumbered to Sheet 6 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block
7 of 13	Old Sheet 10 of 21 renumbered to Sheet 7 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Added "NOTE: FOR DESIGN TABLE NOTES, SEE SHEET 5."
8 of 13	Old Sheet 11 of 21 renumbered to Sheet 8 of 13, Removed all metric dimensions

	and notes ELEVATION: Added 10'-0" fill depth over footings (2 places), Added Note: DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS<10' to the 2'-0" MIN. cover Added Fatigue Category to Design Criteria box NOTES TO DESIGNER: Added a bullet "DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS."
9 of 13	Old Sheet 17 of 21 renumbered to Sheet 9 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-744M SHEET 6." from under table, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fifth bullet, Added "FOR PEDESTAL DETAILS, SEE BC-744M, SHEET 3." as the seventh bullet
10 of 13	Old Sheet 18 of 21 renumbered to Sheet 10 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-744M SHEET 6." from under table
11 of 13	Old Sheet 19 of 21 renumbered to Sheet 11 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-744M SHEET 6." from under table
12 of 13	Old Sheet 20 of 21 renumbered to Sheet 12 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-744M SHEET 6." from under table, Added "NOTE: FOR DESIGN TABLE NOTES, SEE SHEET 9."
13 of 13	Old Sheet 21 of 21 renumbered to Sheet 13 of 13, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-744M SHEET 6." from under table
BD-645M 1 of 7	Deleted old sheets 5, 6, & 7 of 10: Eliminated metric units due to AASHTO decision to no longer publish SI Unit Specifications, Old Sheet 1 of 10 renumbered to Sheet 1 of 7, Removed all metric dimensions and notes Revised notes to refer to Fatigue Category instead of Importance Factor. Revised and expanded note on criteria for use of Press-break members. Revised "VARIABLE MESSAGE SIGNS (VMS)" to "DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS)" GENERAL NOTE 10: Added ", BOLTS, NUTS & WASHERS" after steel, Added "UNLESS STAINLESS STEEL OR OTHERWISE INDICATED" CONSTRUCTION NOTES: Added "65 KSI YIELD MAX" Removed RC-55M reference CONSTRUCTION GENERAL NOTES, ALTERNATE PRESS-BREAK MEMBERS: "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 CHORDS."
2 of 7	Old Sheet 2 of 10 renumbered to Sheet 2 of 7, Removed all metric dimensions and notes
3 of 7	Old Sheet 3 of 10 renumbered to Sheet 3 of 7, Removed all metric dimensions and notes
4 of 7	Old Sheet 4 of 10 renumbered to Sheet 4 of 7, Removed all metric dimensions and notes ELEVATION: Added 10'-0" fill depth over footings (2 places), Added Note: DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS<10' to the 2'-0" MIN. cover Added Fatigue Category to Design Criteria box NOTES TO DESIGNER: Added a bullet "DESIGNER TO PROVIDE DIMENSIONS ON CONTRACT DRAWINGS."
5 of 7	Old Sheet 8 of 10 renumbered to Sheet 5 of 7, Removed "EITHER ALL METRIC OR

BD-647M	6 of 7	ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed FOR PEDESTAL TABLE, SEE BC-745M SHEET 4. from under table, NOTES: Removed "ACTUAL" and revised "FOR FILL HEIGHTS" to "FOR FILL HEIGHTS < 10'." in the fifth bullet, Added "FOR PEDESTAL DETAILS, SEE BC-745M SHEET 2." as the seventh bullet
	7 of 7	Old Sheet 9 of 10 renumbered to Sheet 6 of 7, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-745M SHEET 4." from under table
	7 of 7	Old Sheet 10 of 10 renumbered to Sheet 7 of 7, Removed "EITHER ALL METRIC OR ALL ENGLISH VALUES..." note from over title block, Removed U.S. CUSTOMARY UNITS from title block, Removed "FOR PEDESTAL TABLE, SEE BC-745M SHEET 4." from under table, Added "NOTE: FOR DESIGN TABLE NOTES, SEE SHEET 5."
	1 of 4	NOTES TO DESIGNER: Added a bullet "USE A MINIMUM OF 2 1/4" THICKNESS FOR ALL SPLICE PLATES TO PREVENT DISTORTION DURING WELDING." REFERENCE DRAWINGS: Removed RC-55M DESIGN NOTES: Added "(3 SECOND GUST) BASIC" before "WIND SPEED" in Note 2, Added as Note 4 "DESIGN TABLES MEMBER SIZES ARE ADEQUATE FOR FATIGUE CATEGORY I THEREFORE, PENNDOT MINIMUM REQUIREMENT OF FATIGUE CATEGORY II IS MET.
	2 of 4	ELEVATION: Revised minimum exposed pedestal height from 1'-0" to 6". Added Fatigue Category to Design Criteria box, Added CAMBER DIAGRAM NOTES TO DESIGNER: Moved General Note 7 under remaining General Notes, Added third bullet DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER AND MAST BACK RAKE ON DESIGN PLAN FOR EACH SPECIFIC STRUCTURE SPAN.
	3 of 4	ELEVATION: Revised minimum exposed pedestal heights from 1'-0" to 6". Added Fatigue Category to Design Criteria box.
	4 of 4	FRAME STRUCTURE & CANTILEVER STRUCTURE: Added "2 1/4" MIN. THICK SPLICE PLATE (TYP.)" callout Revised "NOTE:" to "NOTES:", Added "2. FABRICATOR OPTION TO ADD OR ELIMINATE SPLICES." as the second note
	1 of 2	STANDARD BEAM SIZES AND ALLOWABLE SKEW LIMITATIONS: Removed ADJ. BOX (NON-COMP.) row from table Revised "PLAIN" to "EPOXY" in Note 2 of the "END DIAPHRAGMS, SHEAR BLOCKS AND DOWEL" table
	2 of 2	Revised "PLAIN" to "EPOXY" in Note 9 of the "DOWEL AND SHEAR BLOCK" table
	1 of 3	Revised Title of Standard: Added "PRESTRESSED" before "BEAM"
BD-651M	2 of 3	Revised Title of Standard: Added "PRESTRESSED" before "BEAM"
	3 of 3	Revised Title of Standard: Added "PRESTRESSED" before "BEAM"
	1 of 2	FRAMING PLAN FOR SPREAD BOX BEAMS: Revised 450 (1'-6") callout to 375 (1'-3") for W/O backwall condition
BD-652M	1 of 2	DETAIL A - WITH PAVING NOTCH AND BACKWALL: Added "WITHOUT" before "BACKWALL"
	1 of 2	Added Section cut for Section B-B in upper left corner detail. Added "BOTTOM OF DIAPHRAGM" callout on PARTIAL DEPTH DIAPHRAGM detail e-Notification 27 incorporated, INTERMEDIATE DIAPHRAGM w/ VERTICAL CLEARANCE < 4880 (16'-0"): Added "25 (1") MIN. (TYP.)" callout, Added "ONLY REQUIRED AT FASCIA BEAM (EXTERNAL BAYS)" under title, Removed "2-" from before "#16 (#5)" at 2 places
	1 of 2	Revised "PARTIAL DEPTH" to "FULL DEPTH" for callout of diaphragm in CORNER DETAIL AT ABUTMENT WITH OR WITHOUT BACKWALL - EXP. END detail and added "SHOWN" after "DIAPHRAGM". Added as General Note 10: "FOR SECTION B-B, SEE SHEET 2."
BD-653M	2 of 2	Added Section B-B to show #16 (#5) rebar at rear of full depth diaphragm. FULL DEPTH DIAPHRAGM AT ABUTMENT WITH OR WITHOUT BACKWALL OR AT PIER: Inserted "MIN." after "SHOW" for deck thickness callout.
	2 of 7	Added "VERTICAL CLEARANCE >= 4880 (16'-0") under Intermediate Diaphragm title
	3 of 7	Added INTERMEDIATE DIAPHRAGM AT FASCIA BEAM (EXTERNAL BAY), VERTICAL
BD-657M	5 of 7	CLEARANCE < 4880 (16'-0") detail Deleted "*" note from LEGEND
	5 of 7	Changed all legends for shaded triangle symbol to read "SEE NOTE 3" NOTES: Added "GENERAL" before "NOTES" in the 1st note, Added as Note 3 "PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHT. 29."
	6 of 7	Changed all legends for shaded triangle symbol to read "SEE NOTE 3" NOTES: Added "GENERAL" before "NOTES" in the 1st note, Added as Note 3 "PLACED PARALLEL TO BEAMS AND SPACED BETWEEN BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHT. 29."
	7 of 7	Added shaded triangle symbol to #19 (#6) rebar callout, Added legend for shaded triangle reading "SEE NOTE 3" NOTES: Added "GENERAL" before "NOTES" in the 1st note, Added as Note 3 "PLACED PARALLEL TO BEAMS. FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHT. 29.
	1 sht	Reissued with no changes.
	1 of 1	General Note 2: Replaced "A 616M" with "A 996M"
	1 of 2	DECK PLACEMENT SEQUENCE SCHEMES: Added dimensional arrows for placement lengths, Shortened 'DIRECTION OF POUR' arrows NOTE 3: Replaced 5.11.1.2.3 with 5.14.1.2.7.
	1 of 8	Removed Min. Cover for Non-Composite Beams in Note 14 Revised projection dimension on VIEW B-B and ELEVATION A-A to eliminate reference to Non-Composite Beams
	2 of 8	Removed callout to Non-Composite A1 bars on ELEVATION A-A ADJACENT BOX BEAMS PLAN - TYPICAL BEAM: Removed "& NON COMP.", Revised "COMP." to "(COMPOSITE)" VIEW B-B: Removed "& NON COMP.", Revised "COMP." to "(COMPOSITE)"
	7 of 8	TYPICAL REINFORCEMENT ADJACENT BOX BEAM DETAIL: Moved 3 dot bars in top slab of box beam beneath tranverse u-bar. END BLOCK REFORCEMENT WITH BEAM NOTCH: Removed "OR NON-COMP." and revised "COMP." to "(COMPOSITE)"
BD-658M	1 of 2	Deleted "NON-COMPOSITE" and note regarding composite stirrups under "PLAN-305 (12") DEEP PLANK BEAM" Revised "PLAN-305 (12") DEEP PLANK BEAM" to reflect splice location of composite stirrups
	8 of 8	Deleted "END ELEVATION" under "VIEW H-H" ADJACENT BOX BEAM WITH TYPE 3 OR 4 APPROACH SLAB: Added "FOR ALTERNATE REBAR DETAIL, SEE BD-628M, SHT. 29." to NOTE B. e-Notification No. 21 incorporated, Revised 1065 (42") to 990 (39") for Type 3 & 4 Approach Slabs in TABLE B and BEAM NOTCH NOTE 5 under TABLE B
	2 of 4	e-Notification No. 17 incorporated, Revised "VEIW" to "VIEW" in TYPICAL CLIPPED FLANGE REINFORCEMENT DETAILS
BD-659M	3 of 4	SECTION B-B: Revised orientation of End of Beams to show them as perpendicular to bottom of beam, Added Note to dimensions W and A that dimensions are Measured Normal to Centerline of Bearings
	1 of 4	NOTE 2: Replaced "A 616M" with "A 996M"
	2 of 4	POSITIVE MOMENT CONNECTION DETAIL AT PIER (DIFFERENT BEAM DEPTH-EXPANSION): Added 200 (8") FOR to callout before PA BULB-TEE. POSITIVE MOMENT CONNECTION DETAIL AT PIER (DIFFERENT BEAM DEPTH-FIXED): Added 200 (8") FOR to callout before PA BULB-TEE.
BD-660M	4 of 4	e-Notification No. 18 incorporated, OPTIONAL POSITIVE MOMENT CONNECTION DETAIL AT PIER (DIFFERENT BEAM DEPTH-FIXED): Added 200 (8") FOR to callout before PA BULB-TEE.
	1 of 3	NOTE 2: Replaced "A 616M" with "A 996M"
	1 of 9	Eliminated metric units due to AASHTO decision to no longer publish SI Unit Specifications, Added three (3) new sheets, Old Sheet 1 of 6 renumbered to Sheet 1 of 9
BD-661M	2 of 7	GENERAL NOTES: Removed Notes 27 & 30 and Renumbered remaining notes, Removed date in Note 2, Revised splice lengths in Note 8, Added 50 before DUROMETER in Note 15, Added "DETAILS FOR BEAMS LESS THAN 1'-5" ARE NOT
	3 of 7	

		INCLUDED IN THIS STANDARD" to Note 24 TYPICAL ELEVATION: Revised wingwall to center of pile MIN. dimension from 1'-6" to ***, Added a note "**** EXTERIOR PILES TO BE LOCATED TO PROVIDE 3" CLEAR TO THE HORIZONTAL REINFORCEMENT EXTENDING FROM THE WINGWALLS", Deleted 9" MIN. dimension to pile TYPICAL PLAN: Added a note "WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE SELECTED.", Added a note "EXTERIOR BEAMS TO BE LOCATED TO PROVIDE 3" CLEAR TO THE HORIZONTAL REINFORCEMENT EXTENDING FROM THE WINGWALLS." GENERAL NOTES: Added as Note 29 "THE STLRFD 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.", Added as Note 30 "SUPERSTRUCTURE MUST BE ERected and connected to the integral abutments prior to placing backfill behind the abutments.", Added as Note 31 "If an integral abutment bridge is being redecked, the end diaphragm must be removed completely prior to deck removal to avoid subjecting the girders to temperature forces."
2 of 9		Old Sheet 2 of 6 renumbered to Sheet 2 of 9, Removed all metric dimensions and notes, Moved SECTIONS A-A, B-B, C-C, and D-D to new Sheet 3 of 9 LEGEND: Deleted Legend Items 3 and 4, Renumbered Legend Item 6 to 4 and Item 5 to 3, Revised drawing reference in Legend Item 2 from sheet 6 to sheet 8, Added "1/2" before LAP SPLICE LENGTH for P/S BEAMS, Added "THE BARS SHOULD EXTEND TO WITHIN 3" OF THE ADJACENT BEAMS." to FOR P/S BEAMS, Added brackets around "FOR P/S BEAMS" and "FOR STEEL BEAMS" sections PARTIAL SECTION THRU ABUTMENT, CONCRETE GIRDERS: Added to end of THREADED INSERTS callout "ARE NOT TO BE USED ... ARE TO BE PLACED WITHIN 3" OF THE FLANGES.", Added CENTERLINE DIAPHRAGM callout Enlarged SECTION G-G and both STEEL and CONCRETE PARTIAL SECTIONS THRU ABUTMENT PARTIAL SECTION THRU ABUTMENT, STEEL GIRDERS: Deleted SECTION E-E, Renamed "SECTION F-F" to "SECTION E-E", Added lap dimension with *, Added note "* MINIMUM LAP LENGTH SHOWN FOR GIRDER CLEAR SPACING OF 5'-7" OR GREATER. FOR LESSOR SPACINGS SEE NOTE 1." PARTIAL SECTION THRU ABUTMENT, CONCRETE GIRDERS: Added "NOTE: DIAPHRAGM REINFORCEMENT TO BE SYMMETRIC ABOUT SPACE BETWEEN BEAMS", Added "NOTE: DECK REINFORCEMENT NOT SHOWN FOR CLARITY", Added to NOTE A "AS AN ALTERNATE TO THREADED INSERTS AND BAR LAPS, "
3 of 9		New sheet - Moved SECTION A-A, B-B, C-C, & D-D from Sheet 2 to new Sheet 3 All Sections: Removed rebar at end of beam/middle of diaphragm, Added "APPROACH SLAB TIE BARS (TYP.)" callout SECTION A-A: Added "MINIMUM 2 HOLES PER VERTICAL COLUMN" to 2 3/8" DIA. HOLE callout, Added rebar bend detail for #5 @ 9"
4 of 9		Old Sheet 3 of 6 renumbered to 4 of 9, Removed original SECTION E-E, Renamed original SECTION F-F to SECTION E-E, Removed every other vertical dot bar LEGEND: removed FOR ALL BARS AT THE OUTSIDE FACE OF EXTERIOR GIRDERS: EXTEND BARS TO WITHIN 75 mm (3") FROM THE END OF THE ABUTMENT. LEGEND: Added "IF THE LAP SPLICE LENGTH IS GREATER THAN THE GIRDER CLEAR SPACING THE BARS SHOULD EXTEND TO WITHIN 3" OF THE ADJACENT BEAMS." to FOR P/S BEAMS, added "WITH A 9" BENT LEG" after DIAPHRAGM under FOR STEEL BEAMS DETAIL H: Added "CHOKED WITH R4" after EXCAVATION ROCK, CLASS R-8 callout
5 of 9		Old Sheet 4 of 6 renumbered to 5 of 9, Removed metric dimensions and metric TABLE 1, Added LEGEND 10 reference to all SECTION views, Added "3" CLR." to
		SECTIONS M-M, J-J, and L-L, Updated sheet references SECTION J-J and L-L: Added "L" dimension, Added "OPTIONAL BAR BEND" callout and dashed line SECTION L-L: Added "FULL HT OF WING" after USE DIAMETER AND SPACING SECTION K-K: Moved 2'-1" dimension to dimension line SECTION M-M: Fixed 2" CLR. callout LEGEND: Changed 7 to 9, added 10 "WINGWALL WIDTH MAY VARY BASED ON BARRIER TYPE."
6 of 9		Old Sheet 5 of 6 renumbered to 6 of 9, Removed metric dimensions DETAIL P: Revised "SHALL HAVE" to "WITH" in waterproofing note
7 of 9		New sheet - Moved Approach Slab Details from old sheet 6 of 6, Removed metric dimensions Added SECTIONS THRU END DIAPHRAGM BETWEEN BEAMS and AT BEAMS for girder depths greater than and less than 2', Added DETAIL A LEGEND: Added "TO CLEAR GIRDERS" to 11, Renumbered Legend Item 9 to 12 and Item 10 to 13
8 of 9		Old Sheet 6 of 6 renumbered to 8 of 9, Moved both APPROACH SLAB CONNECTION DETAILS to new Sheet 7 of 9 LEGEND: Renumbered Legend Item 11 to 16, Added Legend Item 15 - SPACED WITH LONGITUDINAL DECK REINFORCEMENT THREADED INSERT LOCATIONS: Added "(SEE SHEET 3 FOR HOLE LOCATION IN WEBS OF STEEL BEAMS)", Added plan views for threaded insert locations, Revised minimum edge distance at top and bottom from 3" to 5" for inserts in box beams INTEGRAL ABUTMENT PILE INSTALLATION DETAIL: added "SEE APPENDIX G OF DESIGN MANUAL PART 4 SECTION 1.4.2 FOR PRE AUGERING REQUIREMENTS" SLAB-ABUTMENT CONNECTION DETAIL: Added "SECTIONS BETWEEN GIRDERS SHOWN"
9 of 9		New sheet - Added FIXITY ARRANGEMENT FOR MULTI SPAN STRUCTURES, Added MIXED SUBSTRUCTURE TYPES, Added DETAIL FOR USING EXISTING SUBSTRUCTURE UNIT FOR SLOPE PROTECTION
BD-668M	1 of 3	Eliminate metric units due to AASHTO decision to no longer publish SI unit Specifications. Re-issue of Precast Channel Beams with composite deck slab instead of bituminous wearing course. Details for Typical Concrete Barrier, PA TYPE 10M bridge barrier, and Concrete Vertical Wall barrier done using LRFD specification. TYPICAL CHANNEL SECTIONS: Added "PRECAST" before CHANNEL in title, Replaced "EA" with "-" and added "OF BEAM" to top and bottom slab dimensions, Added "SEE SHEET 3 FOR PA TYPE 10M BRIDGE BARRIER DETAIL AND CONCRETE VERTICAL WALL BARRIER DETAILS." CHANNEL BEAM FABRICATION NOTES: Revised 2 1/2" to 1 1/2" in Note 1 Added "CONSTRUCTION JOINT & V-NOTCH (RAKED FINISH)" dimension, Added "3/4" CHAMFER ON OUTSIDE FACE OF FASCIA BEAMS" callout, Added "2" MIN. STIRRUP PROJECTION INTO BEAM SLAB (TYP.)" callout Revised title "REINFORCEMENT DETAIL" to be "BAR DETAIL" BAR DETAIL: Revised dimensions to include varying deck slab thickness, 'T' ELEVATION B-B: Revised title to "SECTION B-B" SECTION A-A, B-B, & D-D: Moved notes beneath section views, Added as 3rd bullet "BEAM REINFORCEMENT NOT SHOWN FOR CLARITY." NOTES: Revised note 1 "PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD ... EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.", Added note 5 "LIVE LOAD DISTRIBUTION FACTOR USED IS BASED ON 30 FT. OUT-TO-OUT BRIDGE WIDTH.", Added note 13 "FOR SHEAR KEY DETAIL, SEE BC-775M.", Revised note 6 on dead loads to "INCLUDES 30 LB/SQ. FT. WEIGHT FOR FUTURE WEARING SURFACE, INCLUDES 1" ADDITIONAL CONCRETE FOR HAUNCH, INCLUDES TYPICAL CONCRETE BARRIER LOAD OF 217 LB/FT (3 BEAM DISTRIBUTION)" REFERENCE DRAWINGS: Added BD-617M, BD-618M, BD-660M, and BC-734M Added TIEBOLT LOCATION DETAILS & PRECAST CHANNEL BEAMS MAXIMUM
		2 of 3

	CAPACITIES table
	SECTION F-F: Revised deck thickness, Added "BITUMINOUS APPROACH" callout, Revised BITUMINOUS WEARING COURSE dimension to 5 1/2" MIN. COMPOSITE CONCRETE DECK SLAB THICKNESS 'T', Revised joint callout to "1 1/2" x 1/2" SAW CUT JOINT, FILL WITH AN APPROVED SEALER."
3 of 3	Added new sheet to include TYPICAL PRECAST CHANNEL SECTION WITH CONCRETE VERTICAL WALL BRIDGE BARRIER, TYPICAL PRECAST CHANNEL SECTION WITH PA TYPE 10M BRIDGE BARRIER, VERTICAL BARRIER BAR DETAIL, & PA TYPE 10M BARRIER BAR DETAIL
BD-676M 6 shts	Reissued with no changes.
BD-677M 3 of 28	Added a note under GROUND MOUNTED SOUND BARRIER ELEVATION: FOR POSTS WITH BASE PLATES REFER TO "PANEL NOTCH DETAIL FOR BASE PLATE CONNECTIONS" ON BD-676M, SHT. 6.
15 of 28	SECTION J-J: extended #13 (#4) leader to tie
18 of 28	SECTION L-L: extended #13 (#4) leader to tie
23 of 28	SECTION M-M: revised 1'-0" to 1'-10" to be consistent with 560 mm dimension
24 of 28	SECTION N-N: revised 1'-0" to 1'-10" to be consistent with 560 mm dimension
25 of 28	SECTION R-R: revised 1'-0" to 1'-10" to be consistent with 560 mm dimension
26 of 28	SECTION T-T: revised 1'-0" to 1'-10" to be consistent with 560 mm dimension
BD-678M 1 of 18	GENERAL NOTE 3: in 2 nd Bullet changed 1994 to 2002.
3 of 18	Added a note under GROUND MOUNTED SOUND BARRIER ELEVATION: "FOR POSTS WITH BASE PLATES REFER TO "PANEL NOTCH DETAIL FOR BASE PLATE CONNECTIONS" ON BD-676M, SHT. 6."
BD-679M 11 shts	Reissued with no changes.
BD-680M 8 shts	Reissued with no changes.

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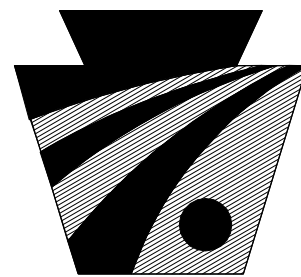
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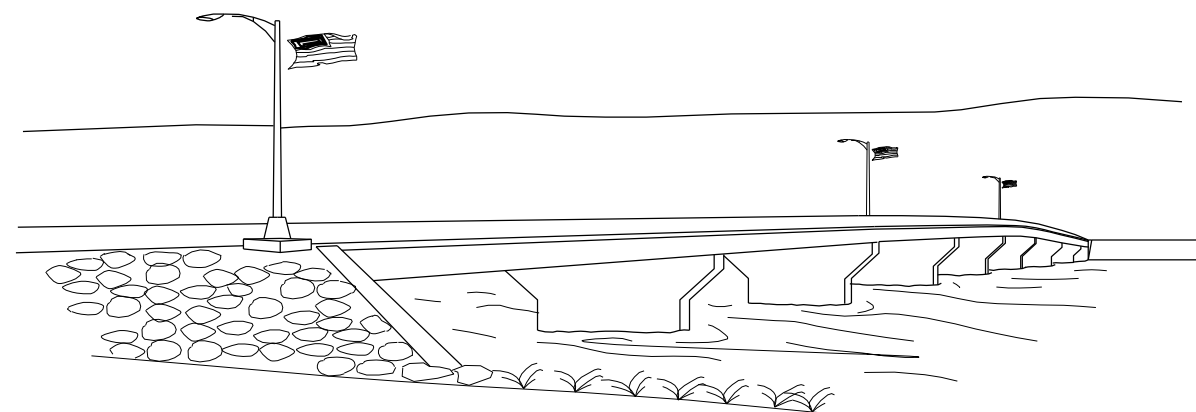
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BUREAU OF DESIGN

STANDARDS FOR BRIDGE DESIGN



BD-600M SERIES

SEPTEMBER 2010 EDITION

PUB. #218M

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	BD-697M	GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM	4	NOV. 21, 2014

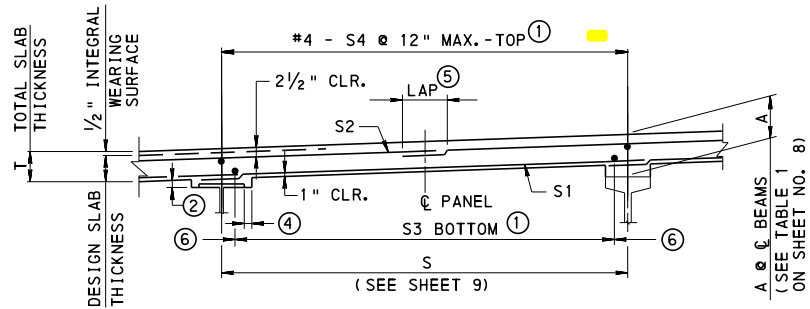
USE THESE STANDARDS AS A GUIDE IN THE PREPARATION OF STRUCTURAL PLANS, IN CONJUNCTION WITH THE BC-700M SERIES STANDARD DRAWINGS.

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.

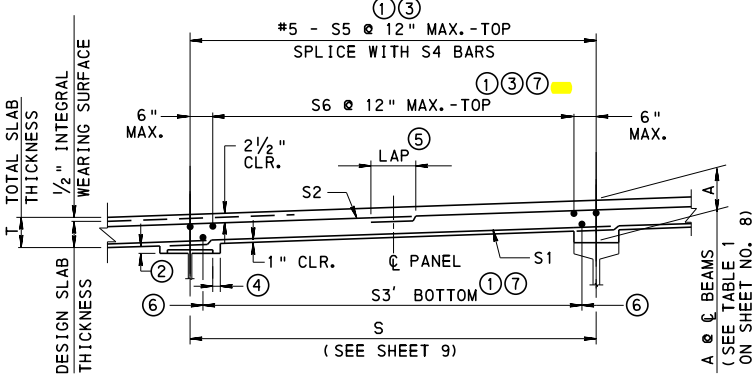
SEPTEMBER 2010 EDITION

- SEE CHANGE #1 FOR AUG. 31, 2012 STANDARD REVISIONS.
- SEE CHANGE #2 FOR NOV. 26, 2013 STANDARD REVISIONS.
- SEE CHANGE #3 FOR NOV. 21, 2014 STANDARD REVISIONS.



TYPICAL SLAB PANEL 1

SIMPLE AND CONTINUOUS
COMPOSITE POSITIVE MOMENT REGIONS



TYPICAL SLAB PANEL 2

CONTINUOUS COMPOSITE
NEGATIVE MOMENT REGIONS

LEGEND:

- SPACE BARS S3, S3', S4, S5 AND S6 SYMMETRICALLY ABOUT THE PANEL CENTERLINE.
- PROVIDE HAUNCH TO COMPENSATE FOR IRREGULARITIES IN CAMBER. SEE TABLE 1, SHEET 8 FOR MINIMUM HAUNCH REQUIREMENTS.
- FOR PRESTRESSED CONCRETE BRIDGES MADE CONTINUOUS, DESIGN S5 AND S6 BARS IN ACCORDANCE WITH DM-4 ARTICLE D5.14.1.4.
- 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 STANDARD DRAWING BC-732M.
- DECK SLAB LAP SPLICE LENGTH: NORMAL WEIGHT CONCRETE: 2' - 7" #5 BARS
3' - 1" #6 BARS
LIGHTWEIGHT CONCRETE: 3' - 5" #5 BARS
4' - 1" #6 BARS
- BEGIN S3 AND S3' BARS AT LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT, SEE SHEET 8. S3 AND S3' BARS DO NOT NEED TO BE PLACED OVER THE BEAM FOR SPREAD BOX BEAM BRIDGE.
- 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.

RC-65M	CONCRETE MOUNTABLE CURBS
BD-609M	PA STRUCTURE MOUNTED GUIDE RAIL
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 STRUCTURE MOUNTED GUIDE RAIL BARRIER MISCELLANEOUS DETAILS
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-718M	ALTERNATE RAILING DETAILS
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-739M	BRIDGE BARRIER TO GUIDE RAIL TRANSITION
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

NOTES:

- DESIGN SPECIFICATIONS:
 - AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AND COMMENTARY
 - PENNDOT DESIGN MANUAL PART 4
- MATERIAL STRENGTH:
 - REINFORCEMENT STEEL $f_y = 60$ KSI
 - CONCRETE $f'_c = 4$ KSI (CLASS AAAP CONCRETE) FOR DECK SLABS AND INTEGRAL SIDEWALKS AND $f'_c = 3.5$ KSI (CLASS AA CONCRETE) FOR BARRIERS AND RAISED OR ALTERNATE SIDEWALKS.
 - MODULAR RATIO (E_s/E_c) $N = 8$
- DEAD LOAD:
 - NORMAL WEIGHT CONCRETE = 150 LB./FT³
 - LIGHTWEIGHT CONCRETE = 115 LB./FT³
 - PERMANENT METAL DECK FORMS = 15 LB./FT²
 - FUTURE WEARING SURFACE = 30 LB./FT²
- DESIGN CONTROLS:
 - CONCRETE COVER: DECK TOTAL TOP COVER = 2 1/2"
DECK BOTTOM COVER = 1"
BARRIER = 2"
SIDEWALK TOP COVER = 2 1/2"
ALTERNATE SIDEWALK DETAIL BARRIER = 2"
 - MIN. CLEAR DISTANCE BETWEEN REINFORCEMENT MATS = 2", EXCEPT AS PERMITTED IN ALTERNATE CONTINUITY REINF. DETAIL, SHEET 8.
 - BAR SIZE: MAXIMUM BAR SIZE : #6, EXCEPT FOR BARS DESIGNED TO MEET 3
MINIMUM BAR SIZE:
S1, S2, S5, AND S6 BARS : #5
S4, S3, S3', AND S7 BARS : #4
 - BAR SPACINGS: MAXIMUM SPACING = 12" SLAB
12" BARRIER
MINIMUM SPACING = 5 1/2"
SPACING INCREMENTS = 1/2"
 - THE TOP 1/2" OF THE SLAB IS CONSIDERED TO BE AN INTEGRAL WEARING SURFACE.
 - DECK THICKNESS: MINIMUM THICKNESS INCLUDING 1/2" INTEGRAL WEARING SURFACE = ((DISTANCE BETWEEN DESIGN SECTIONS FOR NEGATIVE MOMENT + 120") / 30 + 1/2") ≥ 8", THICKNESS INCREMENTS = 1/2"
 - Z FACTOR FOR CRACK CONTROL = 130 KIPS/IN.
- USE ONLY FUSION BONDED EPOXY COATED REINFORCEMENT IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.
- 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 D 5.4.3.1.
- DESIGN TABLES ARE VALID FOR NORMAL WEIGHT CONCRETE DECKS. FOR LIGHTWEIGHT CONCRETE DECKS, INCREASE THE LENGTH L LISTED IN REINFORCEMENT TABLES ON SHEET 9, BY 13".
- DETAIL ALL BARS ON THE CONTRACT DRAWINGS.
- ALL DETAILS SHOWN ALSO APPLY TO P/S I-BEAMS, PA BULB-TEE AND P/S SPREAD BOX BEAMS EXCEPT AS NOTED.
- FOR HAUNCH DETAILS, SEE SHEET 8.
- FOR SKEW ANGLES 75° AND MORE, PLACE TRANSVERSE REINFORCEMENT IN DECK SLAB PARALLEL TO CENTERLINE OF BEARINGS.
- SEE BC-767M AND BD-656M FOR ADDITIONAL REINFORCEMENT AT END OF DECK.
- FOR TRANSITION OF LONGITUDINAL REINFORCEMENT FROM POSITIVE MOMENT AREA TO NEGATIVE MOMENT AREA, USE AASHTO ARTICLES 5.14.1.4 AND 6.10.1.7 AS MODIFIED BY DESIGN MANUAL PART 4, SECTIONS D5.14.1.4 AND D6.10.1.7.
- DESIGN IS BASED ON DECKS SUPPORTED ON 3 OR MORE BEAMS.
- 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.
- THE TYPICAL BARRIER AND DECK SLABS, INCLUDING OVERHANGS, ARE DESIGNED TO RESIST A VEHICULAR COLLISION FORCE AT TEST LEVEL 5. THE SPLIT GLARE SCREEN MEDIAN BARRIERS, 32" ALTERNATE SIDEWALK DETAIL, THE ALTERNATE SPLIT MEDIAN BARRIER, ALTERNATE BARRIER, MEDIAN BARRIER AND THE GLARE SCREEN MEDIAN BARRIER ARE DESIGNED TO RESIST VEHICULAR COLLISION AT TEST LEVEL 4.
- DECK DESIGN TABLES ARE BASED ON THE EQUIVALENT STRIP METHOD AS PER AASHTO, ARTICLE 4.6.2.1.
- FACTORED MOMENT = 1.25 (SLAB AND BARRIER MOMENT) + 1.5 (FWS MOMENT) + 1.75 (1+IM/100)(L.L. MOMENT)
- DYNAMIC LOAD ALLOWANCE (IM) = 50%
- SEE TABLES ON SHEET 9 FOR VALUES OF S, T, S1, S2, S3, S3', S6, S7, So, AND L.
- FOR DECK SLAB AND BARRIER DETAILS AND REINFORCEMENT FOR ADJACENT PRESTRESSED CONCRETE BOX BEAMS, SEE BD-660M AND BD-661M.
- 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 SHEET 9.
- DRAWINGS ARE NOT TO SCALE.
- FOR BARRIER REINFORCEMENT DETAILS, SEE SHEETS 6 AND 7.
- OVERHANG LENGTH MUST NOT EXCEED THE REQUIREMENTS OF DESIGN MANUAL PART 4, SECTION D9.7.1.5.1P.
- THE SLAB REINFORCEMENT SHOWN ON SHEET 9 IS APPLICABLE FOR THE BARRIERS SHOWN ON SHEET 2, 3 AND 4, THE PA HT, TYPE 10M 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 27 FOR MODIFICATIONS REQUIRED WHEN SOUND BARRIERS ARE USED.
- CONCRETE SOUND BARRIER SHOWN ON BC-779M AND BD-679M MAY BE MOUNTED ON THE TOP OF BARRIER AS DETAILED ON SHEET 4. 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 IN EXCESS OF THE TYPICAL BARRIER ≤ 600 LB. PER FOOT OF LENGTH

DECK DESIGN PROCEDURE

- USING THE TABLES AND NOTES ON SHEET 9, 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.

- FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF BARRIERS/DIVISORS SHOWN ON BD-601M ARE AS FOLLOWS:
TYPICAL CONCRETE BARRIER 650 LB./FT
ALTERNATE CONCRETE BARRIER 520 LB./FT
SPLIT CONCRETE GLARE SCREEN MEDIAN BARRIER 750 LB./FT
ALTERNATE SPLIT CONCRETE MEDIAN BARRIER 520 LB./FT
CONCRETE MEDIAN BARRIER 700 LB./FT
CONCRETE GLARE SCREEN MEDIAN BARRIER 960 LB./FT
SPLIT CONCRETE DIVISOR TYPE A 130 LB./FT, TYPE B 140 LB./FT
CONCRETE DIVISOR TYPE A 260 LB./FT, TYPE B 280 LB./FT
ALTERNATE SIDEWALK, VERTICAL WALL BARRIER (WITHOUT RAILING) 530 LB./FT

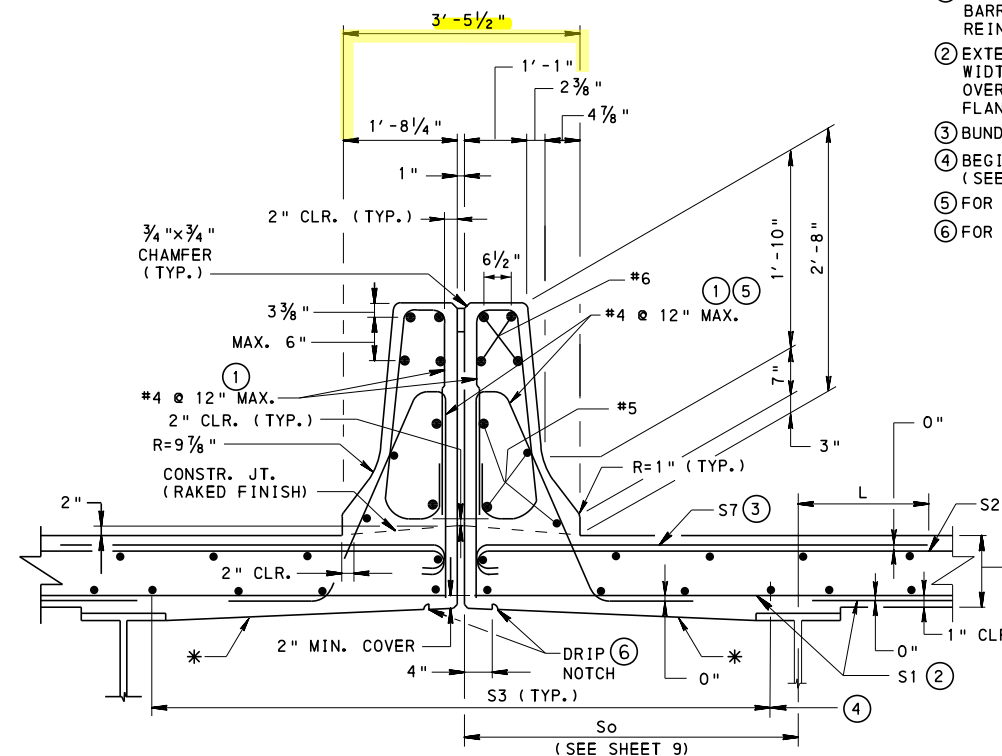
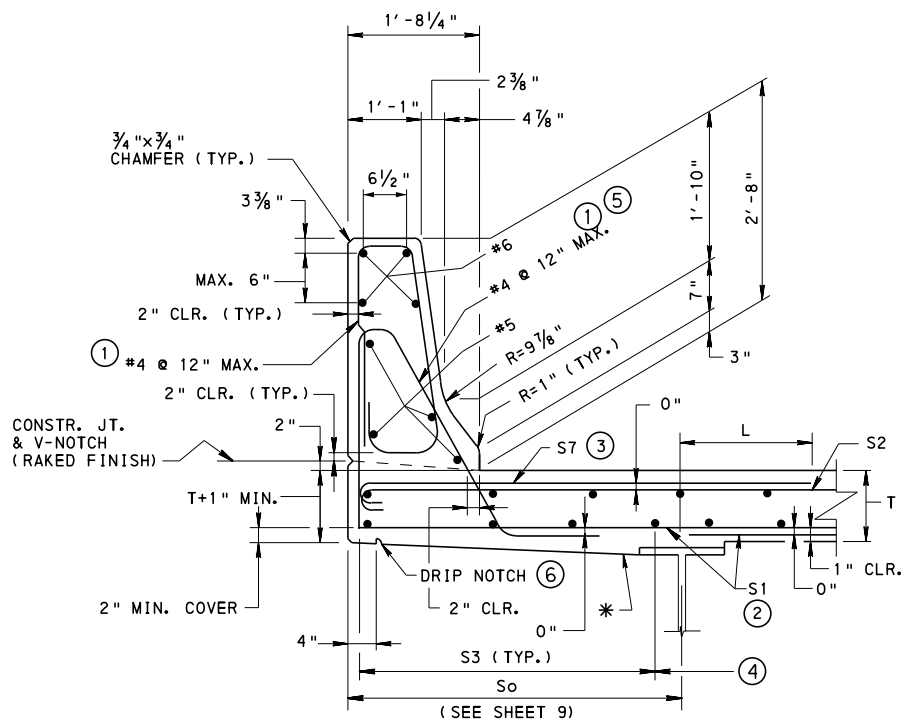
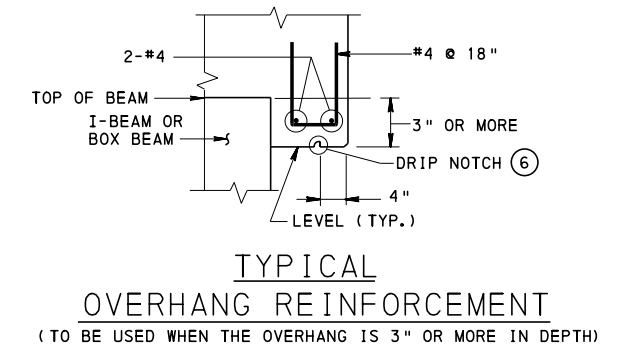
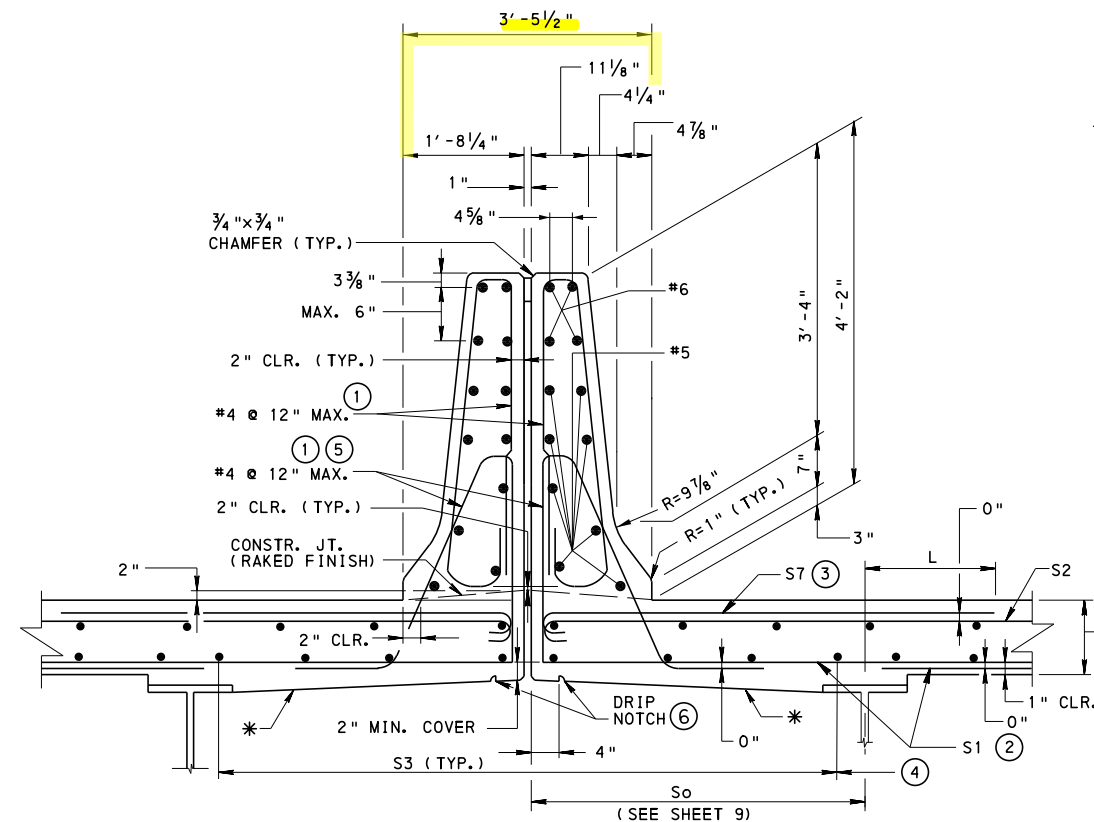
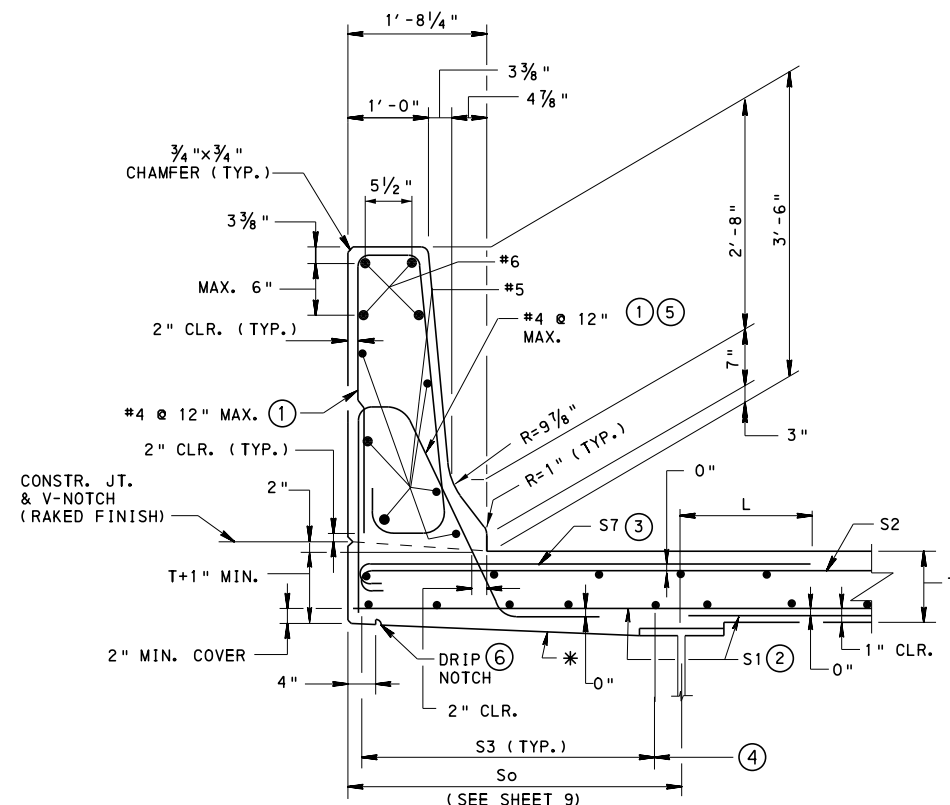
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DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONCRETE DECK SLAB
DESIGN & DETAILS
FOR BEAM BRIDGES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 10
BD-601M



- 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.
- 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 8 FOR LOCATIONS)
- ⑤ FOR EMBEDMENT INTO THE CONCRETE BARRIER, SEE SHEET 6.
- ⑥ FOR DRIP NOTCH DETAILS, SEE BC-775M.

- NOTES:

1. FOR ADDITIONAL NOTES, SEE SHEET 1.
2. BARRIER LAP SPLICE LENGTH: 3' - 7" #5 BARS
4' - 4" #6 BARS

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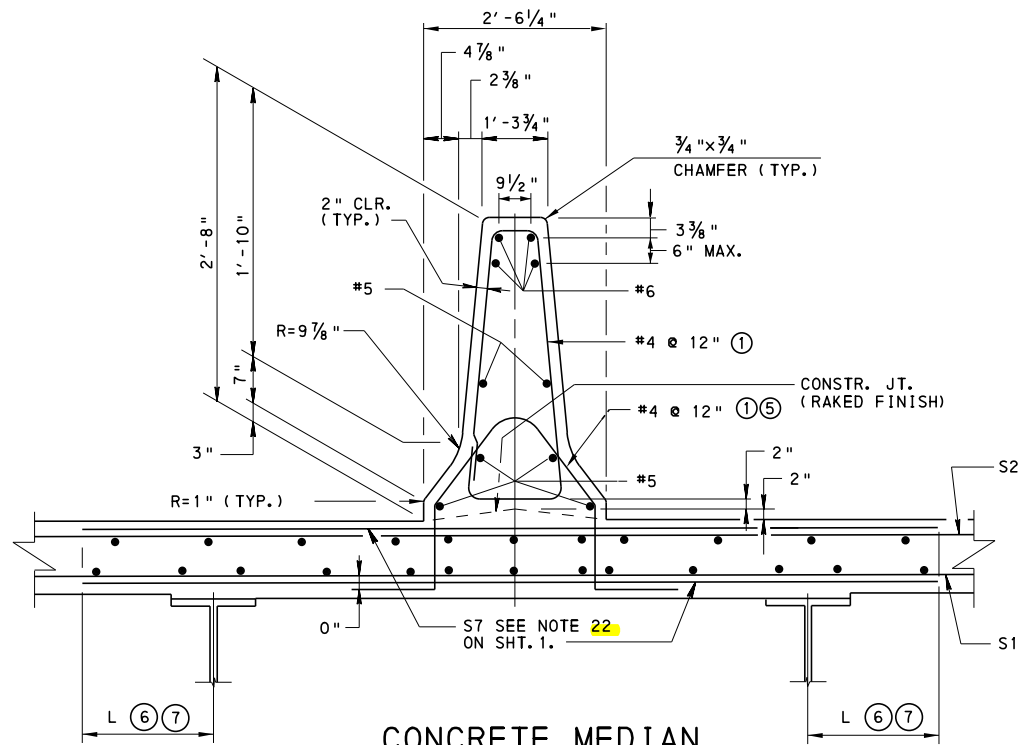
STANDARD CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES

RECOMMENDED NOV. 21, 2014
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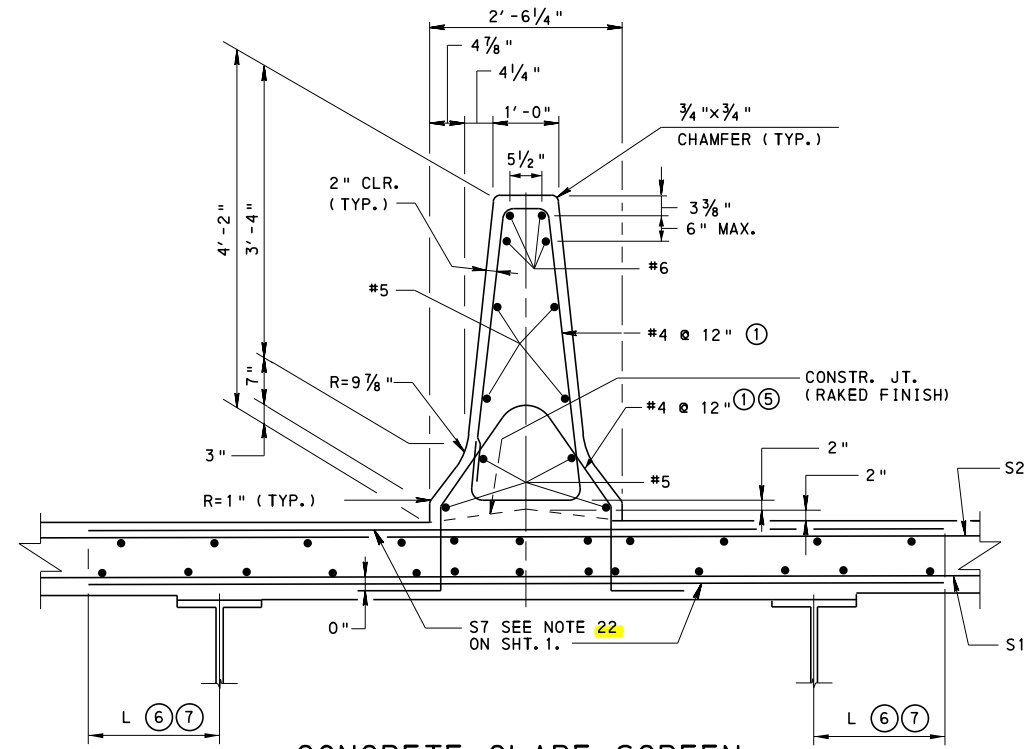
SHEET 2 OF 10

* UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.



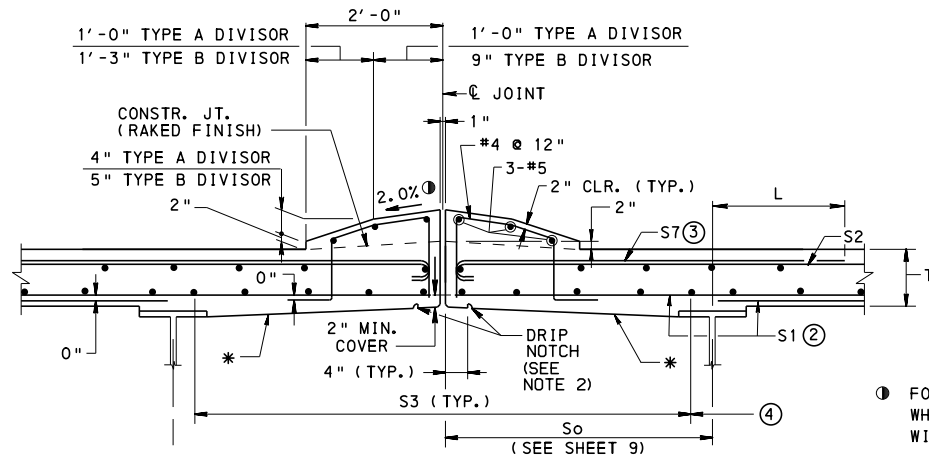
**CONCRETE MEDIAN
BARRIER DETAIL**

- FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHT. 1.
- TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS AND WHEN CONCRETE MEDIAN BARRIER IS SPECIFIED IN APPROACH ROADWAY.



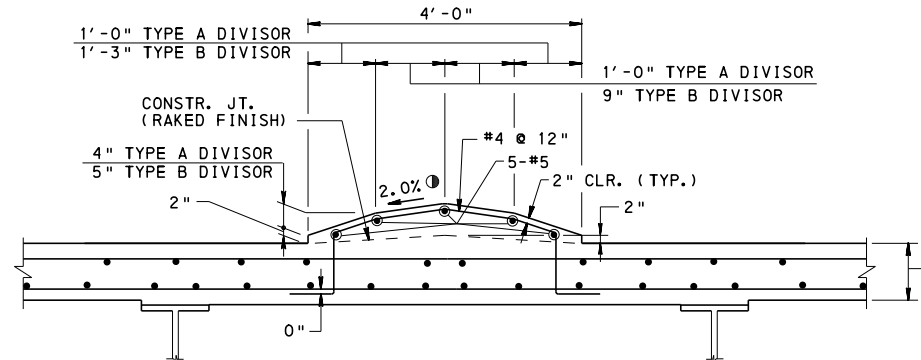
**CONCRETE GLARE SCREEN
MEDIAN BARRIER DETAIL**

- FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHT. 1.
- TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS AND WHEN CONCRETE GLARE SCREEN IS SPECIFIED IN APPROACH ROADWAY.



SPLIT CONCRETE DIVISOR DETAIL

- FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 1.
- SEE BC-788M FOR OPEN JOINT DETAIL
- NOT FOR USE AS A MEDIAN BARRIER, SEE RC-65M.



CONCRETE DIVISOR DETAIL

- FOR DECK SLAB REINFORCEMENT, SEE TYPICAL SLAB PANEL DETAILS, SHEET 1.
- TO BE USED ONLY FOR BRIDGES WITHOUT LONGITUDINAL JOINTS.
- NOT FOR USE AS A MEDIAN BARRIER, SEE RC-65M.

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.
- 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 8 FOR LOCATIONS)
- ⑤ FOR EMBEDMENT INTO THE CONCRETE BARRIER, SEE SHEET 6.
- ⑥ 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.
- ⑦ **DECK SLAB LAP SPLICE LENGTH:** NORMAL WEIGHT CONCRETE: 2'-7" #5 BARS
3'-1" #6 BARS
LIGHTWEIGHT CONCRETE: 3'-5" #5 BARS
4'-1" #6 BARS

NOTES:

1. FOR ADDITIONAL NOTES, SEE SHEET 1.
2. FOR DRIP NOTCH DETAILS, SEE BC-775M.
3. **BARRIER LAP SPLICE LENGTH:** 3'-7" #5 BARS
4'-4" #6 BARS

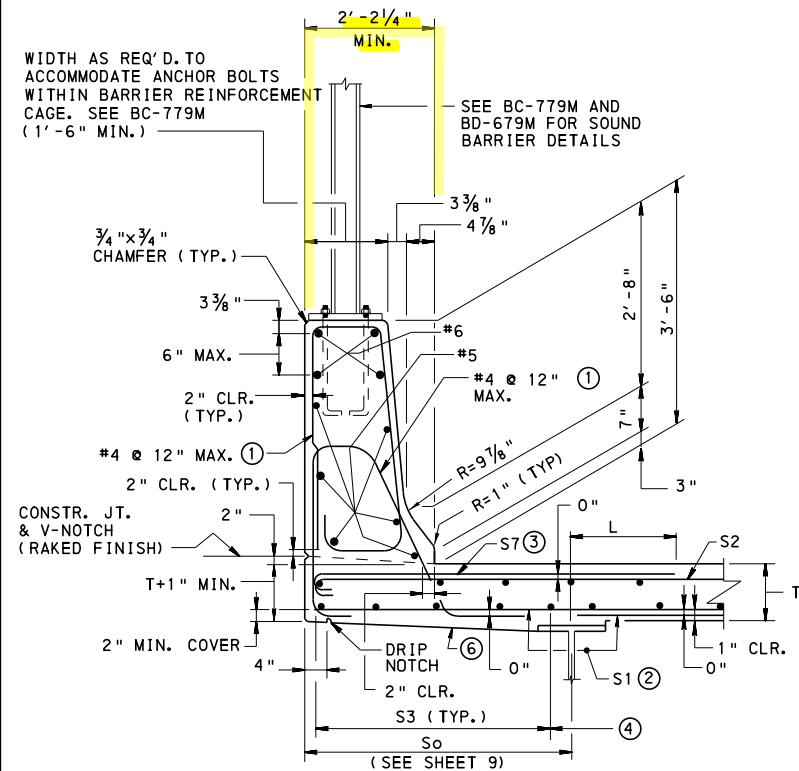
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BUREAU OF **PROJECT DELIVERY**

STANDARD
CONCRETE DECK SLAB
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FOR BEAM BRIDGES

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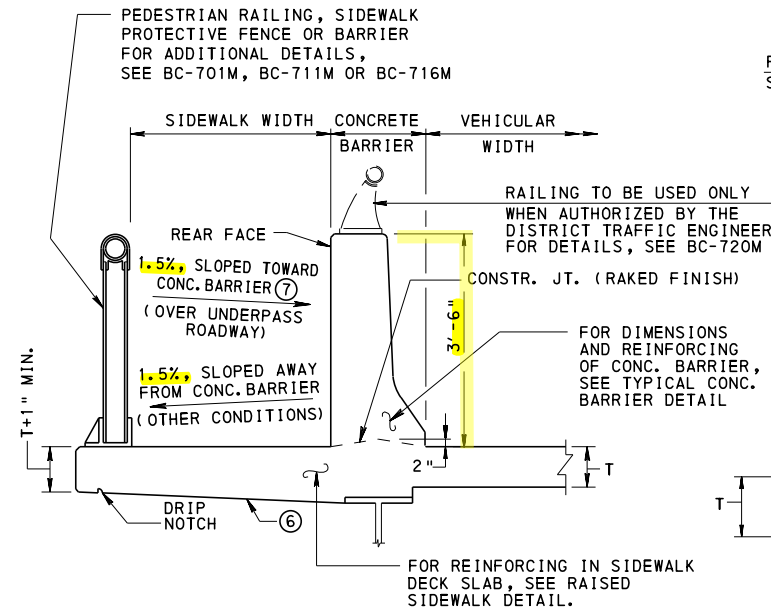
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SHEET 3 OF **10**
BD-601M

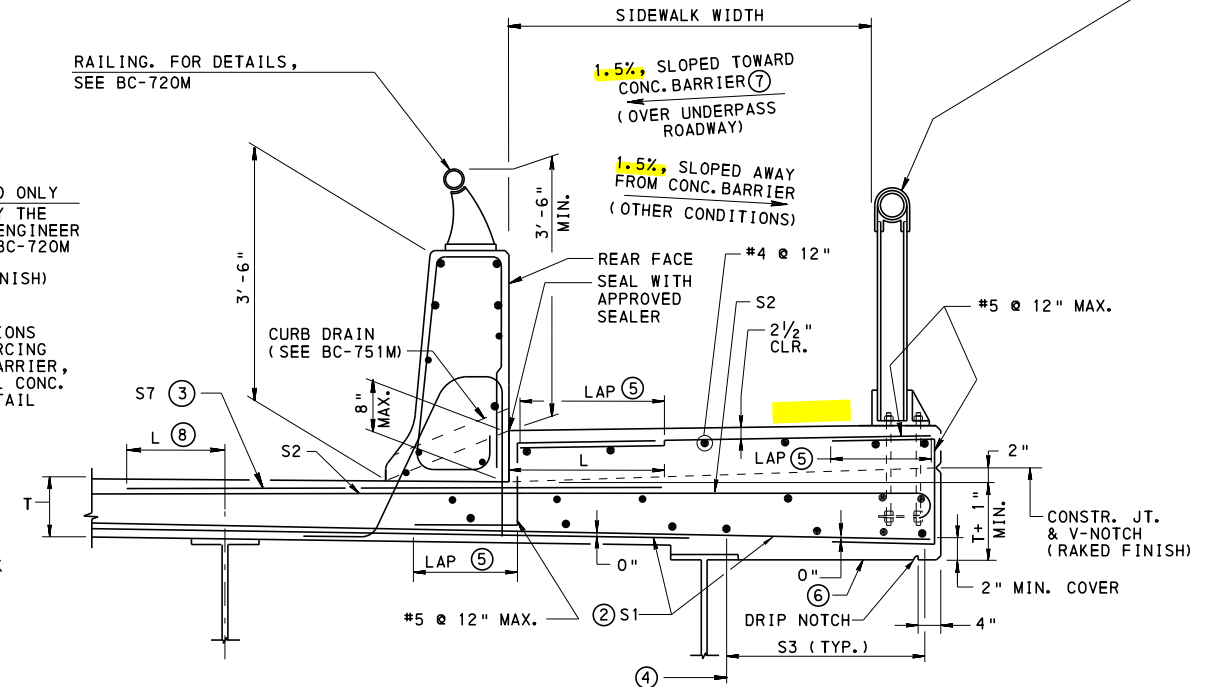


CONCRETE BARRIER WITH STRUCTURE MOUNTED SOUND BARRIER DETAIL

DETAILS SIMILAR FOR PROTECTIVE FENCE, PROTECTIVE BARRIER AND RAILINGS. SEE THE APPROPRIATE BC-STANDARD FOR THE BARRIER TOP WIDTH.



INTEGRAL SIDEWALK DETAIL



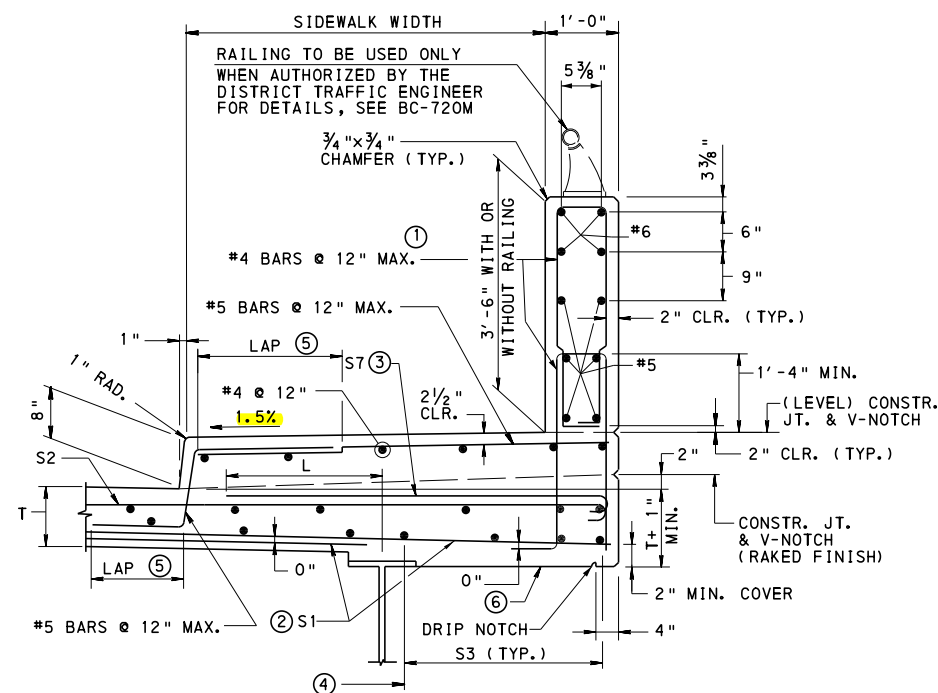
RAISED SIDEWALK DETAIL (SEE SHEET 2 FOR TYPICAL OR ALTERNATE BARRIER REINFORCEMENT)

NOTE:
ALTERNATE BARRIER REQUIRES ALTERNATE RAILING, BC-718M

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).

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.
- 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 8 FOR LOCATIONS)
- ⑤ **DECK SLAB LAP SPLICE LENGTH:** NORMAL WEIGHT CONCRETE: 2'-7" #5 BARS
3'-1" #6 BARS
LIGHTWEIGHT CONCRETE: 3'-5" #5 BARS
4'-1" #6 BARS
- ⑥ UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL
- ⑦ DRAIN RUNOFF WITH CURB DRAINS THROUGH CONC. 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 ELEVATION. THIS MAY RESULT IN INCREASED COVER FOR S2 & S7 BARS. BEVEL DRAINS AS PER BC-751M.
- ⑧ IF THE BARRIER IS POSITIONED DIRECTLY ABOVE A GIRDER THE S7 BAR IF REQUIRED MUST EXTEND A DISTANCE "L" BEYOND THE ADJACENT BEAMS ON **FRONT SIDE OF BARRIER.**



ALTERNATE SIDEWALK DETAIL

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:

1. FOR ADDITIONAL NOTES, SEE SHEET 1.
2. FOR DRIP NOTCH DETAILS, SEE BC-775M.
3. **BARRIER LAP SPLICE LENGTH:** 3'-7" #5 BARS
4'-4" #6 BARS

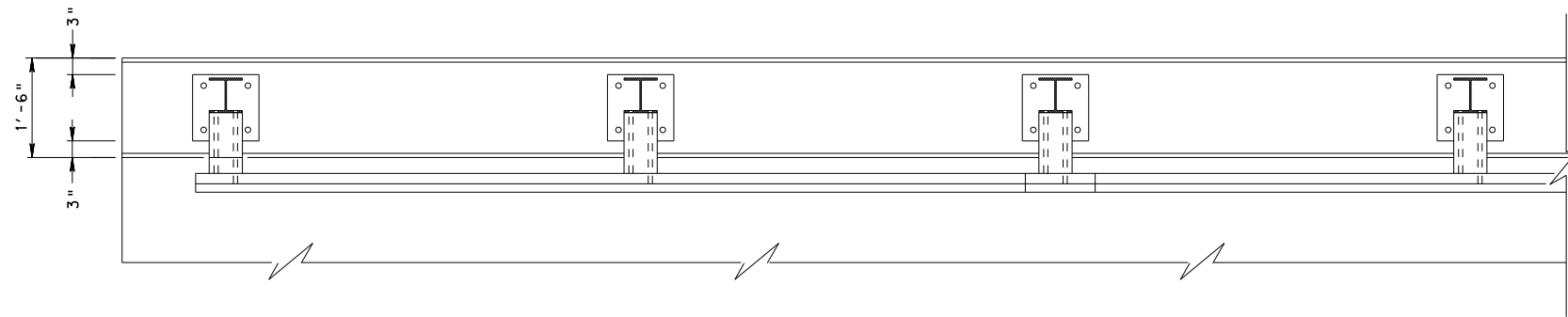
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STANDARD
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DESIGN & DETAILS
FOR BEAM BRIDGES

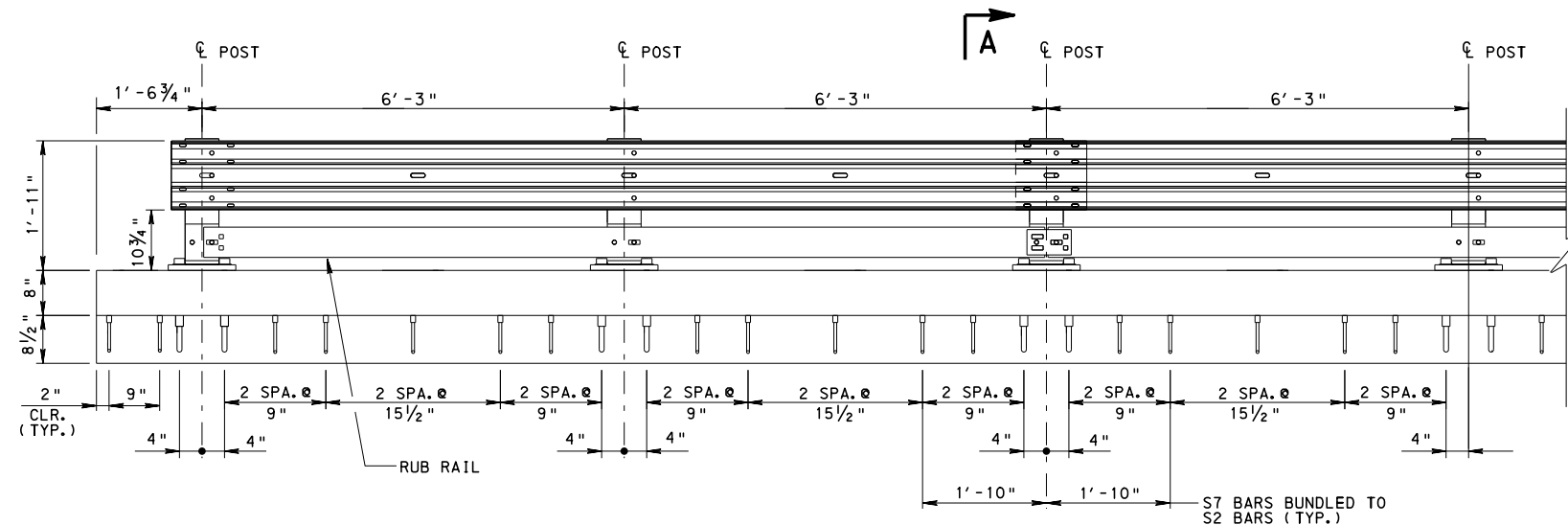
RECOMMENDED NOV. 21, 2014
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SHEET 4 OF 10
BD-601M

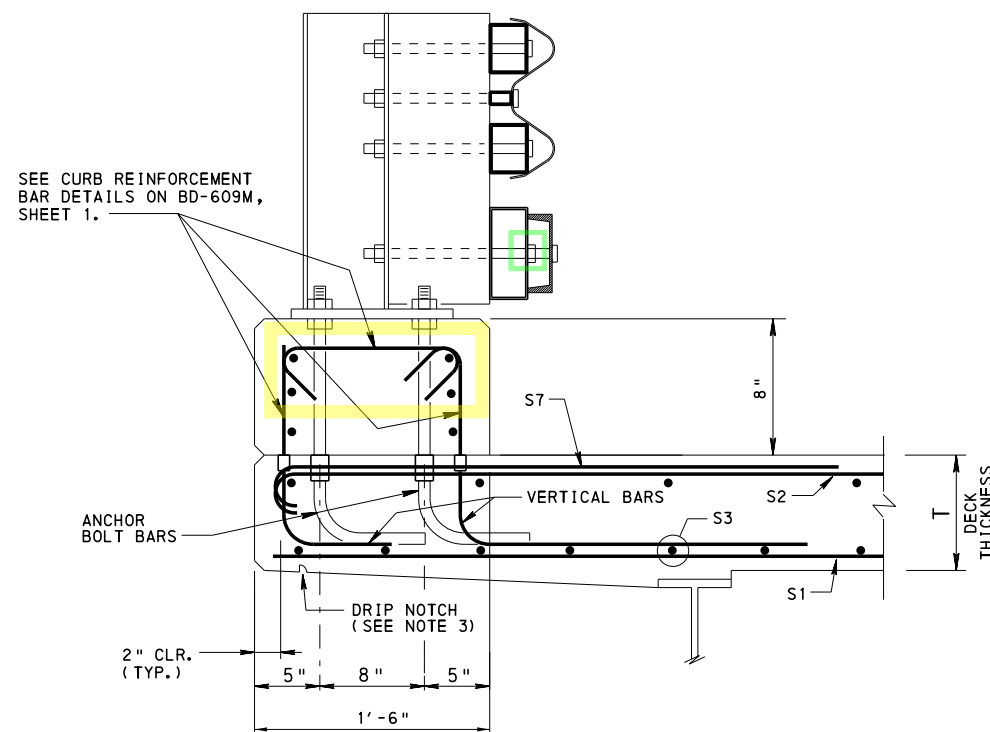


PLAN



ELEVATION

FOR SLAB AND OVERHANG REINFORCEMENT
SEE SHT. 9, TABLES 1 THRU 4.



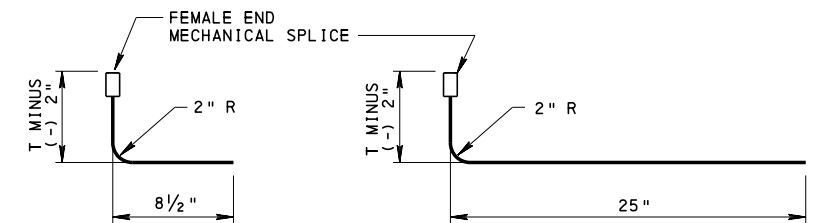
SECTION A-A

CURB REINFORCEMENT SHOWN FOR CLARITY

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

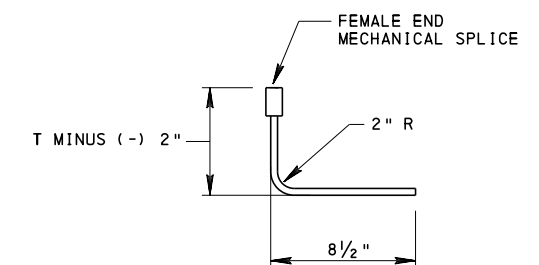
NOTES:

1. MODIFIED STRUCTURE MOUNTED GUIDE RAIL BARRIER GRANTED TL3 DESIGNATION BY FHWA.
2. FOR PA STRUCTURE MOUNTED GUIDE RAIL DETAILS SEE BD-609M.
3. FOR DRIP NOTCH DETAILS, SEE BC-775M.



VERTICAL REINFORCEMENT
ALL VERTICAL REINFORCEMENT #4

REINFORCEMENT BAR DETAILS
MECHANICAL SPLICE AS PER BULLETIN 15



ANCHOR BOLT BAR DETAIL
MECHANICAL SPLICE AS PER BULLETIN 15

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STANDARD
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PA STRUCTURE MOUNTED
GUIDE RAIL
FOR BEAM BRIDGES

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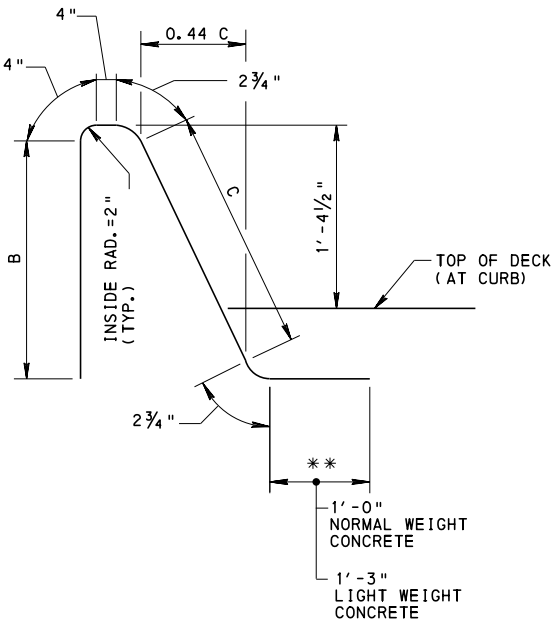
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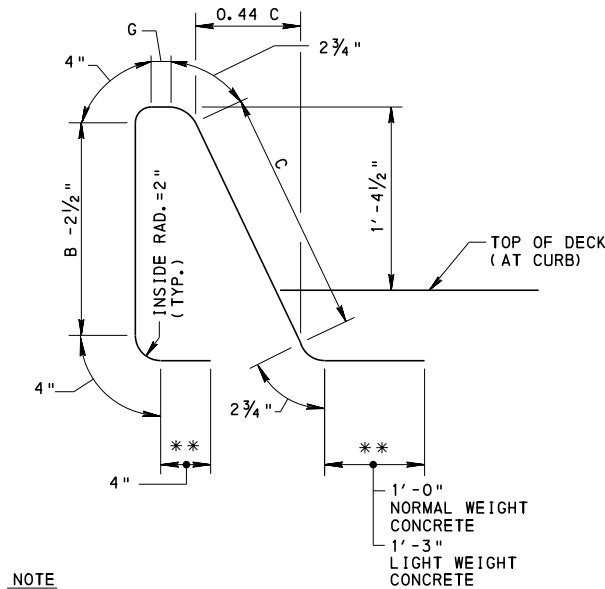
SHEET 5 OF **10**

BD-601M

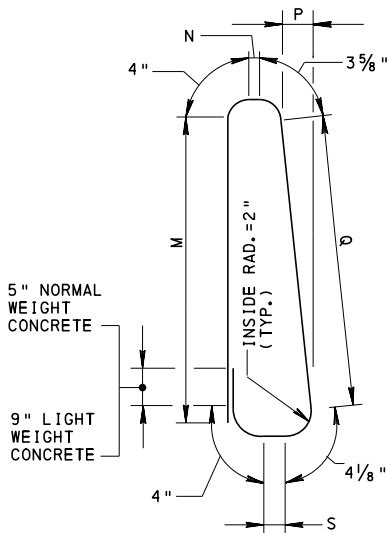
** WHEN THE DECK IS SLOPED AWAY FROM THE GUTTERLINE
 SLOPE LEG TO MATCH DECK CROSS-SLOPE. DESIGNER TO
 PROVIDE NECESSARY DIMENSIONS.



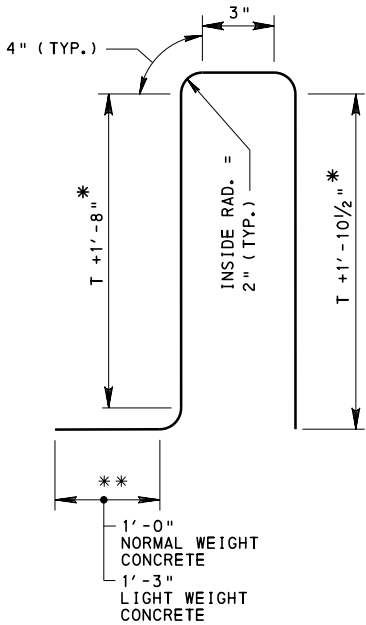
BARRIERS, SPILT GLARE SCREEN
 AND SPLIT MEDIAN BARRIERS
 (FOR DIMENSIONS "B" AND "C", SEE TABLE 1)



NOTE
 DIMENSION G TO BE
 DETERMINED BY THE DESIGNER
 BARRIERS WITH SOUND BARRIERS
 AND ALUMINUM PROTECTIVE BARRIER
 (FOR DIMENSIONS "B" AND "C", SEE TABLE 1)



BARRIERS, SPLIT GLARE SCREEN
 AND SPLIT MEDIAN BARRIER
 (FOR DIMENSIONS M, N, P, Q AND S, SEE TABLE 2)
 (DETERMINE DIMENSIONS N AND S FOR BARRIER
 WITH SOUND BARRIER)



ALTERNATE SIDEWALK
 * DETAILED FOR SIDEWALK WIDTHS
 OF 8' - 0" AND LESS

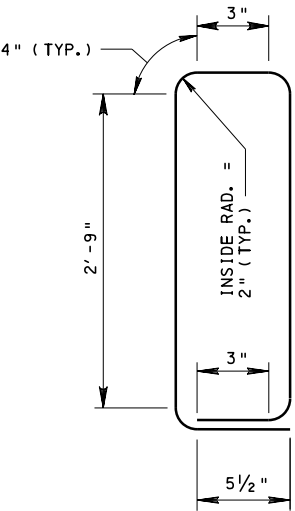


TABLE 1

B AND C DIMENSIONS		
T	BARRIERS, SPLIT MEDIAN AND SPLIT GLARE SCREEN 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
TYPICAL BARRIER	2' - 9 1/2 "	3 3/8 "	3 3/8 "	2' - 7 3/4 "	6 3/4 "
ALTERNATE BARRIER AND SPLIT MEDIAN BARRIER	1' - 11 1/2 "	4 1/2 "	2 1/4 "	1' - 9 3/4 "	6 3/4 "
SPLIT GLARE SCREEN MEDIAN BARRIER	3' - 5 1/2 "	2 1/2 "	4 1/8 "	3' - 3 3/4 "	6 3/4 "

REINFORCEMENT DETAILS

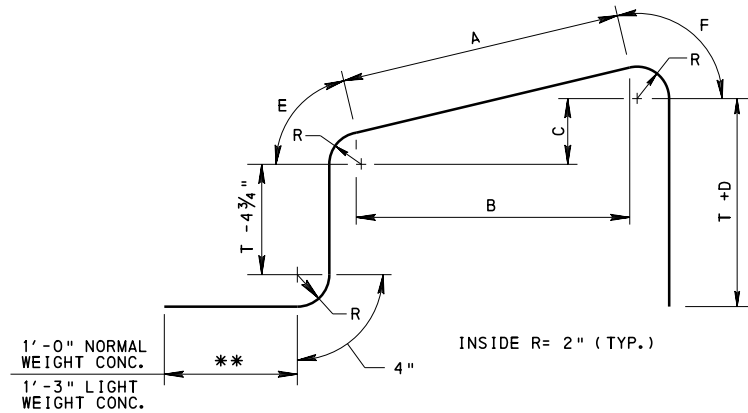
REINFORCEMENT BAR NOTES

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.

COMMONWEALTH OF PENNSYLVANIA
 DEPARTMENT OF TRANSPORTATION
 BUREAU OF PROJECT DELIVERY

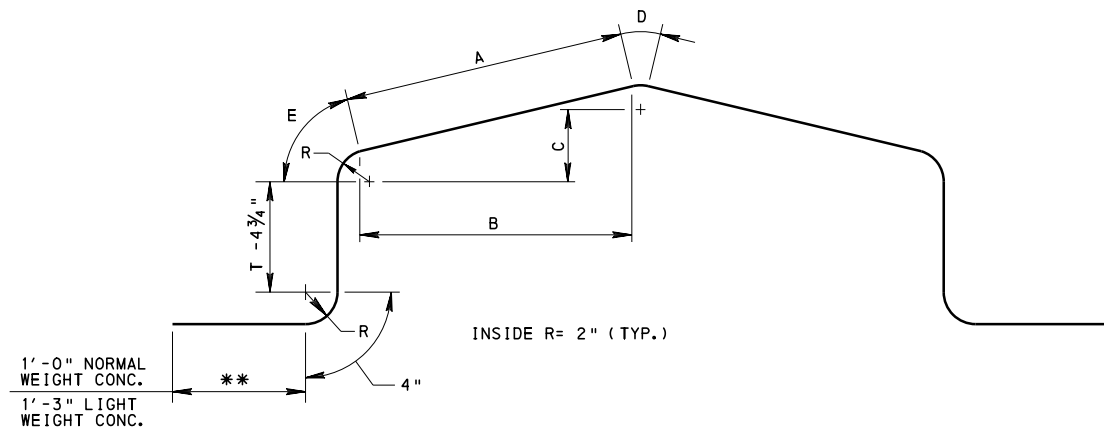
STANDARD
 CONCRETE DECK SLAB
 DESIGN & DETAILS
 FOR BEAM BRIDGES



SPLIT CONCRETE 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)



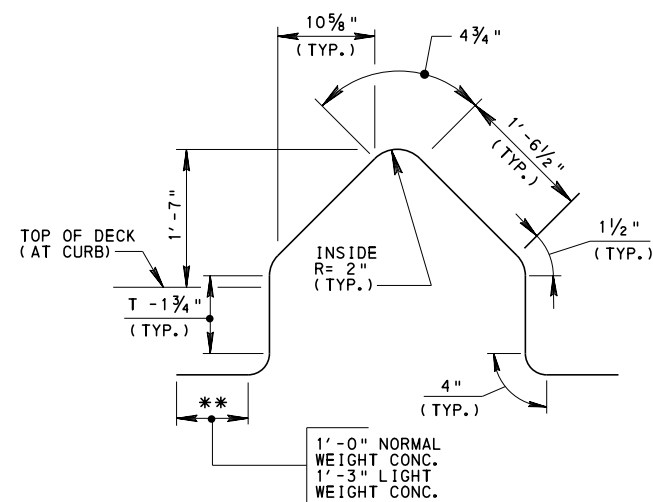
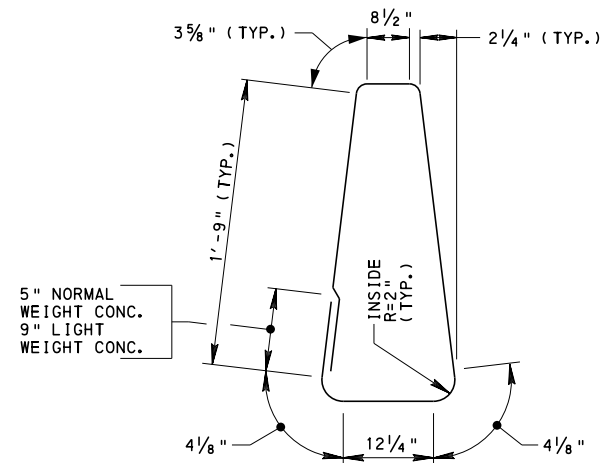
CONCRETE DIVISOR
(FOR DIMENSIONS A, B, C, D, AND E, SEE TABLE 4)

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"

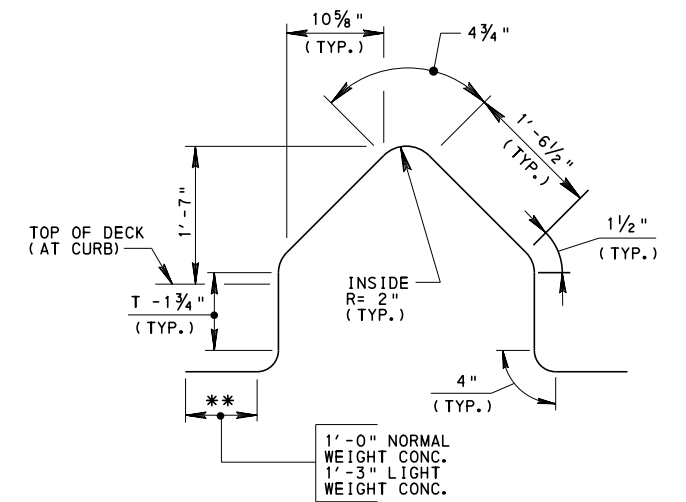
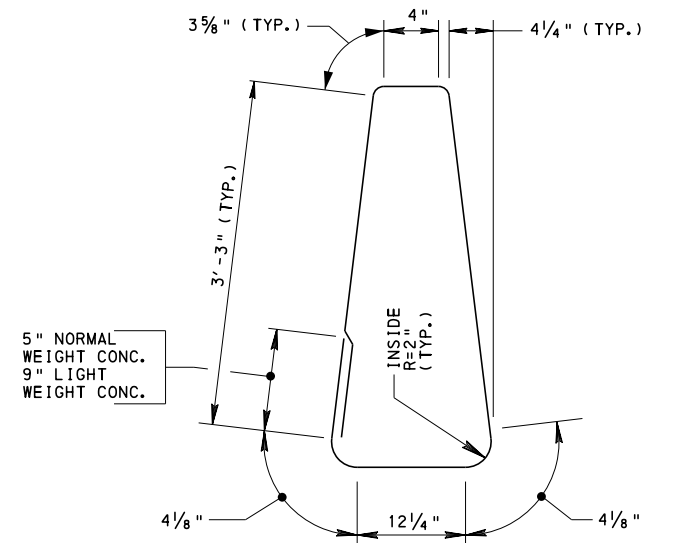
(WHERE WIDER THAN SHOWN DIVISORS ARE USED, PROVIDE WIDTH AND A, B, AND C DIMENSIONS)

REINFORCEMENT DETAILS

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



MEDIAN BARRIER



**GLARE SCREEN
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.

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

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

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thomas
ACTING DIR. BUR. OF **PROJECT DELIVERY**

SHEET 7 OF **10**
BD-601M

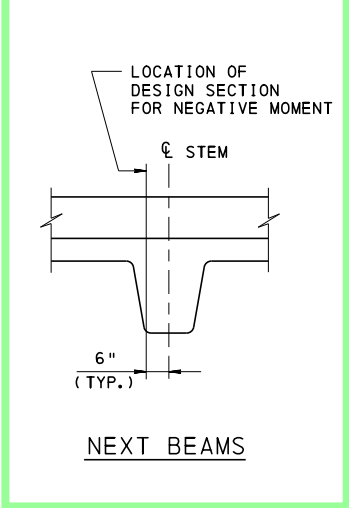
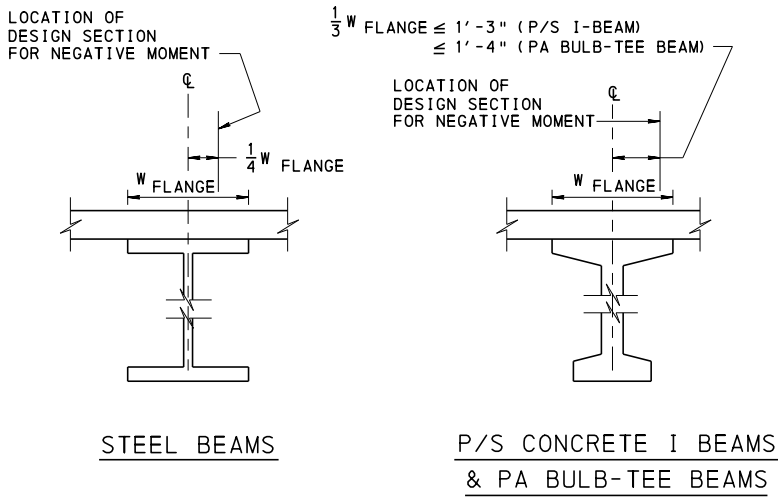
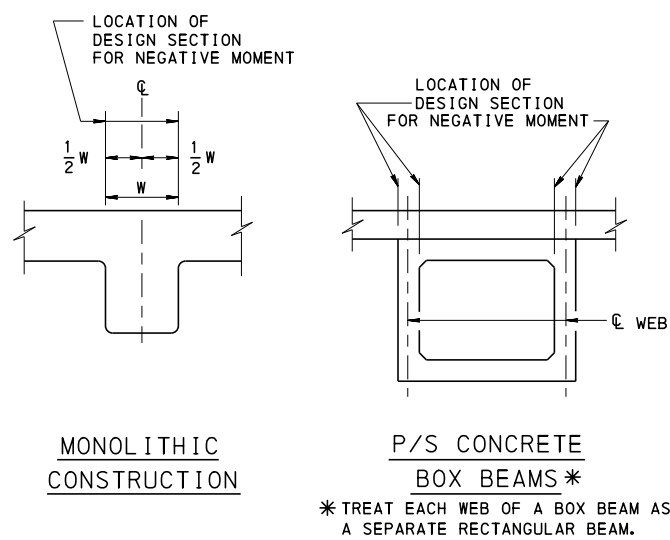
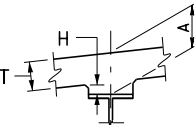
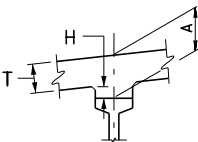


TABLE 1: MINIMUM HAUNCH THICKNESSES		
STEEL I-BEAMS AND PLATE GIRDERS		
PLAN CAMBER	H	
UP TO 1½"	½"	
OVER 1½" TO 3"	¾"	
OVER 3"	1"	
P/S CONC. I-BEAMS, PA BULB-TEE AND SPREAD BOX BEAMS		
PLAN CAMBER	H	
ALL	½"	
<div>1. "T" IS THE DECK THICKNESS AS INDICATED ON SHEETS 1, 2, 3 AND 4.</div> <div>2. PROVIDE 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><div>•DECK THICKNESS, "T"</div><div>•MINIMUM HAUNCH THICKNESS, "H"</div><div>•EFFECT OF DECK CROSS SLOPE</div></div>		

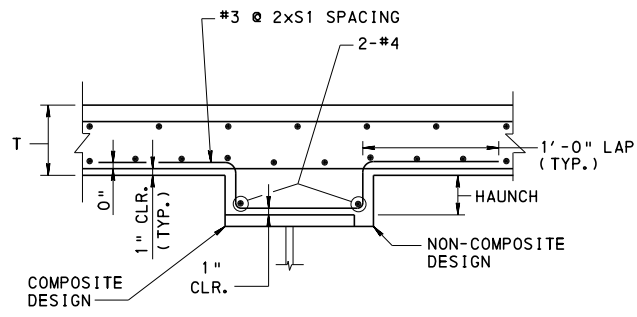


STEEL BEAM/GIRDER

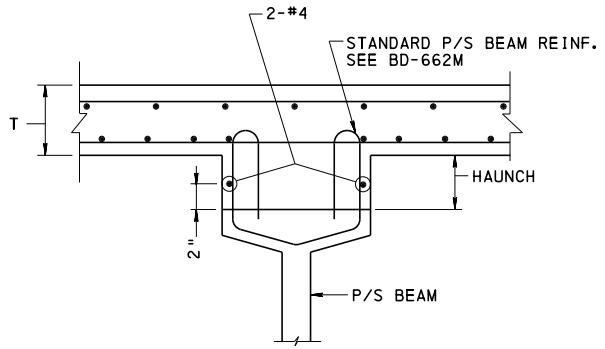


P/S CONCRETE BEAM

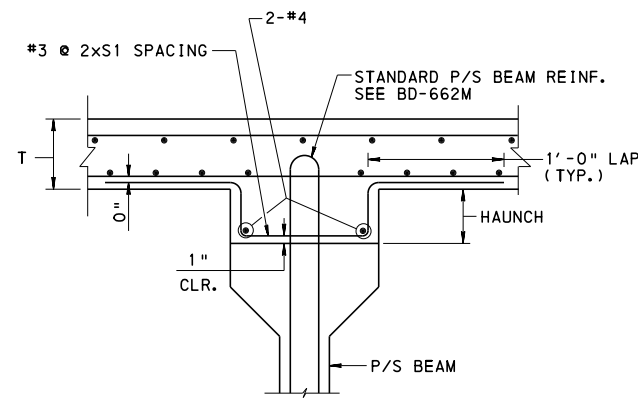
LOCATION OF DESIGN SECTION FOR NEGATIVE MOMENT IN DECK SLABS



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



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



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.

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:

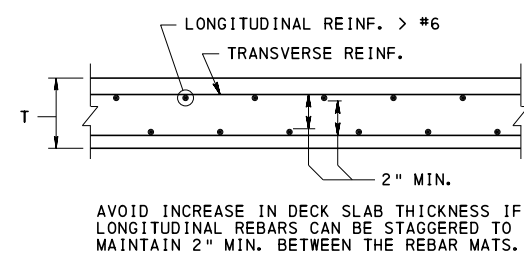
WHEN HAUNCH REINFORCEMENT IS REQUIRED

"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. "



ALTERNATE CONTINUITY REINFORCEMENT DETAIL
AVOID INCREASE IN DECK SLAB THICKNESS IF LONGITUDINAL REBARS CAN BE STAGGERED TO MAINTAIN 2" MIN. BETWEEN THE REBAR MATS.

NOTES:
FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONCRETE DECK SLAB
DESIGN & DETAILS
FOR BEAM BRIDGES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 8 OF 10
BD-601M

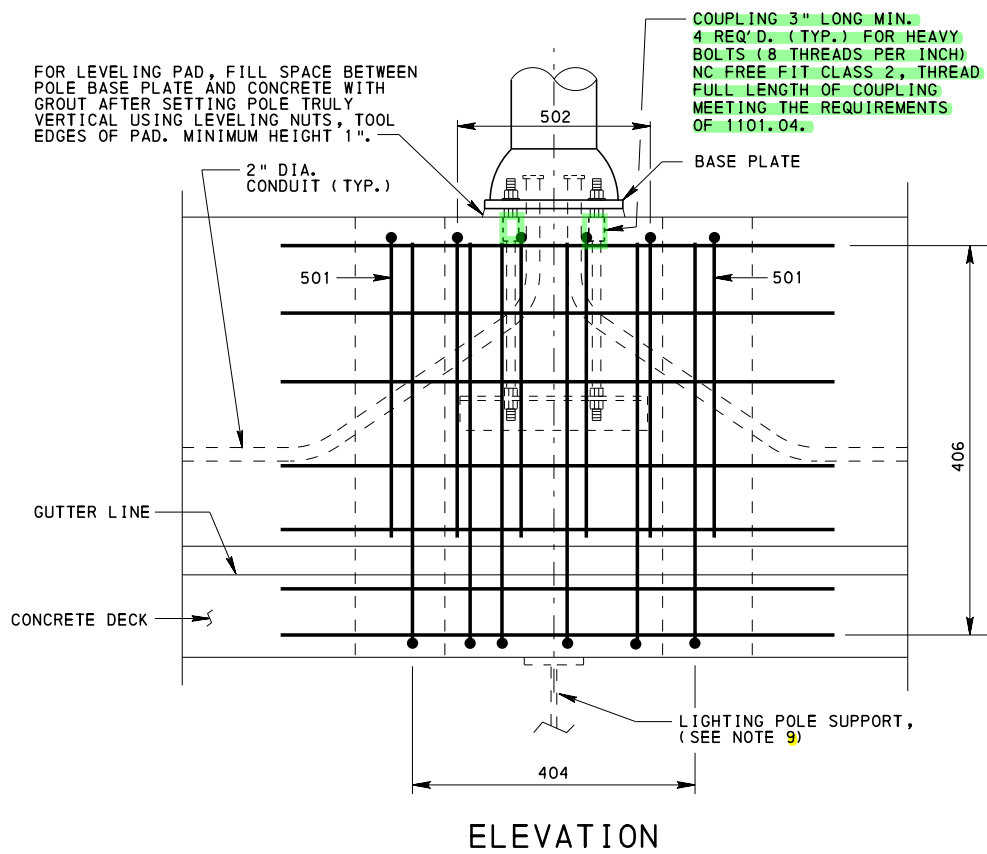
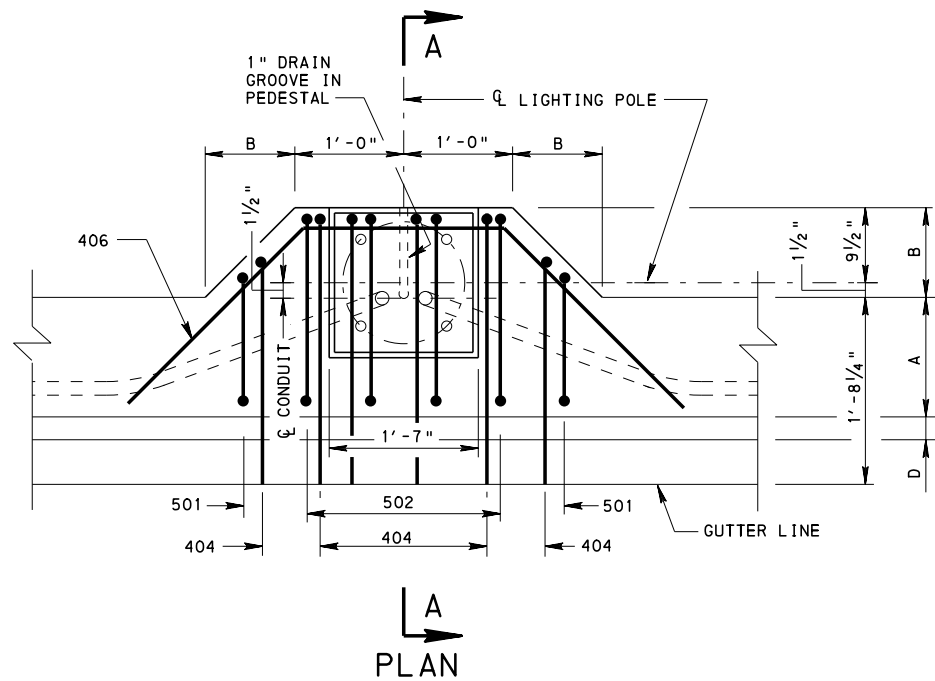
TABLE 1: DISTANCE FROM DESIGN SECTION FOR NEGATIVE MOMENT TO CENTERLINE OF BEAM = 0 IN.										
USE FOR: * PRECAST PRESTRESSED SPREAD BOX BEAMS * PLANK BEAMS * STEEL I-BEAMS WITH TOP FLANGE WIDTH < 12"										
S	T (in.)	S1	S2	S3	S3'	S6	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5 1 #6	2'-8"	3'-1"		
4'-7"	8	#5 Ø9-1/2	#5 Ø10	#4 Ø9	#4 Ø6	#5 1 #5	2'-10"	3'-1"		
4'-11"	8	#5 Ø9	#5 Ø9	#4 Ø9	#4 Ø6	#5 1 #5	3'-1"	2'-10"		
5'-2"	8	#5 Ø9	#5 Ø8	#4 Ø9	#4 Ø6	#5 1 #4	3'-3"	2'-10"		
5'-6"	8	#5 Ø9	#5 Ø7-1/2	#4 Ø8-1/2	#4 Ø6	#5 1 #4	3'-5"	2'-10"		
5'-10"	8	#5 Ø9	#5 Ø7	#4 Ø8-1/2	#4 Ø6	#5 1 #4	3'-8"	2'-5"		
6'-2"	8	#5 Ø8-1/2	#5 Ø6-1/2	#4 Ø8	#4 Ø6	#5 1 #4	3'-10"	2'-6"		
6'-6"	8	#5 Ø8	#5 Ø6	#4 Ø7-1/2	#4 Ø6	#5 1 #4	4'-1"	2'-4"		
6'-10"	8	#5 Ø8	#5 Ø5-1/2	#4 Ø7-1/2	#4 Ø6	#5 1 #4	4'-3"	2'-3"		
7'-2"	8	#5 Ø7-1/2	#5 Ø5-1/2	#5 Ø11	#5 Ø6	#5 1 #4	4'-5"	2'-3"		
7'-6"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø11	#5 Ø6	#5 1 #4	4'-5"	2'-3"		
7'-10"	8	#5 Ø7	#6 Ø7	#5 Ø10	#5 Ø6	#5 ---	3'-9"	---	B,C	
8'-2"	8	#5 Ø7	#6 Ø7	#5 Ø10	#5 Ø6	#5 ---	3'-9"	---	B,C	
8'-6"	8	#5 Ø7	#6 Ø7	#5 Ø10	#5 Ø6	#5 ---	3'-9"	---	B,C	
8'-10"	8	#5 Ø6-1/2	#6 Ø6-1/2	#5 Ø9-1/2	#5 Ø6	#5 ---	3'-10"	---	B,C	
9'-2"	8-1/2	#5 Ø6-1/2	#6 Ø7	#5 Ø9-1/2	#5 Ø6	#6 ---	3'-11"	---	B,C	
9'-6"	8-1/2	#5 Ø6-1/2	#6 Ø7	#5 Ø9-1/2	#5 Ø6	#6 ---	3'-11"	---	B,C	
9'-10"	8-1/2	#5 Ø6	#6 Ø6-1/2	#5 Ø9	#5 Ø6	#6 ---	4'-0"	---	B,C	
10'-2"	9	#5 Ø6-1/2	#6 Ø6-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	4'-3"	---	B,C	
10'-5"	9	#5 Ø6	#6 Ø6	#5 Ø9	#5 Ø6	#6 ---	4'-5"	---	B,C	
10'-9"	9	#5 Ø6	#6 Ø6	#5 Ø9	#5 Ø6	#6 ---	4'-5"	---	B,C	
11'-1"	9-1/2	#5 Ø6	#6 Ø6	#5 Ø9	#5 Ø6	#6 ---	4'-7"	---	B,C	
11'-5"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	4'-10"	---	B,C	
11'-9"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	3'-11"	---	B,C	
12'-1"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	4'-10"	---	B,C	
12'-5"	10	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	5'-2"	---	B,C	
12'-9"	10	#5 Ø6	#6 Ø5-1/2	#5 Ø10	#5 Ø6	#6 ---	5'-2"	---	B,C	
13'-1"	10-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10	#5 Ø6	#6 ---	5'-5"	---	B,C	
13'-5"	10-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10	#5 Ø6	#6 ---	5'-5"	---	B,C	
13'-9"	11	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	#5 Ø6	#6 ---	5'-8"	---	B,C	
14'-1"	11-1/2	#5 Ø6-1/2	#6 Ø5-1/2	#5 Ø11	#5 Ø6	#6 ---	6'-0"	---		
14'-5"	11-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	#5 Ø6	#6 ---	6'-0"	---		
14'-9"	11-1/2	#5 Ø6-1/2	#6 Ø5-1/2	#5 Ø11	#5 Ø6	#6 ---	6'-0"	---		
15'-1"	11-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø11	#5 Ø6	#6 ---	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	S3'	S6	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5 1 #6	2'-8"	3'-3"		
4'-7"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5 1 #6	2'-10"	3'-3"		
4'-11"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5 1 #6	3'-1"	3'-4"		
5'-2"	8	#5 Ø9	#5 Ø11	#4 Ø9	#4 Ø6	#5 1 #6	3'-3"	3'-6"		
5'-6"	8	#5 Ø9	#5 Ø10	#4 Ø8-1/2	#4 Ø6	#5 1 #5	3'-5"	3'-2"		
5'-10"	8	#5 Ø9	#5 Ø9	#4 Ø8-1/2	#4 Ø6	#5 1 #5	3'-8"	3'-2"		
6'-2"	8	#5 Ø8-1/2	#5 Ø9	#4 Ø8	#4 Ø6	#5 1 #5	3'-10"	3'-2"		
6'-6"	8	#5 Ø8	#5 Ø8-1/2	#4 Ø7-1/2	#4 Ø6	#5 1 #4	4'-0"	3'-1"		
6'-10"	8	#5 Ø8	#5 Ø8	#4 Ø7-1/2	#4 Ø6	#5 1 #4	4'-2"	3'-0"		
7'-2"	8	#5 Ø7-1/2	#5 Ø7-1/2	#5 Ø11	#5 Ø6	#5 1 #4	4'-3"	3'-0"	A,C	
7'-6"	8	#5 Ø7	#5 Ø7	#5 Ø11	#5 Ø6	#5 1 #4	4'-5"	3'-0"	A,C	
7'-10"	8	#5 Ø7	#5 Ø7	#5 Ø10	#5 Ø6	#5 1 #4	4'-5"	3'-0"	A,C	
8'-2"	8	#5 Ø7	#5 Ø7	#5 Ø10	#5 Ø6	#5 1 #4	4'-5"	2'-11"	A,C	
8'-6"	8	#5 Ø7	#5 Ø6-1/2	#5 Ø10	#5 Ø6	#5 1 #4	4'-7"	2'-9"	A,C	
8'-10"	8	#5 Ø6-1/2	#5 Ø6-1/2	#5 Ø9-1/2	#5 Ø6	#5 1 #4	4'-7"	2'-11"	A,C	
9'-2"	8	#5 Ø6	#5 Ø6	#5 Ø9	#5 Ø6	#5 1 #4	4'-10"	2'-9"	A,C	
9'-6"	8	#5 Ø6	#5 Ø5-1/2	#5 Ø9	#5 Ø6	#5 1 #4	5'-0"	2'-9"	A,C	
9'-10"	8	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø8-1/2	#5 Ø6	#5 1 #4	5'-0"	2'-9"	A,C	
10'-2"	8-1/2	#5 Ø6	#5 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	4'-3"	---	B,C	
10'-5"	8-1/2	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø8-1/2	#5 Ø6	#6 ---	4'-3"	---	B,C	
10'-9"	8-1/2	#5 Ø5-1/2	#6 Ø7	#5 Ø8-1/2	#5 Ø6	#6 ---	4'-5"	---	B,C	
11'-1"	9	#5 Ø5-1/2	#6 Ø7	#5 Ø8-1/2	#5 Ø6	#6 ---	4'-7"	---	B,C	
11'-5"	9	#5 Ø5-1/2	#6 Ø6-1/2	#5 Ø8-1/2	#5 Ø6	#6 ---	4'-9"	---	B,C	
11'-9"	9	#5 Ø5-1/2	#6 Ø6-1/2	#5 Ø8-1/2	#5 Ø6	#6 ---	4'-9"	---	B,C	
12'-1"	9-1/2	#5 Ø5-1/2	#6 Ø6	#5 Ø8-1/2	#5 Ø6	#6 ---	5'-3"	---	B,C	
12'-5"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-6"	---	B,C	
12'-9"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø8	#5 Ø6	#6 ---	5'-6"	---	B,C	
13'-1"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-6"	---	B,C	
13'-5"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø8-1/2	#5 Ø6	#6 ---	5'-6"	---	B,C	
13'-9"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø8-1/2	#5 Ø6	#6 ---	5'-6"	---	B,C	
14'-1"	10	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-10"	---	B,C	
14'-5"	10	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-10"	---	B,C	
14'-9"	10-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	6'-0"	---		
15'-1"	10-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	6'-0"	---		

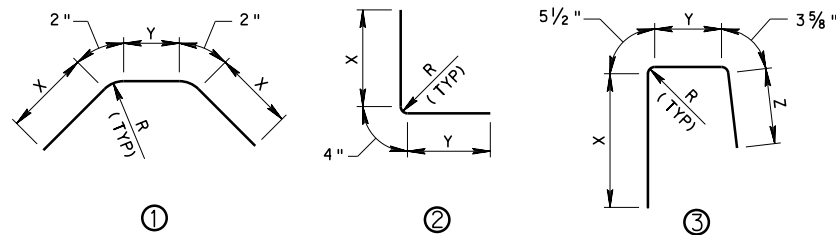
- DESIGN NOTES:
- BEAM SPACING, "S"
 - ALL EXCEPT SPREAD BOX BEAMS AND NEXT BEAMS:
 - S = MAXIMUM BEAM SPACING, CENTERLINE TO CENTERLINE OF ADJACENT BEAMS
 - SPREAD BOX BEAMS:
 - S = MAXIMUM BEAM SPACING - 2'-7" [36" WIDE BEAMS]
 - S = MAXIMUM BEAM SPACING - 3'-7" [48" WIDE BEAMS]
 - NEXT BEAMS:
 - S = 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 26, 27 AND 28 ON SHEET 1 FOR ADDITIONAL LIMITATIONS.
 - FOR LOCATION OF REINFORCEMENT BARS, SEE SHEETS 1, 2, 3 AND 4. FOR LOCATION OF DIMENSION "L", SEE SHEETS 2, 3 AND 4.

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 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5 1 #6	2'-8"	3'-0"		
4'-7"	8	#5 Ø9-1/2	#5 Ø11	#4 Ø9	#4 Ø6	#5 1 #6	2'-10"	3'-2"		
4'-11"	8	#5 Ø9	#5 Ø10	#4 Ø9	#4 Ø6	#5 1 #5	3'-1"	2'-10"		
5'-2"	8	#5 Ø9	#5 Ø9	#4 Ø9	#4 Ø6	#5 1 #5	3'-3"	2'-11"		
5'-6"	8	#5 Ø9	#5 Ø8-1/2	#4 Ø8-1/2	#4 Ø6	#5 1 #4	3'-5"	3'-0"		
5'-10"	8	#5 Ø9	#5 Ø8	#4 Ø8-1/2	#4 Ø6	#5 1 #4	3'-8"	2'-9"		
6'-2"	8	#5 Ø8-1/2	#5 Ø7-1/2	#4 Ø8	#4 Ø6	#5 1 #4	3'-10"	2'-8"		
6'-6"	8	#5 Ø8	#5 Ø7-1/2	#4 Ø7-1/2	#4 Ø6	#5 1 #4	4'-1"	2'-8"		
6'-10"	8	#5 Ø8	#5 Ø7	#4 Ø7-1/2	#4 Ø6	#5 1 #4	4'-2"	2'-8"	A,C	
7'-2"	8	#5 Ø7-1/2	#5 Ø6-1/2	#5 Ø11	#5 Ø6	#5 1 #4	4'-4"	2'-6"	A,C	
7'-6"	8	#5 Ø7	#5 Ø6	#5 Ø11	#5 Ø6	#5 1 #4	4'-6"	2'-6"	A,C	
7'-10"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø10	#5 Ø6	#5 1 #4	4'-8"	2'-6"	A,C	
8'-2"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø10	#5 Ø6	#5 1 #4	4'-8"	2'-6"	A,C	
8'-6"	8	#5 Ø7	#5 Ø5-1/2	#5 Ø10	#5 Ø6	#5 1 #4	4'-8"	2'-6"	A,C	
8'-10"	8	#5 Ø6-1/2	#5 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#5 1 #4	4'-8"	2'-4"	A,C	
9'-2"	8	#5 Ø6	#5 Ø5-1/2	#5 Ø9	#5 Ø6	#5 1 #4	4'-8"	2'-6"	A,C	
9'-6"	8-1/2	#5 Ø6-1/2	#5 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	4'-0"	---	B,C	
9'-10"	8-1/2	#5 Ø6	#5 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	4'-0"	---	B,C	
10'-2"	8-1/2	#5 Ø6	#6 Ø7	#5 Ø9	#5 Ø6	#6 ---	4'-2"	---	B,C	
10'-5"	9	#5 Ø6	#6 Ø7	#5 Ø9	#5 Ø6	#6 ---	4'-4"	---	B,C	
10'-9"	9	#5 Ø6	#6 Ø6-1/2	#5 Ø9	#5 Ø6	#6 ---	4'-6"	---	B,C	
11'-1"	9	#5 Ø5-1/2	#6 Ø6	#5 Ø8-1/2	#5 Ø6	#6 ---	4'-8"	---	B,C	
11'-5"	9-1/2	#5 Ø6	#6 Ø6-1/2	#5 Ø9	#5 Ø6	#6 ---	4'-8"	---	B,C	
11'-9"	9-1/2	#5 Ø6	#6 Ø6	#5 Ø9	#5 Ø6	#6 ---	4'-11"	---	B,C	
12'-1"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-2"	---	B,C	
12'-5"	9-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	5'-2"	---	B,C	
12'-9"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-2"	---	B,C	
13'-1"	9-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-2"	---	B,C	
13'-5"	10	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9	#5 Ø6	#6 ---	5'-6"	---	B,C	
13'-9"	10-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10	#5 Ø6	#6 ---	5'-6"	---	B,C	
14'-1"	10-1/2	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	5'-8"	---	B,C	
14'-5"	11	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	#5 Ø6	#6 ---	6'-0"	---		
14'-9"	11	#5 Ø5-1/2	#6 Ø5-1/2	#5 Ø9-1/2	#5 Ø6	#6 ---	6'-0"	---		
15'-1"	11-1/2	#5 Ø6	#6 Ø5-1/2	#5 Ø10-1/2	#5 Ø6	#6 ---	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	S3'	S6	S7+	So	L	NOTES
4'-3"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5	#16	2'-8"	3'-9"	
4'-7"	8	#5 Ø9-1/2	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5	#16	2'-10"	3'-9"	
4'-11"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5	#16	3'-1"	3'-9"	
5'-2"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø9	#4 Ø6	#5	#16	3'-3"	3'-9"	
5'-6"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø8-1/2	#4 Ø6	#5	#16	3'-5"	3'-9"	
5'-10"	8	#5 Ø9	#5 Ø11-1/2	#4 Ø8-1/2	#4 Ø6	#5	#16	3'-8"	3'-10"	
6'-2"	8	#5 Ø8-1/2	#5 Ø11-1/2	#4 Ø8	#4 Ø6	#5	#16	3'-10"	3'-11"	
6'-6"	8	#5 Ø8	#5 Ø11-1/2	#4 Ø7-1/2	#4 Ø6	#5	#16	4'-1"	4'-1"	
6'-10"	8	#5 Ø8	#5 Ø11	#4 Ø7-1/2	#4 Ø6	#5	#16	4'-3"	4'-0"	
7'-2"	8	#5 Ø7-1/2	#5 Ø11	#5 Ø11	#5 Ø6	#5	#16	4'-6"	4'-0"	
7'-6"	8	#5 Ø7	#5 Ø10	#5 Ø11	#5 Ø6	#5	#15	4'-8"	3'-10"	
7'-10"	8	#5 Ø7	#5 Ø9-1/2	#5 Ø10	#5 Ø6	#5	#15	4'-10"	3'-10"	
8'-2"	8	#5 Ø7	#5 Ø9	#5 Ø10	#5 Ø6	#5	#15	4'-11"	3'-10"	
8'-6"	8	#5 Ø7	#5 Ø9	#5 Ø10	#5 Ø6	#5	#15	4'-11"	3'-10"	
8'-10"	8	#5 Ø6-1/2	#5 Ø8-1/2	#5 Ø9-1/2	#5 Ø6	#5	#14	4'-8"	3'-9"	
9'-2"	8	#5 Ø6	#5 Ø8	#5 Ø9	#5 Ø6	#5	#14	4'-10"	3'-8"	
9'-6"	8	#5 Ø6	#5 Ø7-1/2	#5 Ø9	#5 Ø6	#5	#14	4'-11"	3'-8"	A,C
9'-10"	8	#5 Ø5-1/2	#5 Ø7	#5 Ø8-1/2	#5 Ø6	#5	#14	5'-1"	3'-5"	A,C
10'-2"	8	#5 Ø5-1/2	#5 Ø7	#5 Ø8-1/2	#5 Ø6	#5	#14	5'-1"	3'-4"	A,C
10'-5"	8	#5 Ø5-1/2	#5 Ø6-1/2	#5 Ø7-1/2	#5 Ø6	#5	#14	5'-4"	4'-0"	A,C
10'-9"	8	#5 Ø5-1/2	#5 Ø6	#5 Ø7-1/2	#5 Ø6	#5	#14	5'-6"	4'-0"	A,C
11'-1"	8-1/2	#5 Ø5-1/2	#5 Ø6	#5 Ø7-1/2	#5 Ø6	#6	#14	5'-10"	4'-0"	A,C
11'-5"	8-1/2	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø7-1/2	#5 Ø6	#6	---	4'-10"	---	B,C
11'-9"	8-1/2	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø7-1/2	#5 Ø6	#6	---	4'-10"	---	B,C
12'-1"	9	#5 Ø5-1/2	#5 Ø5-1/2	#5 Ø7-1/2	#5 Ø6	#6	---	5'-0"	---	B,C
12'-5"	9	#5 Ø5-1/2	#5 Ø7	#5 Ø7-1/2	#5 Ø6	#6	---	5'-3"	---	B,C
12'-9"	9	#5 Ø7	#5 Ø7	#5 Ø7	#5 Ø6	#6	---	5'-3"	---	B,C
13'-1"	9-1/2	#5 Ø5-1/2	#5 Ø7	#5 Ø8	#5 Ø6	#6	---	5'-5"	---	B,C
13'-5"	9-1/2	#5 Ø5-1/2	#5 Ø6-1/2	#5 Ø8	#5 Ø6	#6	---	5'-8"	---	B,C
13'-9"	9-1/2	#5 Ø7	#5 Ø6	#5 Ø7	#5 Ø6	#6	---	5'-10"	---	B,C
14'-1"	9-1/2	#5 Ø5-1/2	#5 Ø6	#5 Ø8-1/2	#5 Ø6	#6	---	5'-10"	---	B,C
14'-5"	9-1/2	#5 Ø7	#5 Ø6	#5 Ø7-1/2	#5 Ø6	#6	---	5'-10"	---	B,C
14'-9"	9-1/2	#5 Ø7	#5 Ø5-1/2	#5 Ø7-1/2	#5 Ø6	#6	---	6'-0"	---	B,C
15'-1"	10	#5 Ø7	#5 Ø6	#5 Ø7-1/2	#5 Ø6	#6	---	6'-0"	---	



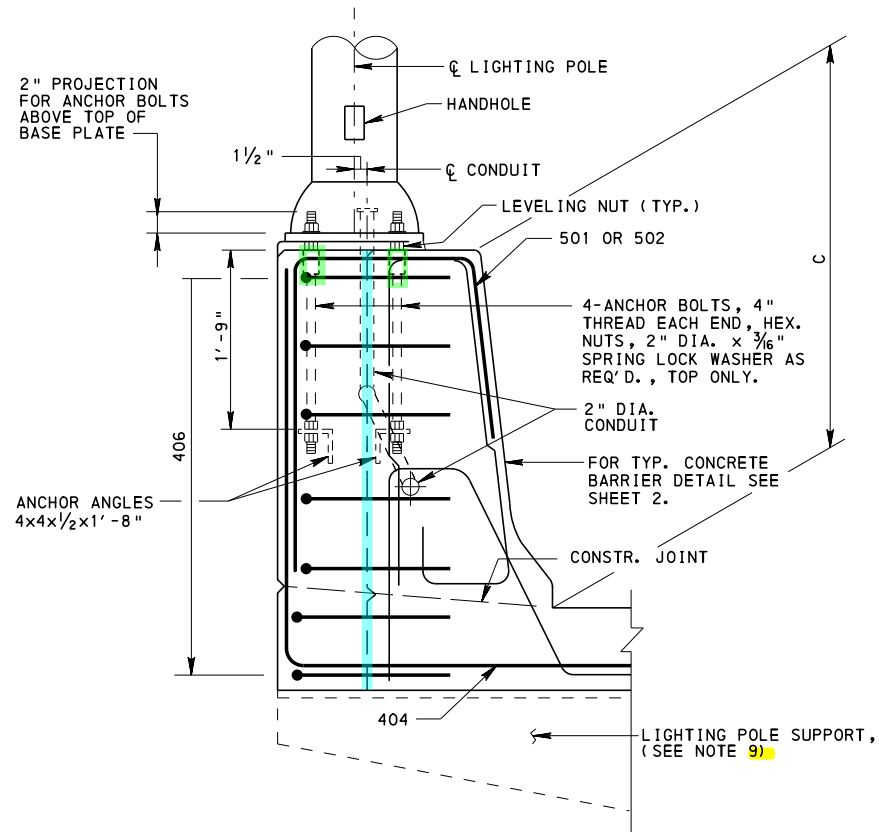
BARRIER TYPE	"A "	"B "	"C "	"D "
TYPICAL	1'-0"	11"	3'-6"	3 3/8"
ALTERNATE	1'-1"	11"	2'-8"	2 3/8"



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 A-A

REINFORCEMENT TABLE

MARK	SIZE	LENGTH TYPICAL	LENGTH ALTERNATE	NUMBER	TYPE	X TYPICAL	X ALTERNATE	Y	Z
404	4	8'-2"	7'-4"	6	(2)	3'-10"	3'-0"	4'-0"	----
406	4	5'-11"	5'-11"	7	(1)	2'-0"	2'-0"	1'-7"	----
501	5	5'-3 5/8"	4'-7 5/8"	2	(3)	2'-8"	2'-0"	4 1/2"	1'-6"
502	5	5'-10 5/8"	5'-2 5/8"	4	(3)	2'-8"	2'-0"	11 1/2"	1'-6"

NOTES:

- PROVIDE MATERIALS AND WORKMANSHIP 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"

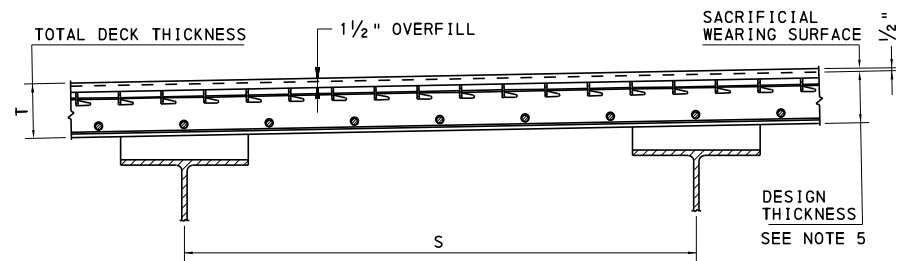
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STANDARD CONCRETE DECK SLAB LIGHTING POLE ANCHORAGE DETAILS FOR BEAM BRIDGES

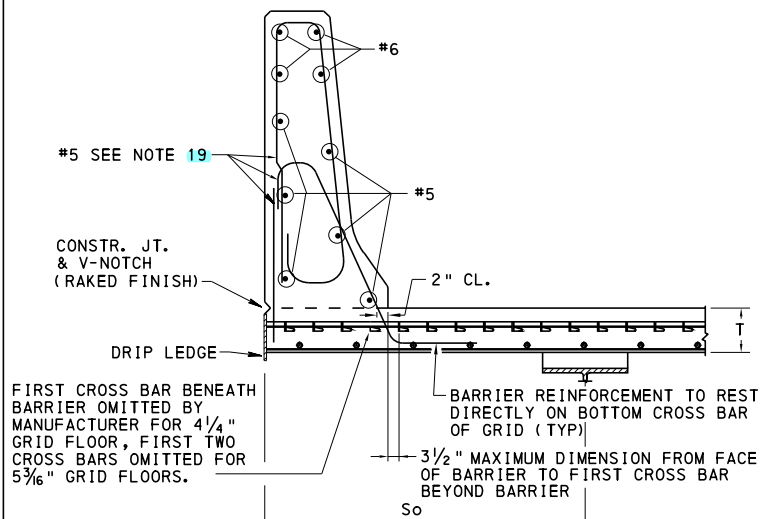
RECOMMENDED NOV. 21, 2014
Theresa P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
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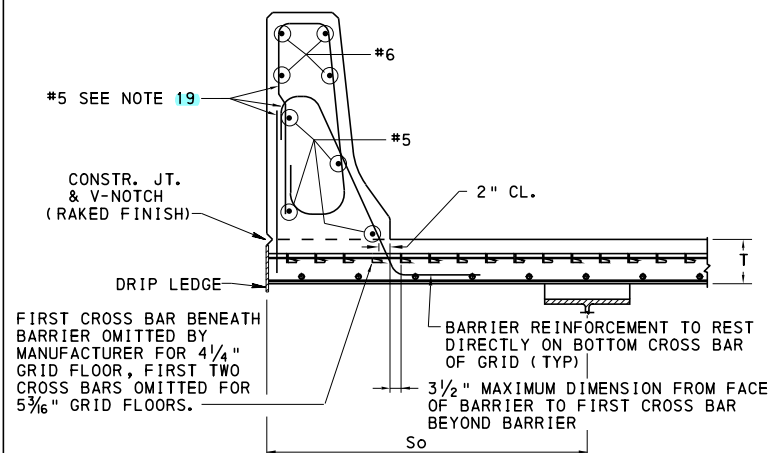
SHEET 10 OF 10
BD-601M



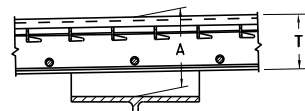
TYPICAL GRID REINFORCED CONCRETE DECK PANEL
DECK ATTACHMENT, PANEL SPLICE AND HAUNCH DETAILS SHOWN ON SHEET 2.
TYPICAL HAUNCH FOR GIRDERS SHOWN FOR ILLUSTRATION ONLY.



TYPICAL CONCRETE BARRIER DETAIL



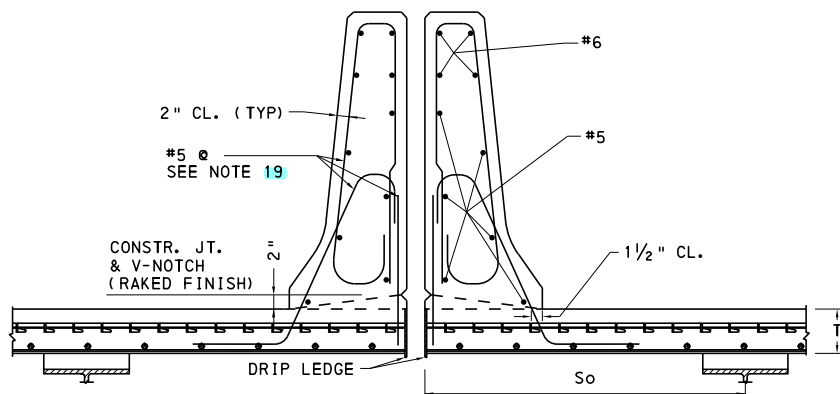
ALTERNATE CONCRETE BARRIER DETAIL
TO BE USED ONLY IF AUTHORIZED BY CHIEF BRIDGE ENGINEER



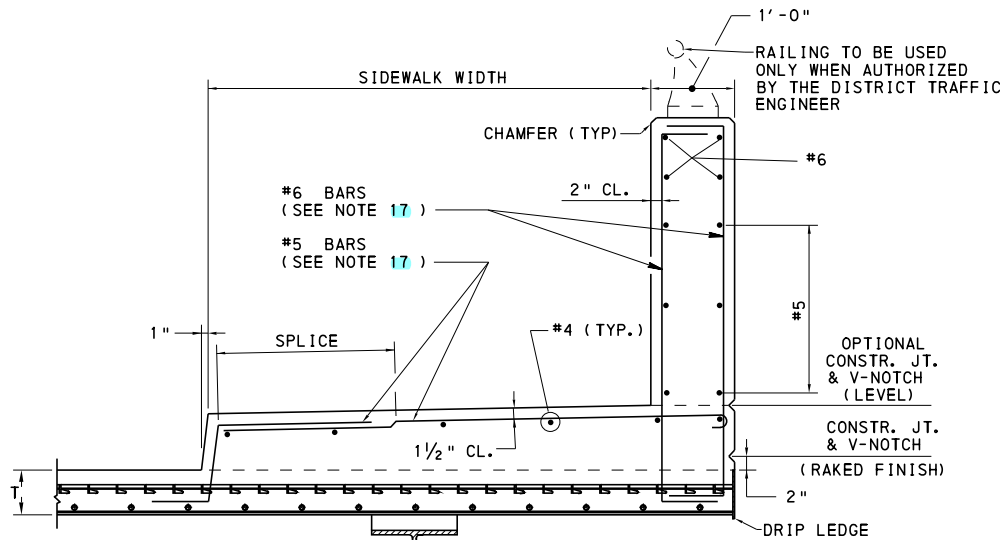
PLAN CAMBER (in)	A (in)
UP TO 1 1/2 "	T+ 1/2 "
OVER 1 1/2 " TO 3 "	T+ 3/4 "
OVER 3 "	T+ 1 "

- 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

17. 4 1/4" FULL DEPTH GRID REINFORCED CONCRETE BRIDGE DECK SHOWN, DETAILS ARE APPROPRIATE FOR 5 3/8" FULL DEPTH DECK DESIGNS AS WELL.
18. FILL HALF DEPTH GRIDS FULL DEPTH FOR A MINIMUM DISTANCE OF 3'-0" FROM THE OUTSIDE EDGE OF THE DECK.
19. 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.
20. CLEAN AND ROUGHEN TOP OF CONCRETE DECK WHICH LIES DIRECTLY BENEATH THE BARRIER PRIOR TO POURING THE BARRIER CONCRETE TO ENSURE ADEQUATE SHEAR TRANSFER.
21. ATTACHMENT DETAIL APPLICABLE FOR ALL OVERLAY TYPES.
22. FOR BARRIER SIDEWALK AND MEDIAN BARRIER DIMENSIONS SEE BD-601M. FOR BARRIER REINFORCEMENT DIMENSIONS NOT SHOWN, SEE BD-601M. FOR BRIDGE BARRIER DETAILS, SEE BC-739M.

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 AAA CONCRETE
 - MODULAR RATIO (E_s/E_c) $N = 8$
4. DEAD LOAD:
 - DENSITY OF NORMAL WEIGHT CONCRETE 150 lbs/ft^3
 - DENSITY OF LIGHTWEIGHT CONCRETE 115 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 3/8" 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 PERFORMANCE LEVEL 3. THE SPLIT MEDIAN BARRIERS AND THE ALTERNATE BARRIER ARE DESIGNED TO RESIST A VEHICULAR COLLISION AT PERFORMANCE LEVEL 2. 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.

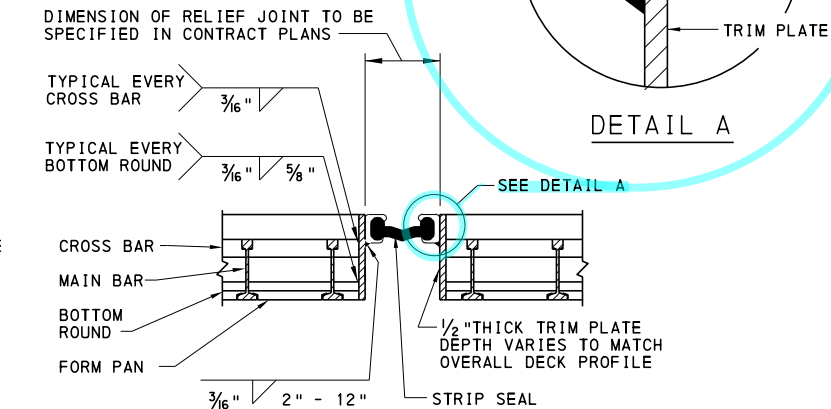
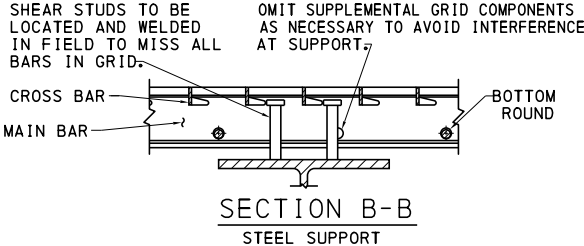
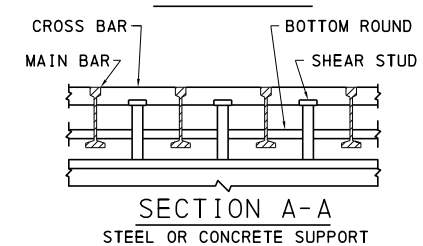
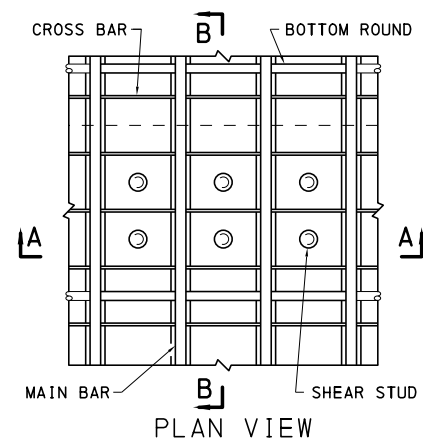
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STANDARD GRID REINFORCED CONCRETE BRIDGE DECK DESIGN & DETAILS FOR BEAM BRIDGES

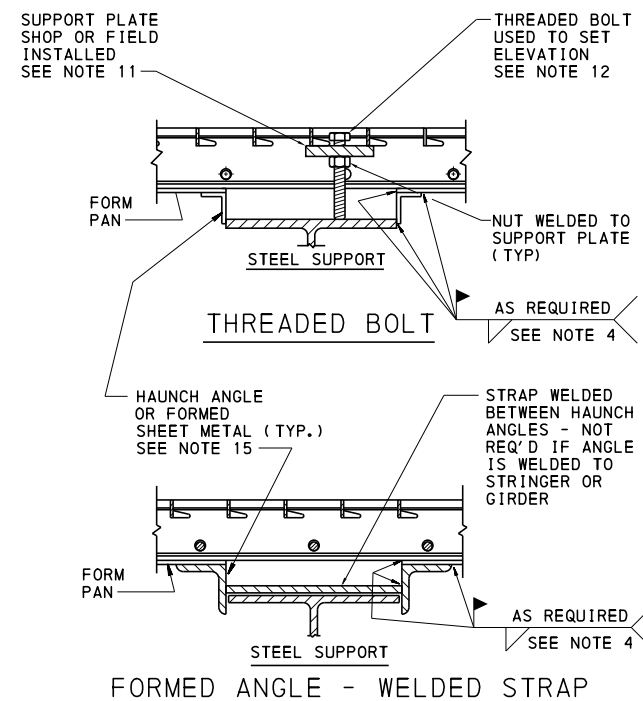
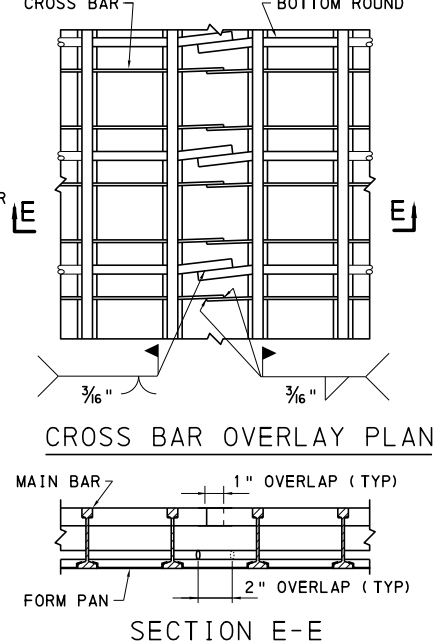
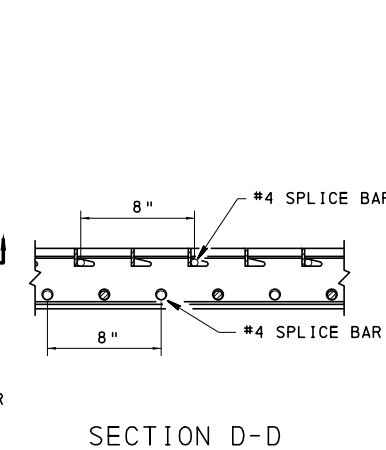
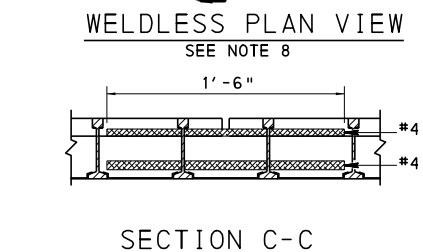
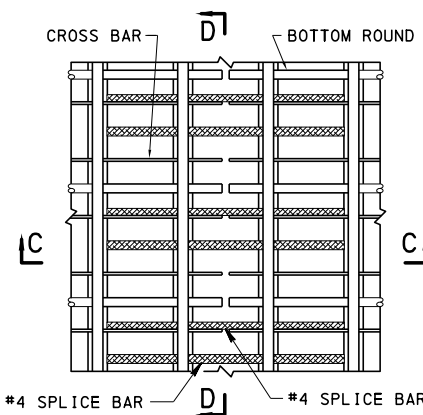
RECOMMENDED NOV. 21, 2014
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SHEET 1 OF 4
BD-604M

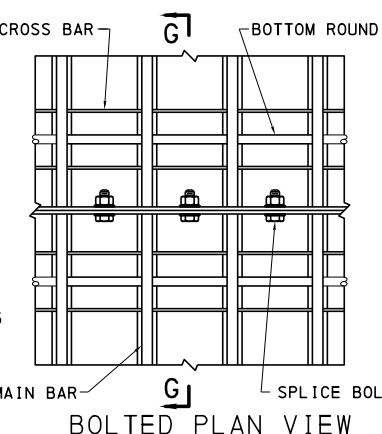
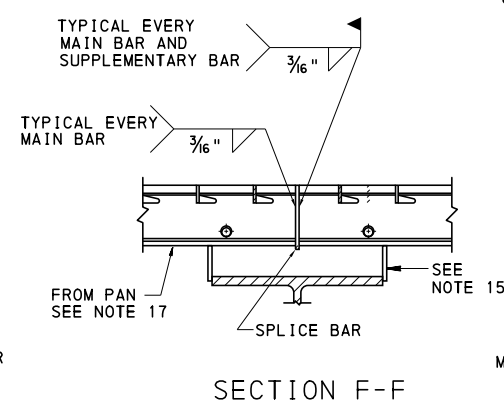
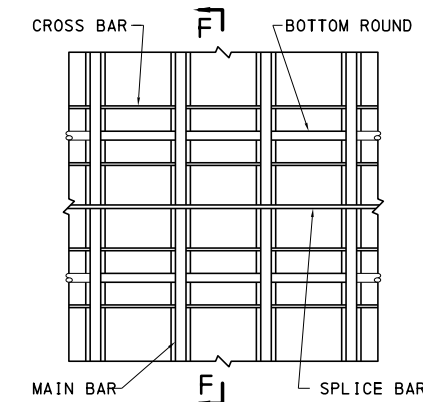


TYPICAL EXPANSION/RELIEF JOINT



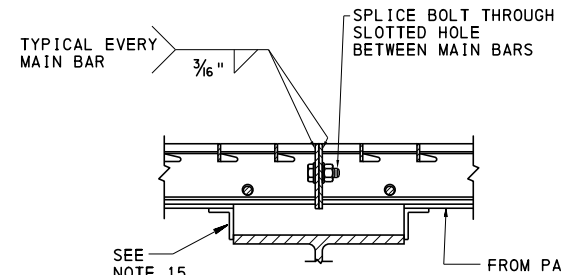
ELEVATION OPTIONS

SEE NOTES 9 THRU 17



MAIN BAR SPLICE AT PANEL ENDS

SEE NOTES 17 & 18



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 $\frac{1}{4}$ " 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 CONCRETE BRIDGE 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.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

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

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

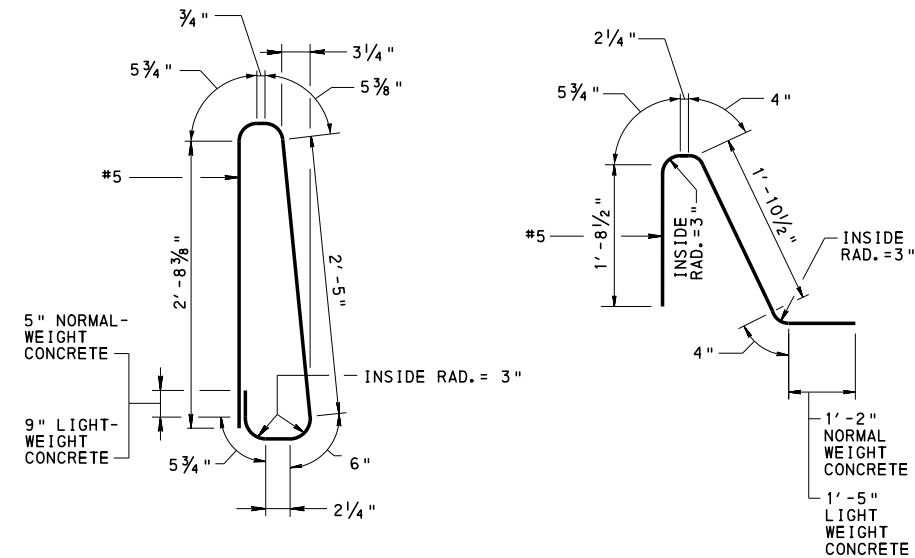
RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR., BUREAU OF PROJECT DELIVERY

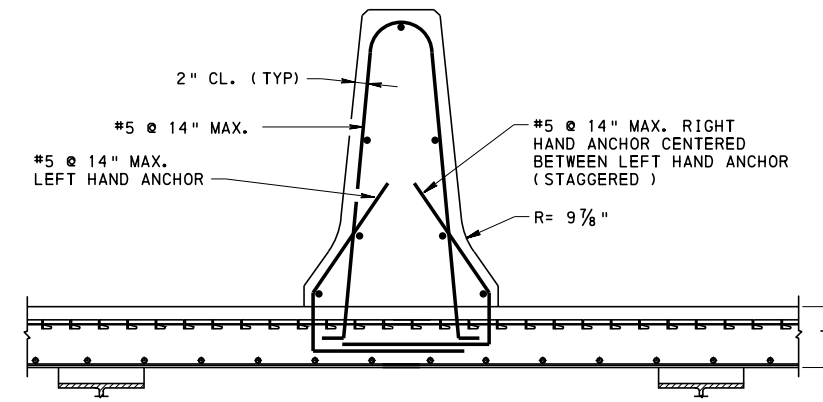
SHEET 2 OF 4

BD-604M

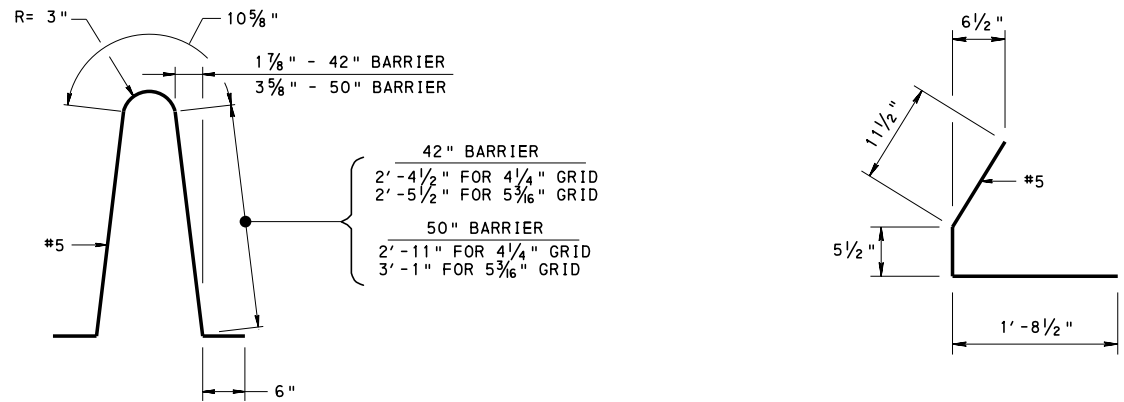
NOTE:
DIMENSIONS INDICATED FOR TYPICAL
BARRIER HEIGHT OF 3'-6", ADJUST
DIMENSIONS ACCORDINGLY IF
ALTERNATE BARRIER IS APPROVED.



BARRIER REINFORCEMENT



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



MODIFIED MEDIAN BARRIER REINFORCEMENT

COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD
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DESIGN & DETAILS
FOR BEAM BRIDGES

RECOMMENDED NOV. 21, 2014 <i>Thomas D. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian J. Thomas</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 3 OF 4 BD-604M
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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)			
3	8	2	5⁄8 x 5⁄8	4.5	OVERFILL	69	59	—	—	—
				4.5	FLUSH FILL	48	42			
4 ¼	6	0	—	7.0	OVERFILL	83	70	#4 @ 6"	4.0	4.0
				7.0	FLUSH FILL	62	53			
4 ¼	8	0	—	4.0	OVERFILL	81	68	#5 @ 4"	3.5	2.5
				4.0	FLUSH FILL	60	51			
5 3⁄16	6	0	—	5.0	OVERFILL	96	81	#4 @ 6"	4.5	3.0
				5.0	FLUSH FILL	75	64			
5 3⁄16	8	0	—	3.5	OVERFILL	94	79	#4 @ 8"	4.0	2.0
				3.5	FLUSH FILL	73	62			
5 3⁄16	6	1	1 x 5⁄16	8.5	OVERFILL	97	82	N/A	4.5	5.0
				8.0	FLUSH FILL	76	65			
5 3⁄16	8	1	1 x 5⁄16	6.0	OVERFILL	96	80	#4 @ 8"	4.0	3.5
				6.0	FLUSH FILL	75	63			
5 3⁄16	10	1	1 x 5⁄16	5.0	OVERFILL	94	78	#5 @ 10"	3.5	3.0
				5.0	FLUSH FILL	73	61			
5 3⁄16	6	2	1 x 5⁄16	11.0	OVERFILL	100	85	N/A	5.0	6.5
				8.0	FLUSH FILL	76	68			
5 3⁄16	8	2	1 x 5⁄16	8.5	OVERFILL	97	82	N/A	4.0	5.0
				6.0	FLUSH FILL	76	65			
5 3⁄16	10	2	1 x 5⁄16	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)			
5 3⁄16	6	1	1 x 5⁄16	7.5	OVERFILL	70	60	N/A	4.5	5.0
				7.5	FLUSH FILL	49	43			
5 3⁄16	8	1	1 x 5⁄16	6.0	OVERFILL	67	57	#4 @ 8"	4.0	3.5
				6.0	FLUSH FILL	46	40			
5 3⁄16	10	1	1 x 5⁄16	4.5	OVERFILL	66	56	#5 @ 10"	3.5	3.0
				4.5	FLUSH FILL	45	39			
5 3⁄16	6	2	1 x 5⁄16	11.0	OVERFILL	72	63	N/A	5.0	6.5
				11.0	FLUSH FILL	51	46			
5 3⁄16	8	2	1 x 5⁄16	8.0	OVERFILL	69	59	N/A	4.0	5.0
				8.0	FLUSH FILL	48	42			
5 3⁄16	10	2	1 x 5⁄16	6.5	OVERFILL	67	57	#4 @ 10"	3.5	4.0
				6.5	FLUSH FILL	46	40			

NOTES ON TABLES:

- COLUMN LABELED "CANTILEVER REBAR" INDICATES SIZE AND SPACING OF REBAR WHICH MUST BE INSERTED FLUSH WITH TOP OF GRID INTO GRID REINFORCED DECK OVERHANG.
- 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.
- ALL LISTED DESIGNS REQUIRE THE USE OF STEEL GRADE 50 EXCEPT DECK DESIGN 5 3⁄16" I-BEAM @ 6" C/C WITH TWO (2) SUPPLEMENTARY BARS WHICH REQUIRES THE USE OF GRADE 36.
- REFER TO LRFD AASHTO SECTION 13.2 FOR DEFINITION OF PL-3 LOADING.

NOTES:

GRID SURFACES COATING:

- 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.
- 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.
- 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:

- 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.
- 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 1 3⁄4" THICKNESS OF CONCRETE ABOVE TOP OF STEEL GRID BARS.
- BITUMINOUS OVERLAYS MAY BE APPLICABLE IN ACCORDANCE WITH PUB 408, SECTION 420, 680, 1080.3(e) , AND AS DIRECTED BY THE ENGINEER.
- 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 1⁄2" SACRIFICIAL WEARING COURSE). FOR EXAMPLE, FOR A HALF DEPTH 5 3⁄16" GRID WITH A 1 3⁄4" OVERFILL, T = 6 7⁄16" (5 3⁄16" + 1 3⁄4" - 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 5 3⁄16" GRID, (2 1⁄2" OF CONCRETE WITHIN THE GRID AND A 1 3⁄4" INTEGRAL OVERFILL OR 4 1⁄4" TOTAL), DESIGN TO USE ALL CROSS BARS AND 3 3⁄4" (4 3⁄4" LESS 1⁄2" SACRIFICIAL) OF CONCRETE ACROSS THE EFFECTIVE WIDTH. PRESENCE OF CONCRETE IS NEGLECTED IN NEGATIVE MOMENT REGION, AND FABRICATION NOTCHES IN CROSS BARS ARE DEDUCTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

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

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 4 OF 4

BD-604M

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.

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

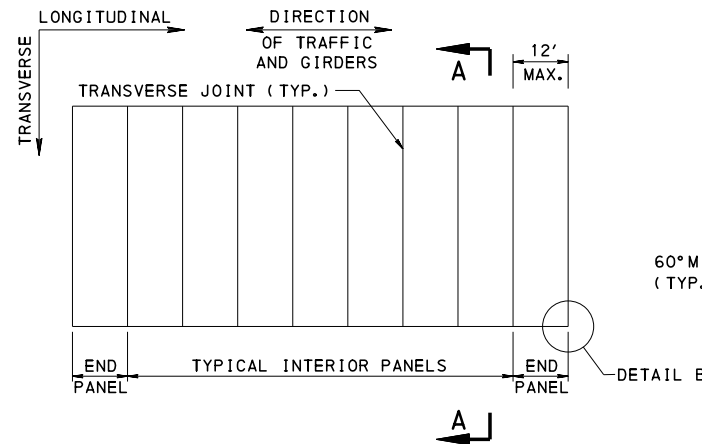
1. PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
2. SUBMIT SHOP DRAWINGS FOR PRECAST CONCRETE DECK PANELS AND ASSOCIATED COMPONENTS.
3. FINAL DESIGN OF POST-TENSIONING SYSTEM SHALL BE PERFORMED BY THE CONTRACTOR. POST-TENSIONING CALCULATIONS SHALL ACCOUNT FOR THE PROPOSED HARDWARE AND SHALL BE SUBMITTED AS PART OF THE SHOP DRAWING SUBMISSION.
4. LIFTING DEVICES SHALL BE DESIGNED BY THE CONTRACTOR. LIFTING DEVICE CALCULATIONS SHALL BE SUBMITTED AS PART OF THE SHOP DRAWING SUBMISSION.
5. THE INSIDE FACES OF THE SHEAR BLOCKOUTS AND ALL SHEAR KEYS SHALL BE BLAST CLEANED TO HAVE AN EXPOSED AGGREGATE FINISH.

SEQUENCE OF CONSTRUCTION

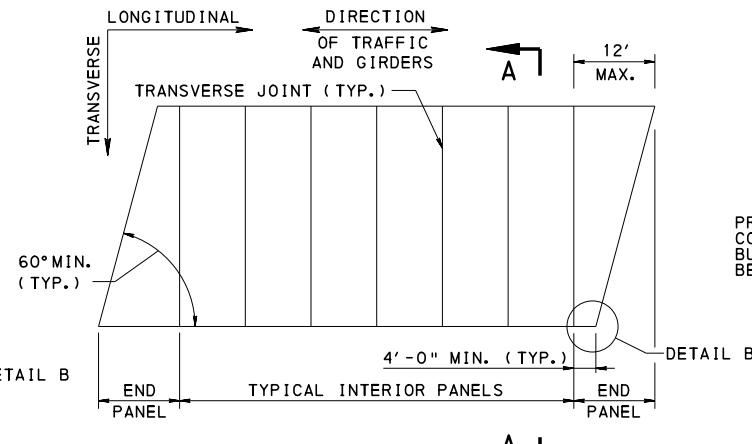
1. ERECT BEAMS AND INSTALL DIAPHRAGMS.
2. IF STAY-IN-PLACE HAUNCH FORMWORK IS APPLICABLE, PLACE FORMWORK PER DETAILS ON SHEET 4. REMOVABLE FORMS ARE PLACED AFTER PANELS ARE SET (SEE STEP 9 BELOW).
3. PREPARE PANELS BY PRE-SETTING THE VERTICAL ADJUSTMENT DEVICES TO THE REQUIRED ANTICIPATED DEPTH.
4. SET 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). FILL TRANSVERSE JOINTS WITH ULTRA HIGH PERFORMANCE CONCRETE OR NON-SHRINK EPOXY GROUT PER MANUFACTURERS RECOMMENDATIONS AND IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, ITEM 1001-0970, IF APPLICABLE.
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 EPOXY NON-SHRINK GROUT OR ULTRA HIGH PERFORMANCE CONCRETE PER MANUFACTURERS RECOMMENDATIONS AND IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, ITEM 1001-0970, IF APPLICABLE.
11. PLACE FORMWORK FOR LONGITUDINAL JOINT IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, ITEM 1001-0970, IF APPLICABLE.
12. FILL LONGITUDINAL CLOSURE POUR WITH ULTRA HIGH PERFORMANCE CONCRETE PER MANUFACTURERS RECOMMENDATIONS AND IN ACCORDANCE WITH ULTRA HIGH PERFORMANCE CONCRETE STANDARD SPECIAL PROVISION, ITEM 1001-0970.
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
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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

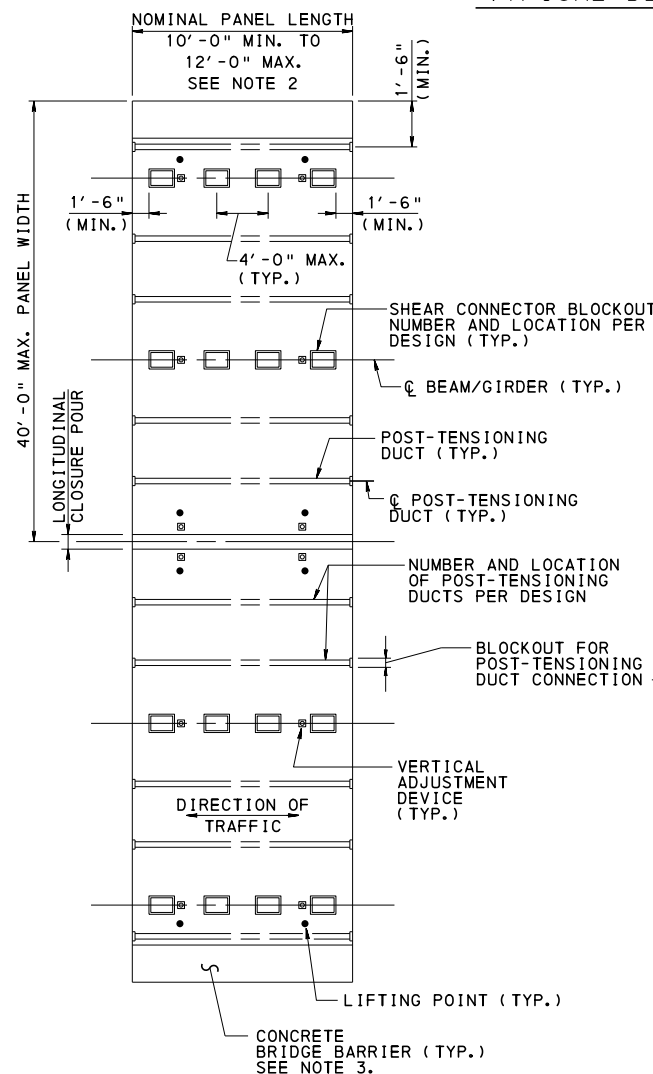


PANELS FOR 90° BRIDGES

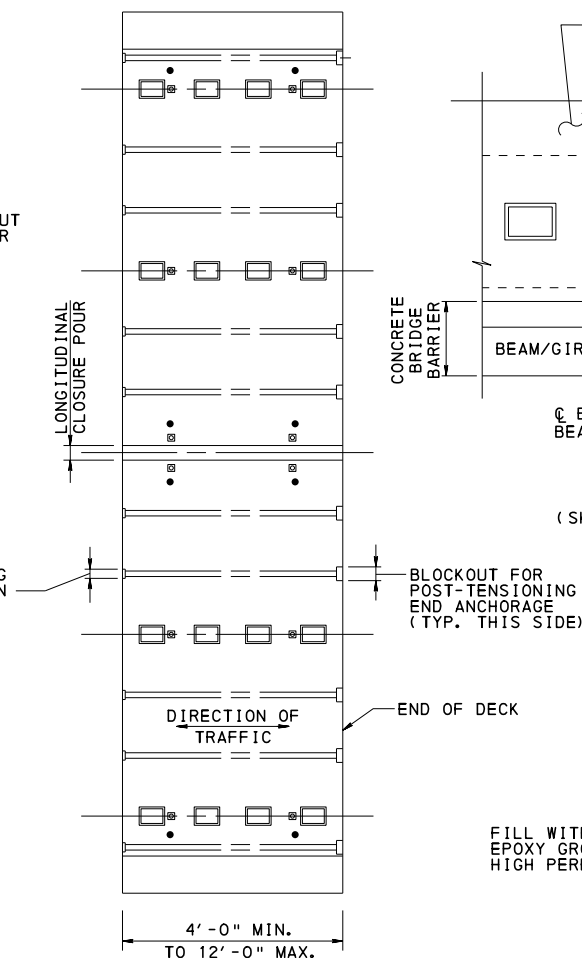


PANELS FOR SKEWED BRIDGES
BETWEEN 90° AND 60°

TYPICAL DECK LAYOUT

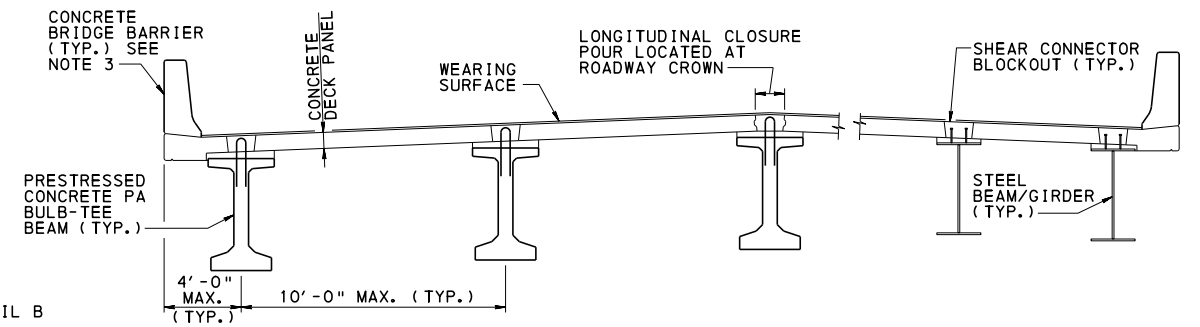


INTERIOR PANEL
(SEE NOTE 4)

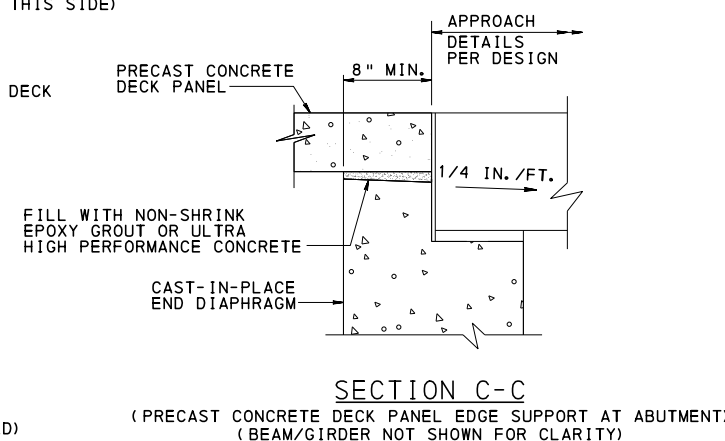
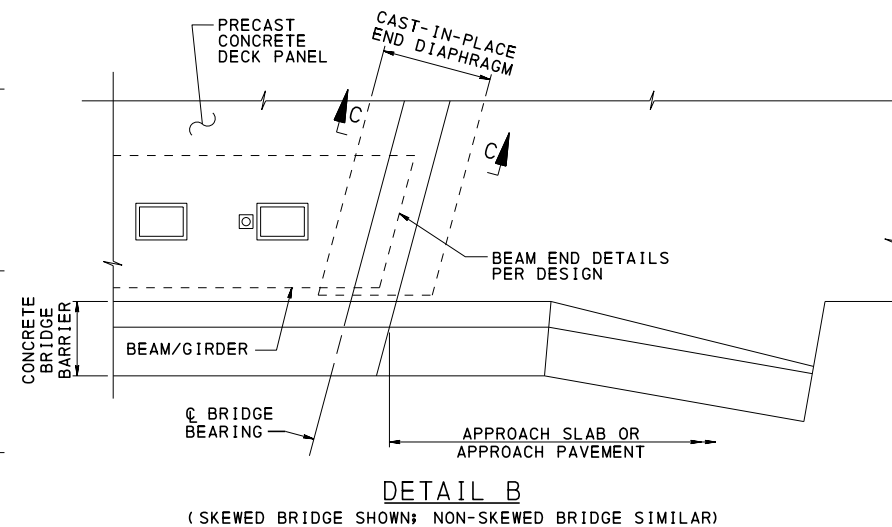


END PANEL
(SIMILAR TO INTERIOR PANEL EXCEPT AS NOTED)
(SEE NOTE 4)

TYPICAL PANEL LAYOUTS



SECTION A-A
PRECAST CONCRETE DECK PANEL



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.

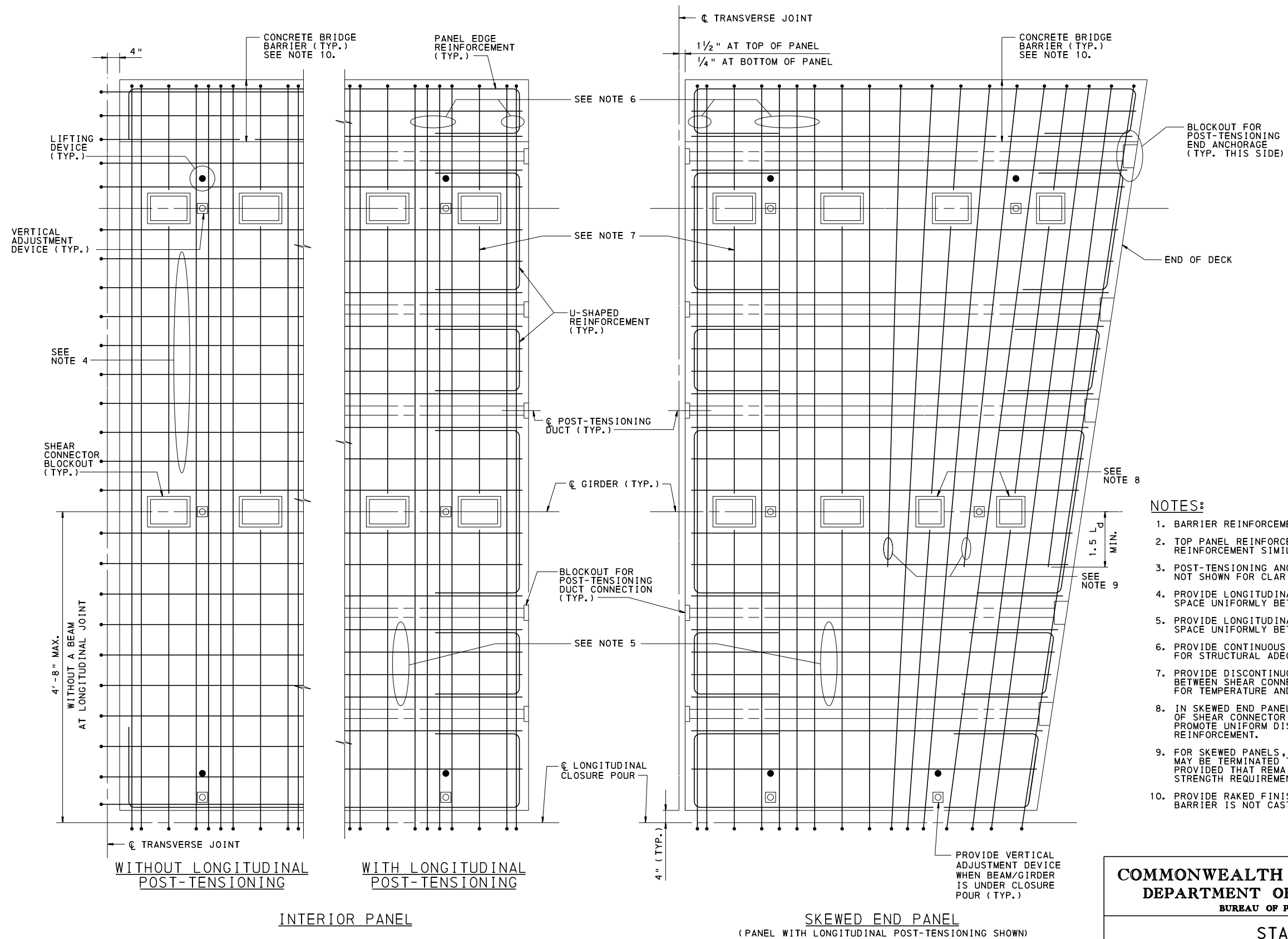
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

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

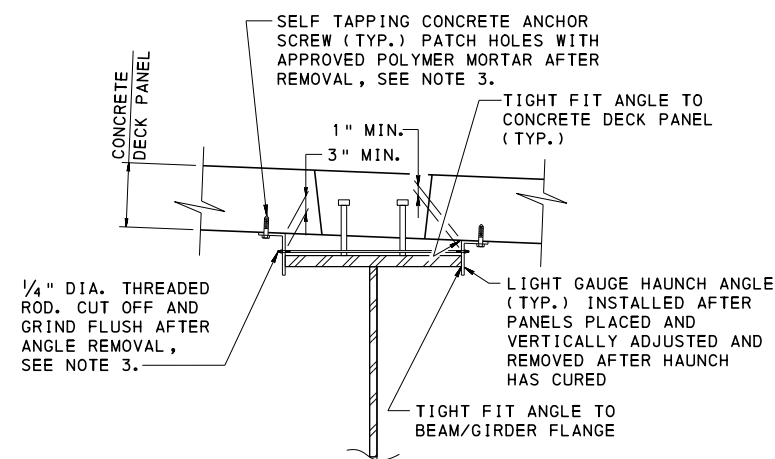
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
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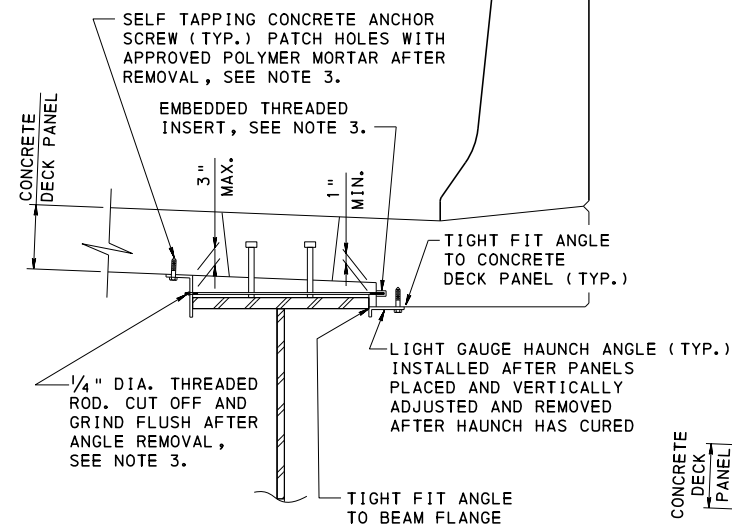
SHEET 2 OF 6
BD-605M



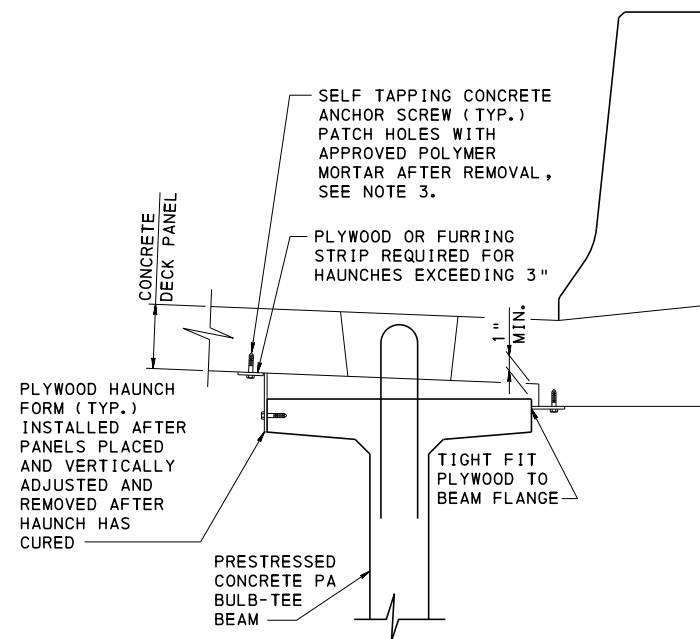
- NOTES:**
1. BARRIER REINFORCEMENT NOT SHOWN FOR CLARITY.
 2. TOP PANEL REINFORCEMENT SHOWN. BOTTOM PANEL REINFORCEMENT SIMILAR.
 3. POST-TENSIONING ANCHORAGE ZONE REINFORCEMENT NOT SHOWN FOR CLARITY.
 4. PROVIDE LONGITUDINAL STEEL FOR DISTRIBUTION. SPACE UNIFORMLY BETWEEN BEAMS.
 5. PROVIDE LONGITUDINAL STEEL FOR DISTRIBUTION. SPACE UNIFORMLY BETWEEN POST-TENSIONING DUCTS.
 6. PROVIDE CONTINUOUS TRANSVERSE REINFORCEMENT FOR STRUCTURAL ADEQUACY.
 7. PROVIDE DISCONTINUOUS TRANSVERSE REINFORCEMENT BETWEEN SHEAR CONNECTOR BLOCKOUTS AS REQUIRED FOR TEMPERATURE AND SHRINKAGE.
 8. IN SKEWED END PANELS, ADJUST SIZE AND SPACING OF SHEAR CONNECTOR BLOCKOUTS AS REQUIRED TO PROMOTE UNIFORM DISTRIBUTION OF TRANSVERSE REINFORCEMENT.
 9. FOR SKEWED PANELS, TRANSVERSE REINFORCEMENT MAY BE TERMINATED TO AVOID SPACING CONFLICTS PROVIDED THAT REMAINING REINFORCEMENT MEETS STRENGTH REQUIREMENTS.
 10. PROVIDE RAKED FINISH CONSTRUCTION JOINT WHEN BARRIER IS NOT CAST INTEGRAL WITH DECK PANEL.



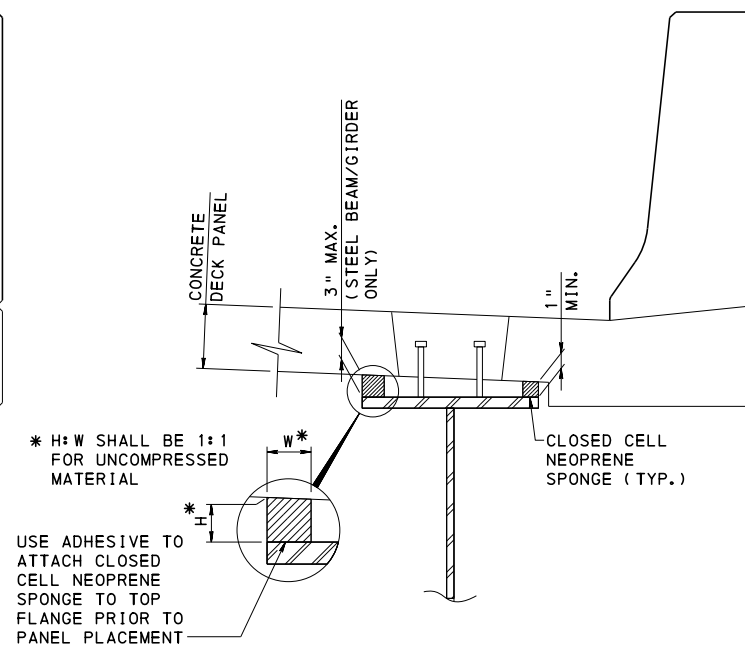
REMOVABLE HAUNCH FORMWORK DETAIL
INTERIOR STEEL BEAM/GIRDER



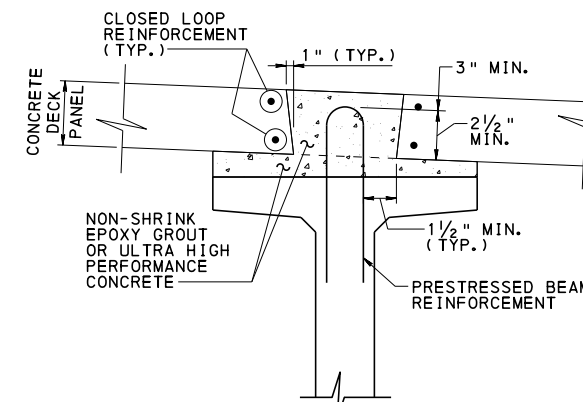
REMOVABLE HAUNCH FORMWORK DETAIL
STEEL FASCIA BEAM/GIRDER



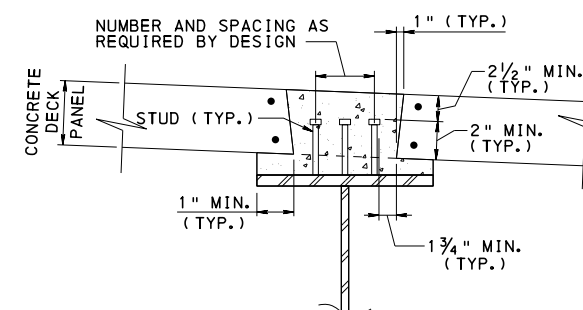
REMOVABLE HAUNCH FORMWORK DETAIL
PRESTRESSED BEAM



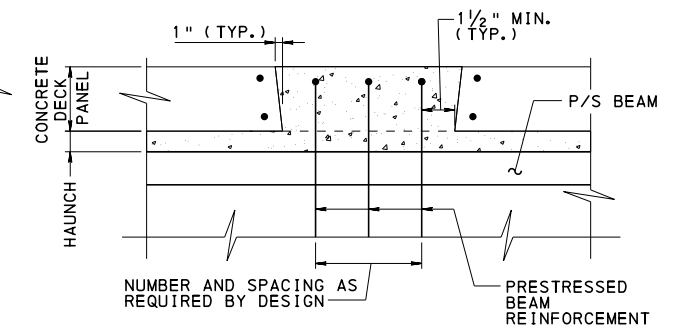
STAY-IN-PLACE HAUNCH FORMWORK DETAIL
(STEEL BEAM/GIRDER SHOWN, CONCRETE BEAM SIMILAR)



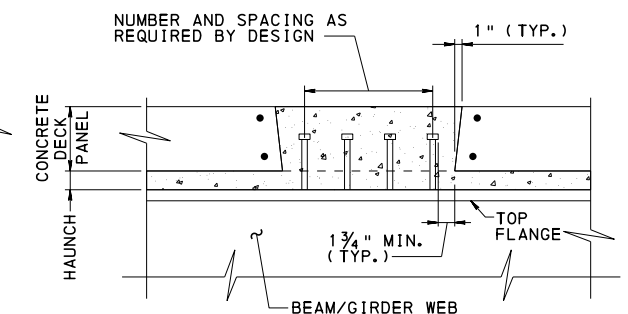
SECTION A-A
FOR PRESTRESSED BEAM



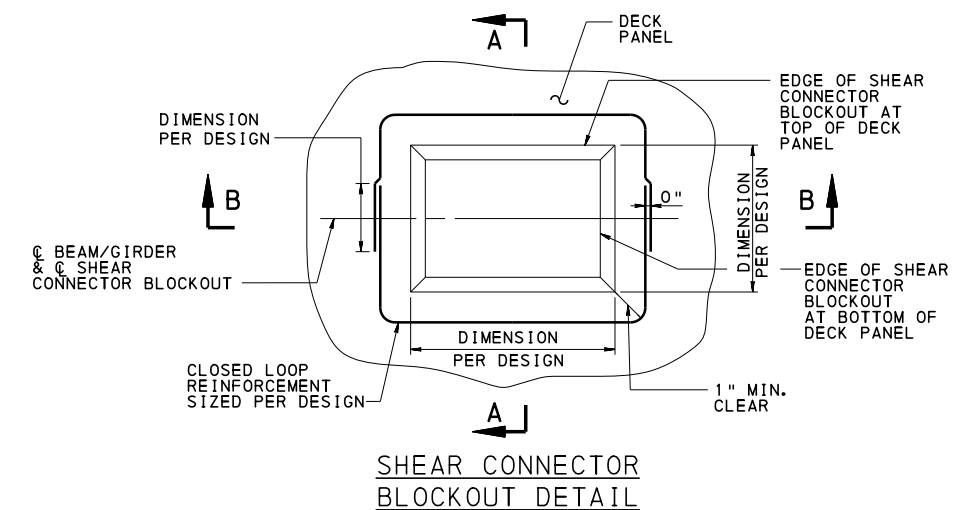
SECTION A-A
FOR STEEL BEAM/GIRDER
(SIMILAR TO PRESTRESSED BEAM EXCEPT AS NOTED)



SECTION B-B
FOR PRESTRESSED BEAM



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".

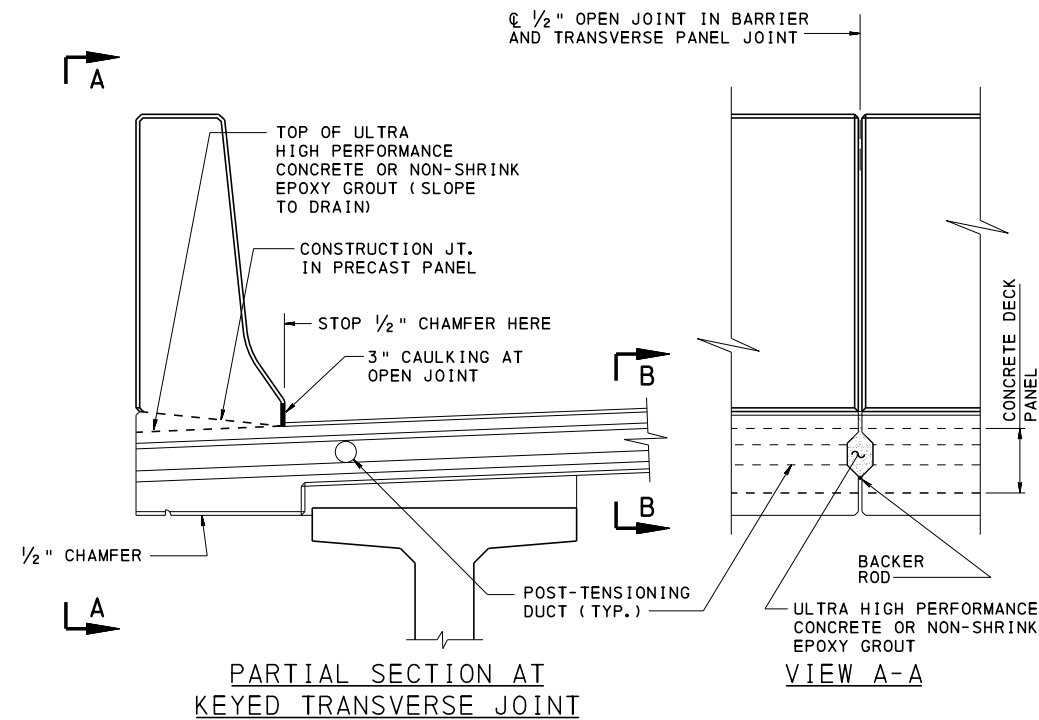
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

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

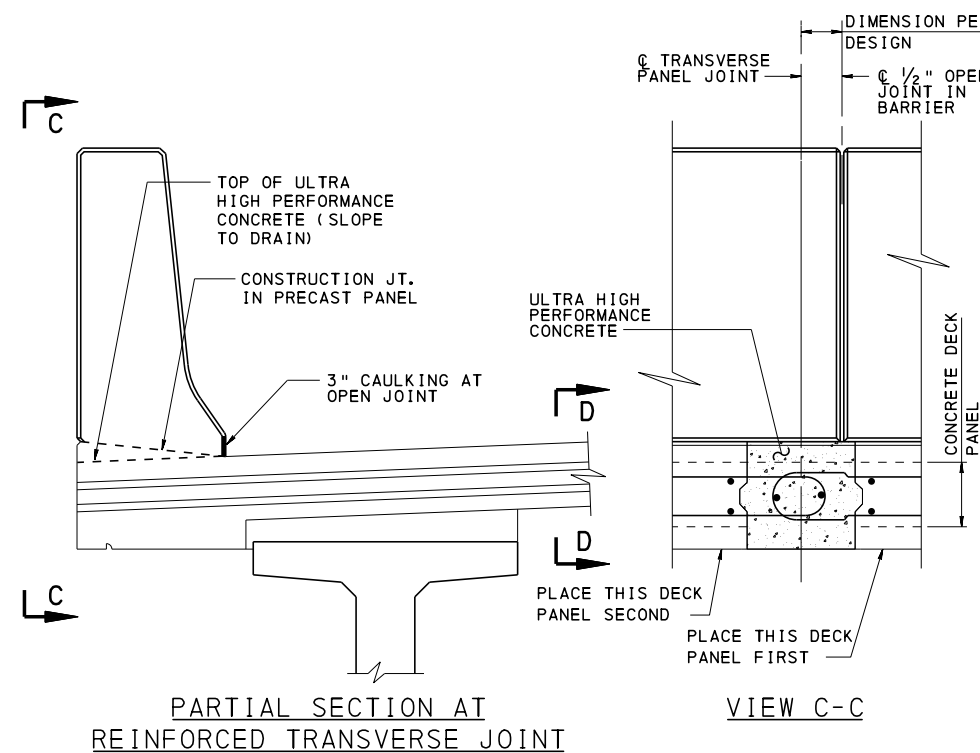
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
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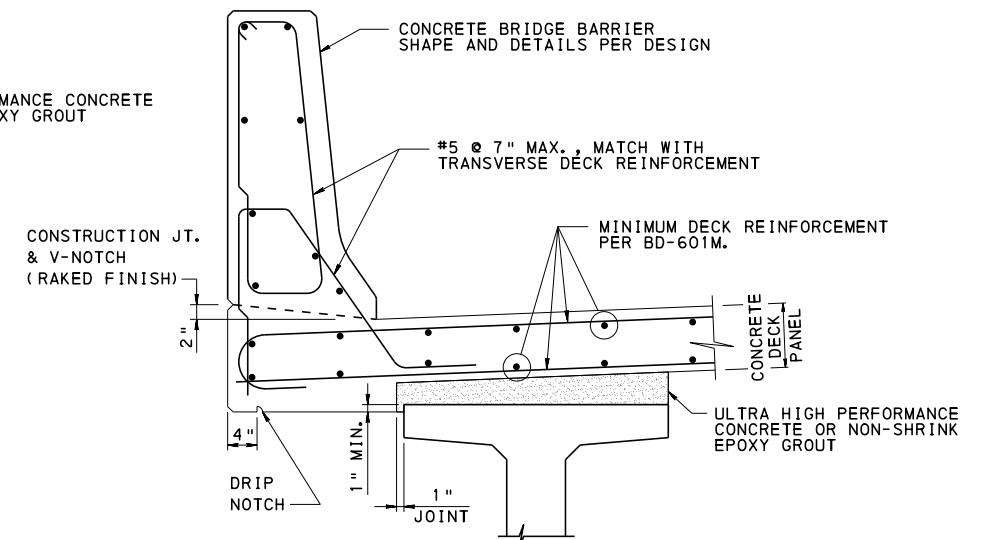
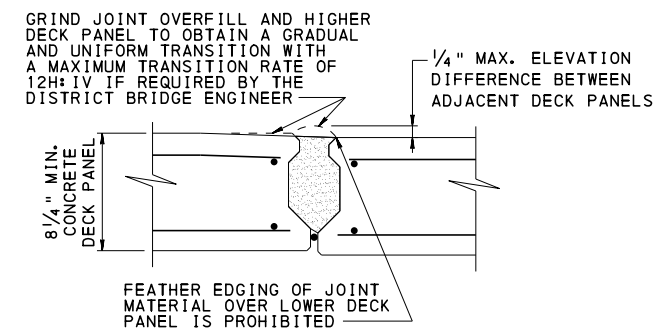
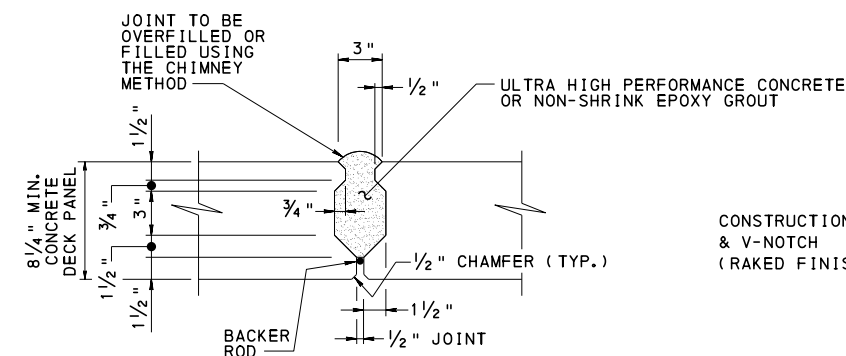
SHEET 4 OF 6
BD-605M



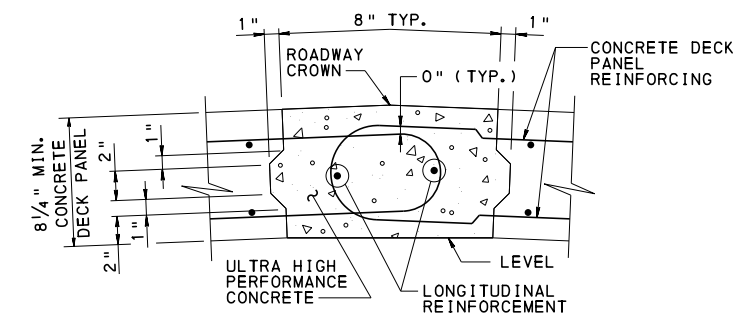
KEYED TRANSVERSE JOINT DETAILS
(TO BE USED FOR DECKS WITH LONGITUDINAL POST-TENSIONING)



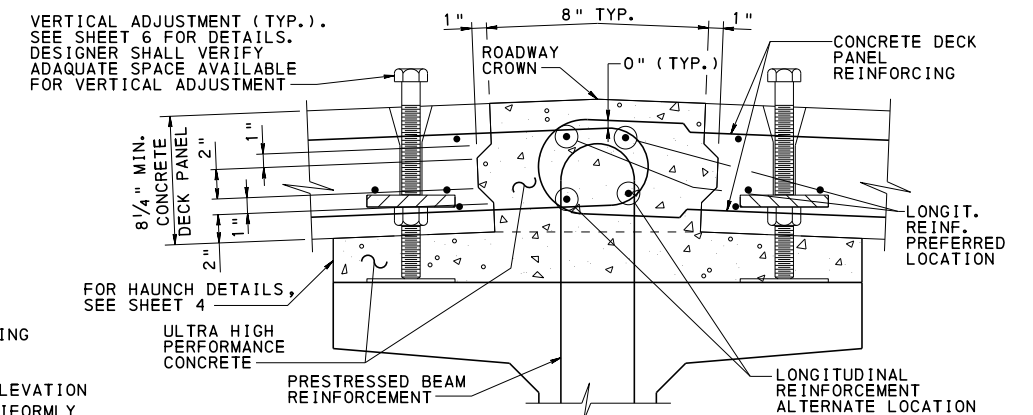
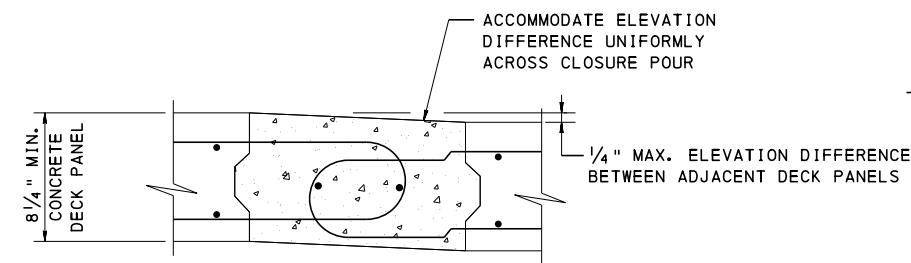
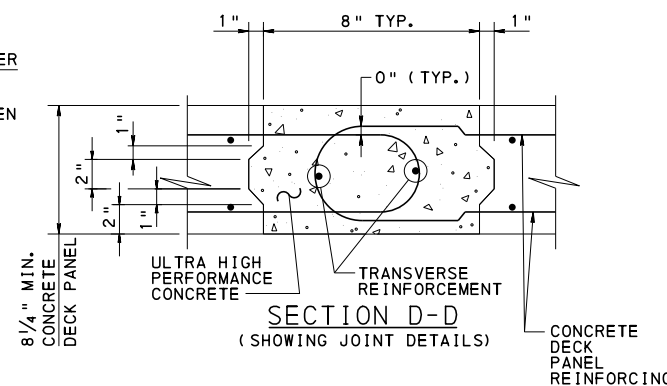
REINFORCED TRANSVERSE JOINT DETAILS
(TO BE USED FOR DECKS WITHOUT LONGITUDINAL POST-TENSIONING)



CONCRETE BRIDGE BARRIER DETAIL
TYPICAL BARRIER SHOWN, OTHERS PER DESIGN



LONGITUDINAL CLOSURE POUR BETWEEN BEAMS/GIRDERS



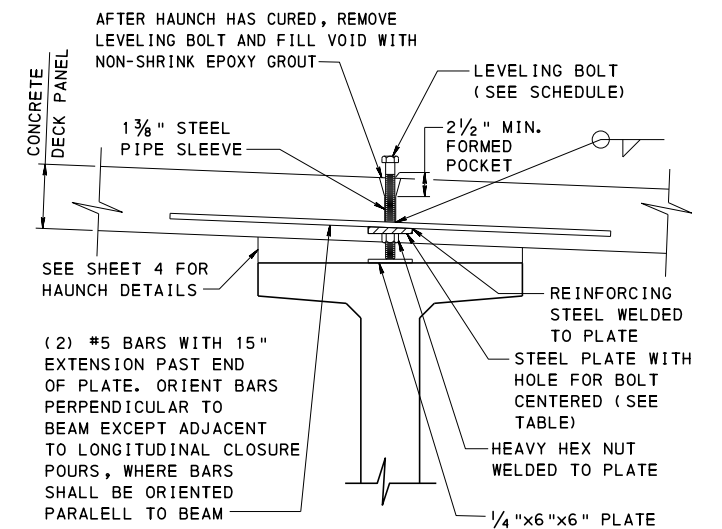
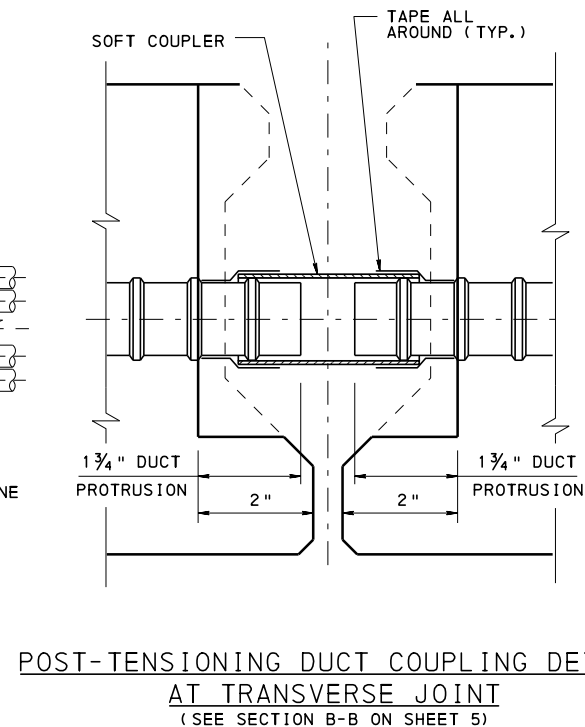
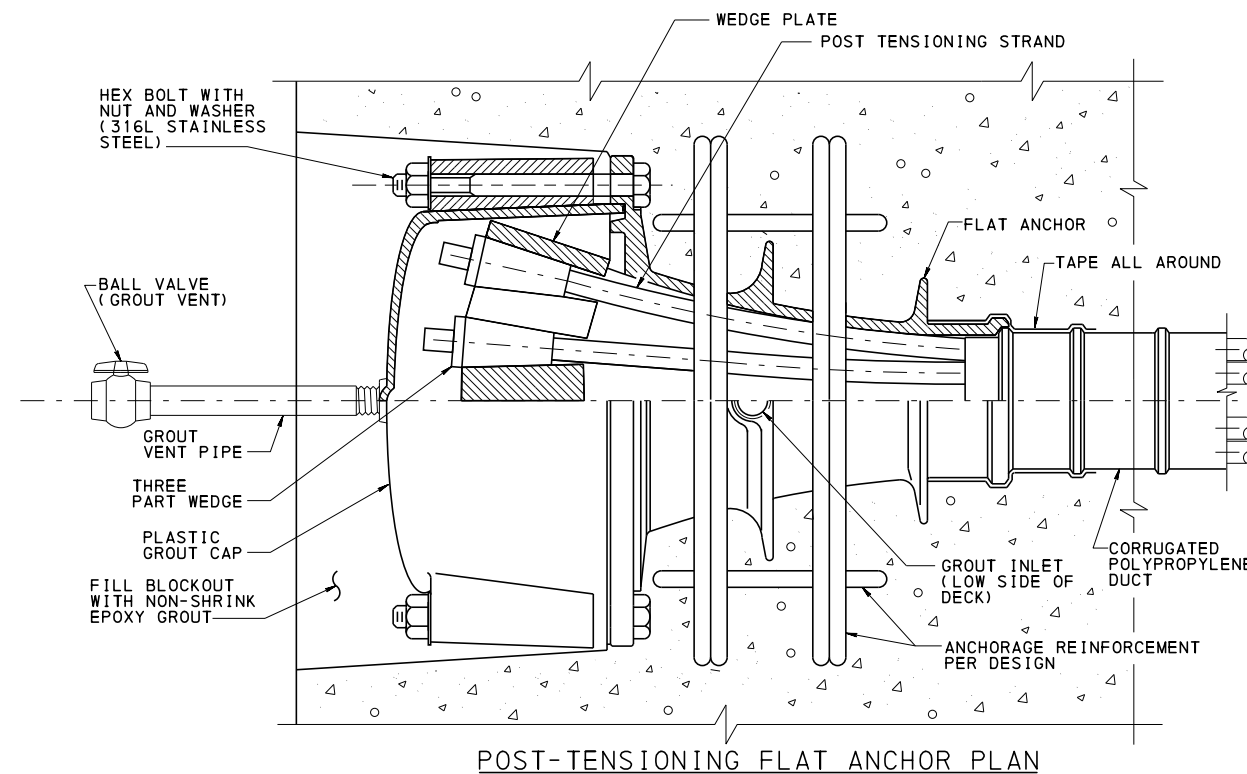
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
FULL DEPTH PRECAST CONCRETE DECK PANELS FOR PRESTRESSED CONCRETE PA BULB-TEE BEAM AND STEEL I-BEAM/I-GIRDER BRIDGES

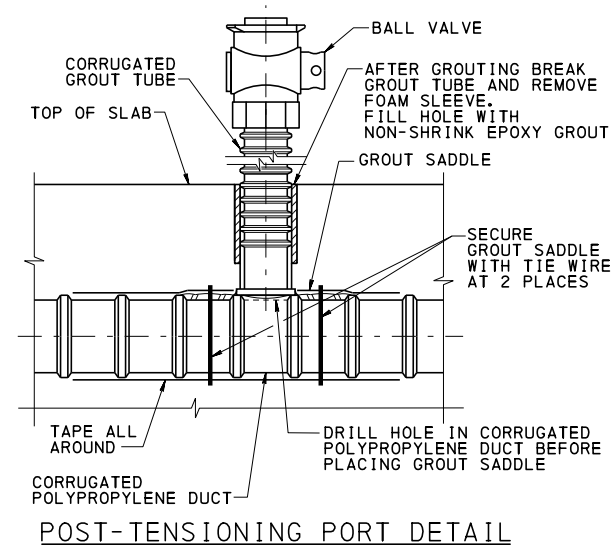
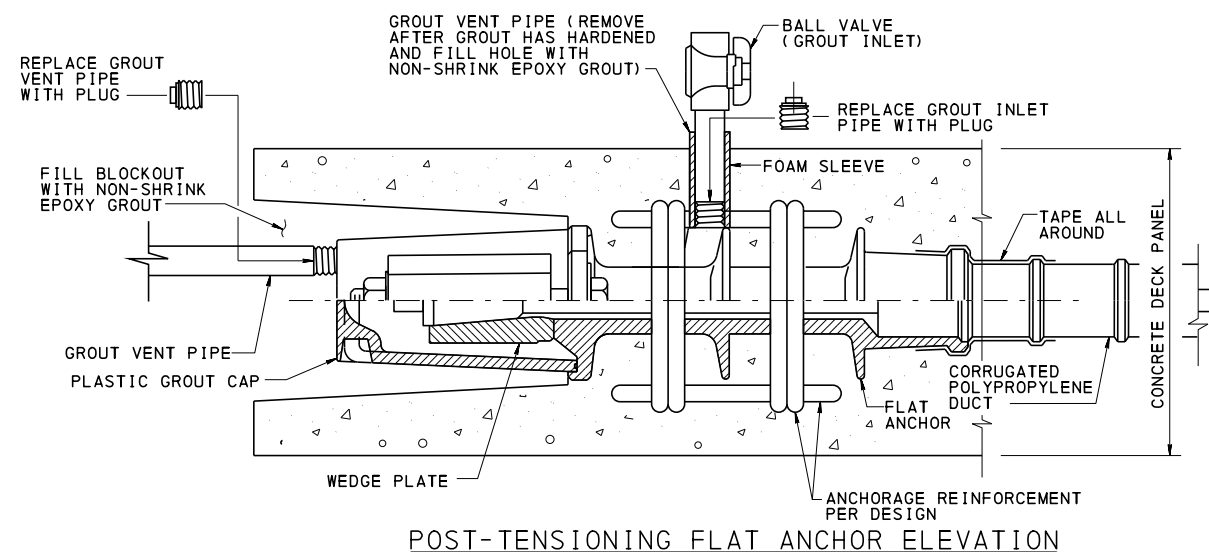
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
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SHEET 5 OF 6
BD-605M



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



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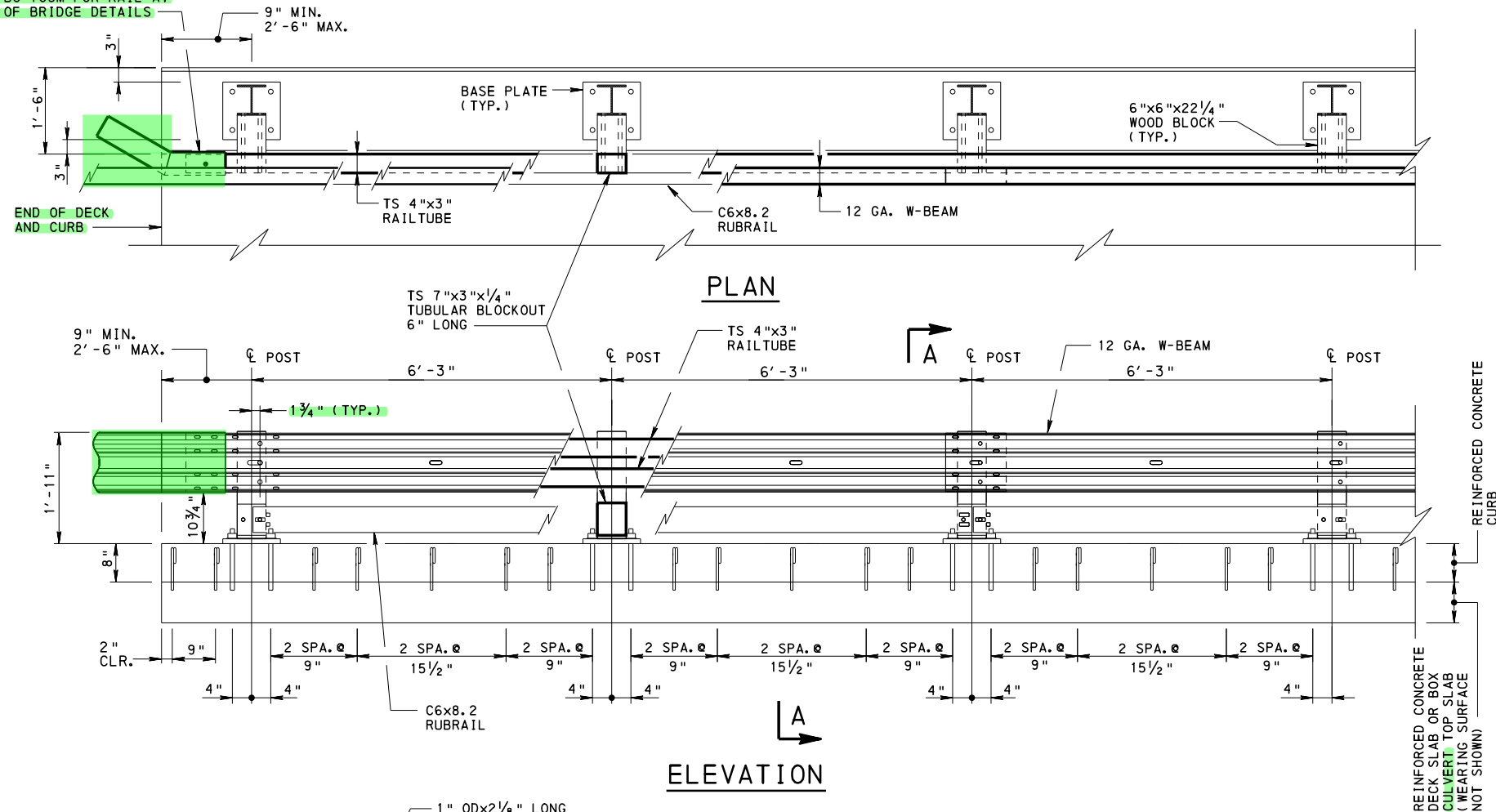
STANDARD
FULL DEPTH PRECAST CONCRETE DECK
PANELS FOR PRESTRESSED CONCRETE
PA BULB-TEE BEAM AND
STEEL I-BEAM/I-GIRDER BRIDGES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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SHEET 6 OF 6
BD-605M

SEE BC-706M FOR RAIL AT
END OF BRIDGE DETAILS

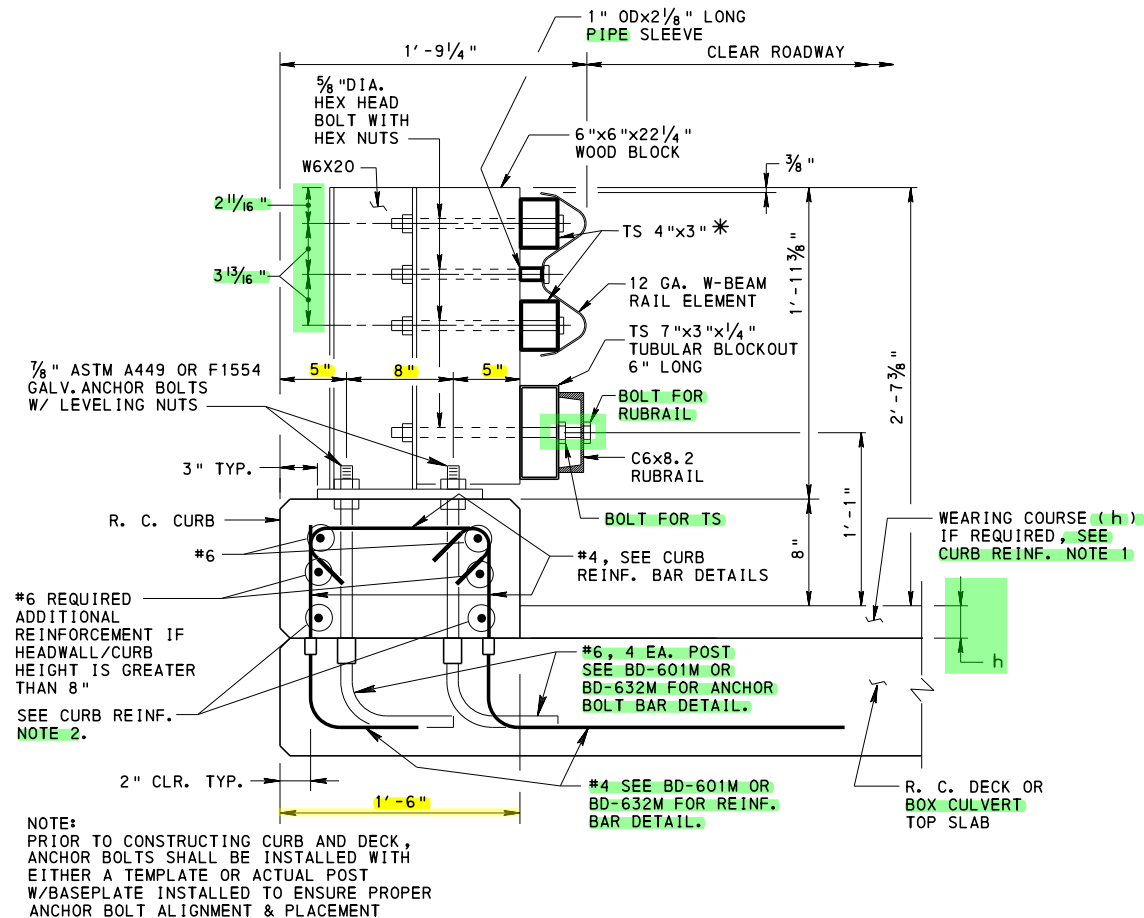


NOTES:

1. MODIFIED STRUCTURE MOUNTED GUIDE RAIL BARRIER GRANTED TL3 DESIGNATION BY FHWA.
2. PROVIDE MATERIALS AND WORKMANSHIP 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.
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. PLACE POST AND POST ANCHOR BOLTS NORMAL TO GRADE AND RAILS PARALLEL TO GRADE.
6. COAT ALL SURFACES OF THE BASE PLATE 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, PUBLICATION 408.
7. DO NOT USE DEFLECTION JOINTS WITH PA STRUCTURE MOUNTED GUIDE RAIL BRIDGE BARRIERS.
8. PROVIDE POST SPACINGS ON THE PLANS.
9. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-706M.
10. FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF PA STRUCTURE MOUNTED GUIDE RAIL BRIDGE BARRIERS ARE 181 LBS/FT.
11. STRUCTURAL STEEL ASTM A709, GRADE 36 OR 50, UNLESS OTHERWISE NOTED.

CHANGE 1

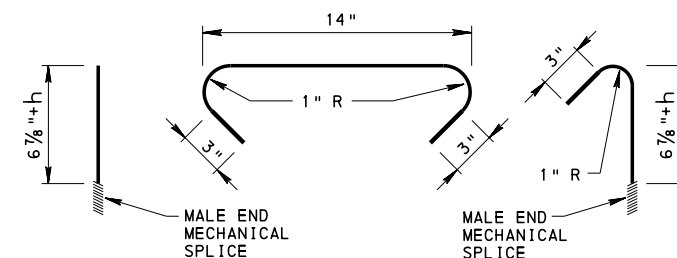
CHANGE 2



SECTION A-A

DECK REINFORCEMENT NOT SHOWN FOR CLARITY

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



CURB REINF. NOTES:

1. 2 1/2" MIN., 11" MAX.
COMBINATION FILL AND OVERLAY
TOTAL WEARING COURSE THICKNESS (h)
2. TWO #4 BARS REQUIRED IF TOTAL
WEARING COURSE THICKNESS (h)
IS GREATER THAN 6"

CURB REINFORCEMENT BAR DETAILS

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

RC-52M	TYPE 2 STRONG POST GUIDE RAIL
BD-601M	CONCRETE DECK SLAB
BD-632M	R.C. BOX CULVERT
BC-706M	PA STRUCTURE MOUNTED GUIDE RAIL BARRIER MISCELLANEOUS DETAILS
BC-734M	ANCHOR SYSTEMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
REFERENCE DRAWINGS	

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STANDARD

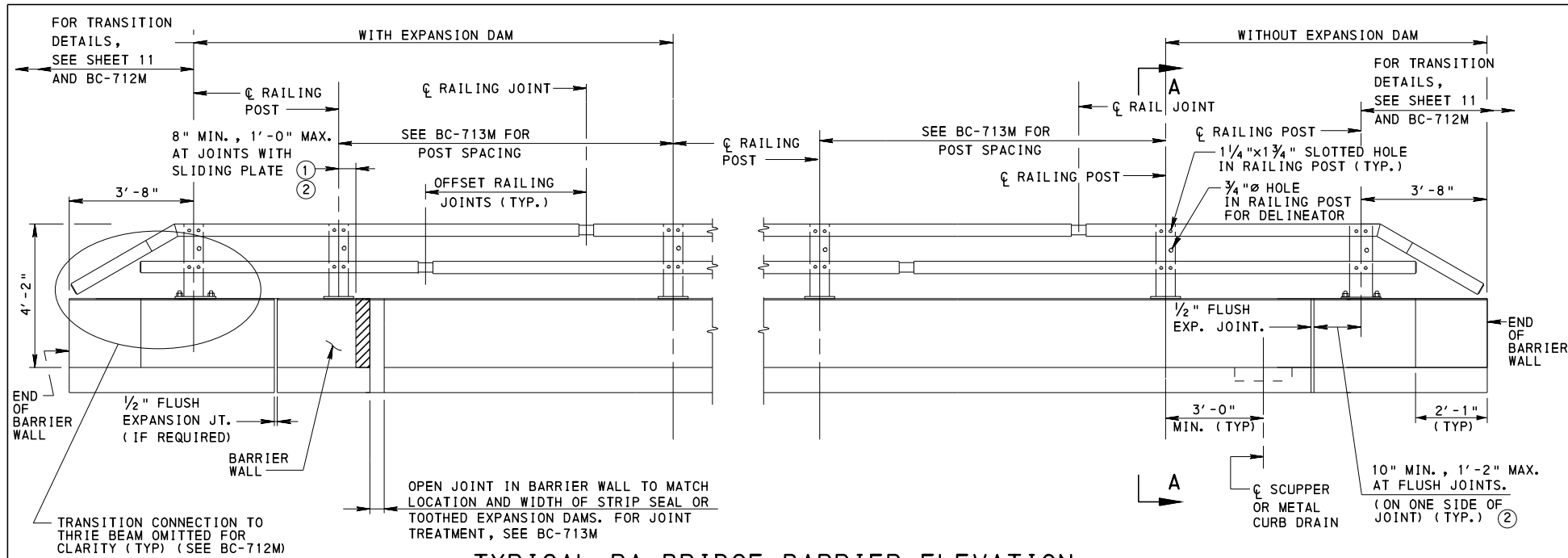
PA STRUCTURE MOUNTED GUIDE RAIL BARRIER

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

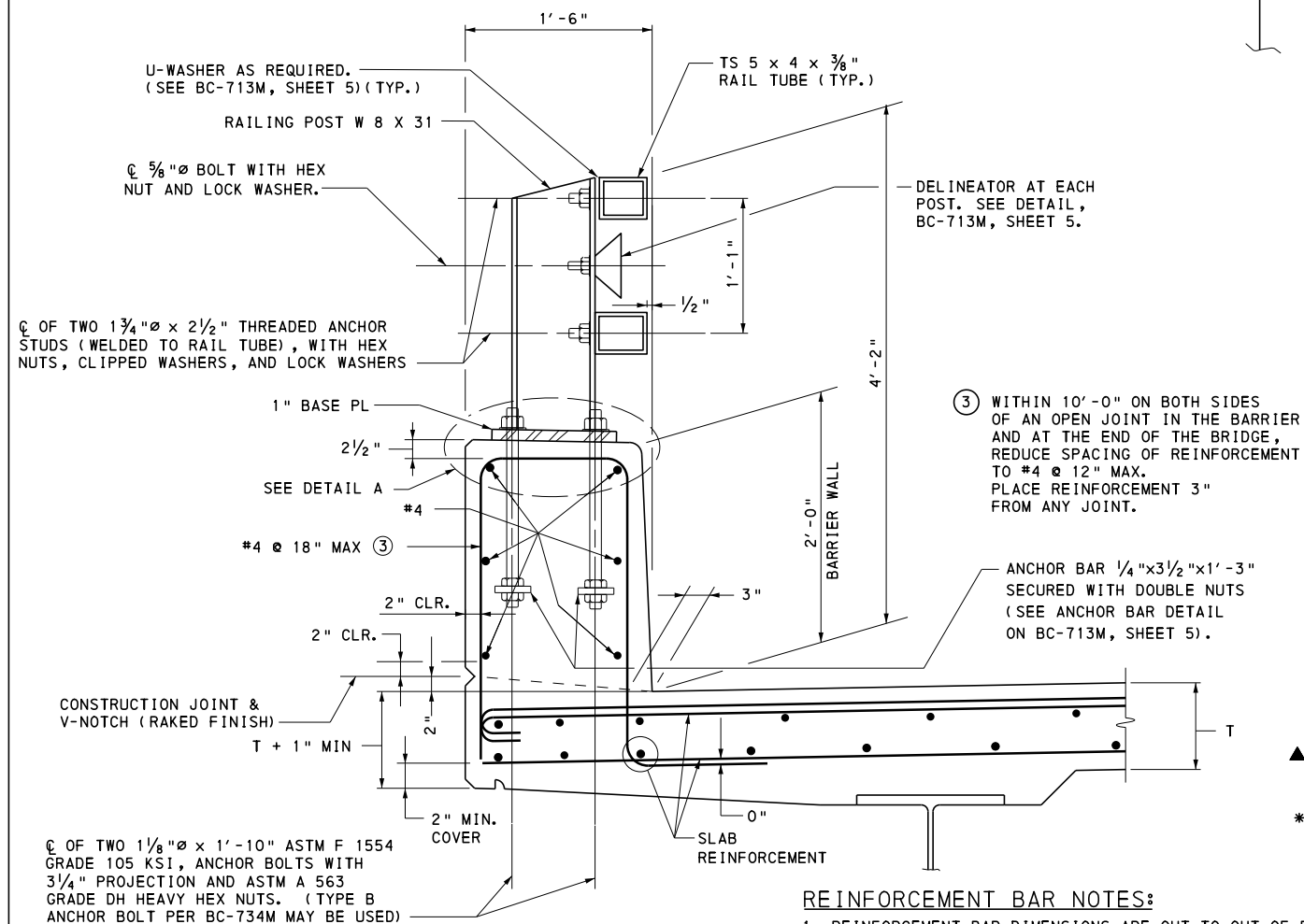
SHEET 1 OF 1
BD-609M

CHANGE 3



TYPICAL PA BRIDGE BARRIER ELEVATION

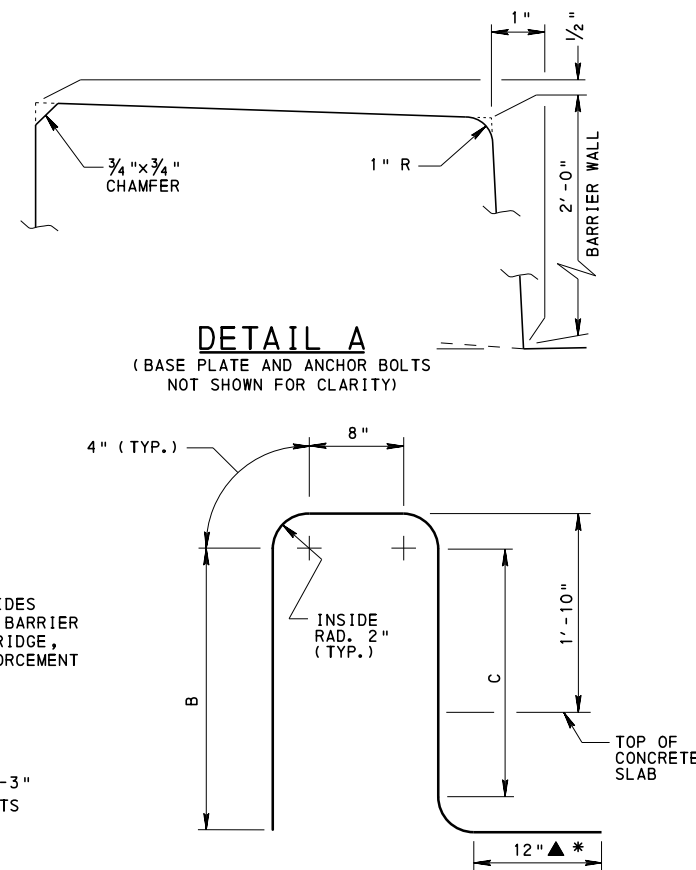
- (WITHOUT INLET PLACEMENT SHOWN; WITH INLET PLACEMENT SIMILAR, SEE SHEET 11)
1. RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE
 2. NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL. IF POSTS LOCATED AT EXPANSION JOINT



SECTION A-A

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).



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.

BD-601M	CONCRETE DECK SLAB
BC-712M	THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
REFERENCE DRAWINGS	

NOTES:

1. PA BRIDGE BARRIER HAS BEEN ACCEPTED BY FHWA AS A TL-5 BARRIER DESIGNATION.
2. PROVIDE MATERIALS AND WORKMANSHIP 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.
4. THE MAXIMUM JOINT MOVEMENT FOR THE PA BRIDGE BARRIER IS 9".
5. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE BC-713M, SHEET 2.
6. PROVIDE RAILING JOINTS IN ALL RAILS IN THE BAY ABOVE AN EXPANSION DAM. SEE BC-713M, SHEET 1, FOR RAILING JOINT DETAILS.
7. FOR DEAD LOAD CALCULATIONS, THE MASS OF FOUR TYPES OF PA BRIDGE BARRIER ARE AS FOLLOWS:

TYPICAL SIDEWALK	500 LB./FT.
RAISED SIDEWALK	510 LB./FT.
ALT. SIDEWALK	510 LB./FT.
(ALL CASES ASSUME 5'-9" POST SPACING)	
8. POST SPACING TO BE DETERMINED BY THE CONTRACTOR AS PER BC-713M.
9. ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615, A 996, OR A 706.
10. USE $f'_c = 3.5$ KSI CLASS AA CONCRETE FOR BARRIER WALL.
11. 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.

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

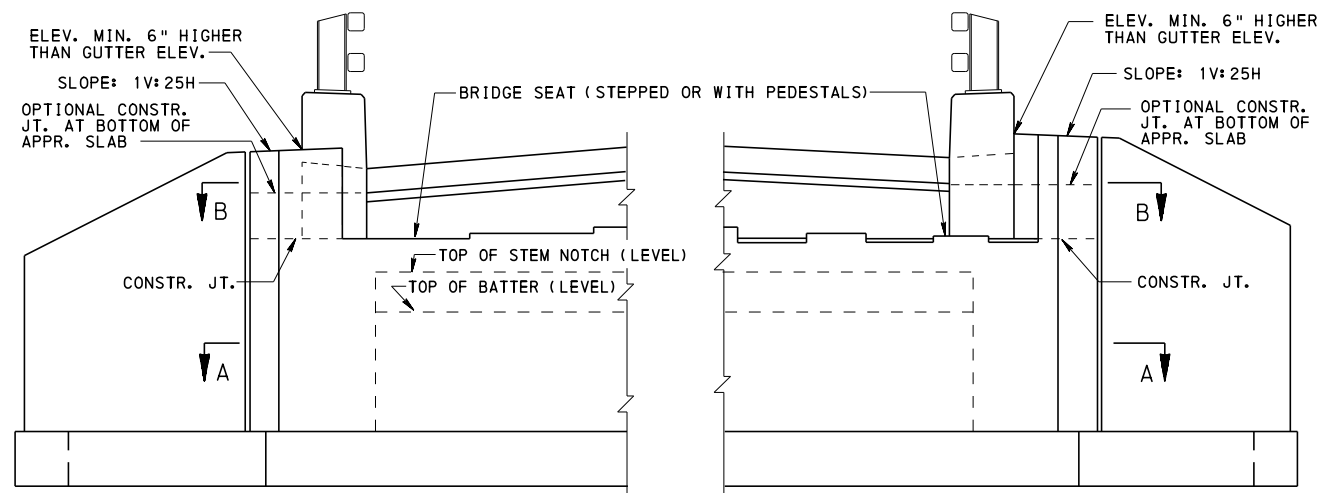
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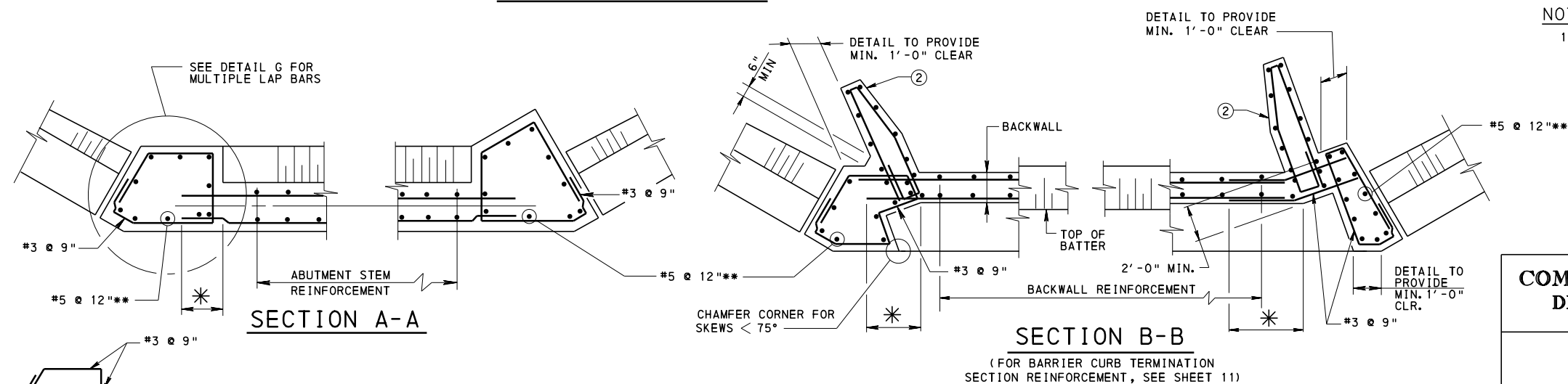
PA BRIDGE BARRIER

BARRIER DETAILS

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR., BUR. OF PROJECT DELIVERY	SHEET 1 OF 17 BD-610M
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TYPICAL ELEVATION



ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE
LAP BARS. SEE DETAIL G.

**** 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.**

NOTE:
1. FOR SECTION C-C, SEE SHEET 3.

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DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PA BRIDGE BARRIER
R. C. ABUTMENTS WITH BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

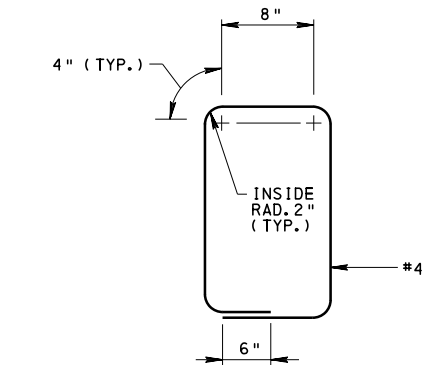
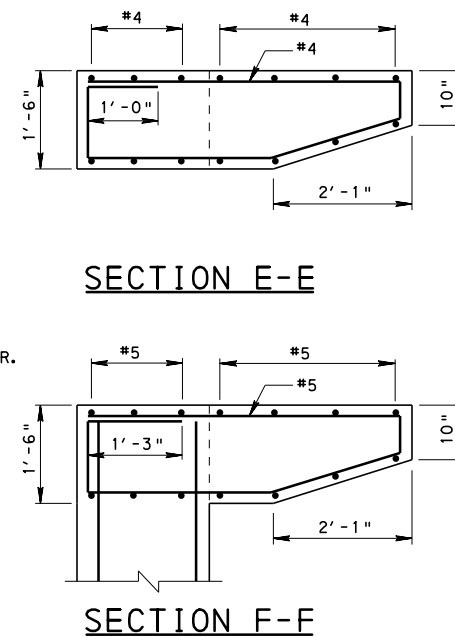
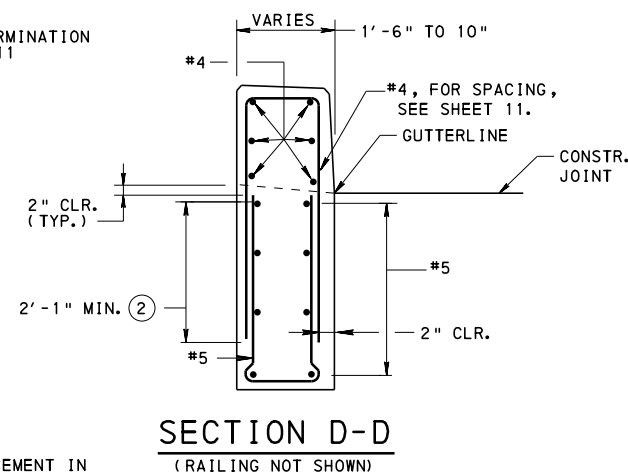
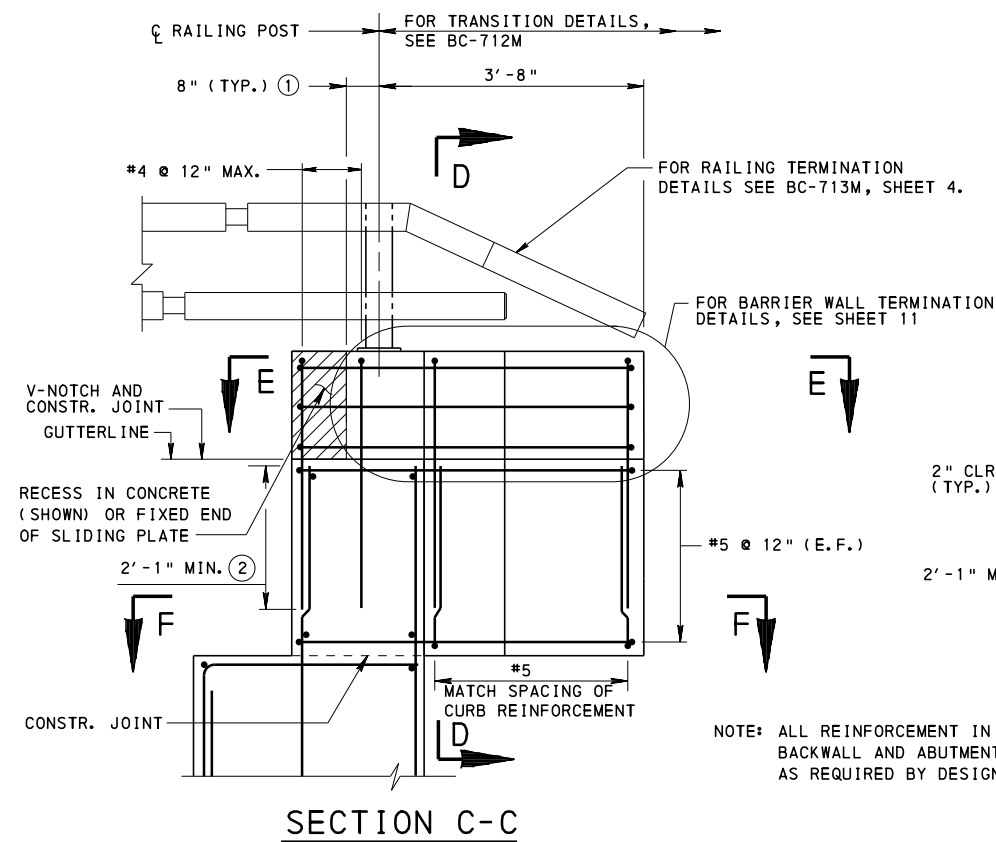
Thomas P Macioce
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SHEET 2 OF 17

BD-610M

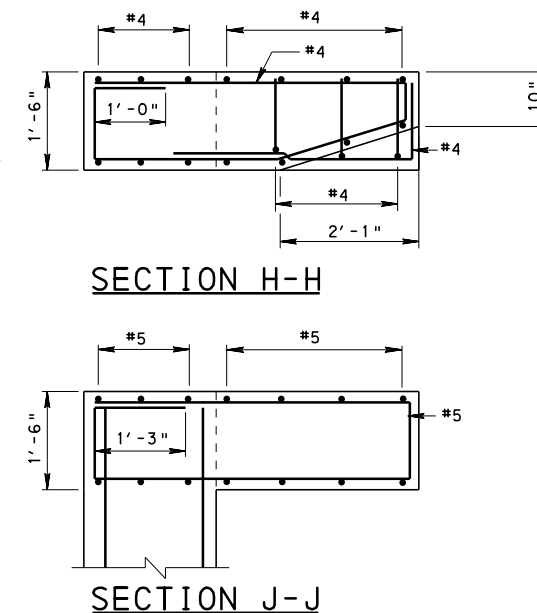
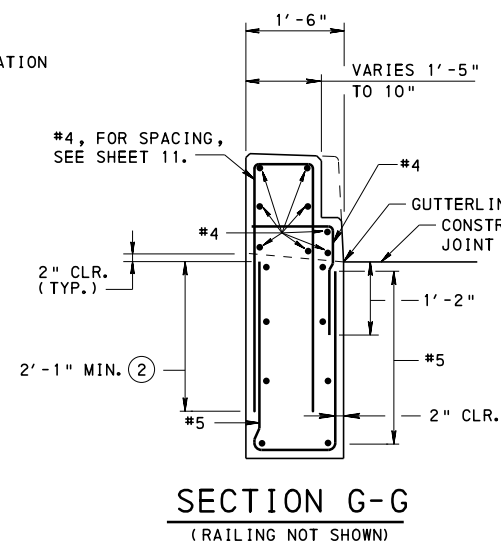
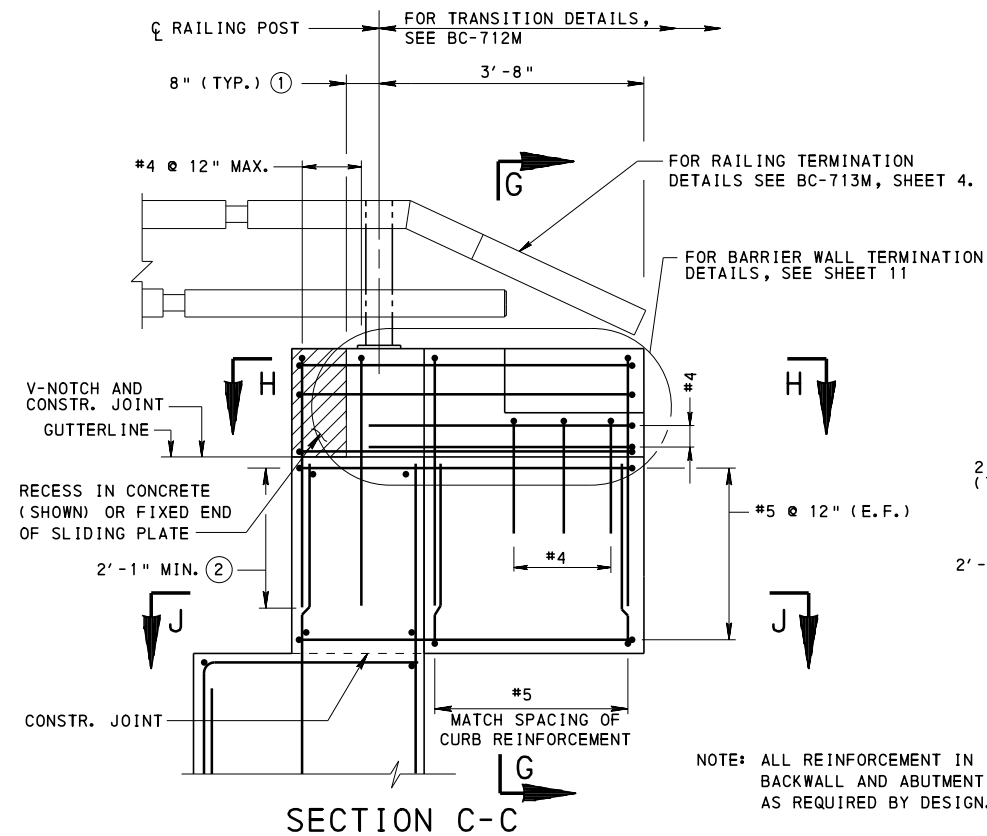
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BC-712M	THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	



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).

- ① ϕ RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR ϕ RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE.
- ② FOR SUPERSTRUCTURES WHICH ARE TOO SHALLOW TO ACCOMMODATE THE 2'-1" MIN. LAP, USE SINGLE HOOP BAR. SEE ALTERNATE REINFORCEMENT DETAIL.



NOTE:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 2.
2. OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 2'-1".
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

WITHOUT INLET PLACEMENT

WITH INLET PLACEMENT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

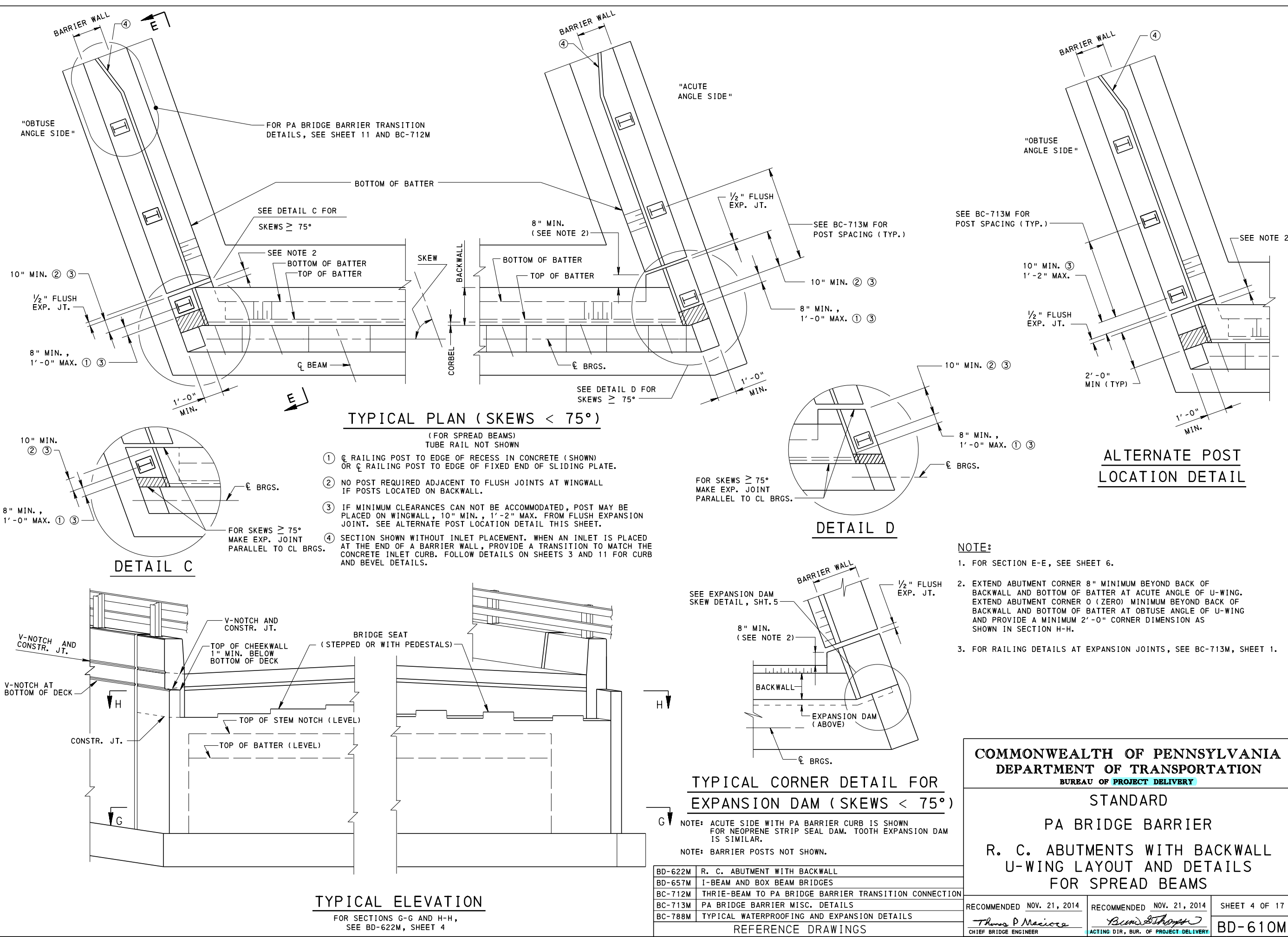
STANDARD

PA BRIDGE BARRIER

R.C. ABUTMENTS WITH BACKWALL
FLARED WINGS

BC-712M	THREE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
REFERENCE DRAWINGS	

RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014	SHEET 3 OF 17
Thomas P. Maciore CHIEF BRIDGE ENGINEER	Brian S. Thompson ACTING DIR. OF PROJECT DELIVERY	BD-610M



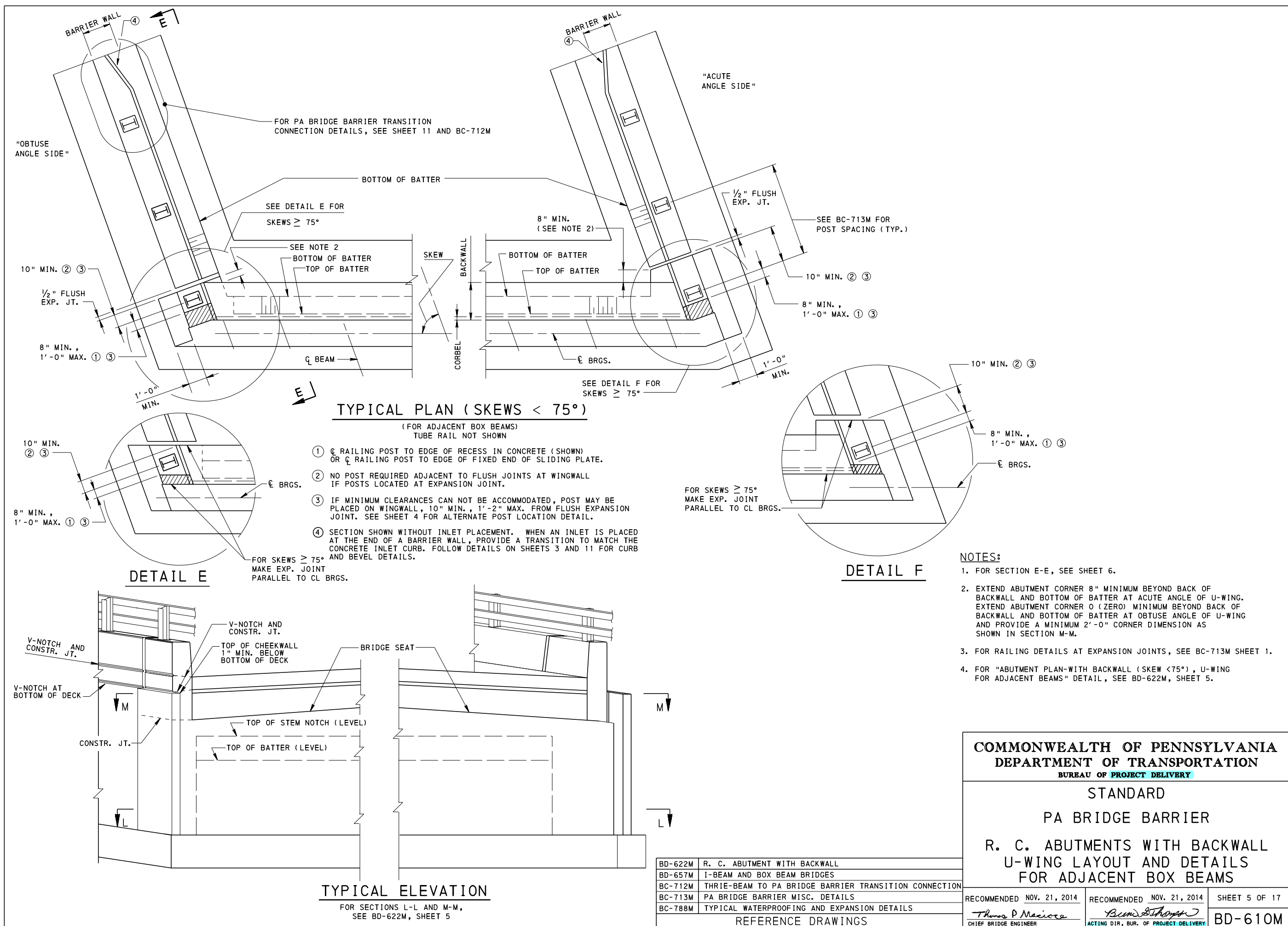
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

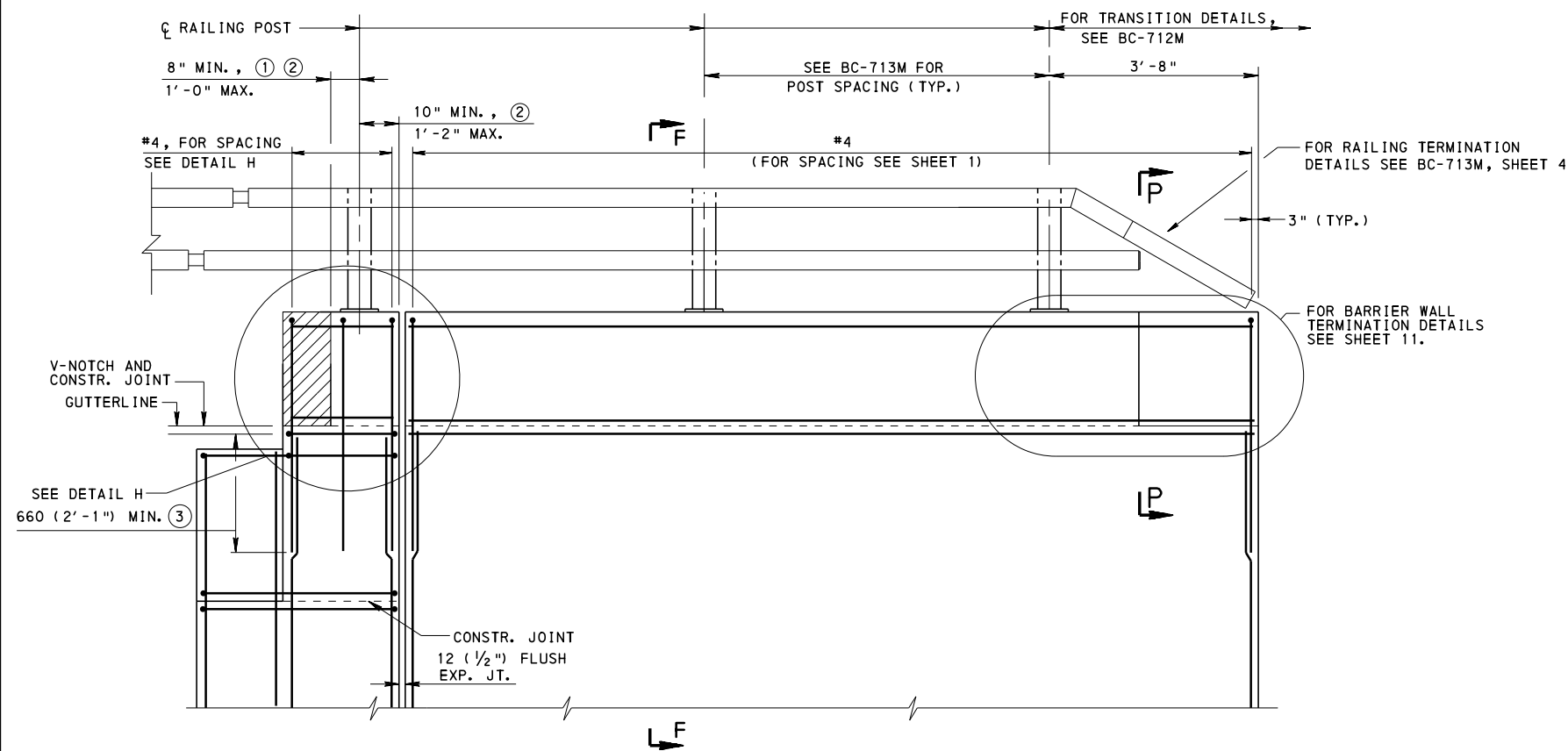
STANDARD
PA BRIDGE BARRIER
R. C. ABUTMENTS WITH BACKWALL
U-WING LAYOUT AND DETAILS
FOR SPREAD BEAMS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
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SHEET 4 OF 17
BD-610M



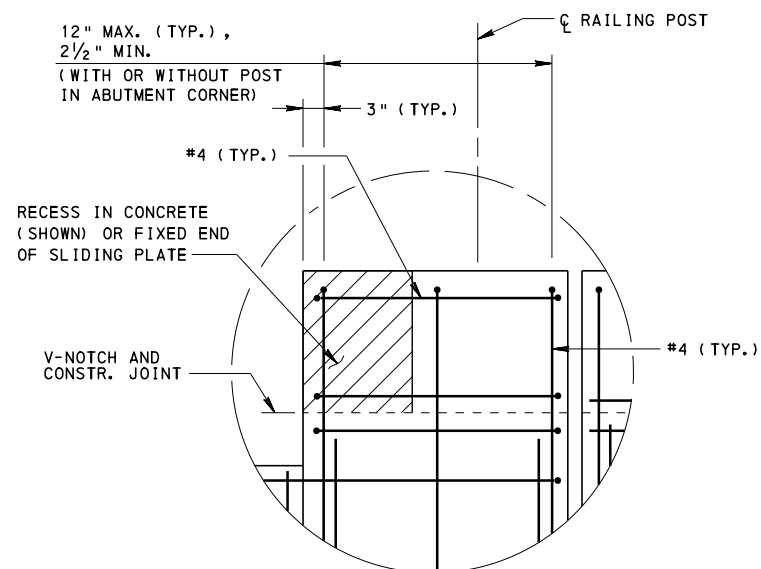


SECTION E-E

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

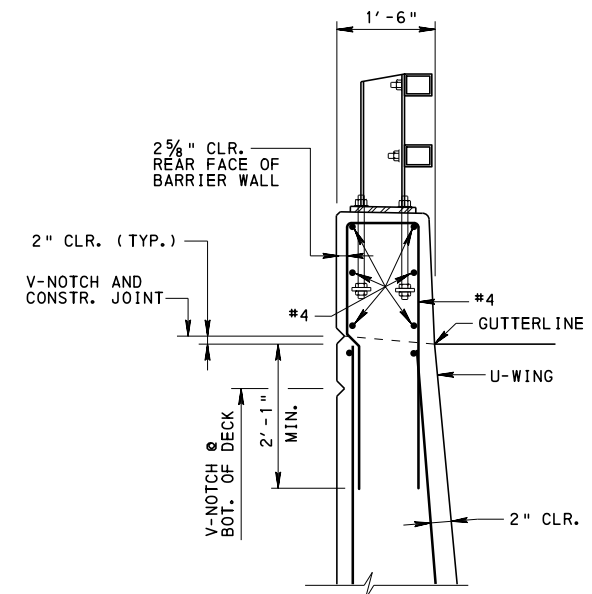
NOTE: FOR REINFORCEMENT IN ABUTMENT CORNER, CHEEKWALL AND BACKWALL BELOW BARRIER, SEE BD-622M, SHEETS 4 AND 5.

- ① \bar{C} RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR \bar{C} RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE.
- ② IF MINIMUM CLEARANCES CAN NOT BE ACCOMMODATED, POST MAY BE PLACED ON THE WINGWALL 10" MIN., 1'-2" MAX. FROM FLUSH EXPANSION JOINT. SEE SHEET 4 FOR ALTERNATE POST LOCATION DETAIL.
- ③ FOR SUPERSTRUCTURES WHICH ARE TOO SHALLOW TO ACCOMMODATE THE 2'-1" MIN. LAP, USE SINGLE HOOP BAR. SEE ALTERNATE REINFORCEMENT DETAIL, SHEET 3.



DETAIL H

NOTE: RAILING POST NOT SHOWN.



SECTION F-F

(WITH OR WITHOUT BATTER)

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 4 AND SHEET 5.
2. FOR SECTION P-P, SEE SHEET 11.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
PA BRIDGE BARRIER

R. C. ABUTMENTS WITH BACKWALL
U-WINGS

BD-622M	R. C. ABUTMENT WITH BACKWALL
BC-712M	THREE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER DETAIL

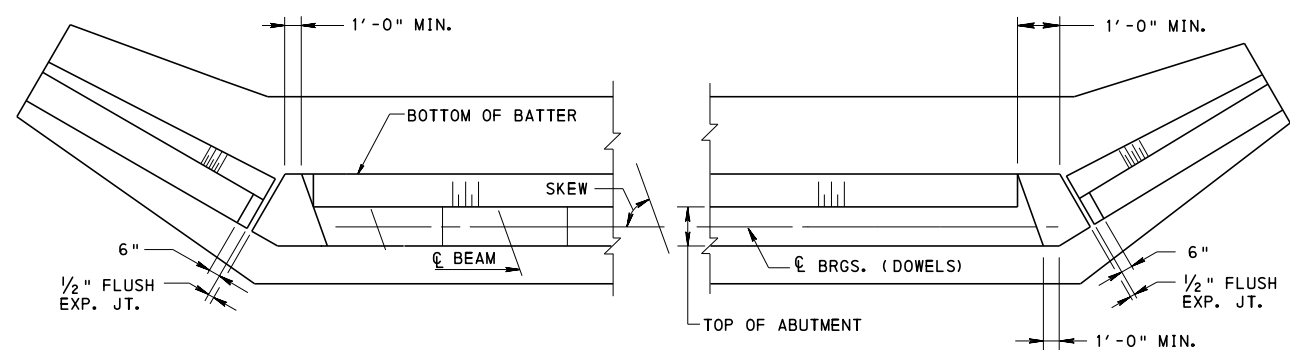
REFERENCE DRAWINGS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

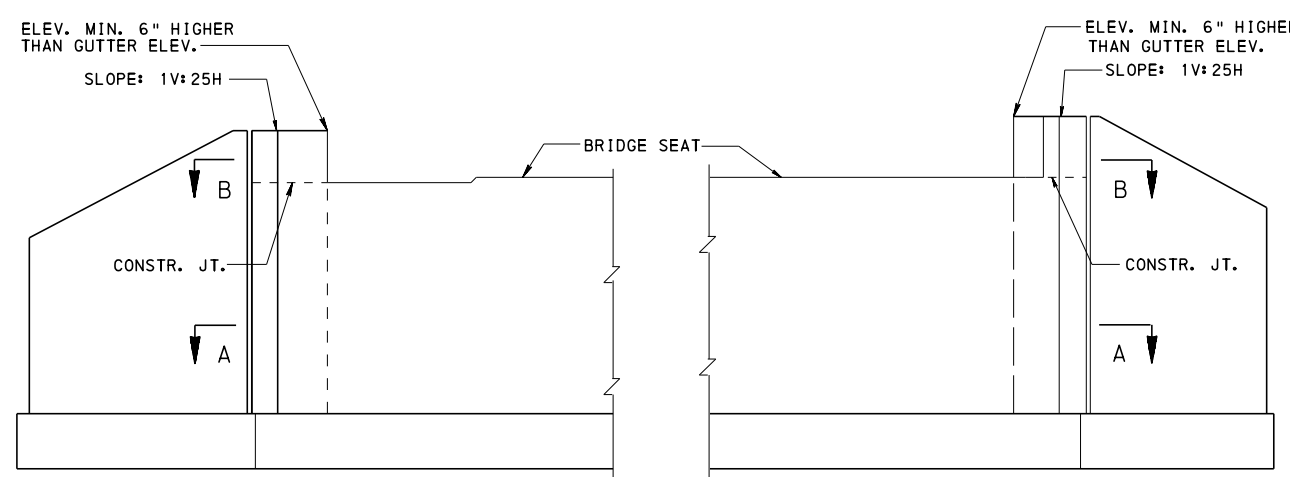
RECOMMENDED NOV. 21, 2014
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ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 6 OF 17

BD-610M

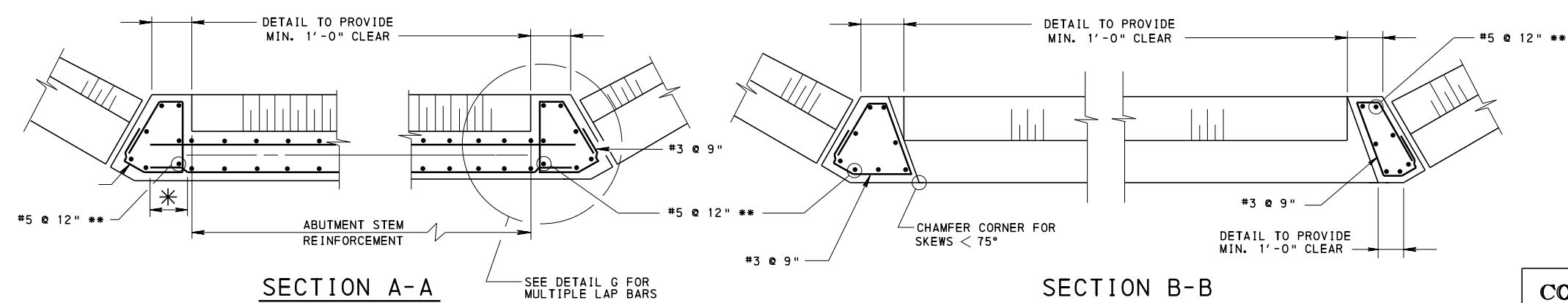


TYPICAL PLAN



TYPICAL ELEVATION

- NOTES:**
1. PA BRIDGE BARRIER TERMINATES AT END OF BRIDGE DECK SLAB. FOR BARRIER WALL TERMINATION DETAILS, SEE SHEET 11. FOR TRANSITION DETAILS, SEE BC-712M.



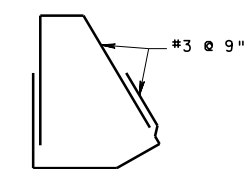
SECTION A-A

SECTION B-B

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. SEE DETAIL G.

** 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.



DETAIL G

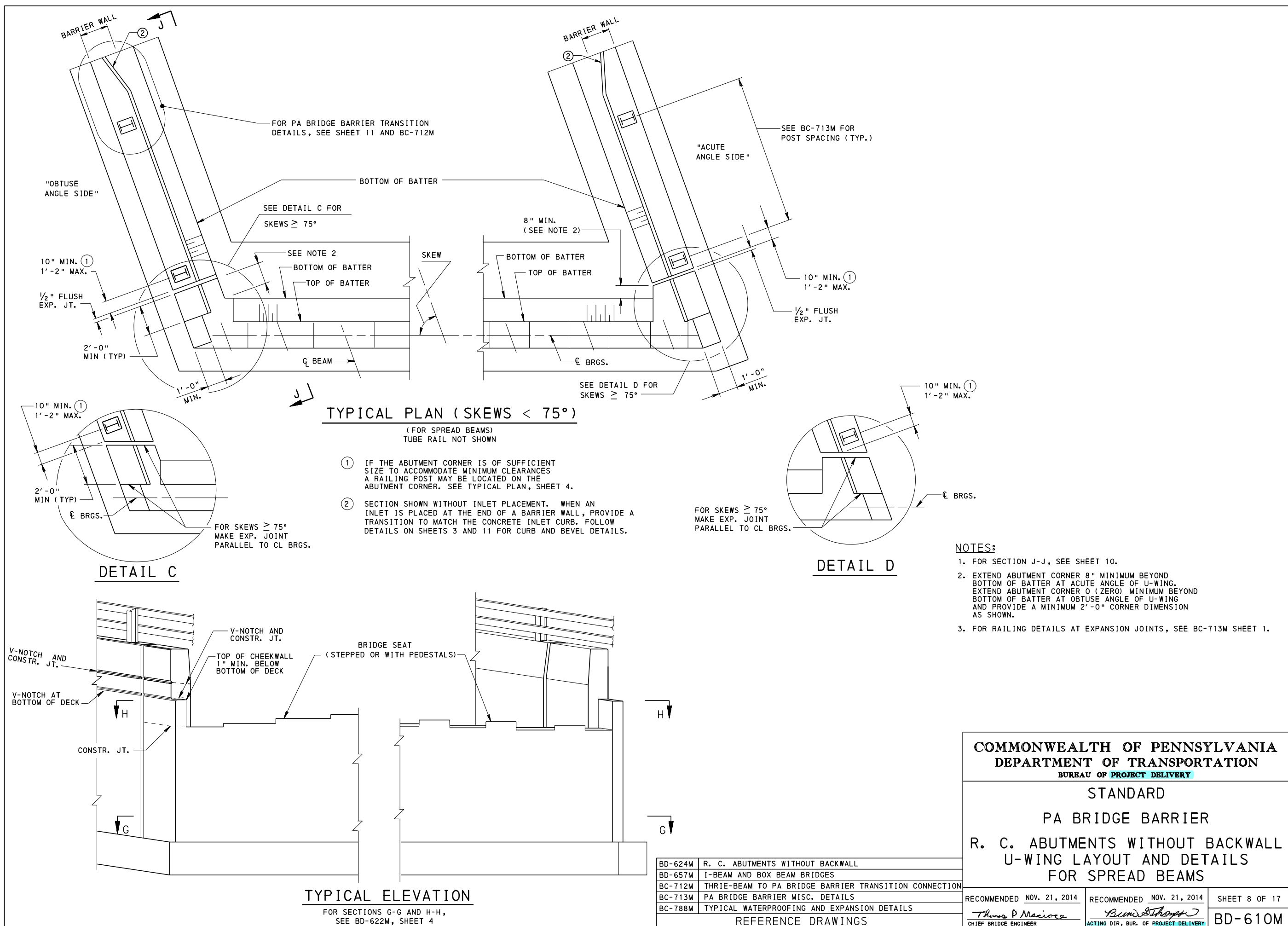
* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED TO OBTAIN MINIMUM DEVELOPMENT LENGTH. (TYP.)

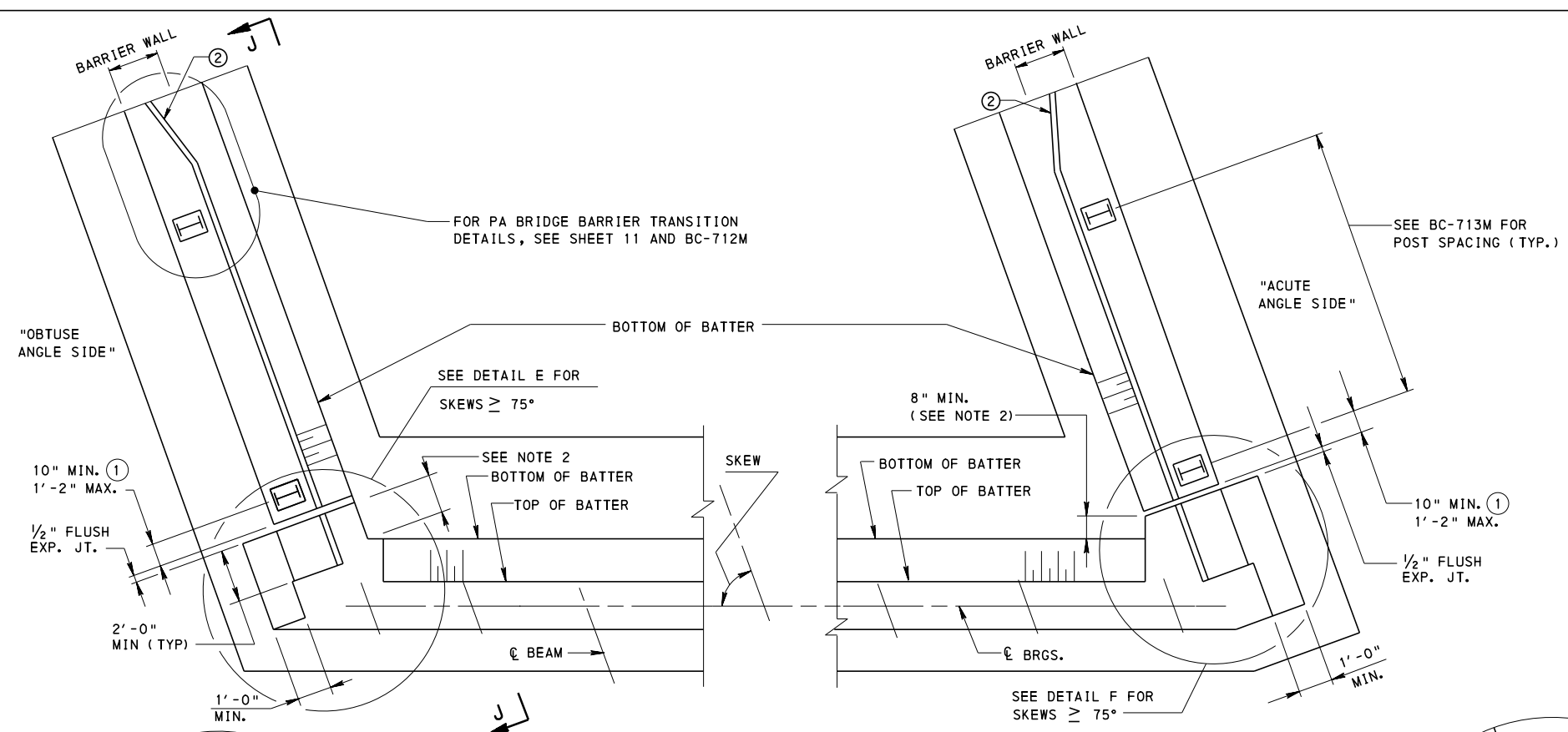
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BC-712M	THREE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
PA BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014	SHEET 7 OF 17
Thomas P. Maciore CHIEF BRIDGE ENGINEER	Brian J. Thompson ACTING DIR. BUR. OF PROJECT DELIVERY	BD-610M

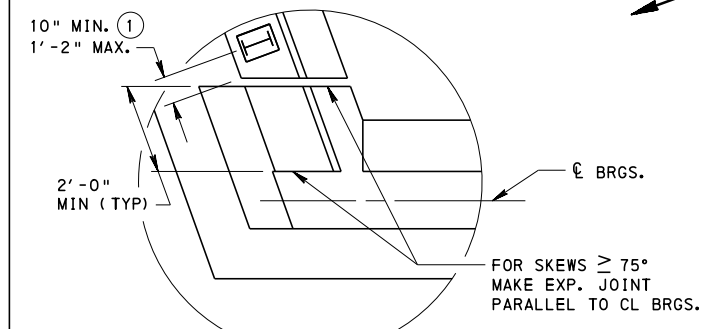




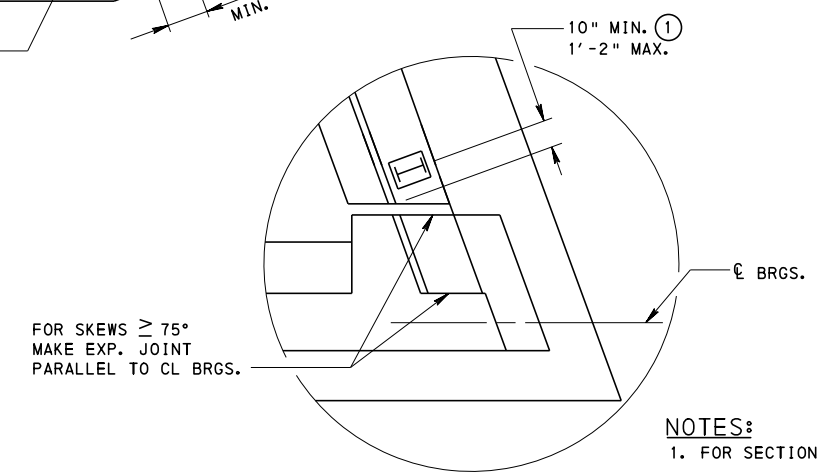
TYPICAL PLAN (SKEWS < 75°)

(FOR ADJACENT BOX BEAMS)
TUBE RAIL NOT SHOWN

- ① IF THE ABUTMENT CORNER IS OF SUFFICIENT SIZE TO ACCOMMODATE MINIMUM CLEARANCES A RAILING POST MAY BE LOCATED ON THE ABUTMENT CORNER. SEE TYPICAL PLAN, SHEET 4.
- ② SECTION SHOWN WITHOUT INLET PLACEMENT. WHEN AN INLET IS PLACED AT THE END OF A BARRIER WALL, PROVIDE A TRANSITION TO MATCH THE CONCRETE INLET CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR CURB AND BEVEL DETAILS.

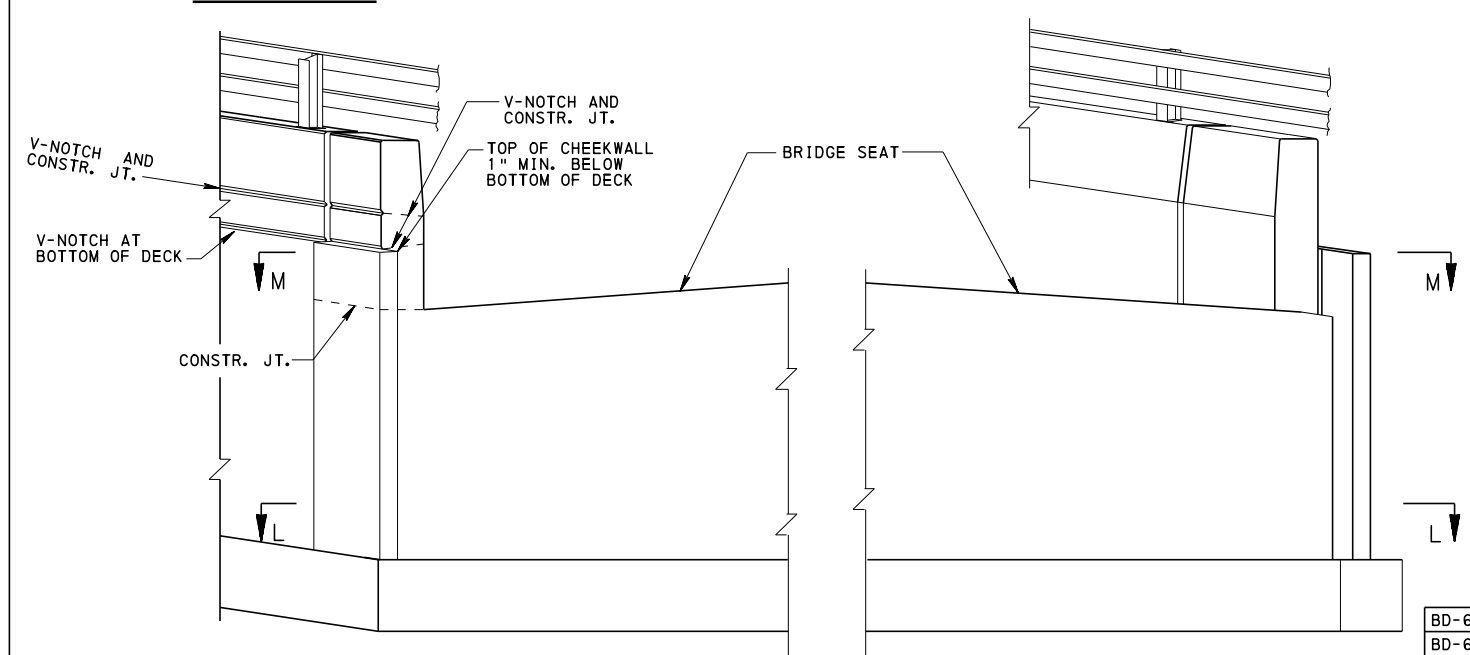


DETAIL E



DETAIL F

- NOTES:**
1. FOR SECTION J-J, SEE SHEET 10.
 2. 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.
 3. FOR RAILING DETAILS AT EXPANSION JOINTS, SEE BC-713M SHEET 1.
 4. FOR THE "ABUTMENT PLAN - WITHOUT BACKWALL (SKEWS < 75°), U-WINGS FOR ADJACENT BEAMS" DETAIL, SEE BD-624M SHEET 5.



TYPICAL ELEVATION

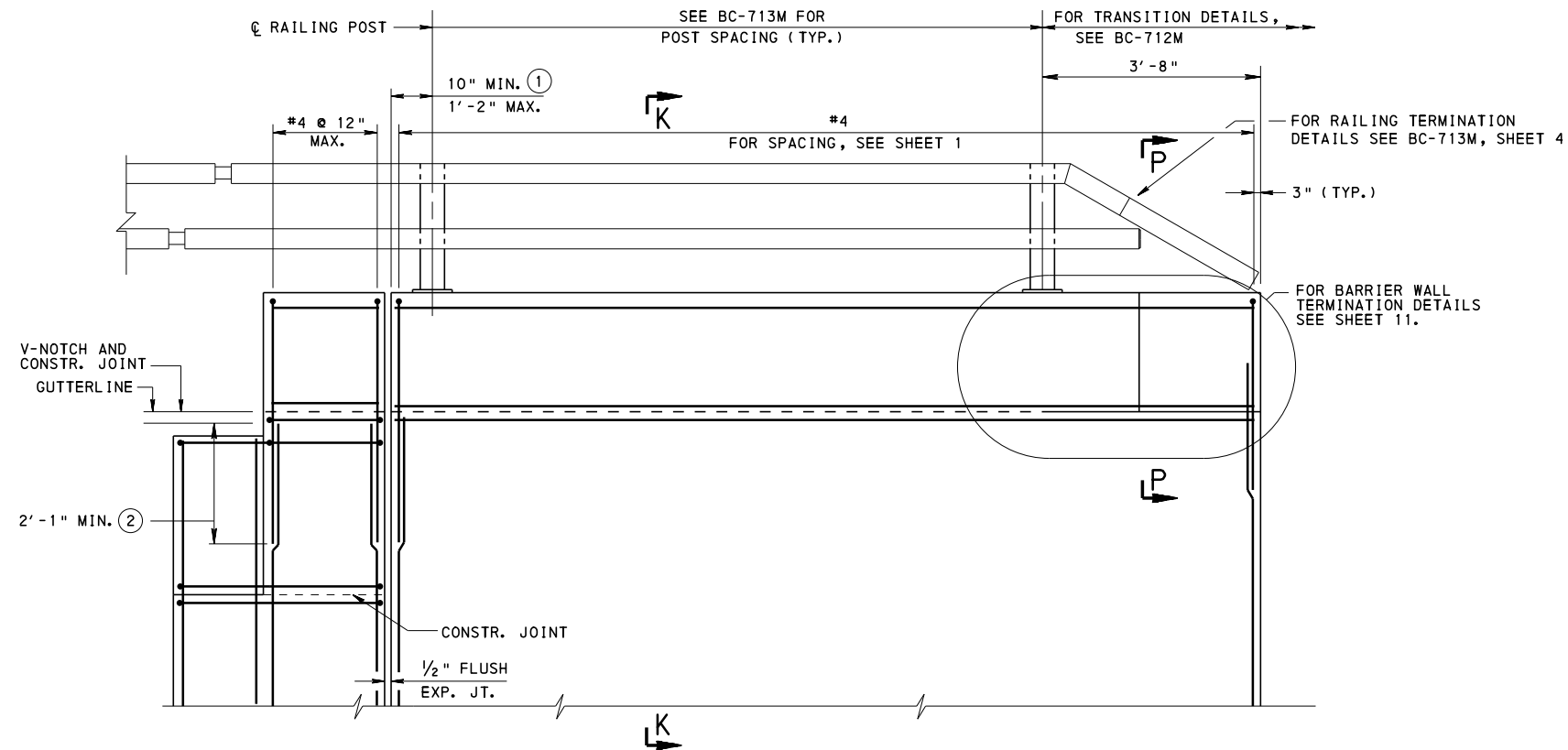
FOR SECTIONS L-L AND M-M,
SEE BD-624M, SHEET 5

BD-624M	R. C. ABUTMENTS WITHOUT BACKWALL
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BC-712M	THREE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PA BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
U-WING LAYOUT AND DETAILS
FOR ADJACENT BEAMS

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 9 OF 17 BD-610M
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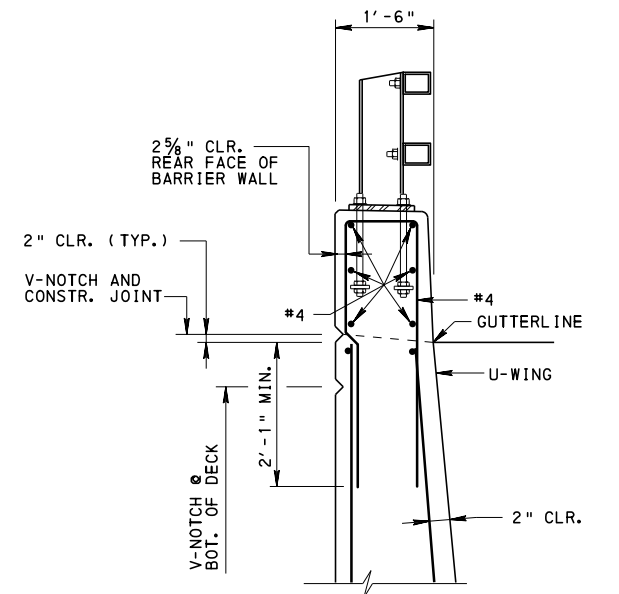


SECTION J-J

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

NOTE: FOR REINFORCEMENT IN ABUTMENT CORNER, CHEEKWALL, AND BACKWALL BELOW BARRIER, SEE BD-624M, SHEETS 4 AND 5.

- ① IF THE ABUTMENT CORNER IS OF SUFFICIENT SIZE TO ACCOMMODATE MINIMUM CLEARANCES A RAILING POST MAY BE LOCATED ON THE CORNER. SEE TYPICAL PLAN, SHEET 4.
- ② FOR SUPERSTRUCTURES WHICH ARE TOO SHALLOW TO ACCOMMODATE THE 2'-1" MIN. LAP, USE SINGLE HOOP BAR. SEE ALTERNATE REINFORCEMENT DETAIL, SHEET 3.



SECTION K-K

(WITH OR WITHOUT BATTER)

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 8 AND SHEET 9.
2. FOR SECTION P-P, SEE SHEET 11.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

PA BRIDGE BARRIER

R. C. ABUTMENTS WITHOUT BACKWALL
U-WINGS

BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BC-712M	THREE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER DETAIL

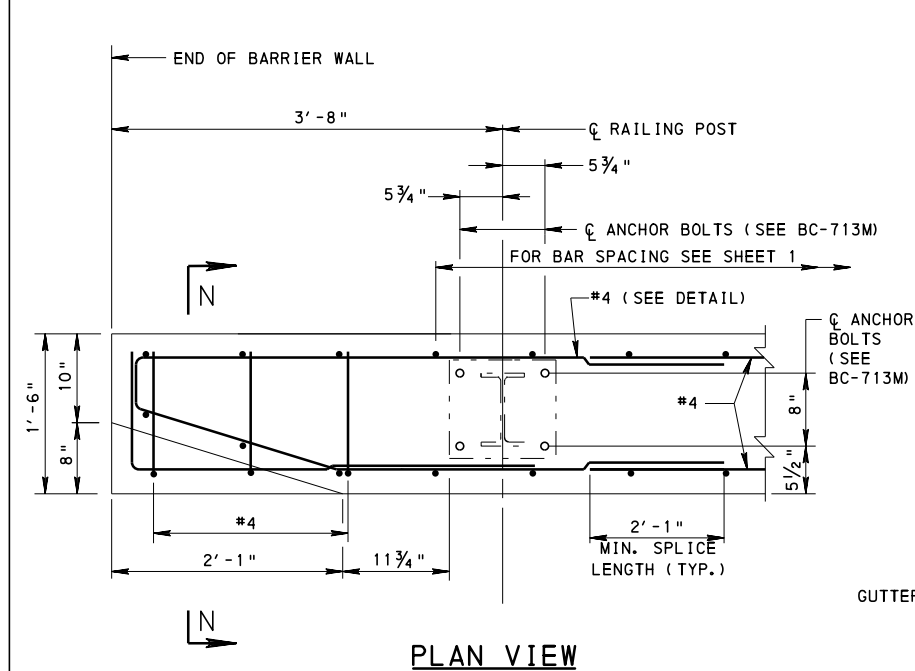
REFERENCE DRAWINGS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

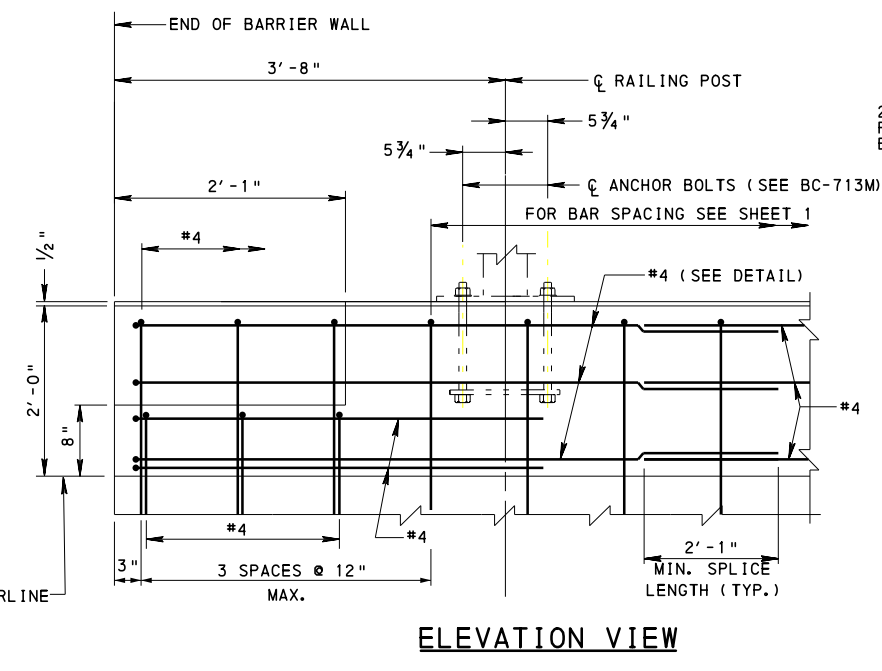
RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. OF PROJECT DELIVERY

SHEET 10 OF 17

BD-610M

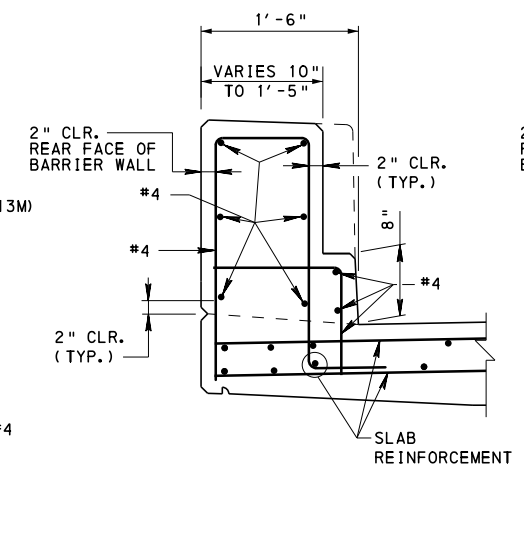


PLAN VIEW

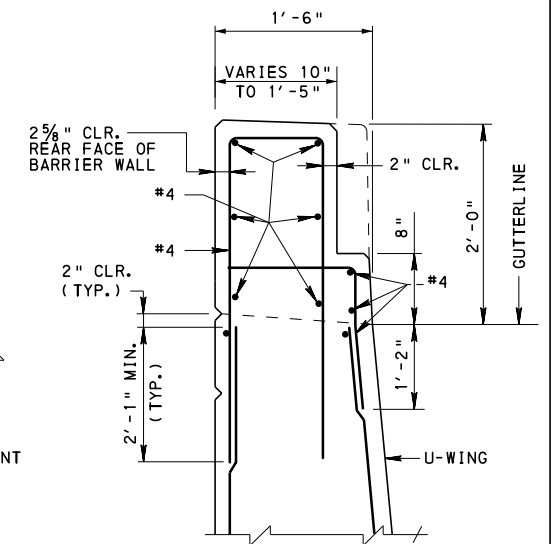


ELEVATION VIEW

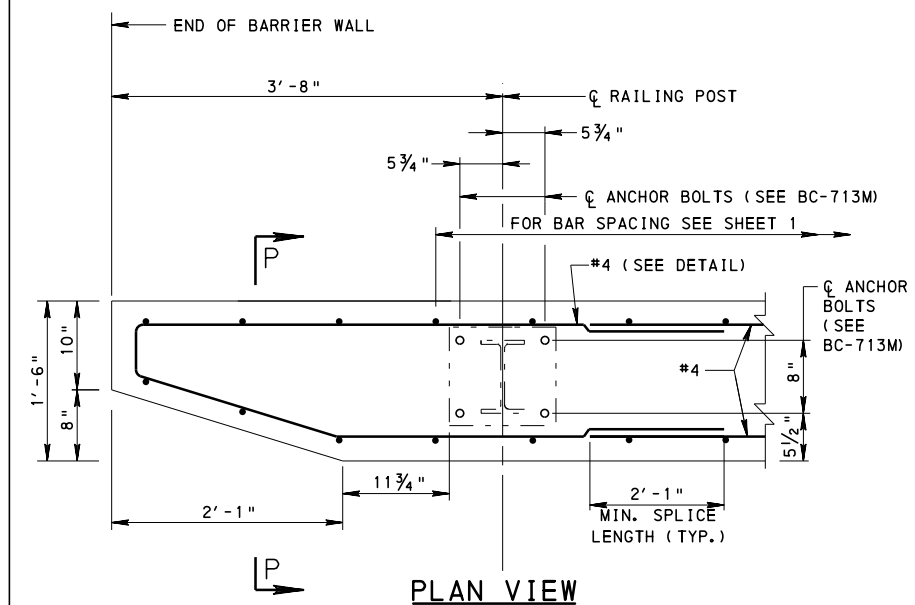
BARRIER WALL TERMINATION SECTION
(WITH INLET PLACEMENT)



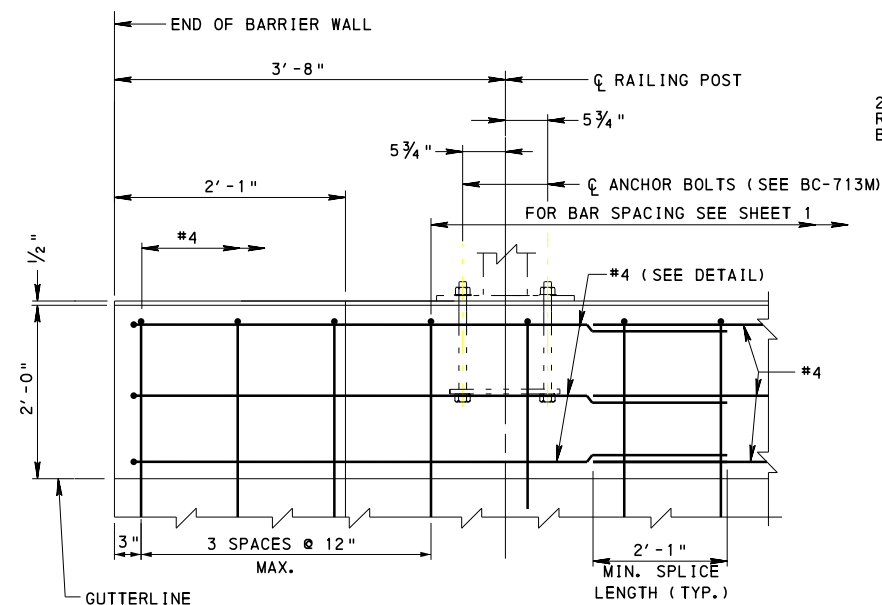
SECTION N-N
(BARRIER ON STRUCTURE)



SECTION N-N
(BARRIER ON U-WING)
(WITH OR WITHOUT BATTER)
(SECTION ON BACKWALL SIMILAR)

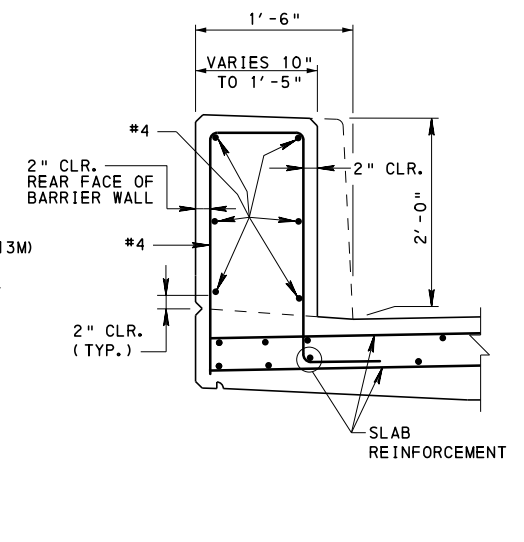


PLAN VIEW

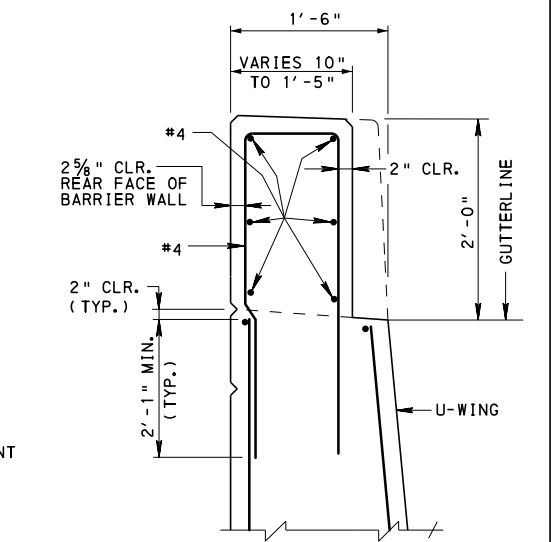


ELEVATION VIEW

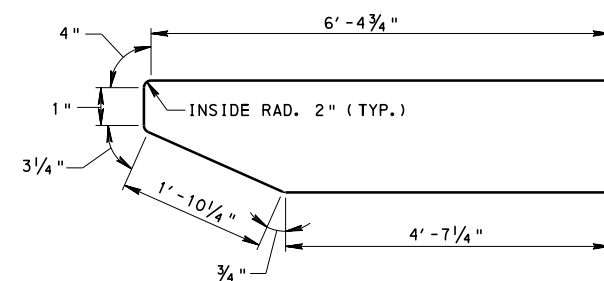
BARRIER WALL TERMINATION SECTION
(WITHOUT INLET PLACEMENT)



SECTION P-P
(BARRIER ON STRUCTURE)



SECTION P-P
(BARRIER ON U-WING)
(WITH OR WITHOUT BATTER)
(SECTION ON BACKWALL SIMILAR)



REINFORCEMENT DETAILS
(AT END OF BARRIER WALL)

REINFORCEMENT BAR NOTES:

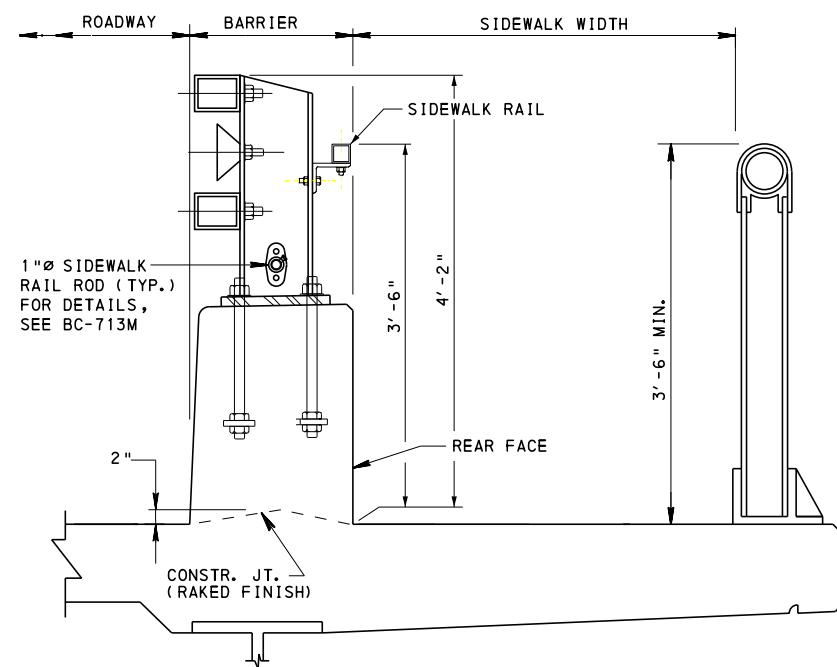
1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

NOTES:

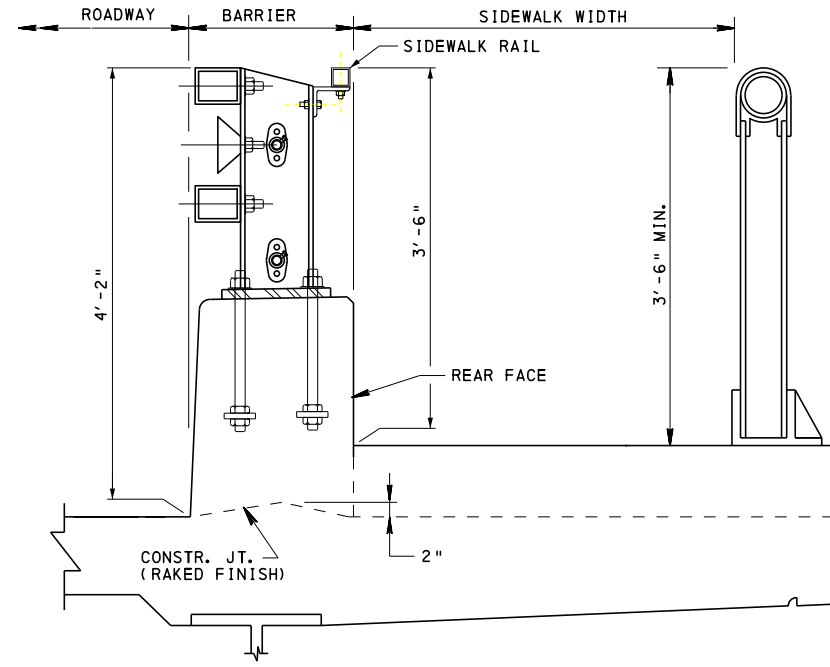
1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

BC-712M	THREE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER MISC DETAILS
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD		
PA BRIDGE BARRIER		
BARRIER DETAILS		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 11 OF 17 BD-610M



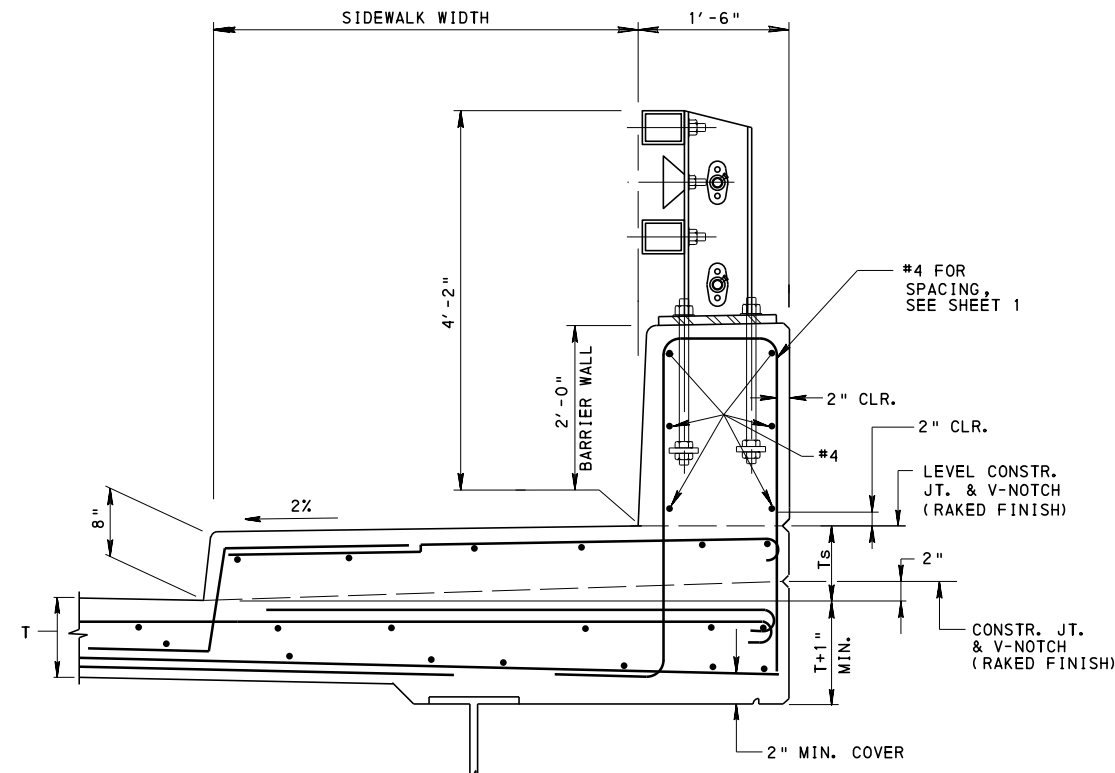
TYPICAL SIDEWALK DETAIL
(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE DECK SLAB, SEE BD-601M)



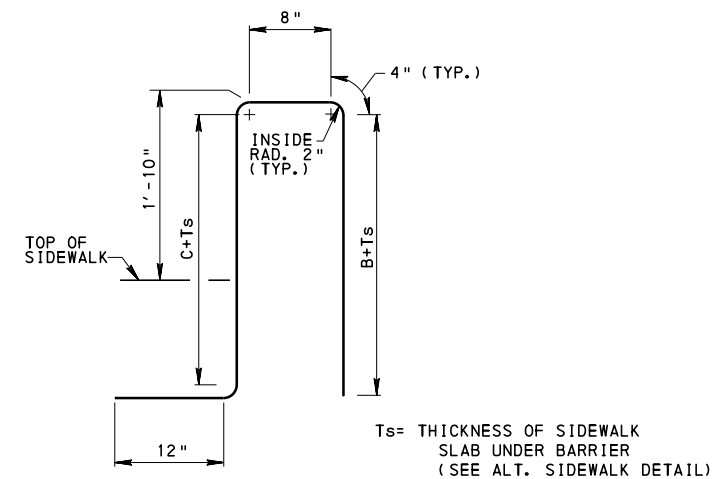
RAISED SIDEWALK DETAIL
(FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)

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"

NOTE: T DESIGNATES DECK SLAB THICKNESS



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:

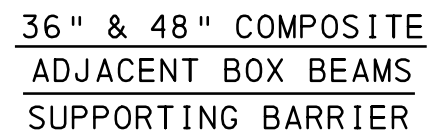
1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

BD-601M	CONCRETE DECK SLAB
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-734M	ANCHOR SYSTEMS
REFERENCE DRAWINGS	

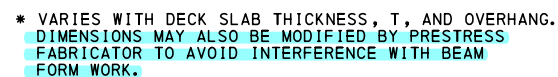
NOTES:

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

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD		
PA BRIDGE BARRIER		
MISCELLANEOUS DETAILS		
RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014	SHEET 12 OF 17
Thomas P. Maciore CHIEF BRIDGE ENGINEER	Brian S. Thompson ACTING DIR. BUR. OF PROJECT DELIVERY	BD-610M



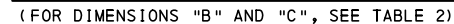
NOTE: T DESIGNATES DECK SLAB THICKNESS



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

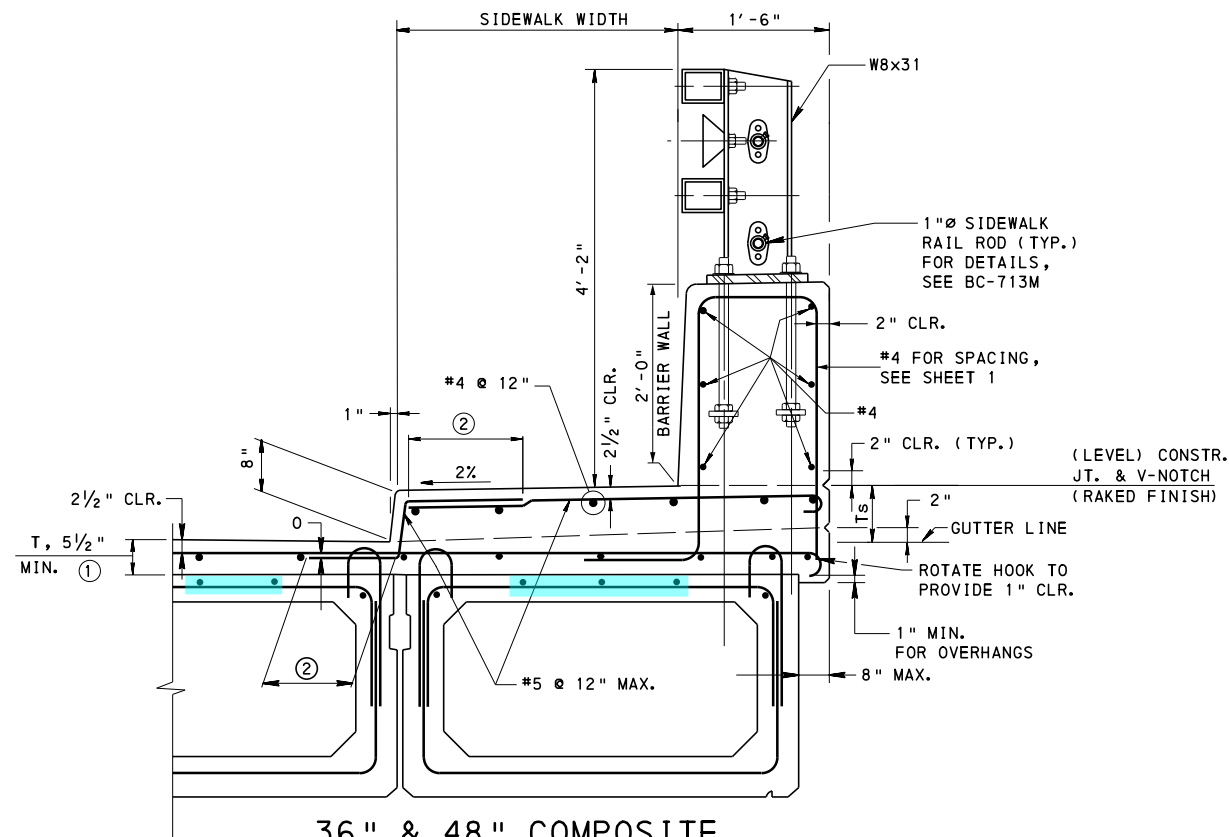


NOTE: T DESIGNATES DECK SLAB THICKNESS

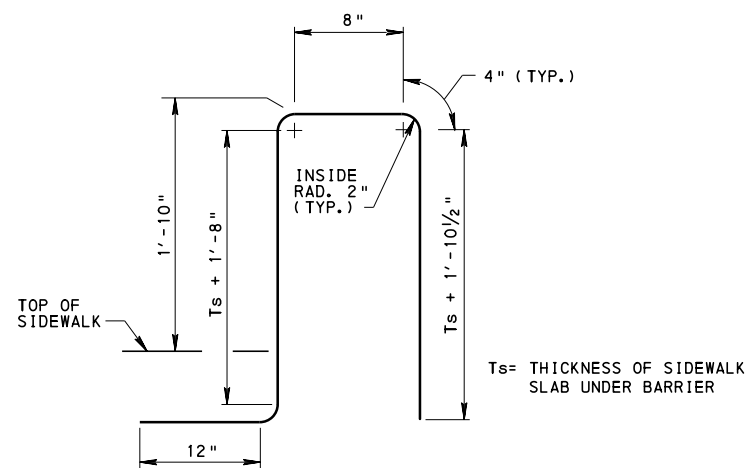


1. FOR GEOMETRIC AND REINFORCEMENT DETAILS
OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
2. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD PA BRIDGE BARRIER MISCELLANEOUS DETAILS		
RECOMMENDED <u>NOV. 21, 2014</u> <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED <u>NOV. 21, 2014</u> <i>Brenda Thompson</i> ACTING DIR. - BUREAU OF PROJECT DELIVERY	SHEET 13 OF 17 <div style="font-size: 2em; font-weight: bold;">BD-610M</div>



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



VERTICAL REINFORCEMENT

LEGEND

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

NOTES:

- 1. FOR GEOMETRY AND REINFORCEMENT DETAILS OF THE PA BRIDGE BARRIER NOT SHOWN, SEE SHEET 1.
- 2. FOR ADDITIONAL NOTES, SEE SHEET 1.
- 3. 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.

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

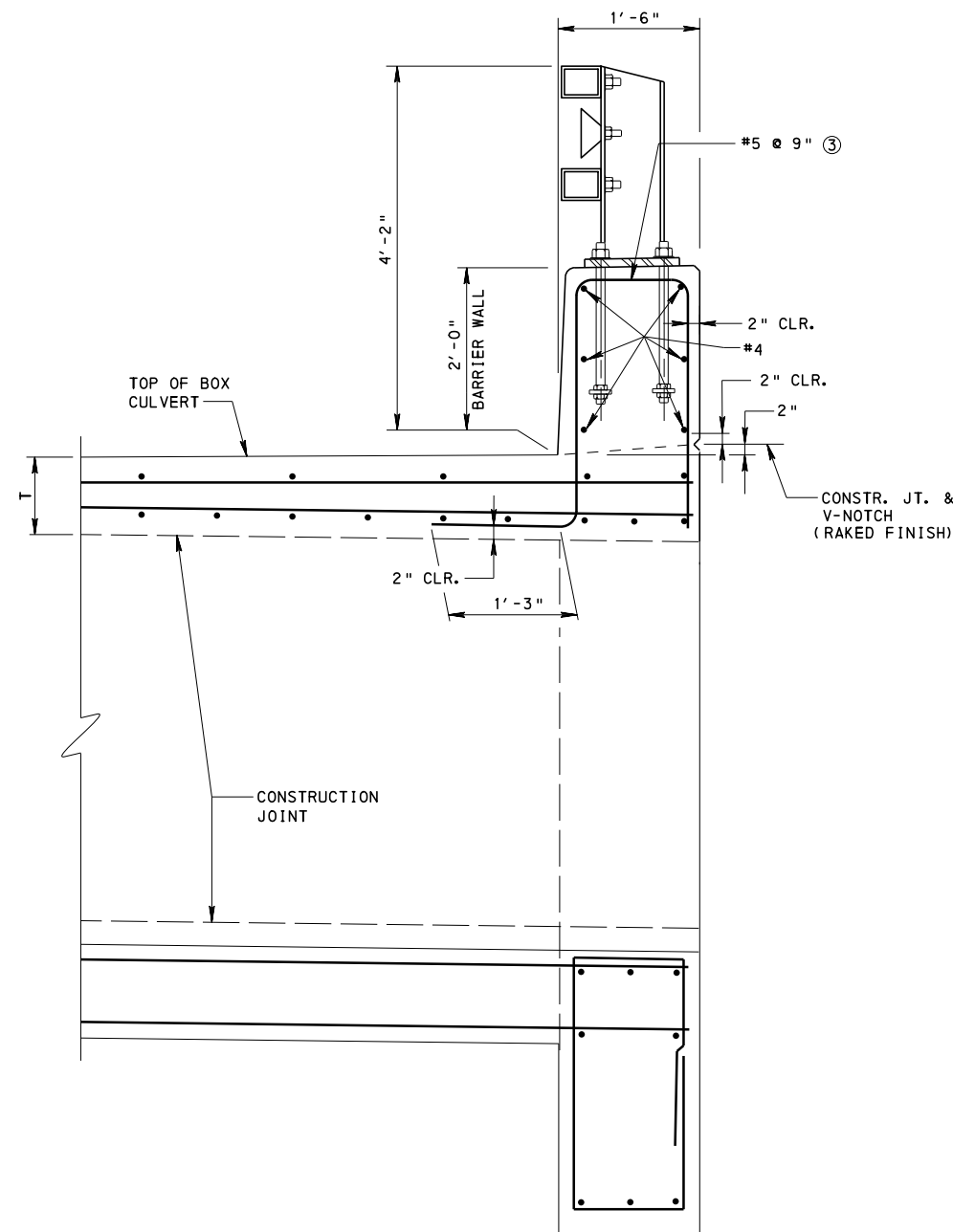
STANDARD

PA BRIDGE BARRIER

MISCELLANEOUS DETAILS

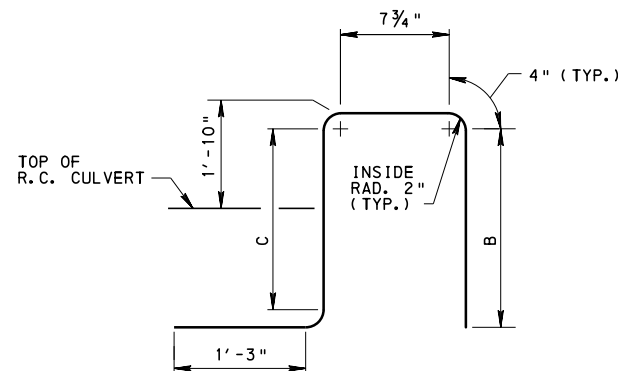
BD-601M	CONCRETE DECK SLAB
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS-BOX BEAM BRIDGES
REFERENCE DRAWINGS	

RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014	SHEET 14 OF 17
<i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	<i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	BD-610M



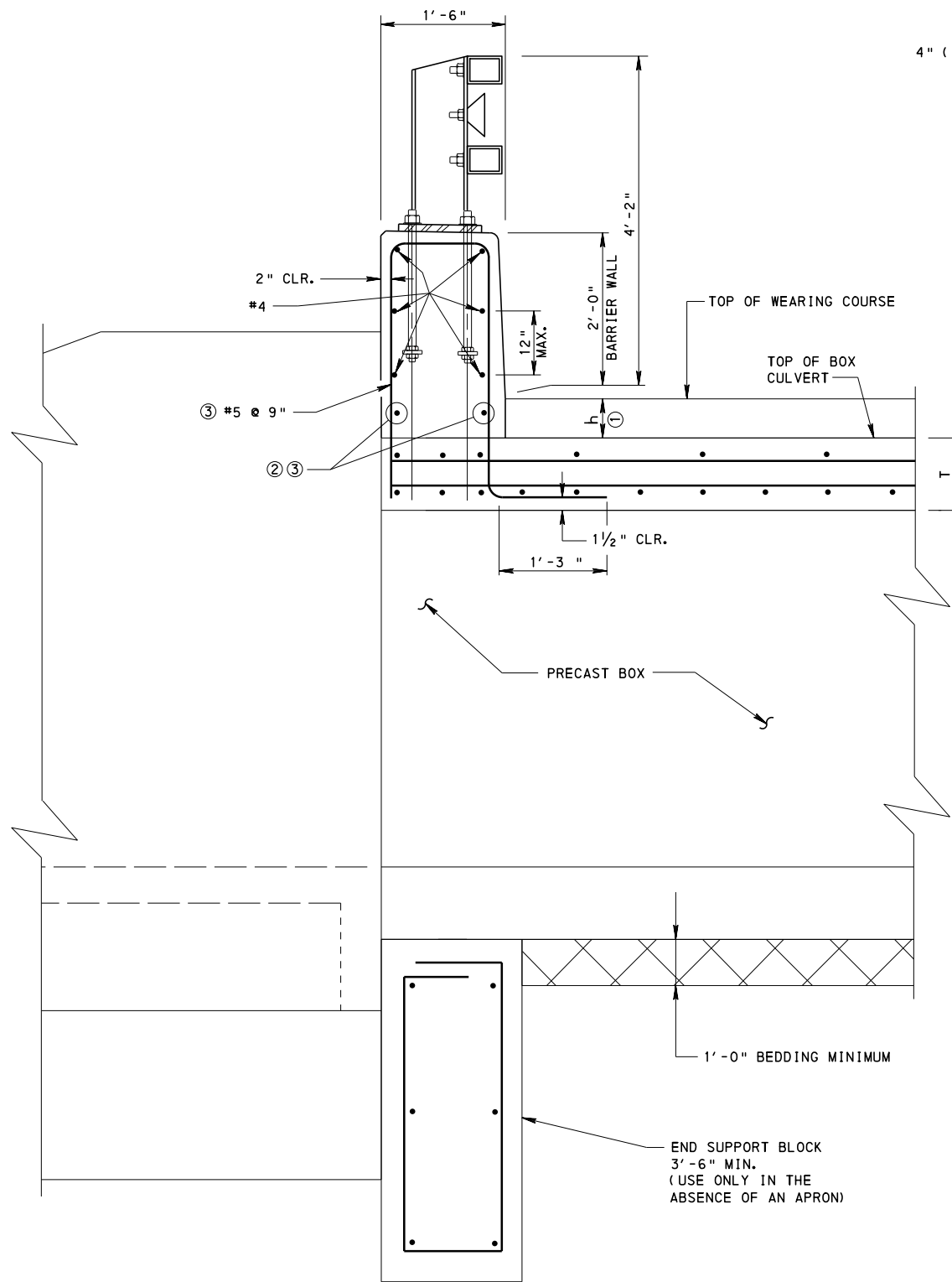
AT GRADE SECTION AT C.I.P. R.C. CULVERT

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



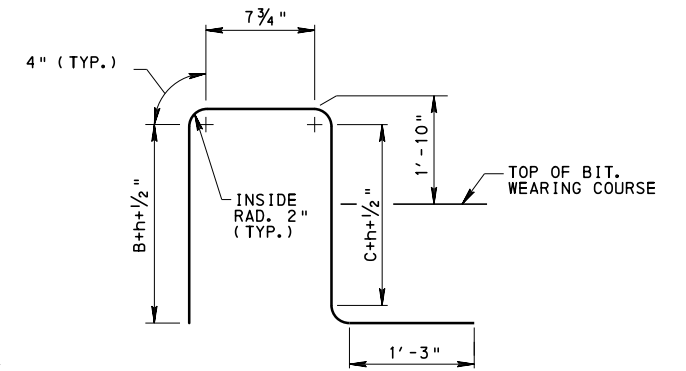
VERTICAL REINFORCEMENT

CAST IN PLACE CULVERT
(FOR DIMENSIONS "B" & "C", SEE TABLE 1)



AT GRADE SECTION AT PRECAST R.C. CULVERT

NOTE: SEE BC-713M FOR POST SPACING



VERTICAL REINFORCEMENT

PRECAST CULVERT
(FOR DIMENSIONS "B" & "C", SEE TABLE 1)

TABLE 1	
B & C DIMENSIONS	
FOR PA BRIDGE BARRIER	
AT R.C. CULVERT AND PRECAST R.C. CULVERT	
B	C
1'-5 1/2" + T	1'-2 1/2" + T

NOTE: T DESIGNATES TOP SLAB THICKNESS

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).

- 2 1/2" MIN., 2'-0" MAX. TOTAL THICKNESS (h); h IS THE DISTANCE MEASURED FROM TOP OF BOX CULVERT TO TOP OF WEARING COURSE.
- ADD SETS OF 2 - #4 BARS AS REQUIRED.
- FOR TRANSITION DETAIL, USE SHEET 11 OF 17 WITH REINFORCEMENT MODIFIED AS SHOWN.

NOTES:

- FOR PA 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 1.
- FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

PA BRIDGE BARRIER

MISCELLANEOUS DETAILS

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

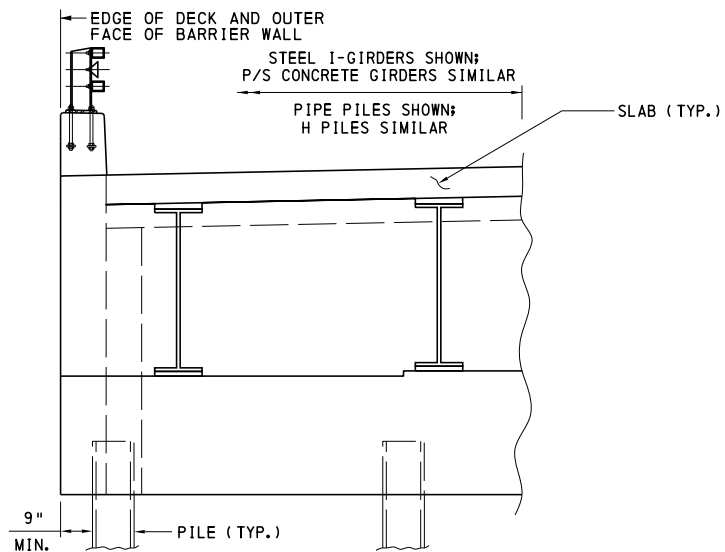
RECOMMENDED NOV. 21, 2014

Brian D. Thompson
ACTING DIR. OF PROJECT DELIVERY

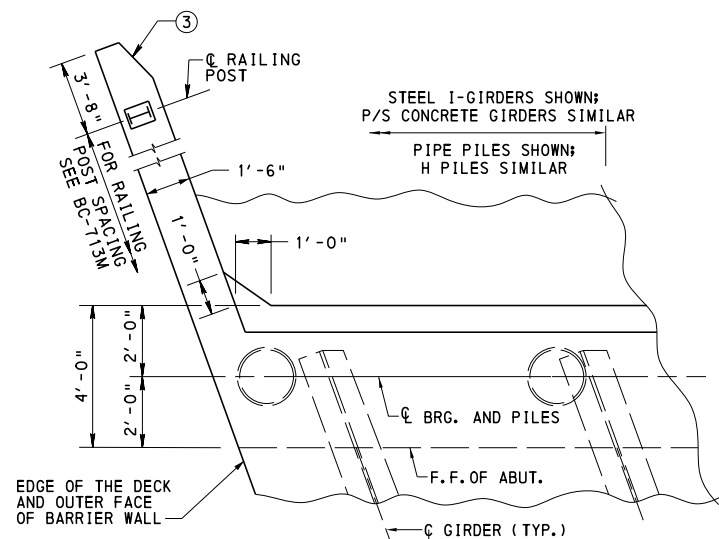
SHEET 15 OF 17

BD-610M

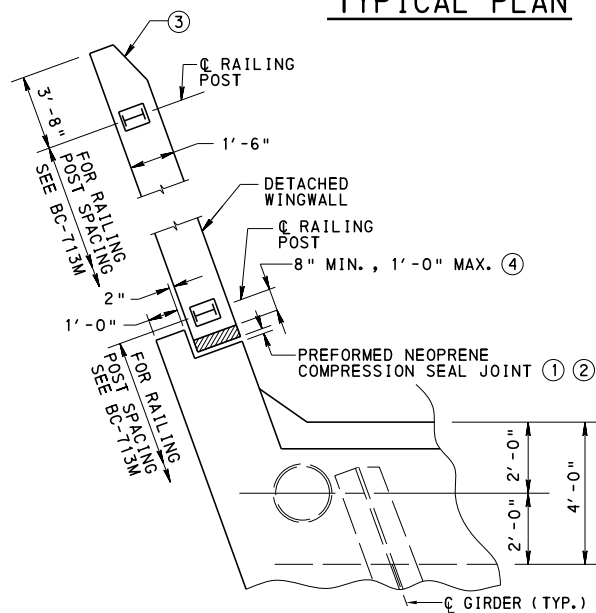
BD-632M R.C. BOX CULVERT
REFERENCE DRAWINGS



TYPICAL ELEVATION



TYPICAL PLAN

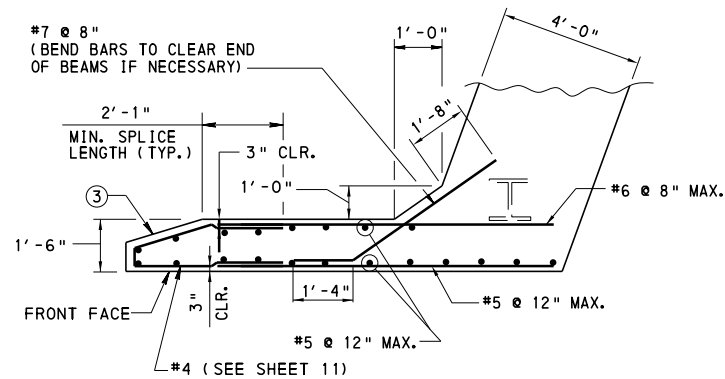


DETACHED WINGWALL PLAN

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

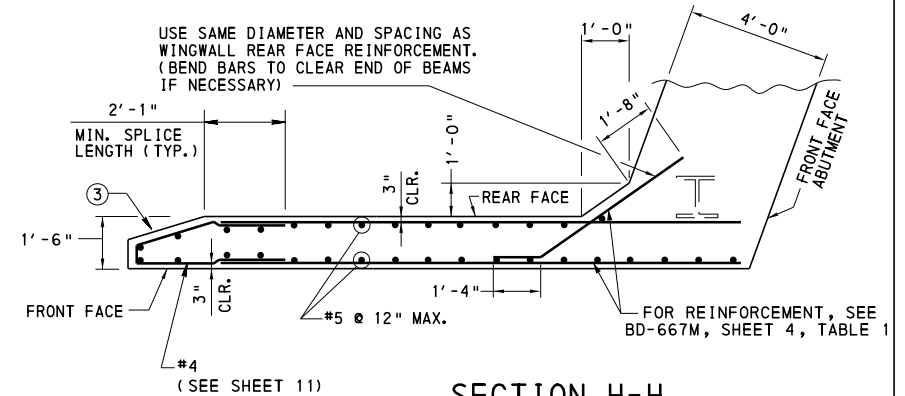
FOR RECTANGULAR WINGWALL REINFORCEMENT: SEE SECTION G-G
FOR TAPERED WINGWALL REINFORCEMENT: SEE BD-667M, SHEET 4, TABLE 1.

- ① FOR DETAILS OF THE PREFORMED NEOPRENE COMPRESSION SEAL JOINT AND SLIDING PLATE, SEE BD-667M, SHEET 4.
- ② FOR DETAILS OF THE BENT PLATE ON CONCRETE BARRIER WALL, SEE BC-713M.
- ③ SECTION SHOWN WITHOUT INLET PLACEMENT. WHEN AN INLET IS PLACED AT THE END OF A BARRIER WALL, PROVIDE A TRANSITION TO MATCH THE CONCRETE INLET CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR BARRIER WALL AND BEVEL DETAILS.
- ④ CL RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR CL RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE

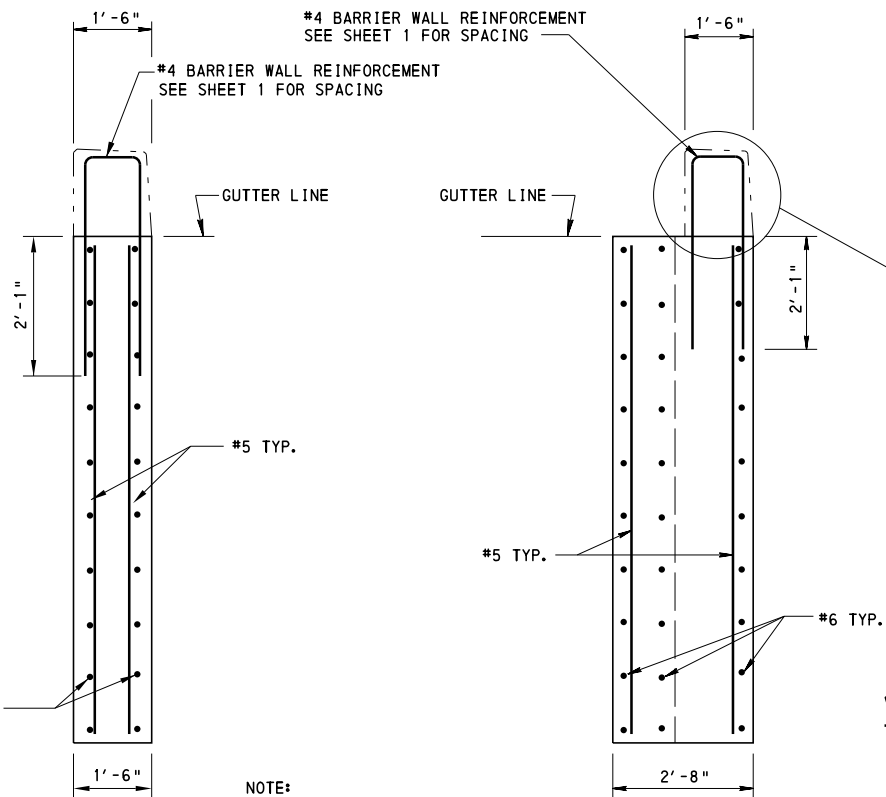
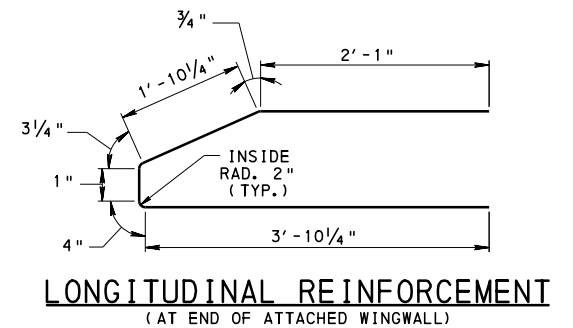


SECTION G-G

NOTE:
SEE BD-667M SHEET 4 FOR LOCATION OF SECTIONS G-G AND H-H.



SECTION H-H

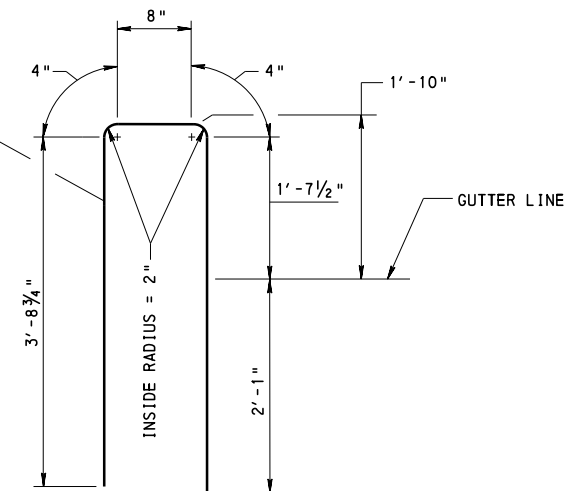


SECTION J-J
(RECTANGULAR OR TAPERED WING)

SECTION K-K
(DETACHED WING)

NOTE:
SEE BD-667M SHEET 4 FOR LOCATION OF SECTIONS J-J AND K-K.

VERTICAL CURB REINFORCEMENT



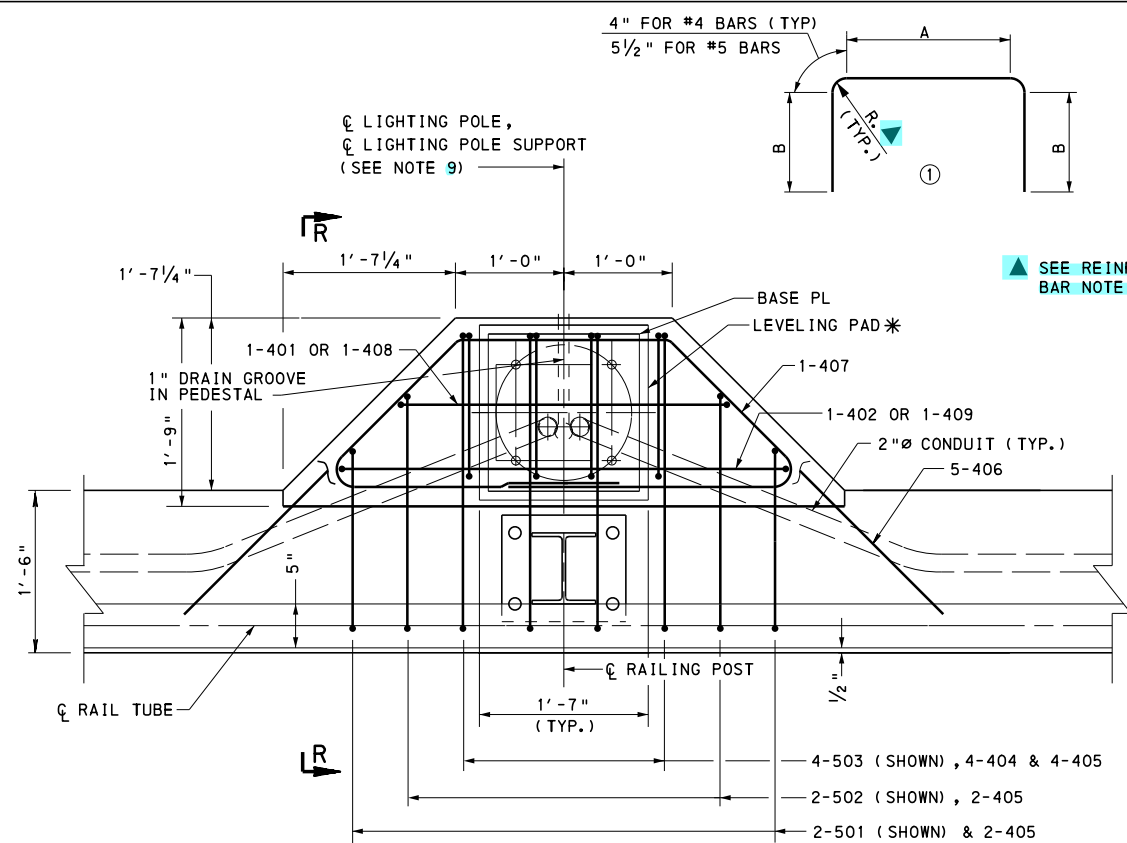
NOTE:
SEE BD-667M FOR ALL OTHER INTEGRAL ABUTMENT DETAILS.

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.
3. EPOXY COAT ALL REINFORCEMENT STEEL IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.1(c).

BD-667M	INTEGRAL ABUTMENT DETAILS
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
REFERENCE DRAWINGS	

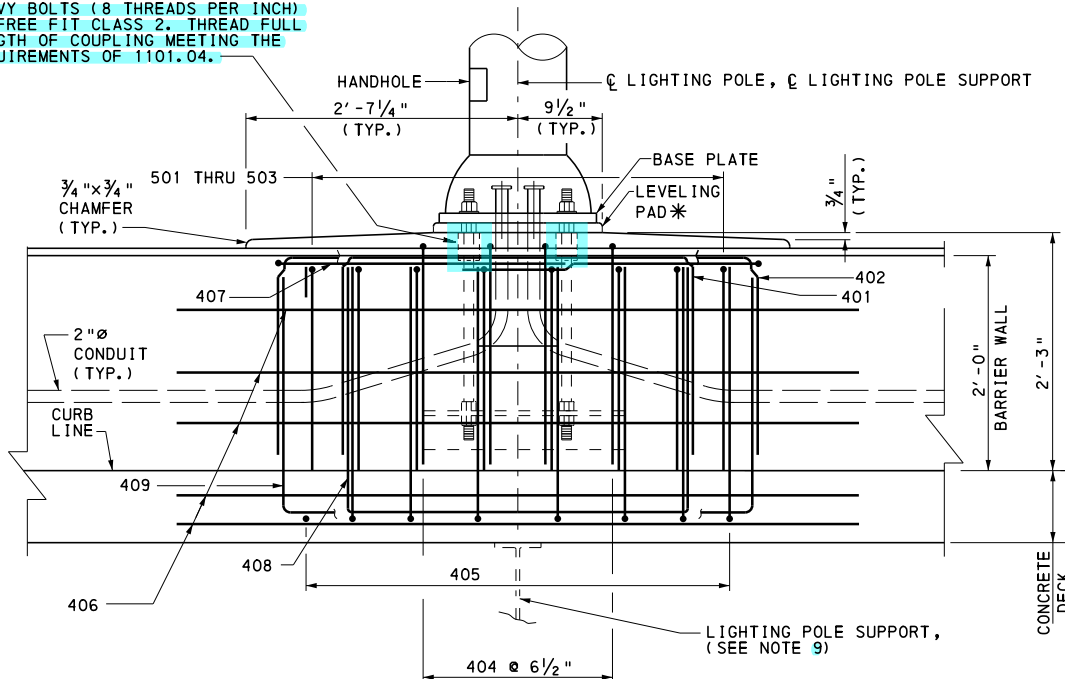
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY			
STANDARD PA BRIDGE BARRIER INTEGRAL ABUTMENT DETAILS			
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 16 OF 17 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 1101.04.



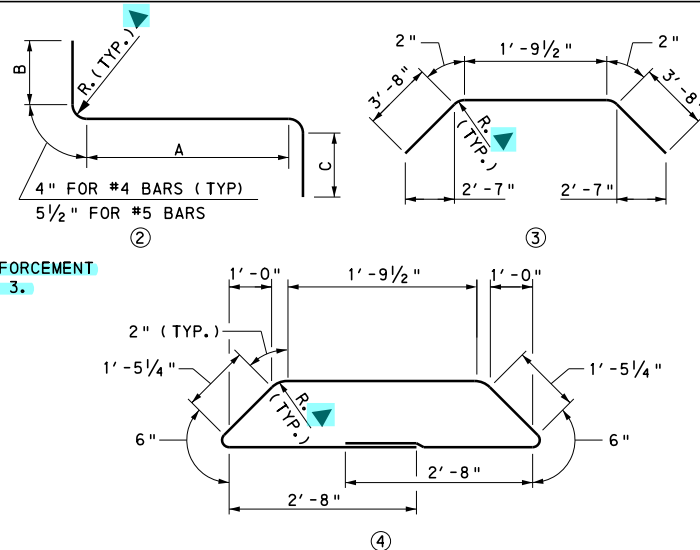
ELEVATION

(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"

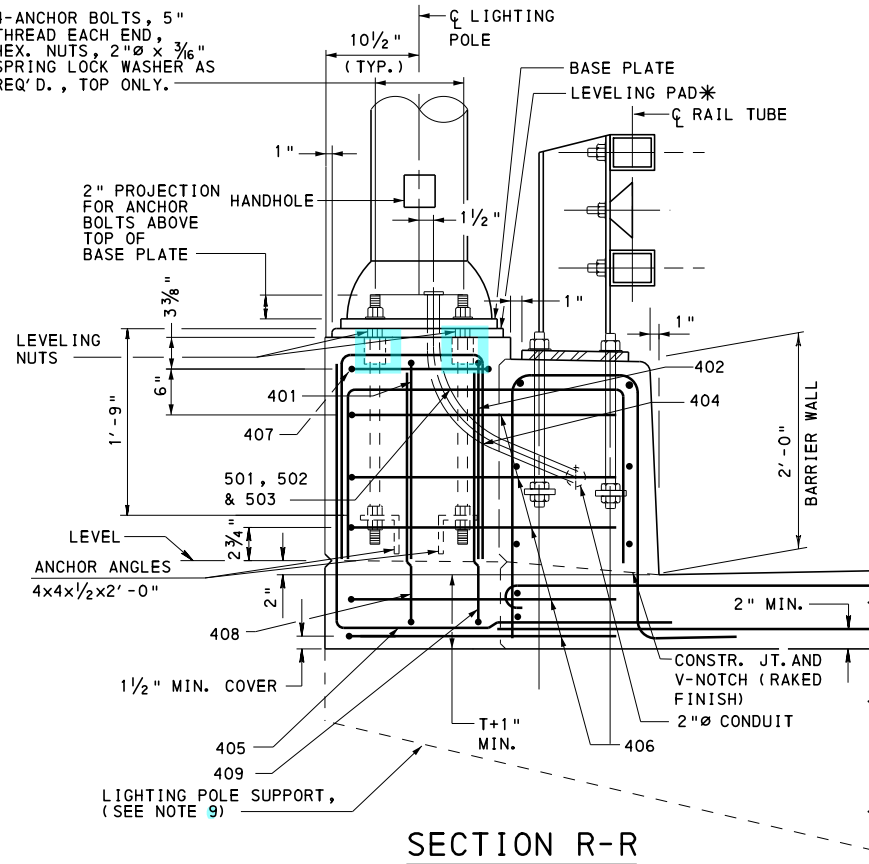


REINFORCEMENT DETAILS

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 3" FOR #5 BARS, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.

4-ANCHOR BOLTS, 5" THREAD EACH END, HEX. NUTS, 2"Ø x 3/6" SPRING LOCK WASHER AS REQ'D., TOP ONLY.



SECTION R-R

BD-601M	CONCRETE DECK SLAB
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-658M	SHEAR BLOCK DETAILS AT PIER - P/S CONCRETE I-BEAM AND BOX BEAM BRIDGES
BC-713M	PA BRIDGE BARRIER MISC. DETAILS
BC-721M	STANDARD ELECTRICAL DETAILS
BC-722M	STANDARD LIGHTING POLE ANCHORAGE
BC-734M	ANCHOR SYSTEMS
REFERENCE DRAWINGS	

REINFORCEMENT TABLE

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

NOTES:

- PROVIDE MATERIALS AND WORKMANSHIP 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 EXCEPT DO NOT GALVANIZE ANCHOR ANGLES.
- 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.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

STANDARD

PA BRIDGE BARRIER

LIGHTING POLE ANCHORAGE DETAILS

RECOMMENDED NOV. 21, 2014

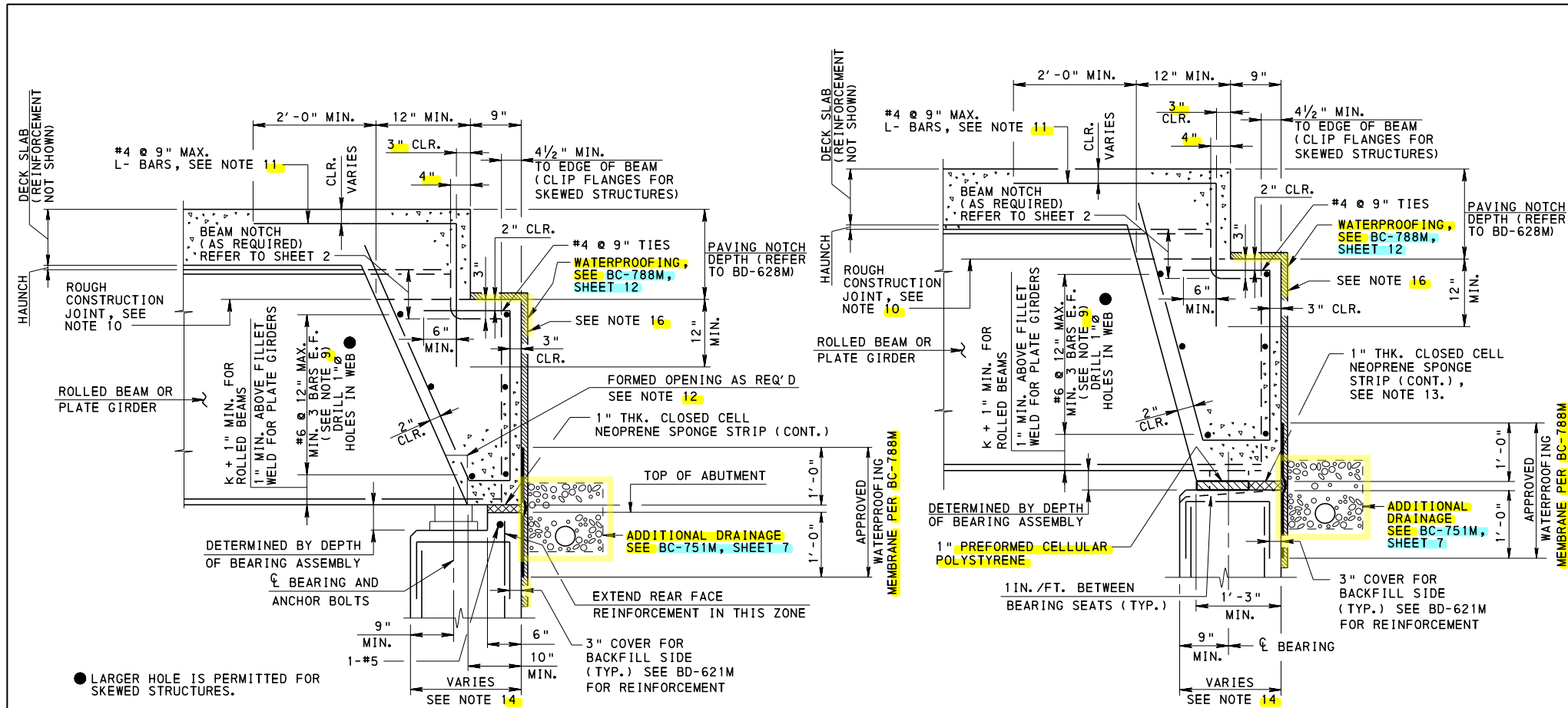
Thomas P. Maciara
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 17 OF 17

BD-610M

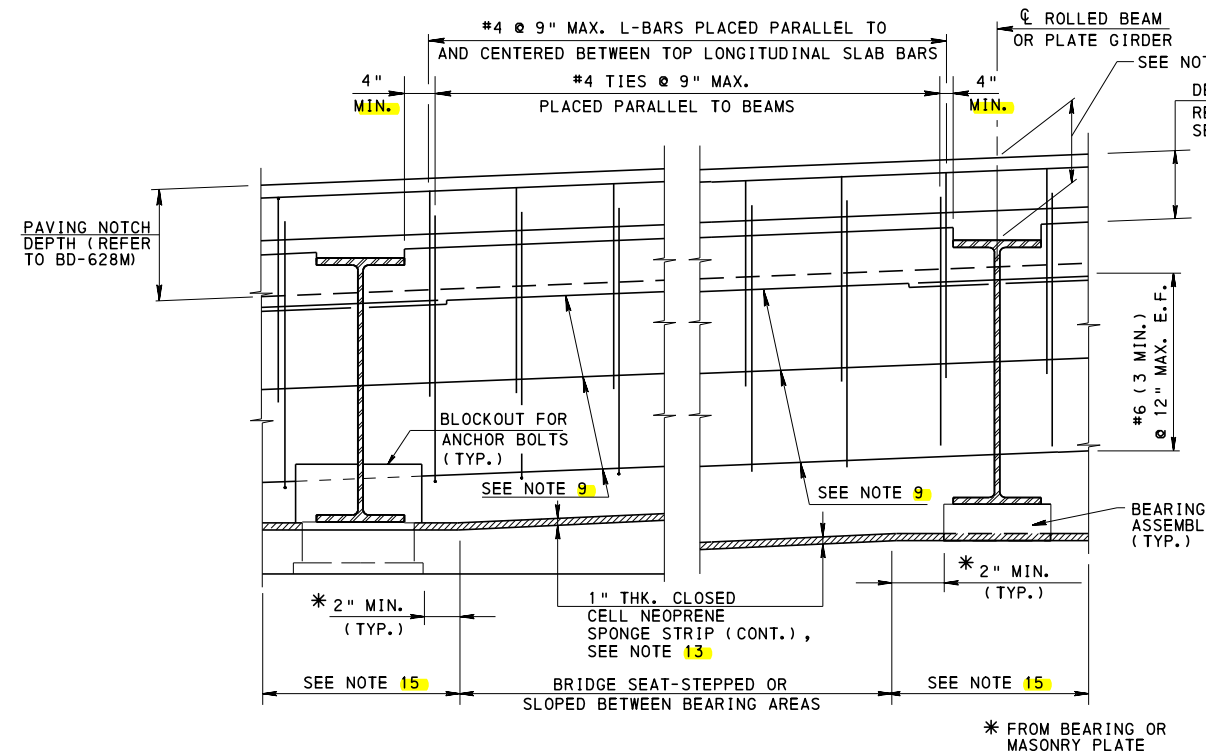


SECTION - POT BEARINGS

SECTION - ELASTOMERIC BEARINGS

FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL WITH PAVING NOTCH

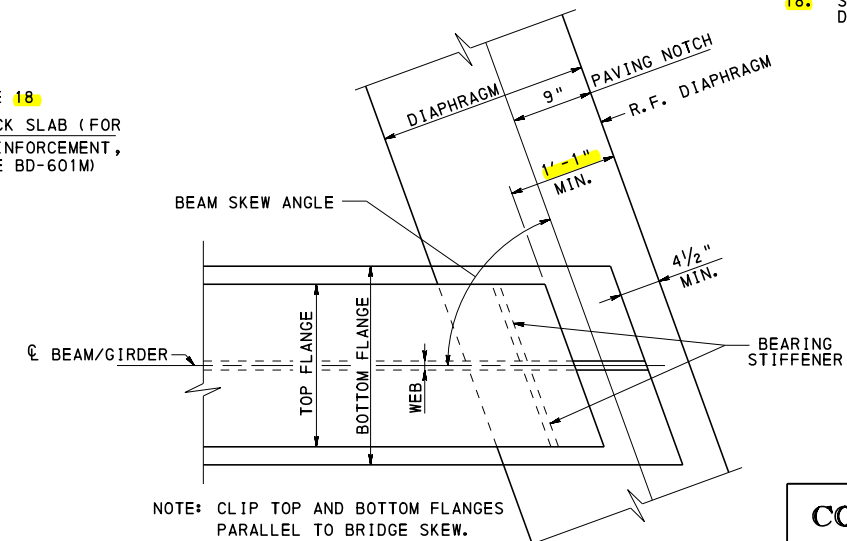
(FOR TYPE 1 AND 2 APPROACH SLABS)



POT BEARINGS

ELASTOMERIC BEARINGS

ELEVATION



PLAN - SKEWED STRUCTURES

BD-601M	CONCRETE DECK SLAB
BD-621M	R.C. ABUT. TYP. SECT. AND DETAILS
BD-624M	R.C. ABUT. WITHOUT BACKWALL
BD-628M	BRIDGE APPROACH SLABS
BC-751M	BRIDGE DRAINAGE
BC-755M	BEARINGS
BC-788M	TYP. WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS
REFERENCE DRAWINGS	

NOTES:

1. PROVIDE MATERIAL AND WORKMANSHIP IN ACCORDANCE WITH PUBLICATION 408.
 2. PROVIDE 2" MINIMUM CONCRETE COVER ON REINFORCEMENT BARS EXCEPT WHERE NOTED.
 3. ALL REINFORCEMENT BARS ARE EPOXY COATED.
 4. USE OF THE CONCRETE DIAPHRAGM IS RESTRICTED TO GIRDER DEPTHS UP TO 6'-0" OR THE DECK MOVEMENT CAUSED BY THE TEMPERATURE CHANGE AND THE ROTATION DUE TO LIVE LOAD PLUS IMPACT NOT TO EXCEED 1/2", WHICHEVER CONTROLS.
 5. "K" = FLANGE THICKNESS + FILLET, AS INDICATED IN AISC TABLES OF BEAM DIMENSIONS.
 6. USE CLASS AAAP CEMENT CONCRETE UP TO BOTTOM OF PAVING NOTCH.
 7. SLOPE TOP OF ABUTMENT TO DRAIN TO FRONT FACE BETWEEN BEARING AREAS ON SPANS GREATER THAN 50 FT.
 8. PROVIDE A FULL DEPTH KEYED CONSTRUCTION JOINT WHEN STAGE CONSTRUCTION IS REQUIRED.
- THE FOLLOWING NOTES ARE TO BE USED WHEN REFERENCED ON THE DRAWINGS:
9. PROVIDE LAP SPLICES FOR BARS THRU BEAM/GIRDER WEBS WHERE CONTINUOUS BARS ARE IMPRACTICAL. REAR FACE BARS ARE CONTINUOUS.
 10. PLACE PORTION OF DIAPHRAGM TO THE CONSTRUCTION JOINT ELEVATION INDICATED. WAIT TWO HOURS MINIMUM BEFORE PLACING DECK CONCRETE.
 11. PLACE TOP LEG OF #4 L- BARS PARALLEL TO AND ON THE SAME PLANE AS THE TOP LONGITUDINAL DECK SLAB REINFORCEMENT.
 12. FORM AN OPENING AS REQUIRED TO CLEAR ANCHOR BOLT BY 1" ALL AROUND AT LIMITS OF THERMAL MOVEMENT. ADJUST REINFORCEMENT TO PROVIDE MINIMUM CONCRETE COVER.
 13. CUT NEOPRENE SPONGE TO CLEAR BEARING ASSEMBLY.
 14. WIDTH OF TOP OF ABUTMENT IS GOVERNED BY THE DIAPHRAGM WIDTH, REQUIRED BEARING AREA, AND APPLICABLE CLEARANCES.
 15. FOR BEARING SEAT SLOPE, REFER TO DESIGN DRAWINGS.
 16. PLACE 2" THICK PREFORMED CELLULAR POLYSTYRENE (ASTM C578) OVER WATERPROOFING MEMBRANE ON REAR FACE OF CONCRETE DIAPHRAGM PER BC-788M.
 17. 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.
 18. SHOW THICKNESS AT CENTERLINE OF BEARINGS ON CONTRACT DRAWINGS:
 PLATE GIRDERS: PROVIDE DISTANCE FROM TOP OF DECK SLAB TO TOP OF WEB
 ROLLED SHAPES: PROVIDE DISTANCE FROM TOP OF DECK SLAB TO TOP OF FLANGE

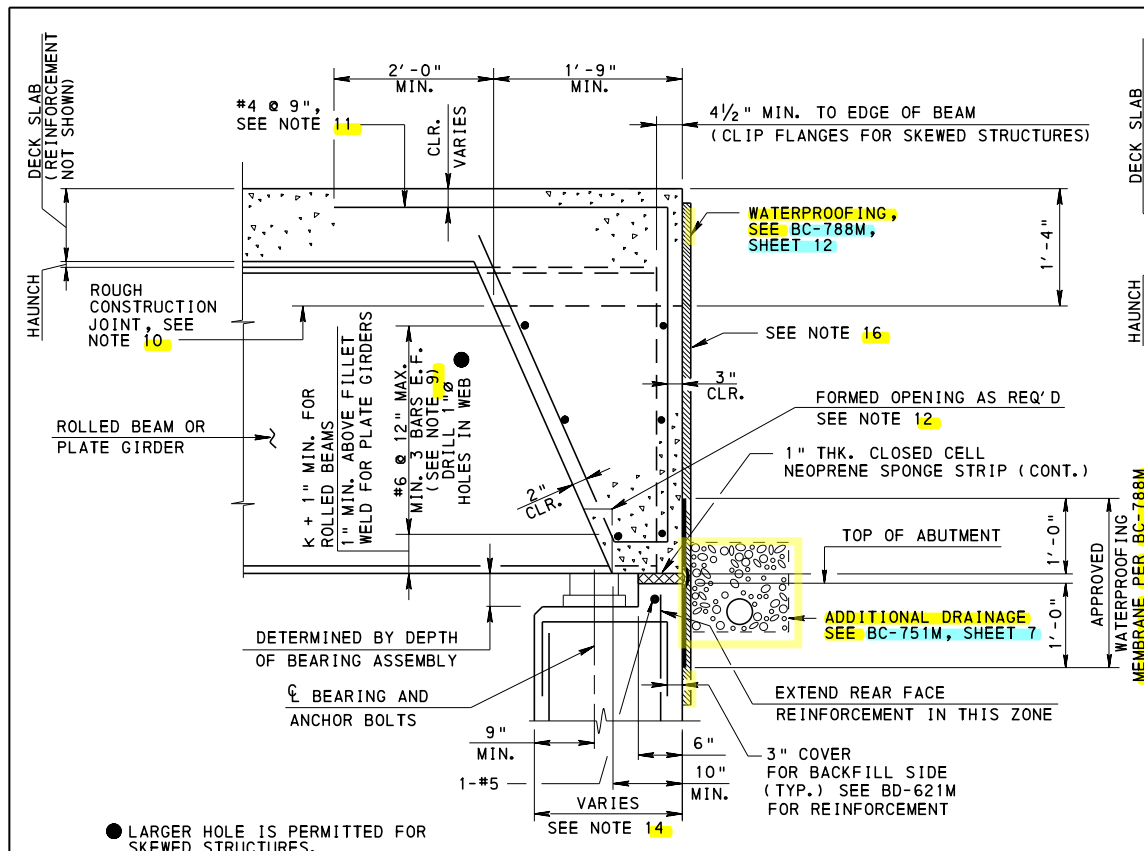
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD CONCRETE DIAPHRAGM DETAILS FOR STEEL I-BEAM STRUCTURES

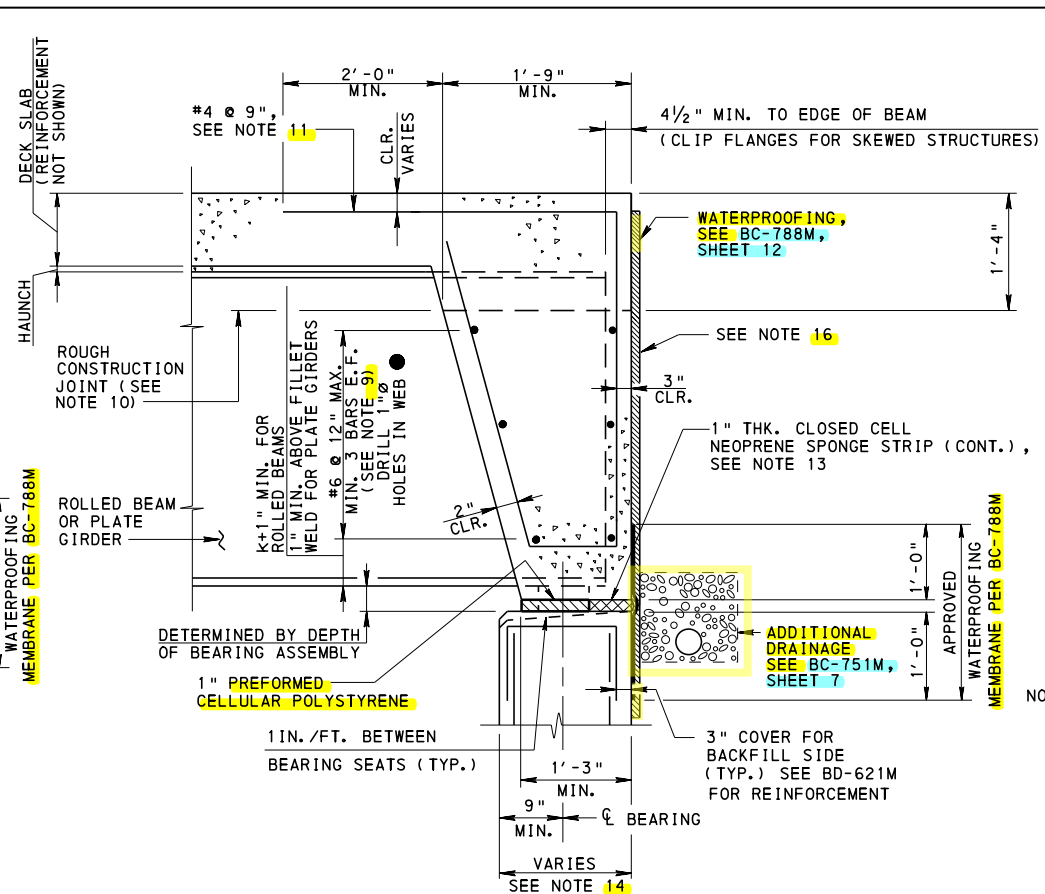
RECOMMENDED NOV. 21, 2014
 Thomas P. Maciore
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
 Bruce S. Thompson
 ACTING DIR. BUREAU OF PROJECT DELIVERY

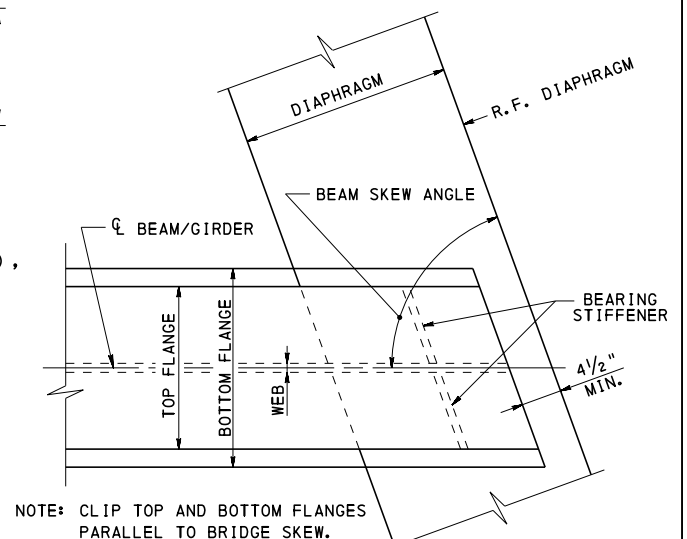
SHEET 1 OF 3
 BD-611M



SECTION - POT BEARINGS



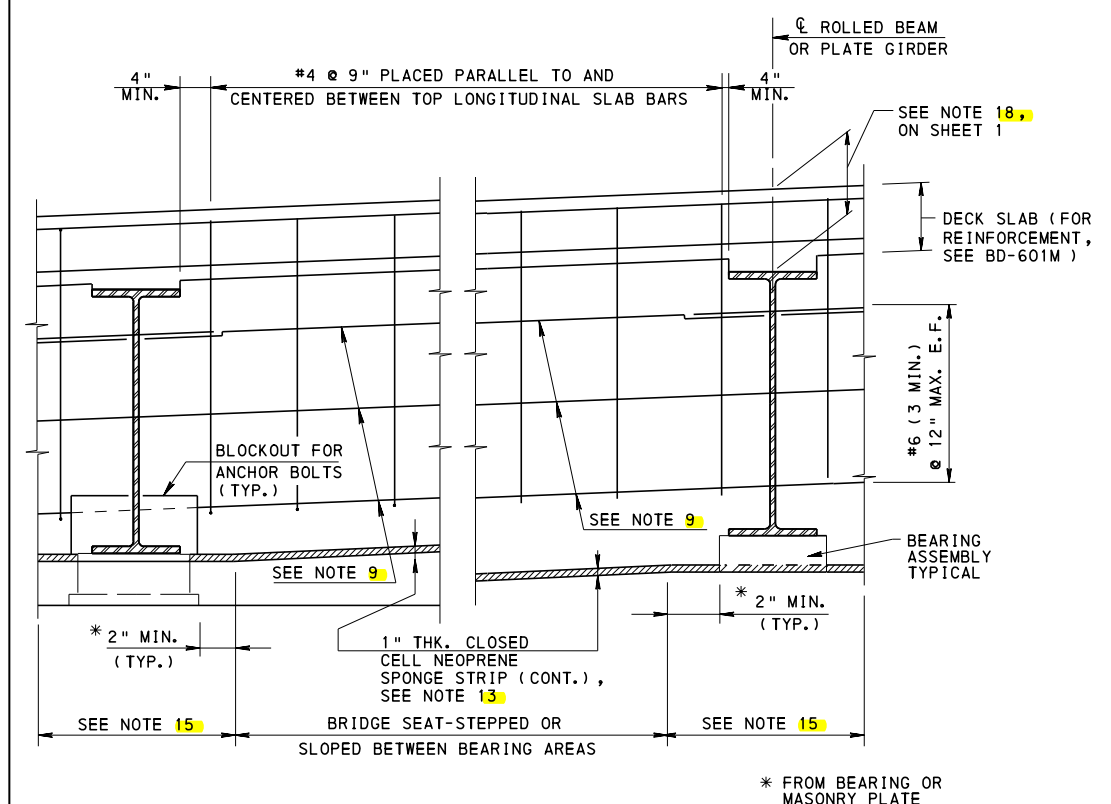
SECTION - ELASTOMERIC BEARINGS



PLAN - SKEWED STRUCTURES

FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND PAVING NOTCH

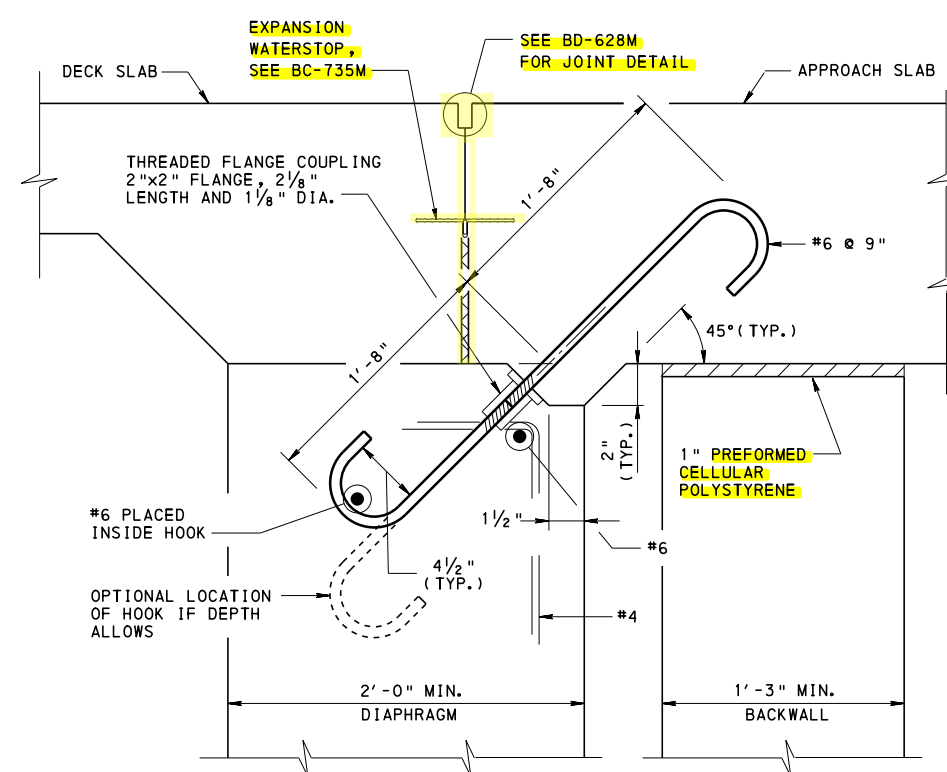
NOTES:
1. FOR NOTES, SEE SHEET 1.



POT BEARINGS

ELASTOMERIC BEARINGS

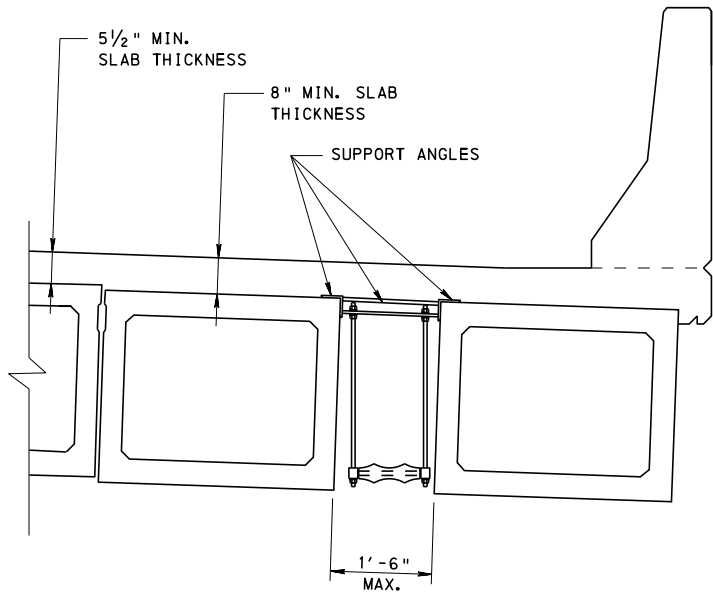
ELEVATION



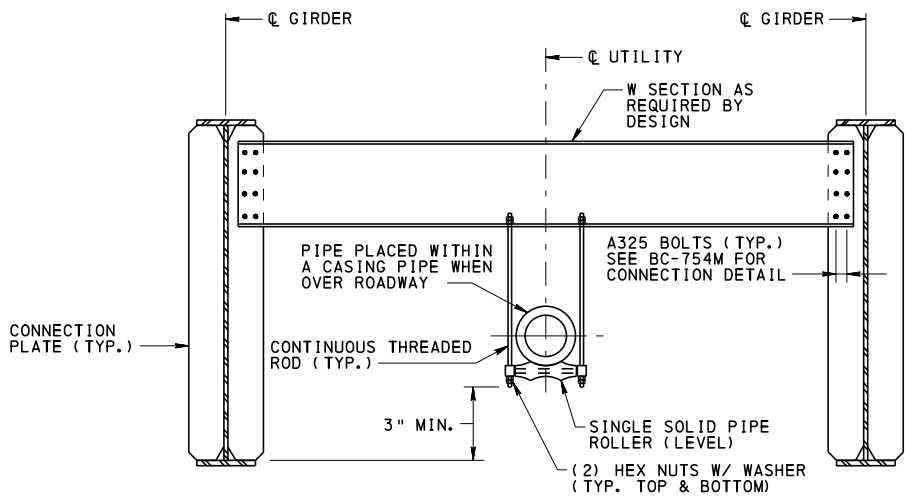
ALTERNATE REBAR DETAIL

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 NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 3 OF 3 BD-611M



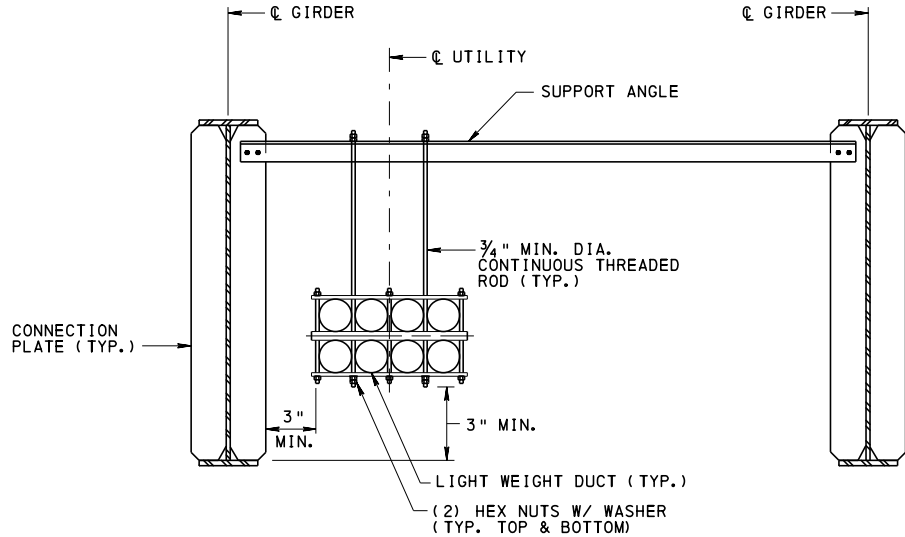
LOCATION OF UTILITIES
ON ADJACENT BOX BRIDGES



WATER OR GAS LINE SUPPORT DETAIL

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

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.

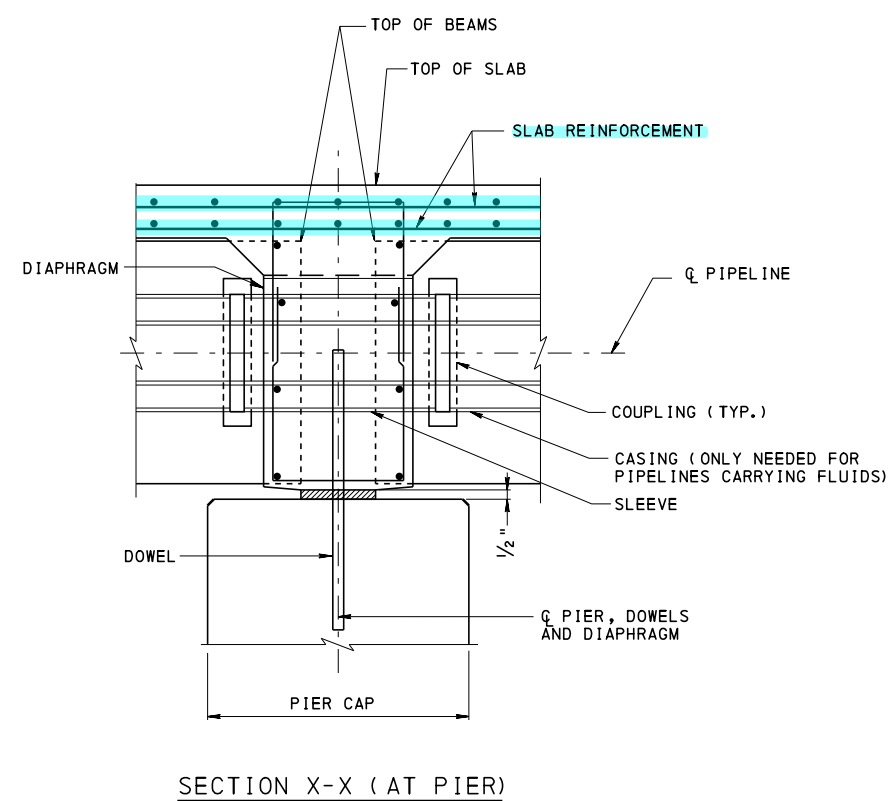
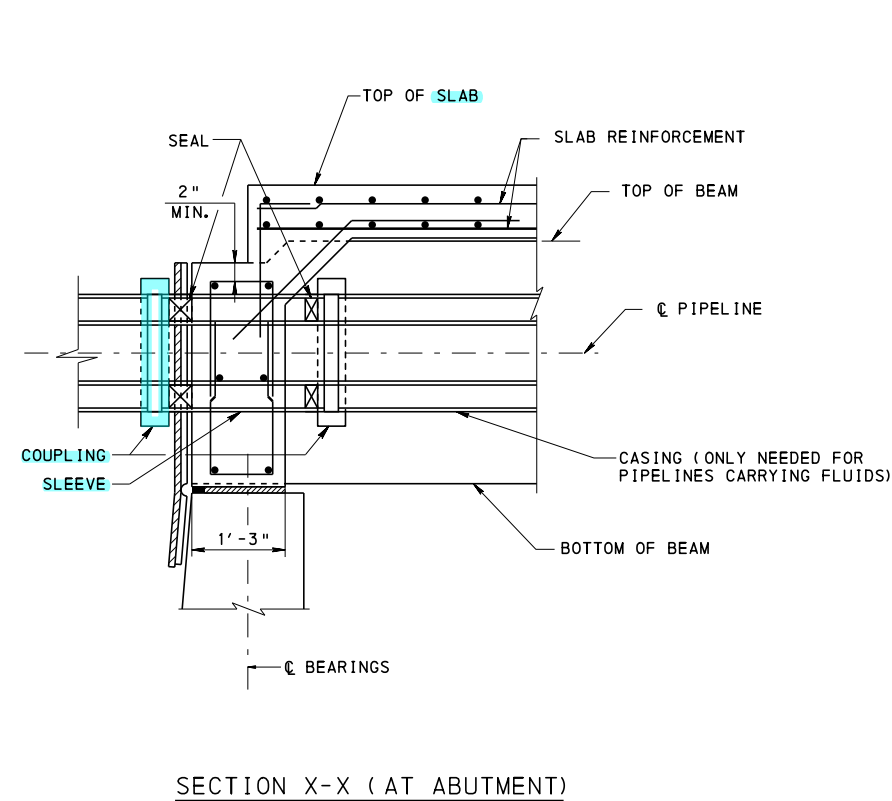
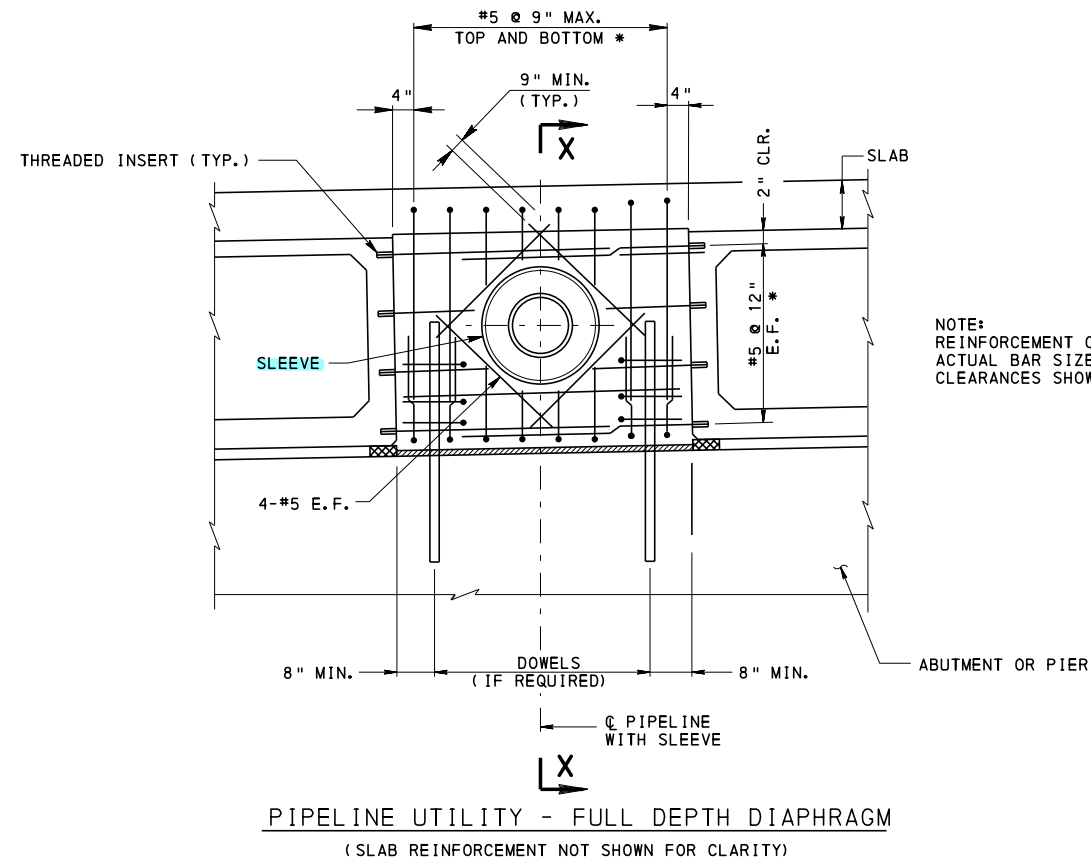
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
UTILITY ATTACHMENT
TO SUPERSTRUCTURE

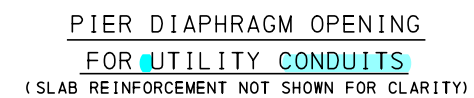
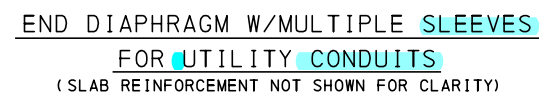
BD-601M	CONCRETE DECK SLAB
BC-754M	STEEL DIAPHRAGMS
REFERENCE DRAWINGS	

RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014
Thomas P. Maciore CHIEF BRIDGE ENGINEER	Brian S. Thompson ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 1 OF 3
BD-612M



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



LEGEND:

* SPLAY OR CUT AS NEEDED TO
ACCOMMODATE UTILITY



STANDARD
UTILITY ATTACHMENT
TO SUPERSTRUCTURE

SHEET 3 OF 3

BD-612M

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_r), AND USING AASHTO (1998) LRFD EQUATION 14.7.4.6-5 (Pr=10%P_r) 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.

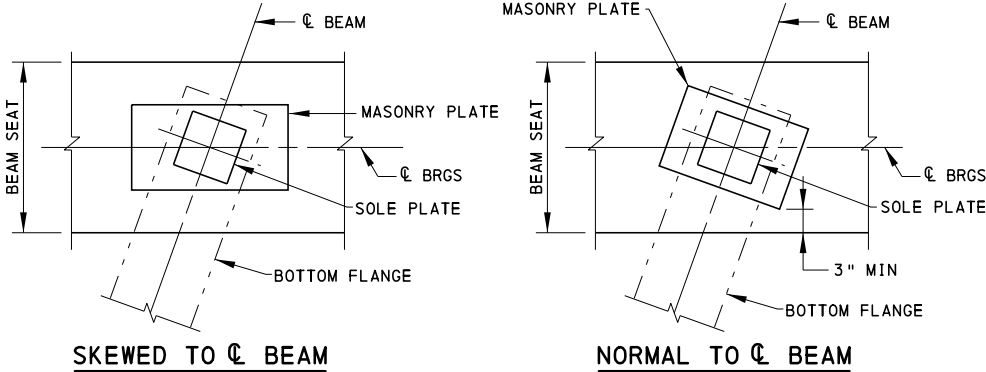
5. FOR FIXED AND GUIDED BEARINGS, COMPUTE THE RATIO OF THE MAXIMUM HORIZONTAL DESIGN LOAD TO THE MAXIMUM VERTICAL DESIGN LOAD (H/V)_{DES} ON THE BEARING. FOR (H/V)_{DES} RATIOS LESS THAN OR EQUAL TO 0.10, USE THE 10% HORIZONTAL LOAD TABLES. FOR (H/V)_{DES} RATIOS GREATER THAN 0.10 AND LESS THAN OR EQUAL 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)_{DES} 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

5 SHTS. WERE REMOVED FROM THIS STD. TO
CREATE BC-756M, SHT.3 IS NEW TO THIS STD.

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
BUREAU OF PROJECT DELIVERY

STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS
DESIGN METHODOLOGY

RECOMMENDED NOV. 26, 2013
Thomas P. MacIsaac
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SHEET 1 OF 7
BD-613M

BC-756M	HIGH LOAD MUTI ROTATIONAL POT BEARINGS
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 THESE STANDARDS 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 THESE STANDARDS 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.

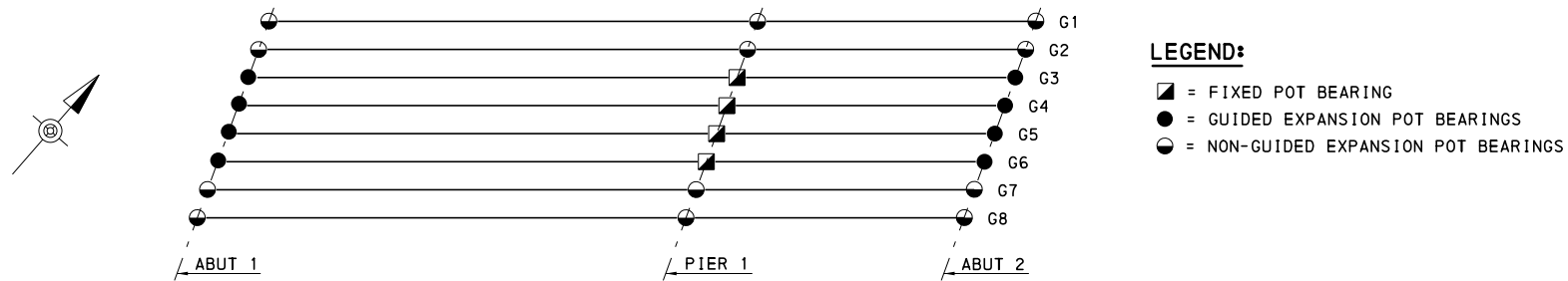
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STANDARD
HIGH LOAD MULTI-ROTATIONAL
POT BEARINGS
ILLUSTRATIVE DESIGN EXAMPLE

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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

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

RECOMMENDED NOV. 26, 2013
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SHEET 3 OF 7
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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	PP	
200	20	0.03	1 1/2 "	11 7/8 "	19 3/8 "	7 7/16 "	3 11/16 "	-	4	1 1/4 "	13/16 "	PER DESIGN (BEVELED SOLE PLATE)	10 3/8 "	10 3/8 "	2 1/16 "	10 3/8 "	1 1/2 "	9/16 "	1/4 "	3/4 "	1 "	8 7/8 "	3/8 "	1 1/8 "	1 1/8 "	8.835	5/16 "	1/4 "	5 1/8 "
250	25	0.03	1 1/2 "	13 1/8 "	20 5/8 "	8 1/16 "	4 5/16 "	-	4	1 1/4 "	13/16 "		11 5/8 "	11 5/8 "	2 3/16 "	11 5/8 "	1 1/8 "	5/8 "	1/4 "	7/8 "	1 "	9 7/8 "	3/8 "	1 1/8 "	9.835	5/16 "	1/4 "	5 3/16 "	
300	30	0.03	1 1/2 "	14 "	21 1/2 "	8 1/2 "	4 3/4 "	-	4	1 1/4 "	13/16 "		12 1/2 "	12 1/2 "	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 "	5 3/8 "	
350	35	0.03	1 1/2 "	15 1/4 "	22 5/8 "	9 1/16 "	5 3/8 "	-	4	1 1/4 "	13/16 "		13 5/8 "	13 5/8 "	2 7/16 "	13 5/8 "	1 7/8 "	9/16 "	1/4 "	1 "	1 1/4 "	11 5/8 "	3/8 "	1 1/4 "	11.585	3/8 "	1/4 "	5 1/2 "	
400	40	0.03	1 5/8 "	15 7/8 "	23 3/8 "	9 7/16 "	5 11/16 "	-	4	1 1/4 "	13/16 "		14 3/8 "	14 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 1/4 "	12.335	3/8 "	1/4 "	5 11/16 "	
450	45	0.03	1 5/8 "	16 3/8 "	24 3/8 "	9 15/16 "	6 3/16 "	-	4	1 1/4 "	13/16 "		15 3/8 "	15 3/8 "	2 3/4 "	15 3/8 "	2 1/16 "	11/16 "	1/4 "	1 1/8 "	1 3/8 "	13 1/8 "	3/8 "	1 3/8 "	13.085	7/16 "	1/4 "	6 "	
500	50	0.03	1 5/8 "	17 1/2 "	25 "	10 1/4 "	6 1/2 "	-	4	1 1/4 "	13/16 "		16 "	16 "	2 13/16 "	16 "	2 1/8 "	11/16 "	1/4 "	1 1/8 "	1 3/8 "	13 3/4 "	3/8 "	1 3/8 "	13.710	7/16 "	1/4 "	6 "	
550	55	0.03	1 5/8 "	18 1/2 "	26 "	10 3/4 "	7 "	-	4	1 1/4 "	13/16 "		17 "	17 "	3 3/16 "	17 "	2 1/4 "	15/16 "	1/4 "	1 1/4 "	1 1/2 "	14 1/2 "	3/8 "	1 1/2 "	14.460	7/16 "	1/4 "	6 1/2 "	
600	60	0.03	1 5/8 "	19 3/8 "	26 5/8 "	11 1/16 "	7 11/16 "	-	4	1 1/4 "	13/16 "		17 5/8 "	17 5/8 "	3 3/16 "	17 5/8 "	2 3/16 "	3/4 "	1/4 "	1 1/4 "	1 5/8 "	15 1/8 "	3/8 "	1 1/2 "	15.085	1/2 "	1/4 "	6 7/16 "	
650	65	0.03	1 5/8 "	21 1/4 "	27 1/4 "	11 3/8 "	8 3/8 "	-	4	1 1/4 "	13/16 "		18 1/4 "	18 1/4 "	3 3/16 "	18 1/4 "	2 7/16 "	3/4 "	1/4 "	1 1/4 "	1 5/8 "	15 3/4 "	3/8 "	1 1/2 "	15.710	1/2 "	1/4 "	6 7/16 "	
700	70	0.03	1 5/8 "	22 1/2 "	28 "	11 3/4 "	9 "	-	4	1 1/4 "	13/16 "		19 "	19 "	3 7/16 "	19 "	2 1/2 "	15/16 "	1/4 "	1 3/8 "	1 5/8 "	16 1/4 "	3/8 "	1 1/2 "	16.210	1/2 "	1/4 "	6 5/8 "	
750	75	0.03	1 5/8 "	23 3/4 "	28 5/8 "	12 1/16 "	9 5/8 "	-	4	1 1/4 "	13/16 "		19 5/8 "	19 5/8 "	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	1/2 "	1/4 "	6 3/4 "	
800	80	0.03	1 5/8 "	24 3/8 "	29 3/8 "	12 3/16 "	10 3/16 "	-	4	1 1/4 "	13/16 "		20 3/8 "	20 3/8 "	3 11/16 "	20 3/8 "	2 11/16 "	1 "	1/4 "	1 1/2 "	1 3/4 "	17 3/8 "	3/8 "	1 5/8 "	17.335	9/16 "	1/4 "	6 5/16 "	
850	85	0.03	1 5/8 "	26 1/8 "	29 7/8 "	12 11/16 "	10 13/16 "	-	4	1 1/4 "	13/16 "		20 7/8 "	20 7/8 "	3 11/16 "	20 7/8 "	2 13/16 "	7/8 "	1/4 "	1 1/2 "	1 5/8 "	17 3/4 "	3/8 "	1 5/8 "	17.835	9/16 "	1/4 "	6 15/16 "	
900	90	0.03	1 7/8 "	26 5/8 "	31 7/8 "	13 5/16 "	10 7/16 "	-	4	1 1/2 "	13/16 "		21 3/8 "	21 3/8 "	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 5/8 "	18.335	9/16 "	1/4 "	7 3/16 "	
950	95	0.03	1 7/8 "	27 "	32 5/8 "	13 11/16 "	10 5/8 "	-	4	1 1/2 "	13/16 "		22 1/8 "	22 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 "	7 1/2 "	
1000	100	0.03	1 7/8 "	28 5/8 "	33 3/8 "	13 15/16 "	11 1/16 "	-	4	1 1/2 "	13/16 "		22 5/8 "	22 5/8 "	3 15/16 "	22 5/8 "	3 "	15/16 "	1/4 "	1 5/8 "	2 "	19 3/8 "	1/2 "	1 3/4 "	19.335	5/8 "	1/4 "	7 1/2 "	
1100	110	0.03	1 7/8 "	30 1/4 "	34 1/8 "	14 1/16 "	12 1/2 "	-	4	1 1/2 "	13/16 "		23 3/8 "	23 3/8 "	4 3/16 "	23 5/8 "	3 3/16 "	1 "	1/4 "	1 5/8 "	2 1/8 "	20 3/8 "	1/2 "	1 3/4 "	20.335	5/8 "	1/4 "	7 11/16 "	
1200	120	0.03	1 7/8 "	32 1/8 "	35 1/4 "	15 "	13 7/16 "	-	4	1 1/2 "	13/16 "		24 3/4 "	24 3/4 "	4 3/16 "	24 3/4 "	3 3/16 "	1 "	1/4 "	1 3/4 "	2 1/8 "	21 1/4 "	1/2 "	1 7/8 "	21.210	11/16 "	1/4 "	7 13/16 "	
1300	130	0.03	2 "	33 3/8 "	37 3/4 "	15 3/8 "	13 5/16 "	-	4	1 3/4 "	13/16 "		25 3/4 "	25 3/4 "	4 7/16 "	25 3/4 "	3 3/8 "	1 1/16 "	1/4 "	1 7/8 "	2 1/4 "	22 "	1/2 "	1 7/8 "	21.960	11/16 "	1/4 "	8 1/8 "	
1400	140	0.03	2 "	35 5/8 "	38 5/8 "	16 3/16 "	14 13/16 "	-	4	1 3/4 "	13/16 "		26 5/8 "	26 5/8 "	4 11/16 "	26 5/8 "	3 1/2 "	1 3/8 "	1/4 "	1 7/8 "	2 3/8 "	22 7/8 "	1/2 "	2 "	22.835	11/16 "	1/4 "	8 1/2 "	
1500	150	0.03	2 "	37 1/4 "	39 5/8 "	16 13/16 "	15 5/8 "	-	4	1 3/4 "	13/16 "		27 5/8 "	27 5/8 "	4 11/16 "	27 5/8 "	3 3/16 "	1 1/8 "	1/4 "	2 "	2 3/8 "	23 5/8 "	1/2 "	2 "	23.585	3/4 "	1/4 "	8 7/16 "	

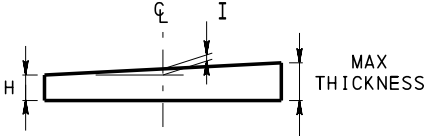
DESIGN TABLES FOR FIXED POT BEARINGS (30% HORIZONTAL LOAD)

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 3⁄8 "	12 7⁄8 "	20 3⁄8 "	7 15⁄16 "	4 3⁄16 "	-	4	1 1⁄4 "	13⁄16 "	PER DESIGN (BEVELED SOLE PLATE)	11 3⁄8 "	11 3⁄8 "	2 1⁄4 "	11 3⁄8 "	1 5⁄8 "	5⁄8 "	1⁄4 "	1 1⁄4 "	1 "	8 7⁄8 "	3⁄8 "	1 1⁄8 "	1 1⁄8 "	8.835	5⁄16 "	1⁄4 "	5 1⁄16 "
250	75	0.03	1 3⁄8 "	14 1⁄8 "	21 5⁄8 "	8 9⁄16 "	4 13⁄16 "	-	4	1 1⁄4 "	13⁄16 "		12 5⁄8 "	12 5⁄8 "	2 3⁄16 "	12 5⁄8 "	1 5⁄8 "	9⁄16 "	1⁄4 "	1 3⁄8 "	1 "	9 7⁄8 "	3⁄8 "	1 1⁄4 "	9.835	3⁄8 "	1⁄4 "	5 1⁄8 "	
300	90	0.03	1 5⁄8 "	15 1⁄4 "	24 1⁄4 "	9 1⁄2 "	5 "	-	4	1 1⁄2 "	13⁄16 "		13 3⁄4 "	13 3⁄4 "	2 1⁄16 "	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 "	5 11⁄16 "	
350	105	0.03	1 5⁄8 "	16 3⁄8 "	25 3⁄8 "	10 1⁄16 "	5 9⁄16 "	-	4	1 1⁄2 "	13⁄16 "		14 7⁄8 "	14 7⁄8 "	2 "	14 7⁄8 "	2 "	9⁄16 "	1⁄4 "	1 5⁄8 "	1 1⁄4 "	11 3⁄8 "	3⁄8 "	1 3⁄8 "	11.585	7⁄16 "	1⁄4 "	5 3⁄4 "	
400	120	0.03	1 5⁄8 "	17 3⁄8 "	26 3⁄8 "	10 9⁄16 "	6 1⁄16 "	-	4	1 1⁄2 "	13⁄16 "		15 7⁄8 "	15 7⁄8 "	2 11⁄16 "	15 7⁄8 "	2 1⁄16 "	5⁄8 "	1⁄4 "	1 3⁄4 "	1 1⁄4 "	12 3⁄8 "	3⁄8 "	1 1⁄2 "	12.335	1⁄2 "	1⁄4 "	5 5⁄16 "	
450	135	0.03	1 7⁄8 "	18 3⁄8 "	28 7⁄8 "	11 7⁄16 "	6 3⁄16 "	-	4	1 3⁄4 "	13⁄16 "		16 3⁄8 "	16 3⁄8 "	2 15⁄16 "	16 3⁄8 "	2 1⁄4 "	11⁄16 "	1⁄4 "	1 7⁄8 "	1 3⁄8 "	13 1⁄8 "	3⁄8 "	1 1⁄2 "	13.085	1⁄2 "	1⁄4 "	6 3⁄8 "	
500	150	0.03	1 7⁄8 "	19 1⁄4 "	29 3⁄4 "	11 7⁄8 "	6 5⁄8 "	-	4	1 3⁄4 "	13⁄16 "		17 3⁄4 "	17 3⁄4 "	2 15⁄16 "	17 3⁄4 "	2 1⁄4 "	11⁄16 "	1⁄4 "	2 "	1 3⁄8 "	13 3⁄4 "	3⁄8 "	1 1⁄2 "	13.710	9⁄16 "	5⁄16 "	6 3⁄8 "	
550	165	0.03	1 7⁄8 "	20 1⁄4 "	30 1⁄2 "	12 1⁄4 "	7 1⁄8 "	-	4	1 3⁄4 "	13⁄16 "		18 1⁄2 "	18 1⁄2 "	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	9⁄16 "	5⁄16 "	6 11⁄16 "	
600	180	0.03	2 1⁄8 "	20 7⁄8 "	32 7⁄8 "	13 1⁄16 "	7 1⁄16 "	-	4	2 "	13⁄16 "		19 3⁄8 "	19 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 5⁄8 "	15.085	5⁄8 "	5⁄16 "	7 3⁄16 "	
650	195	0.03	2 1⁄8 "	21 3⁄4 "	33 3⁄4 "	13 1⁄2 "	7 1⁄2 "	-	4	2 "	13⁄16 "		20 1⁄4 "	20 1⁄4 "	3 1⁄16 "	20 1⁄4 "	2 5⁄8 "	13⁄16 "	1⁄4 "	2 1⁄4 "	1 5⁄8 "	15 3⁄4 "	3⁄8 "	1 3⁄4 "	15.710	5⁄8 "	5⁄16 "	7 1⁄4 "	
700	210	0.03	2 1⁄8 "	22 1⁄2 "	34 1⁄4 "	13 3⁄4 "	7 7⁄8 "	-	4	2 "	13⁄16 "		20 3⁄4 "	20 3⁄4 "	3 7⁄16 "	20 3⁄4 "	2 5⁄8 "	13⁄16 "	1⁄4 "	2 1⁄4 "	1 5⁄8 "	16 1⁄4 "	3⁄8 "	1 3⁄4 "	16.210	11⁄16 "	5⁄16 "	7 1⁄4 "	
750	225	0.03	2 1⁄8 "	23 5⁄8 "	35 1⁄8 "	14 3⁄16 "	8 7⁄16 "	-	4	2 "	13⁄16 "		21 5⁄8 "	21 5⁄8 "	3 11⁄16 "	21 5⁄8 "	2 13⁄16 "	7⁄8 "	1⁄4 "	2 3⁄8 "	1 3⁄4 "	16 7⁄8 "	3⁄8 "	1 7⁄8 "	16.835	11⁄16 "	5⁄16 "	7 9⁄16 "	
800	240	0.03	2 "	24 "	34 3⁄8 "	14 3⁄16 "	9 "	-	6	1 3⁄4 "	13⁄16 "		22 3⁄8 "	22 3⁄8 "	3 11⁄16 "	22 3⁄8 "	2 13⁄16 "	7⁄8 "	1⁄4 "	2 1⁄2 "	1 3⁄4 "	17 3⁄8 "	3⁄8 "	1 7⁄8 "	17.335	11⁄16 "	3⁄8 "	7 7⁄16 "	
850	255	0.03	1 15⁄16 "	24 1⁄2 "	34 7⁄8 "	14 7⁄16 "	9 1⁄4 "	-	6	1 3⁄4 "	13⁄16 "		22 7⁄8 "	22 7⁄8 "	3 15⁄16 "	22 7⁄8 "	3 "	15⁄16 "	5⁄16 "	2 1⁄2 "	1 7⁄8 "	17 7⁄8 "	3⁄8 "	2 "	17.835	11⁄16 "	3⁄8 "	7 11⁄16 "	
900	270	0.03	2 3⁄16 "	25 1⁄4 "	37 1⁄8 "	15 3⁄16 "	9 1⁄4 "	-	6	2 "	13⁄16 "		23 5⁄8 "	23 5⁄8 "	3 15⁄16 "	23 5⁄8 "	3 "	15⁄16 "	5⁄16 "	2 5⁄8 "	1 7⁄8 "	18 3⁄8 "	3⁄8 "	2 "	18.335	3⁄4 "	3⁄8 "	7 5⁄16 "	
950	285	0.03	2 3⁄16 "	25 7⁄8 "	37 5⁄8 "	15 1⁄16 "	9 9⁄16 "	-	6	2 "	13⁄16 "		24 1⁄8 "	24 1⁄8 "	4 3⁄16 "	24 1⁄8 "	3 3⁄16 "	1 "	5⁄16 "	2 5⁄8 "	2 "	18 7⁄8 "	1⁄2 "	2 "	18.835	3⁄4 "	3⁄8 "	8 1⁄8 "	
1000	300	0.03	2 3⁄16 "	26 5⁄8 "	38 3⁄8 "	15 13⁄16 "	9 15⁄16 "	-	6	2 "	13⁄16 "		24 7⁄8 "	24 7⁄8 "	4 3⁄16 "	24 7⁄8 "	3 3⁄16 "	1 "	5⁄16 "	2 3⁄4 "	2 "	19 3⁄8 "	1⁄2 "	2 1⁄8 "	19.335	3⁄4 "	3⁄8 "	8 1⁄4 "	
1100	330	0.03	2 3⁄16 "	28 5⁄8 "	39 5⁄8 "	16 3⁄16 "	10 15⁄16 "	-	6	2 "	13⁄16 "		26 1⁄8 "	26 1⁄8 "	4 7⁄16 "	26 1⁄8 "	3 3⁄8 "	1 1⁄16 "	5⁄16 "	2 7⁄8 "	2 1⁄8 "	20 3⁄8 "	1⁄2 "	2 1⁄8 "	20.335	13⁄16 "	7⁄16 "	8 7⁄16 "	
1200	360	0.03	2 5⁄16 "	29 1⁄8 "	40 3⁄4 "	17 "	11 3⁄16 "	5 "	8	2 "	13⁄16 "	27 1⁄4 "	27 1⁄4 "	4 9⁄16 "	27 1⁄4 "	3 3⁄16 "	1 "	5⁄16 "	3 "	2 1⁄8 "	21 1⁄4 "	1⁄2 "	2 1⁄4 "	21.210	7⁄8 "	7⁄16 "	8 5⁄8 "		
1300	390	0.03	2 1⁄4 "	30 1⁄4 "	41 3⁄4 "	17 1⁄2 "	11 3⁄4 "	5 1⁄16 "	8	2 "	13⁄16 "	28 1⁄4 "	28 1⁄4 "	4 5⁄16 "	28 1⁄4 "	3 9⁄16 "	1 1⁄16 "	3⁄8 "	3 1⁄8 "	2 1⁄4 "	22 "	1⁄2 "	2 3⁄8 "	21.960	7⁄8 "	7⁄16 "	8 3⁄8 "		
1400	420	0.03	2 1⁄4 "	31 1⁄2 "	42 7⁄8 "	18 1⁄16 "	12 3⁄8 "	5 1⁄4 "	8	2 "	13⁄16 "	29 3⁄8 "	29 3⁄8 "	4 15⁄16 "	29 3⁄8 "	3 3⁄4 "	1 3⁄16 "	3⁄8 "	3 1⁄4 "	2 3⁄8 "	22 7⁄8 "	1⁄2 "	2 3⁄8 "	22.835	15⁄16 "	7⁄16 "	9 1⁄8 "		
1500	450	0.03	2 1⁄4 "	33 "	43 7⁄8 "	18 9⁄16 "	13 1⁄8 "	5 1⁄2 "	8	2 "	13⁄16 "	30 3⁄8 "	30 3⁄8 "	4 15⁄16 "	30 3⁄8 "	3 13⁄16 "	1 1⁄8 "	3⁄8 "	3 3⁄8 "	2 3⁄8 "	23 5⁄8 "	1⁄2 "	2 1⁄2 "	23.585	15⁄16 "	1⁄2 "	9 3⁄16 "		

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 1/16 "	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 "	1 1/16 "	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	3/8 "	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	3/8 "	18 5/8 "	23 3/8 "	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 3/16 "	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. 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 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
BUREAU OF PROJECT DELIVERY



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

RECOMMENDED NOV. 26, 2013
Thomas P. MacIsaac
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
[Signature]
ACTING DIR. BUR. OF PROJECT DELIVERY

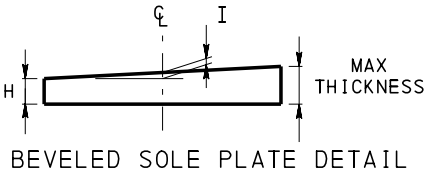
SHEET 5 OF 7
BD-613M

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 7/8 "	9 11/16 "	3 11/16 "	-	4	1 1/4 "	13/16 "	PER DESIGN (BEVELED SOLE PLATE)	15 1/4 "	14 3/8 "	2 "	10 3/8 "	1 1/2 "	1/2 "	1/4 "	3/4 "	1 "	8 3/8 "	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 7/8 "	5 1/8 "	-	4	1 1/4 "	13/16 "		17 3/8 "	17 1/4 "	2 5/16 "	12 1/2 "	1 3/4 "	3/8 "	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 7/16 "	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 3/16 "	9 1/8 "	-	4	1 1/4 "	13/16 "		25 3/4 "	26 3/8 "	3 3/8 "	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 13/16 "	-	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 3/8 "	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 5/16 "	24 3/4 "	3 3/16 "	1 1/8 "	1/4 "	1 3/4 "	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 "	

▲ - 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.

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 5/8 "	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 7/8 "
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 5/8 "
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
BUREAU OF PROJECT DELIVERY

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

RECOMMENDED NOV. 26, 2013
Thomas P. MacIsaac
CHIEF BRIDGE ENGINEER


RECOMMENDED NOV. 26, 2013
[Signature]
ACTING DIR. BUR. OF PROJECT DELIVERY

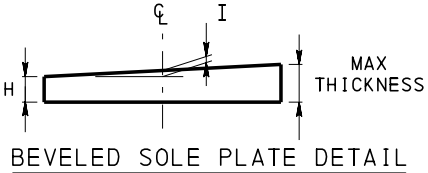
SHEET 6 OF 7
BD-613M

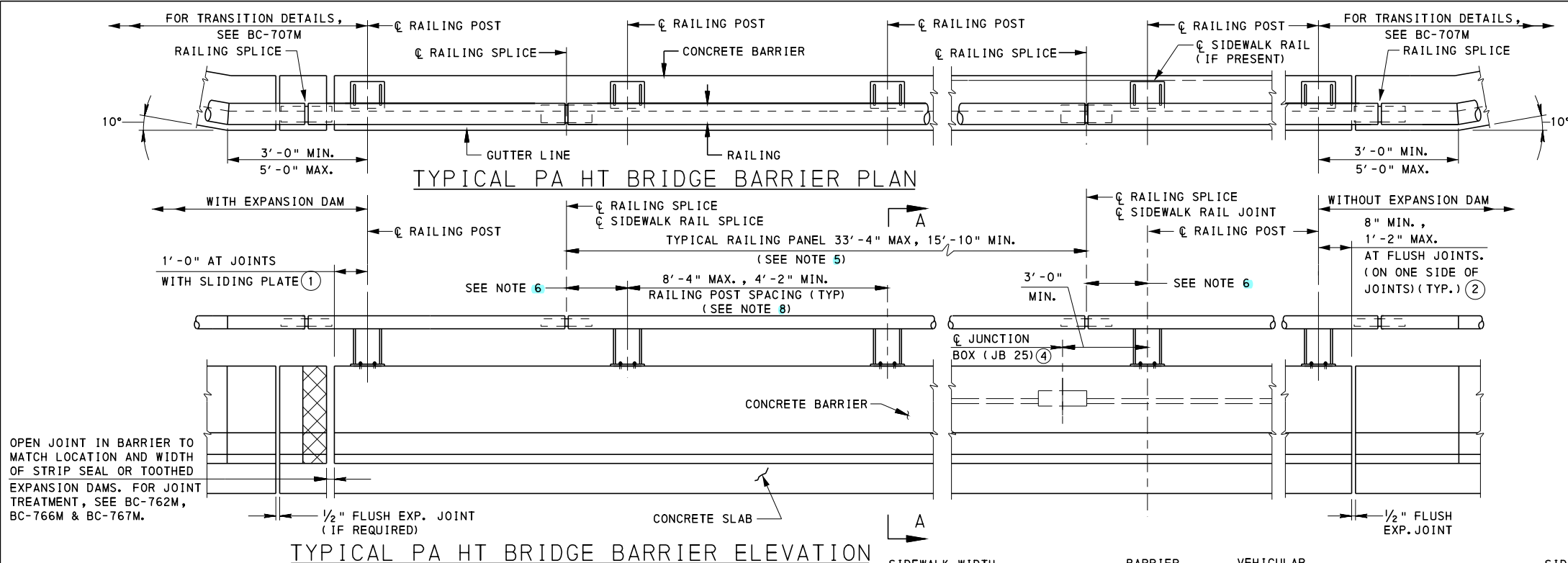
DESIGN TABLES FOR GUIDED POT BEARINGS (30% HORIZONTAL LOAD)

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	Z
200	60	0.03	2 "	12 7⁄8 "	26 7⁄8 "	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 1 3⁄16 "	-	4	1 1⁄4 "	3⁄16 "		17 1⁄2 "	19 5⁄8 "	2 3⁄16 "	12 5⁄8 "	1 1 1⁄16 "	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 1 3⁄16 "	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 1 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 "	1 1⁄16 "	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 1 5⁄16 "	-	4	1 3⁄4 "	5⁄16 "		22 5⁄8 "	26 1⁄4 "	2 1 5⁄16 "	17 3⁄4 "	2 1⁄4 "	1 1⁄16 "	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 "	1 3⁄16 "	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 "	1 3⁄16 "	1⁄4 "	2 1⁄4 "	1 5⁄8 "	16 1⁄4 "	3⁄8 "	2 "	16.210	1 1⁄16 "	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 1 1⁄16 "	21 5⁄8 "	2 1 3⁄16 "	7⁄8 "	1⁄4 "	2 3⁄8 "	1 3⁄4 "	16 7⁄8 "	3⁄8 "	2 "	16.835	1 1⁄16 "	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 1 1⁄16 "	22 3⁄8 "	2 1 3⁄16 "	7⁄8 "	5⁄16 "	2 1⁄2 "	1 3⁄4 "	17 3⁄8 "	3⁄8 "	2 1⁄8 "	17.335	1 1⁄16 "	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 1 5⁄16 "	22 7⁄8 "	3 "	1 5⁄16 "	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 1 5⁄16 "	23 5⁄8 "	3 "	1 5⁄16 "	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 3⁄8 "	9 7⁄8 "	-	6	2 "	1 7⁄16 "		29 "	35 "	4 1⁄16 "	24 1⁄8 "	3 3⁄16 "	1 5⁄16 "	5⁄16 "	2 5⁄8 "	2 "	18 7⁄8 "	1⁄2 "	2 1⁄4 "	18.835	1 3⁄16 "	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 1 1⁄16 "	-	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	1 3⁄16 "	3⁄8 "	4 1⁄8 "	24 7⁄8 "
1100	330	0.03	3 1 1⁄16 "	28 1⁄8 "	51 1⁄8 "	22 3⁄16 "	10 1 1⁄16 "	-	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	1 3⁄16 "	7⁄16 "	4 1⁄8 "	26 1⁄8 "
1200	360	0.03	3 1 1⁄16 "	29 1⁄2 "	52 5⁄8 "	22 1 5⁄16 "	11 3⁄8 "	3 1 1⁄16 "	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 1 5⁄16 "	30 1⁄4 "	54 1⁄8 "	23 1 1⁄16 "	11 3⁄4 "	3 7⁄8 "	8	2 "	1 1 1⁄16 "		33 1⁄8 "	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	1 5⁄16 "	7⁄16 "	4 9⁄16 "	28 1⁄4 "
1400	420	0.03	3 1 5⁄16 "	31 1⁄2 "	55 5⁄8 "	24 7⁄16 "	12 3⁄8 "	4 1⁄16 "	8	2 "	1 1 1⁄16 "		34 1⁄4 "	42 1⁄8 "	4 1 3⁄16 "	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	1 5⁄16 "	1⁄2 "	4 1 3⁄16 "	29 3⁄8 "
1500	450	0.03	3 1 5⁄16 "	33 3⁄8 "	56 7⁄8 "	25 1⁄16 "	13 5⁄16 "	4 1⁄4 "	8	2 "	1 1 3⁄16 "		35 1⁄4 "	43 3⁄8 "	5 1⁄4 "	30 3⁄8 "	3 1 3⁄16 "	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 1 3⁄16 "	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. 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.

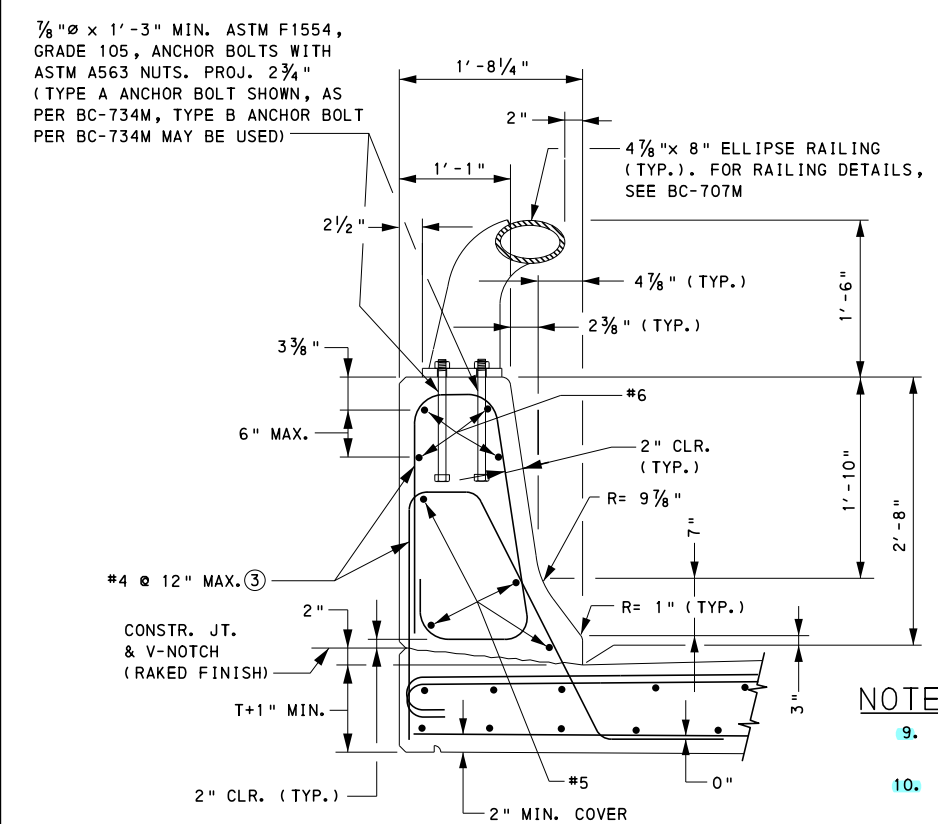
VERTICAL LOAD (KIPS)	HORIZONTAL LOAD (KIPS)	GUIDE BARS							PTFE				STAINLESS STEEL				BEARING HEIGHT * 
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	
200	60	2 3⁄8 "	2 3⁄8 "	16 1⁄4 "	5⁄16 "	1⁄2 "	5⁄16 "	5.934	7 5⁄8 "	3⁄16 "	1 5⁄8 "	11 1⁄8 "	16 1⁄8 "	8 5⁄8 "	16 1⁄8 "	1 7⁄8 "	7 13⁄16 "
250	75	2 5⁄8 "	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 "	1 1⁄16 "	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 "	1 1⁄16 "	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 "	1 1⁄16 "	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 "	1 1⁄16 "	1 3⁄16 "	1 1⁄16 "	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 "	1 1⁄16 "	1 3⁄16 "	1 1⁄16 "	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 "





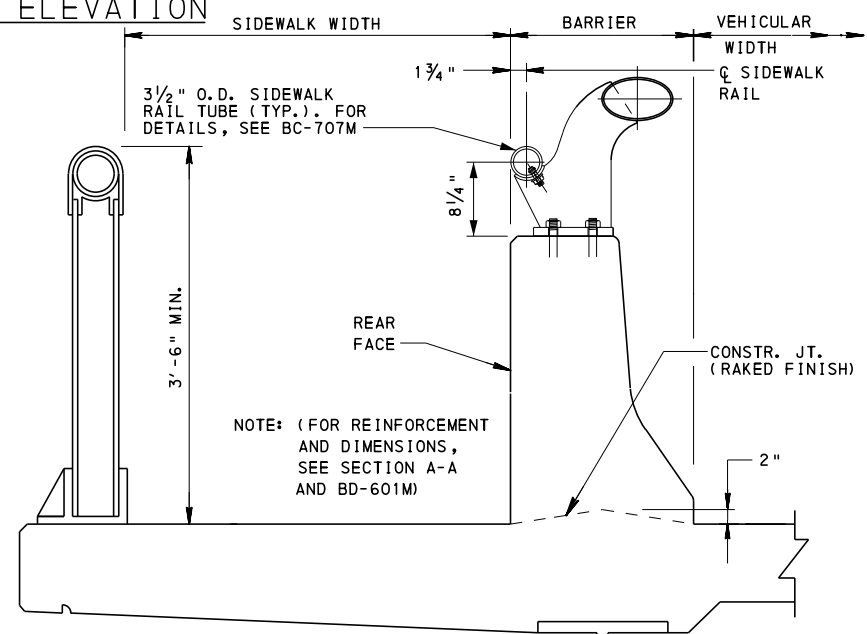
- NOTES:**
- PA HT BRIDGE BARRIER HAS BEEN ACCEPTED BY FHWA AS A TL-5 BARRIER DESIGNATION.
 - PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH PUBLICATION 408.
 - ALL RAILING COMPONENTS TO BE GALVANIZED IN ACCORDANCE WITH SECTION 1105.02 (S), PUBLICATION 408 UNLESS OTHERWISE SHOWN ON THE PLANS.
 - PLACE POST AND POST ANCHOR BOLTS NORMAL TO GRADE AND RAILS PARALLEL TO GRADE.
 - LOCATE RAILING SPLICES AT EXPANSION JOINTS AND AT OTHER LOCATIONS WHERE NECESSARY. PROVIDE RAILINGS AS LONG AS PRACTICAL, WITH A MINIMUM OF THREE POSTS BETWEEN RAILING SPLICES.
 - THE CENTERLINE OF THE RAIL TUBE SPLICE TO A POST IS POST IS TO BE 1'-8" MINIMUM AND 2'-6" MAXIMUM FROM THE CENTERLINE OF THE RAILING POSTS.
 - COAT ALL SURFACES OF THE BASE PLATE 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, PUBLICATION 408.
 - ONE OR MORE 8'-4" MAX. POST SPACINGS MAY BE REDUCED TO 4'-2" MIN. IN ORDER TO MAINTAIN APPROPRIATE SPACING DIMENSION FROM THE END OF THE RAIL, EXPANSION JOINTS AND DRAINAGE SCUPPERS.

- ① \varnothing RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR \varnothing RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE
- ② NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL. IF POSTS LOCATED AT EXPANSION JOINT.

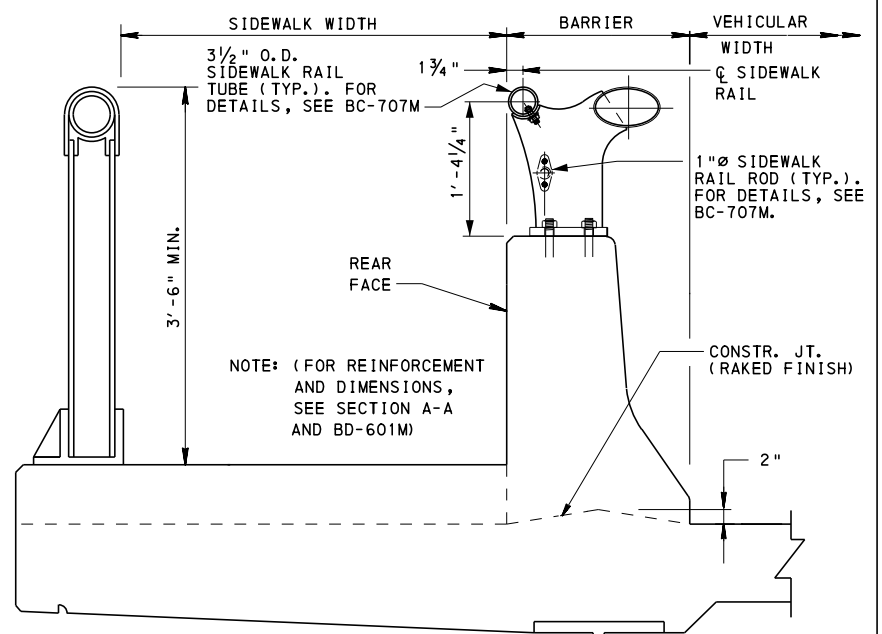


SECTION A-A
(TYPICAL)

- ③ WITHIN 10'-0" ON BOTH SIDES OF AN OPEN JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING.
- ④ FOR LOCATION AND DETAILS OF JUNCTION BOX WITHIN CONCRETE SECTION OF BARRIER, SEE BC-721M AND BC-722M.



SIDEWALK SECTION A-A



RAISED SIDEWALK SECTION A-A

- NOTES: CONTINUED**
- THE CONCRETE PORTION OF PA HT BRIDGE BARRIER IS THE ALTERNATE CONCRETE BARRIER. BD-601M DETAILS APPLY.
 - JOINTS IN THE SIDEWALK RAIL TUBE TO BE PLACED IN THE SAME LOCATION AS THE 4 7/8" x 8" ELLIPSE RAILING.
 - FOR LOCATION OF DRAIN HOLES IN ELLIPSE RAILING AND SIDEWALK RAIL TUBE, SEE BC-707M.
 - FOR DEAD LOAD CALCULATIONS, THE WEIGHT OF FOUR TYPES OF PA HT BRIDGE BARRIERS ARE AS FOLLOWS:
- | | |
|--------------------|-------------|
| TYPICAL HT | 550 LB./FT. |
| SIDEWALK HT | 560 LB./FT. |
| RAISED SIDEWALK HT | 570 LB./FT. |
| ALT. SIDEWALK HT | 550 LB./FT. |
- (ALL CASES ASSUME 6'-3" POST SPACING)

BD-601M	CONCRETE DECK SLAB
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BC-707M	PA HT BRIDGE BARRIER MISC DETAILS
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-721M	ELECTRICAL DETAILS
BC-722M	LIGHTING POLE ANCHORAGE
BC-734M	STANDARD ANCHOR SYSTEMS
BC-739M	BRIDGE BARRIER TO GUIDE RAIL TRANSITION
BC-751M	BRIDGE DRAINAGE
BC-752M	CONCRETE DECK SLAB DETAILS
BC-762M	TOOTH EXPANSION DAM
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL
BC-767M	NEOPRENE STRIP SEAL DAM

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

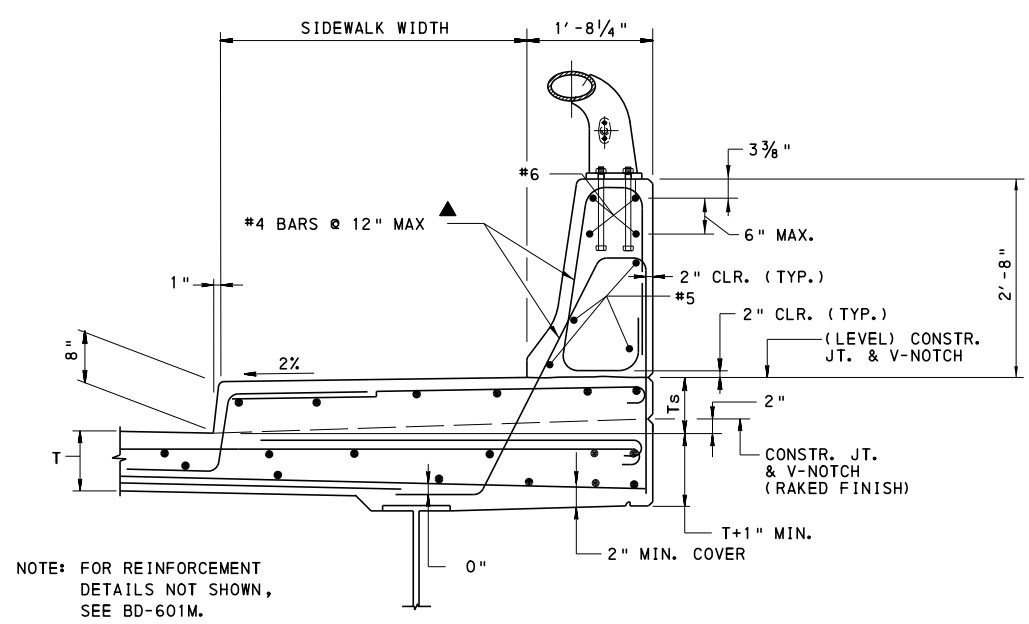
STANDARD

PA HT BRIDGE BARRIER

DETAILS

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 1 OF 3 BD-615M
--	---	--------------------------------

CHANGE 3



NOTE: FOR REINFORCEMENT DETAILS NOT SHOWN, SEE BD-601M.

ALTERNATE SIDEWALK DETAIL

▲ WITHIN 10'-0" ON BOTH SIDES OF AN EXPANSION JOINT IN THE BARRIER AND AT THE END OF THE BRIDGE, REDUCE SPACING OF REINFORCEMENT BARS TO HALF THE SHOWN SPACING.

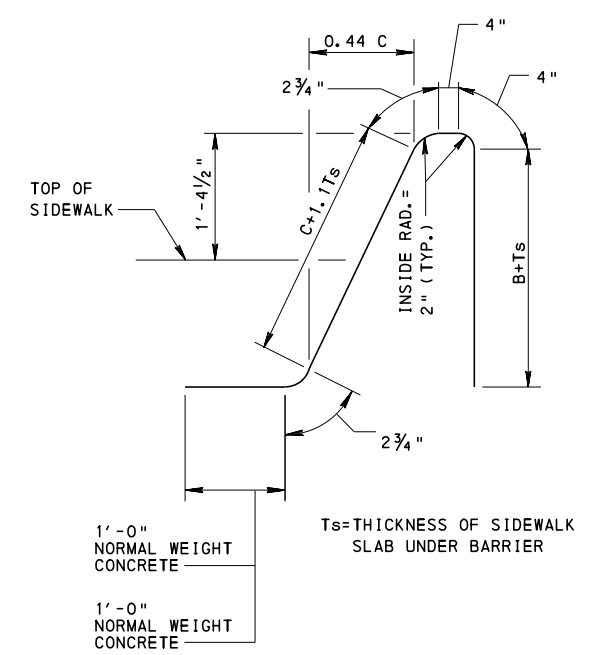


TABLE 1		
FOR PA HT BRIDGE BARRIER AT ALTERNATE SIDEWALK		
B AND C DIMENSIONS		
T	B	C
8.0"	1'-9"	1'-11"
8.5"	1'-9 1/2"	1'-11 1/2"
9.0"	1'-10"	2'-0"
9.5"	1'-10 1/2"	2'-0 1/2"
10.0"	1'-11"	2'-1"
10.5"	1'-11 1/2"	2'-1 1/2"
11.0"	2'-0"	2'-2"
11.5"	2'-0 1/2"	2'-2 1/2"

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.

PA HT BRIDGE BARRIER
(FOR DIMENSIONS "B" AND "C", SEE TABLE 1)

NOTES:
1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PA HT BRIDGE BARRIER
ALTERNATE SIDEWALK DETAILS

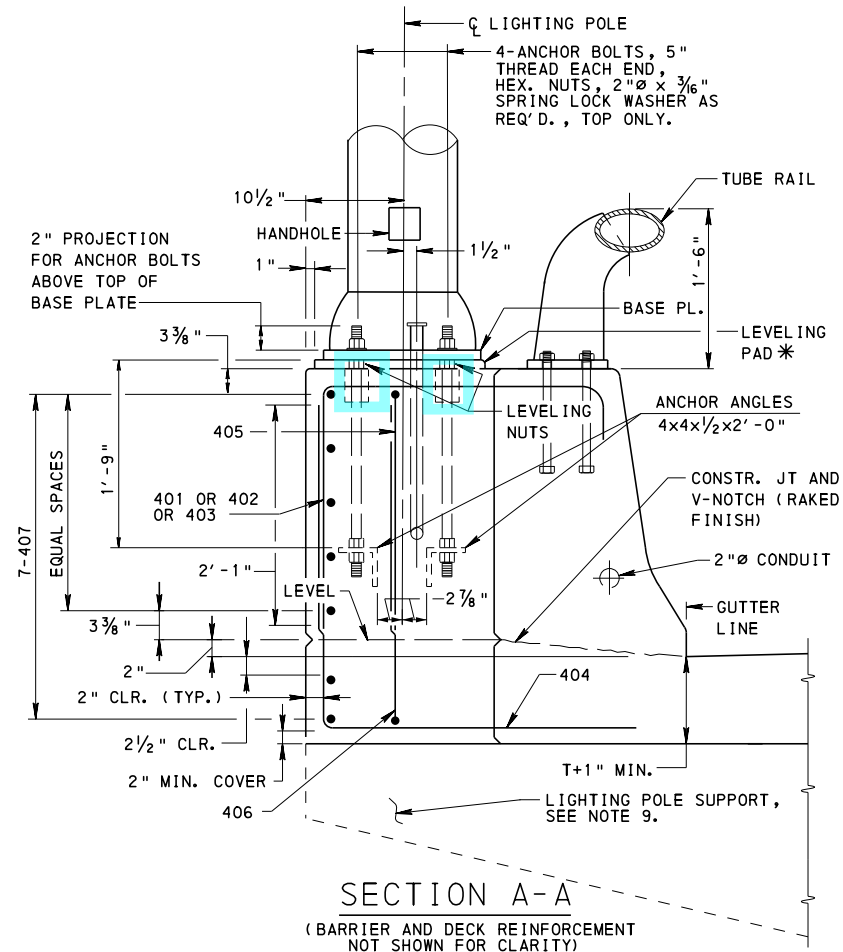
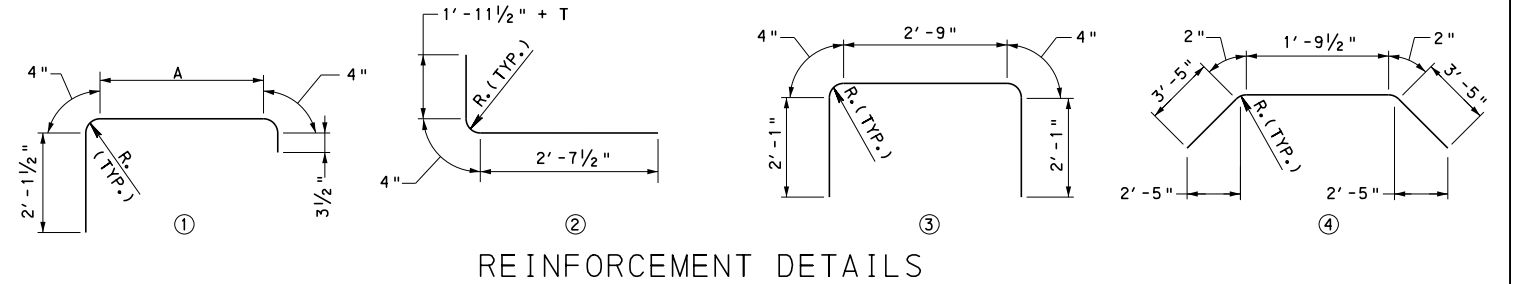
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
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SHEET 2 OF 3
BD-615M

1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. ALL REINFORCEMENT BARS SHALL BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.
3. RADIUS, $R=2"$, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.
4. T = THICKNESS OF SLAB.

Diagram 5 shows a U-shaped cross-section of a channel. The top flanges are 4 inches wide. The bottom flange is 2 feet 9 inches wide. The height of the flanges is 1 inch. The radius of the bottom flange is R (TYP.).



- ## NOTES:
1. PROVIDE MATERIALS AND WORKMANSHIP 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 TO 1101.4 PUB. 408 EXCEPT DO NOT GALVANIZE ANCHOR ANGLES.
 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. LIGHTING POLE SUPPORT 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.

* FILL SPACE BETWEEN POLE BASE PLATE AND TOP OF CONCRETE BARRIER 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"

BD-601M	CONCRETE DECK SLAB
BD-657M	ABUTMENT DETAILS, I-BEAM AND BOX BEAM BRIDGES
BD-658M	PIER DETAILS, I-BEAM AND BOX BEAM BRIDGES
BC-707M	PA HT BRIDGE BARRIER MISC. DETAILS
BC-721M	ELECTRICAL DETAILS
BC-722M	LIGHTING POLE ANCHORAGE
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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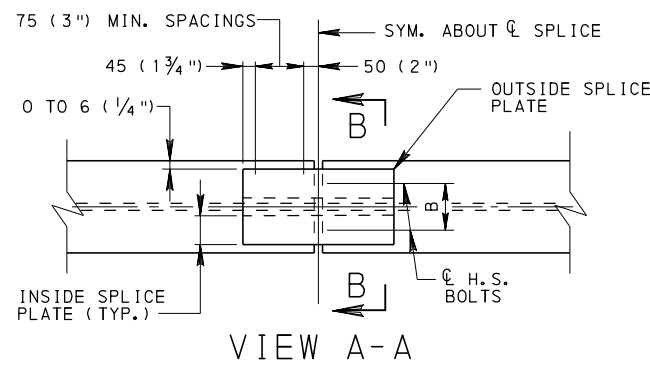
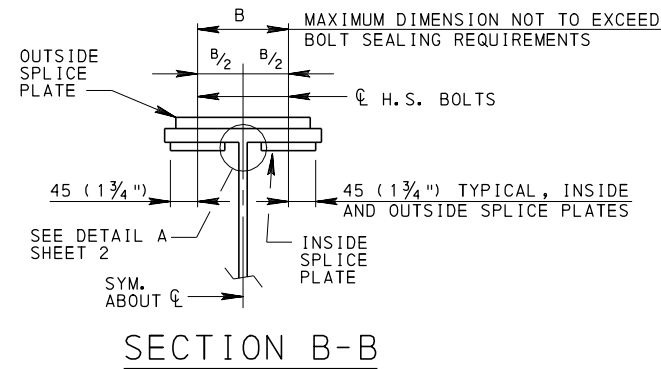
STANDARD PA HT BRIDGE BARRIER LIGHTING POLE ANCHORAGE DETAILS

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Thomas P Maciore
 CHIEF BRIDGE ENGINEER

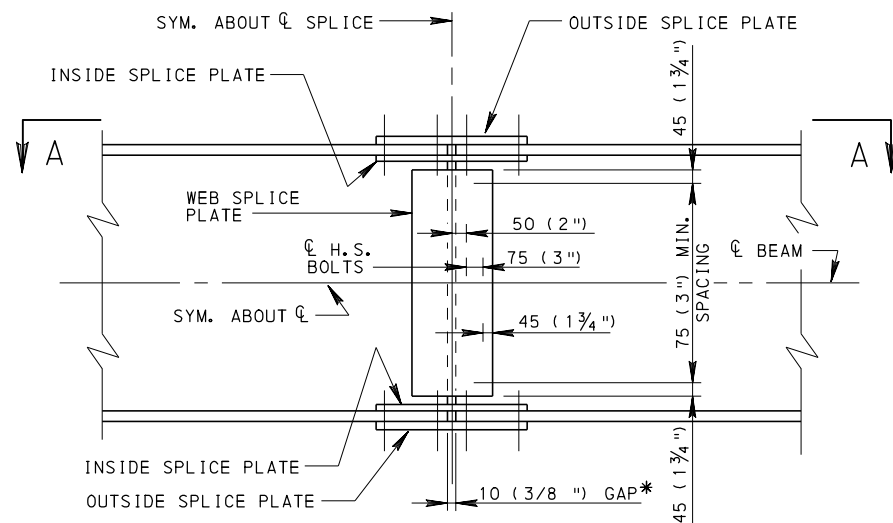
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SHEET 3 OF 3

BD-615M



FLANGE SPLICE DETAIL - TYPE 1



* USE 10 (3/8 inch) GAP FOR DESIGN, DETAIL AS 6 (1/4 inch) GAP ON DRAWINGS.

GENERAL NOTES

- ALL DIMENSIONS GIVEN IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES.
- DESIGN SPECIFICATIONS: 1998 AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DM-4.
- DETAILS SHOWN ARE FOR 22.2 (7/8 inch) 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 7 (1/4 inch) 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.
- CAPACITY OF COMPONENT SPLICE PLATE TO EQUAL CAPACITY OF COMPONENT. COMPONENT BEING TOP FLANGE, WEB OR BOTTOM FLANGE.
- CHECK GIRDER CAPACITY FOR REDUCTION DUE TO BOLTS HOLES IN THE TENSION FLANGE USING THE EFFECTIVE NET AREA, A_e , IN ACCORDANCE WITH THE FOLLOWING:

$$A_e = A_n + \beta A_g \leq A_g$$

$$\beta = \left(\frac{A_n}{A_g} \right) \left[\left(\frac{\phi_u F_u}{\phi_y F_{yf}} \right) - 1 \right] > 0.0$$

A_n = NET AREA OF FLANGE, mm² (in²)

A_g = GROSS AREA OF FLANGE, mm² (in²)

ϕ_u = 0.80

ϕ_y = 0.95

F_u = SPECIFIED MINIMUM TENSILE STRENGTH OF THE FLANGE, MPa (ksi)

F_{yf} = SPECIFIED MINIMUM YIELD STRENGTH OF THE FLANGE, MPa (ksi)

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 900 (3'-0 inch) FROM STEEL FIELD GIRDER SPLICES.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

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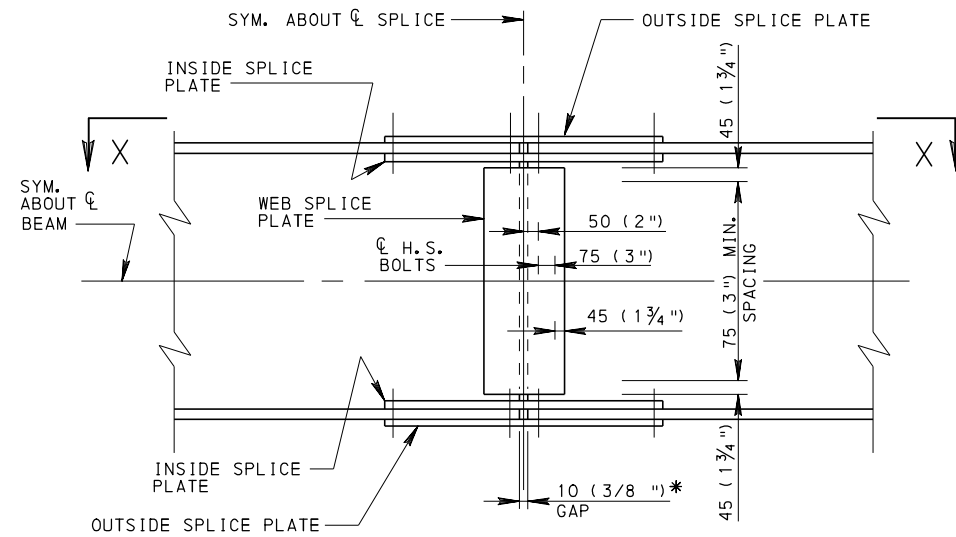
STANDARD

FIELD SPLICE

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

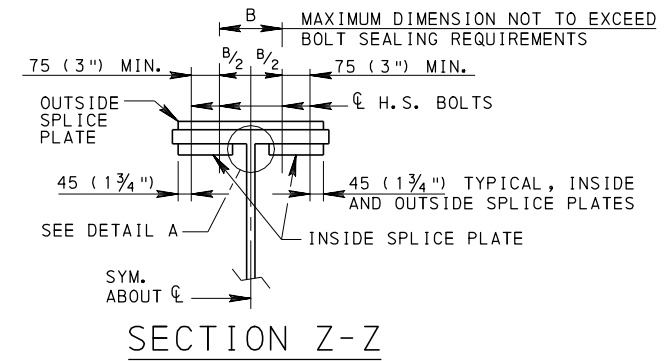
RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 1 OF 2
BD-616M

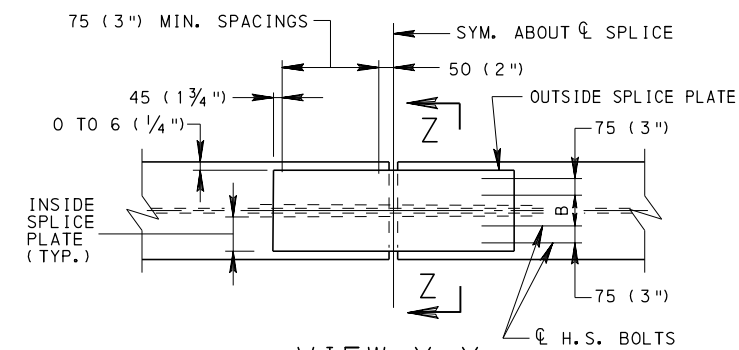


WEB SPLICE DETAIL

* USE 10 (3/8") GAP FOR DESIGN, DETAIL AS 6 (1/4") GAP ON DRAWINGS.

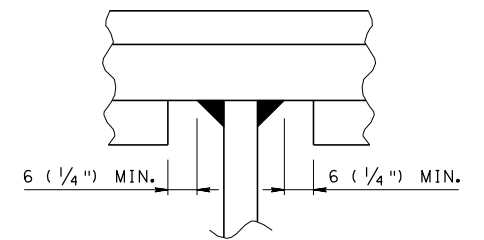


SECTION Z-Z

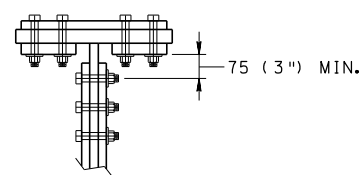


VIEW X-X

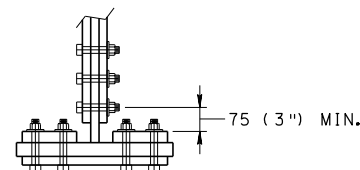
FLANGE SPLICE DETAIL - TYPE 2



DETAIL A

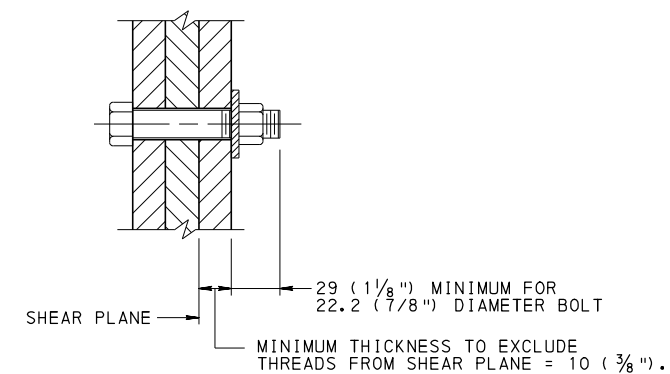


TOP FLANGE



BOTTOM FLANGE

22.2 (7/8") DIAMETER BOLT ENTERING AND TIGHTENING CLEARANCES



BOLT SHEAR PLANE

MINIMUM PLATE THICKNESS IS 10 (3/8").

NOTE:
BASED ON 38.1 (1 1/2") THREAD LENGTH FOR 22.2 (7/8") DIAMETER BOLT

NOTE:
SEE SHEET 1 FOR GENERAL NOTES.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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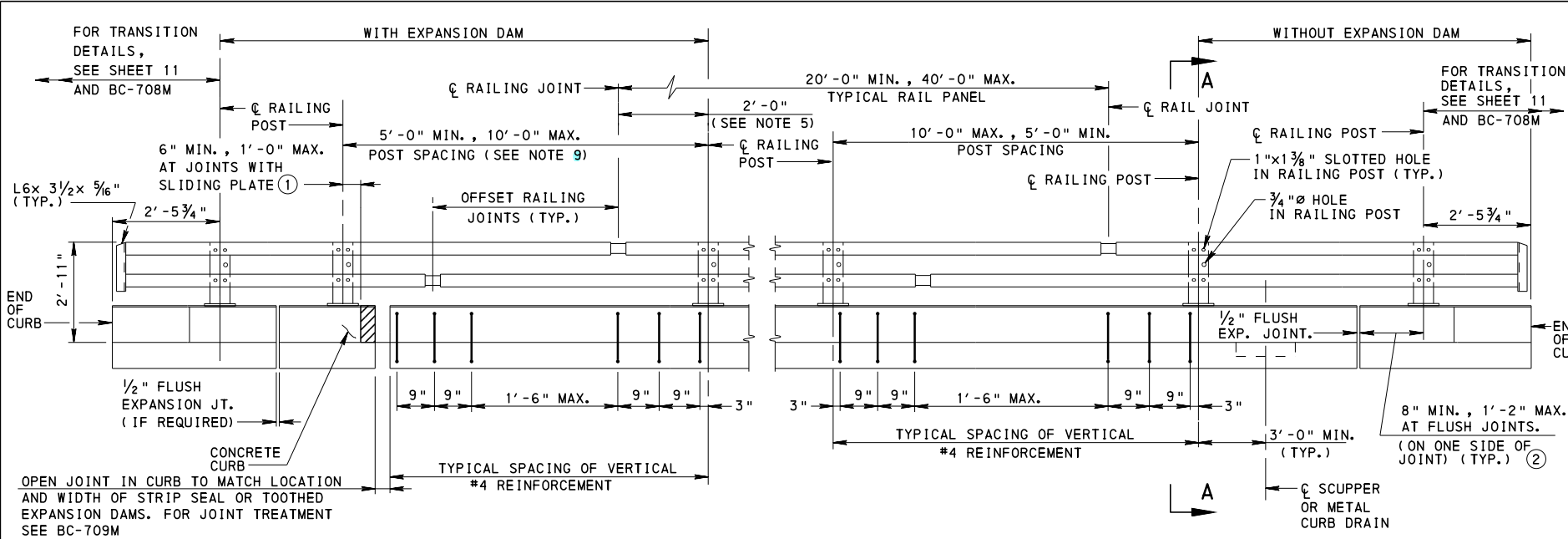
**STANDARD
FIELD SPLICE**

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Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

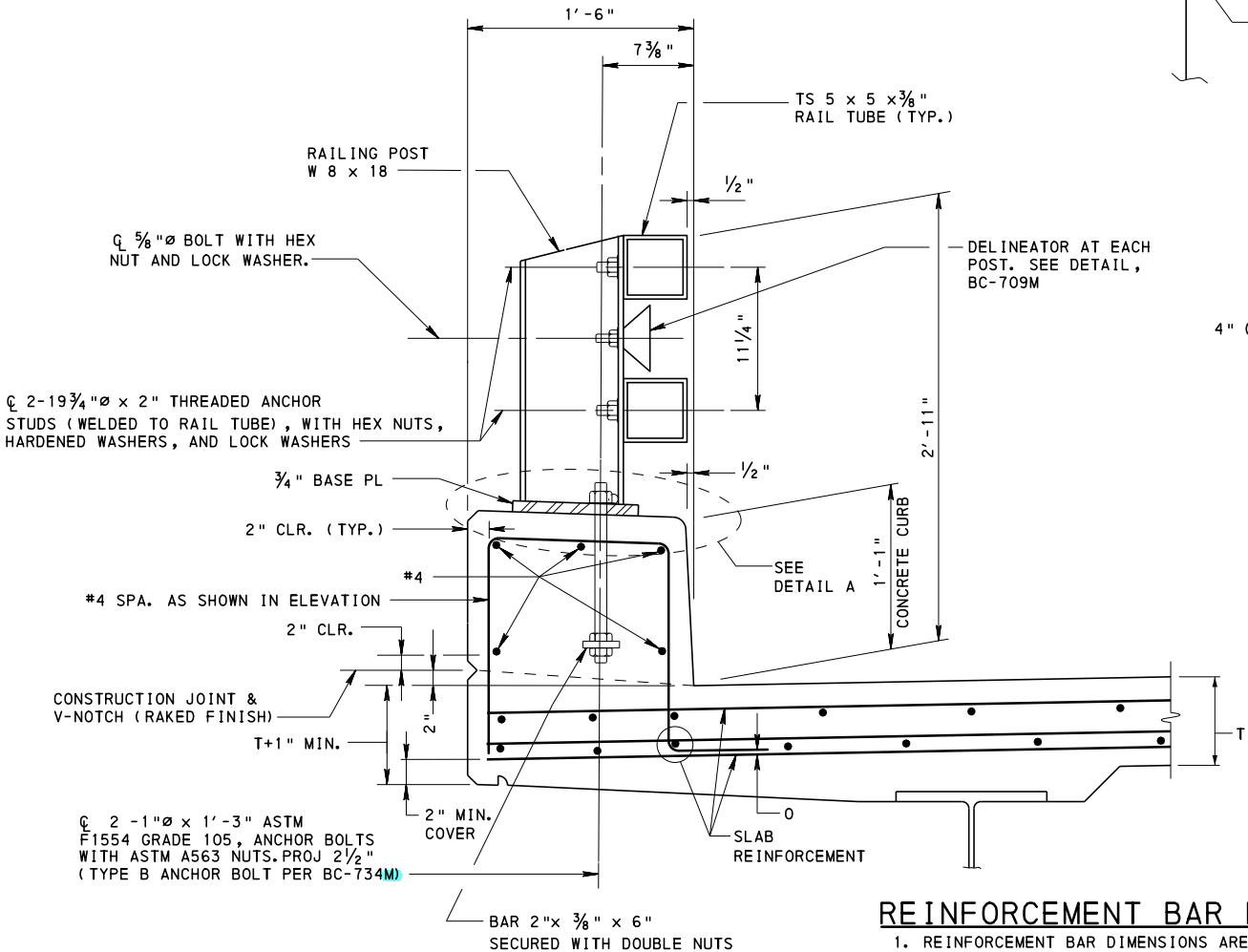
SHEET 2 OF 2
BD-616M

CHANGE 3



TYPICAL PA TYPE 10M BRIDGE BARRIER ELEVATION

- (WITHOUT INLET PLACEMENT SHOWN;
WITH INLET PLACEMENT SIMILAR, SEE SHEET 11)
- ① ϕ RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN)
OR ϕ RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE
- ② NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL.
IF POSTS LOCATED AT EXPANSION JOINT



SECTION A-A

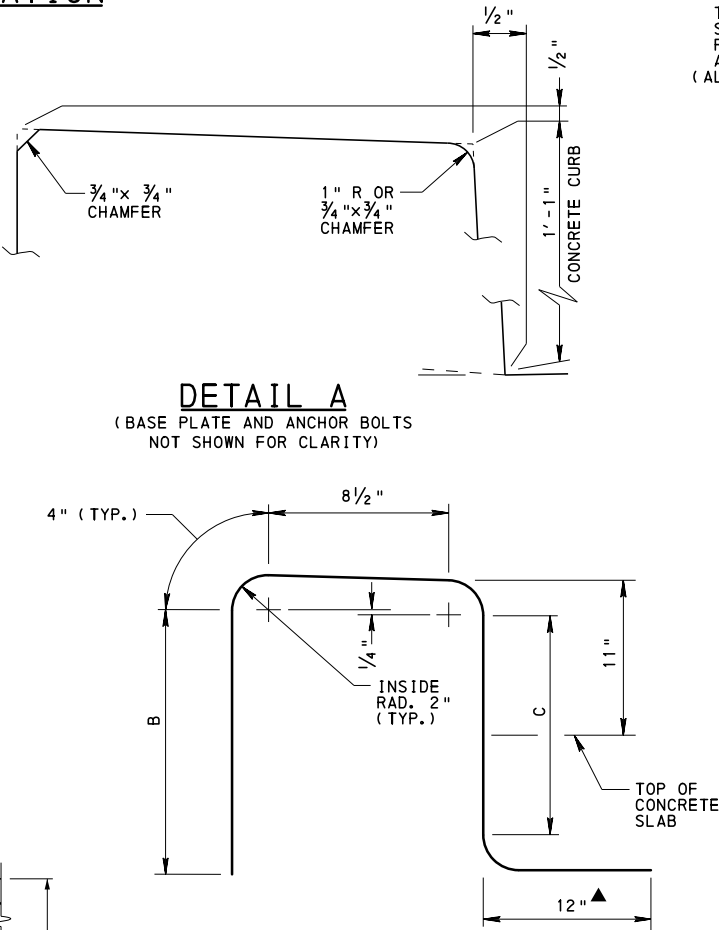
REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

NOTES:

1. PA TYPE 10M BRIDGE BARRIER HAS BEEN ACCEPTED BY FHWA AS A TL-4 BARRIER DESIGNATION.
2. PROVIDE MATERIALS AND WORKMANSHIP 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.
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. THE CENTERLINE OF THE RAIL TUBE SPLICE TO A POST IS TO BE 1'-8" MINIMUM AND 2'-6" MAXIMUM FROM THE CENTERLINE OF THE RAILING POSTS.
6. TIGHTEN ALL BOLTS THAT HAVE LOCK WASHERS TO SNUG CONDITION ONLY.
7. PLACE POST AND POST ANCHOR BOLTS NORMAL TO GRADE AND RAILS PARALLEL TO GRADE.
8. COAT ALL SURFACES OF THE BASE PLATE 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, PUBLICATION 408.
9. ONE OR MORE 10'-0" MAX. POST SPACINGS MAY BE REDUCED TO 5'-0" MIN. IN ORDER TO MAINTAIN APPROPRIATE SPACING DIMENSIONS FROM THE END OF THE RAIL, EXPANSION JOINTS AND DRAINAGE SCUPPERS.
10. DO NOT USE DEFLECTION JOINTS WITH PA TYPE 10M BRIDGE BARRIERS.
11. PROVIDE POST SPACINGS ON THE PLANS.
12. THE MAXIMUM JOINT MOVEMENT FOR THE PA TYPE 10M BRIDGE BARRIER IS 9".
13. FOR LOCATION OF DRAIN HOLES IN RAIL TUBES, SEE SHEET BC-709M.
14. PROVIDE RAILING JOINTS IN ALL RAILS IN THE BAY ABOVE AN EXPANSION DAM.
15. FOR DEAD LOAD CALCULATIONS, THE MASS OF FOUR TYPES OF PA TYPE 10M BRIDGE BARRIER ARE AS FOLLOWS:

TYPICAL 10M	300 LB./FT.
SIDEWALK 10M	310 LB./FT.
RAISED SIDEWALK 10M	360 LB./FT.
ALT. SIDEWALK 10M	310 LB./FT.
(ALL CASES ASSUME 7'-6" POST SPACING)	



DETAIL A

(BASE PLATE AND ANCHOR BOLTS NOT SHOWN FOR CLARITY)

VERTICAL REINFORCEMENT

(FOR DIMENSIONS "B" AND "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.

BD-601M	CONCRETE DECK SLAB
BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
BC-734M	ANCHOR SYSTEMS
BC-751M	BRIDGE DRAINAGE
RC-50M	GUIDE RAIL TRANSITION AT END OF STRUCTURE
REFERENCE DRAWINGS	

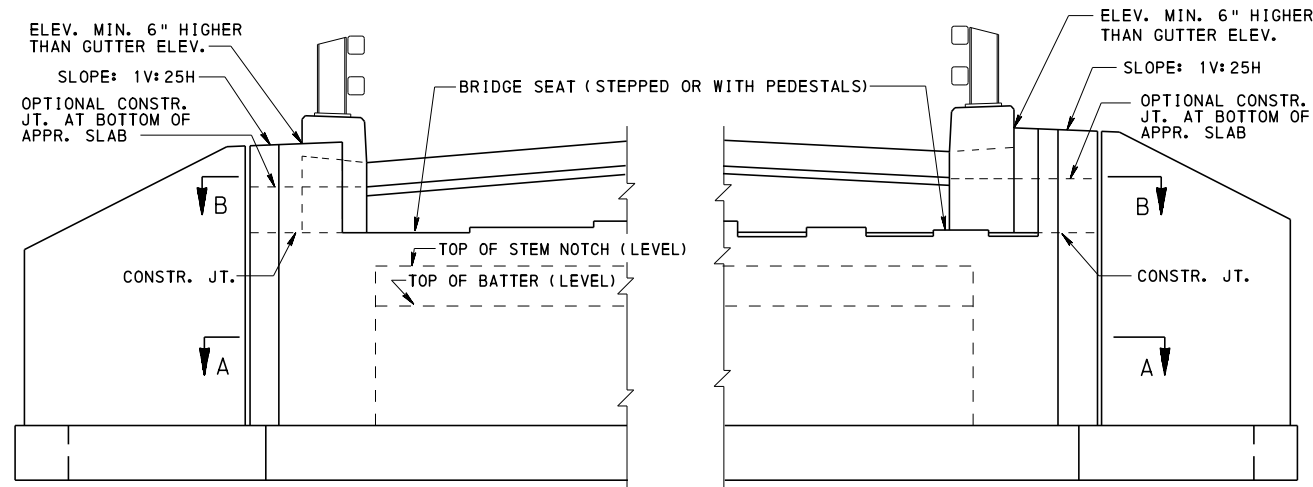
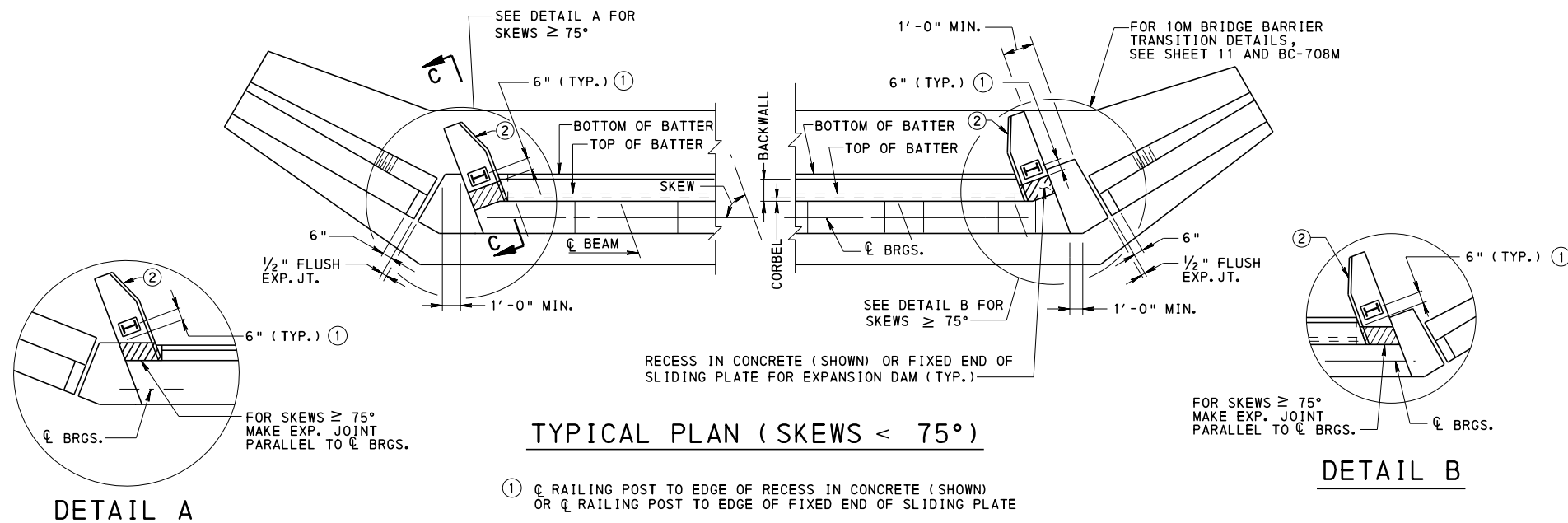
TABLE 1		
B AND C DIMENSIONS		
FOR PA TYPE 10M BARRIER		
T	B	C
8.0"	1'-3 3/4"	1'-1"
8.5"	1'-4 1/4"	1'-1 1/2"
9.0"	1'-4 3/4"	1'-2"
9.5"	1'-5 1/4"	1'-2 1/2"
10.0"	1'-5 3/4"	1'-3"
10.5"	1'-6 1/4"	1'-3 1/2"
11.0"	1'-6 3/4"	1'-4"
11.5"	1'-7 1/4"	1'-4 1/2"

COMMONWEALTH OF PENNSYLVANIA
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STANDARD

PA TYPE 10M BRIDGE BARRIER
BARRIER DETAILS

RECOMMENDED NOV. 21, 2014 Thomas P. Maciara CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 Brenda S. Thompson ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 1 OF 17 BD-617M
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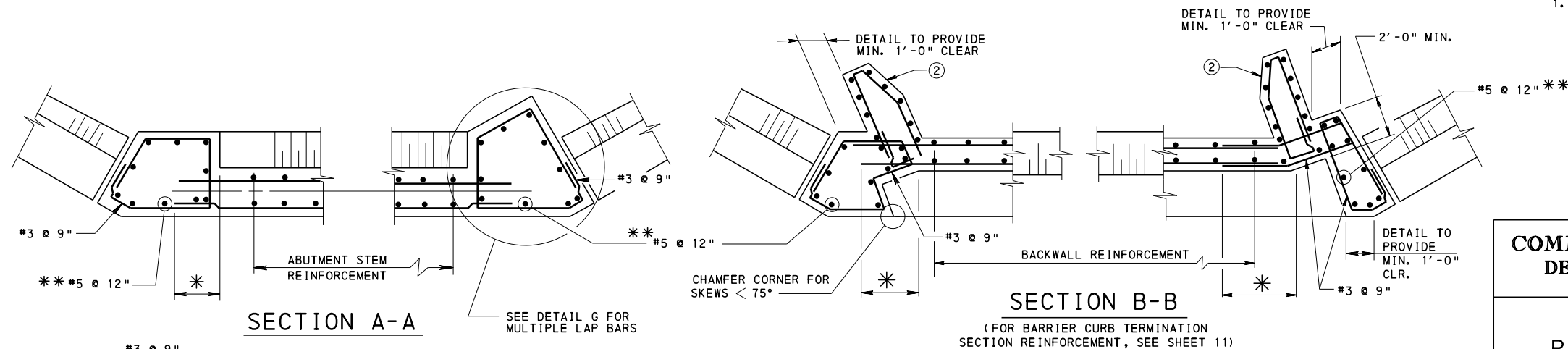


TYPICAL ELEVATION

② SECTION SHOWN WITHOUT INLET PLACEMENT. WITH INLET PLACEMENT THE WALL THICKNESS TO BE 1'-6" FULL HEIGHT TO TOP OF CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR CURB AND BEVEL DETAILS.

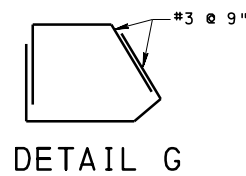
NOTES:

1. FOR SECTION C-C, SEE SHEET 3.



ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS.



* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED TO OBTAIN MINIMUM DEVELOPMENT LENGTH. (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.

SECTION B-B
(FOR BARRIER CURB TERMINATION SECTION REINFORCEMENT, SEE SHEET 11)

BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-622M	R.C. ABUTMENTS WITH BACKWALL
BD-657M	ABUTMENT DETAILS
BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PA TYPE 10M BRIDGE BARRIER
R. C. ABUTMENTS WITH BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED NOV. 21, 2014

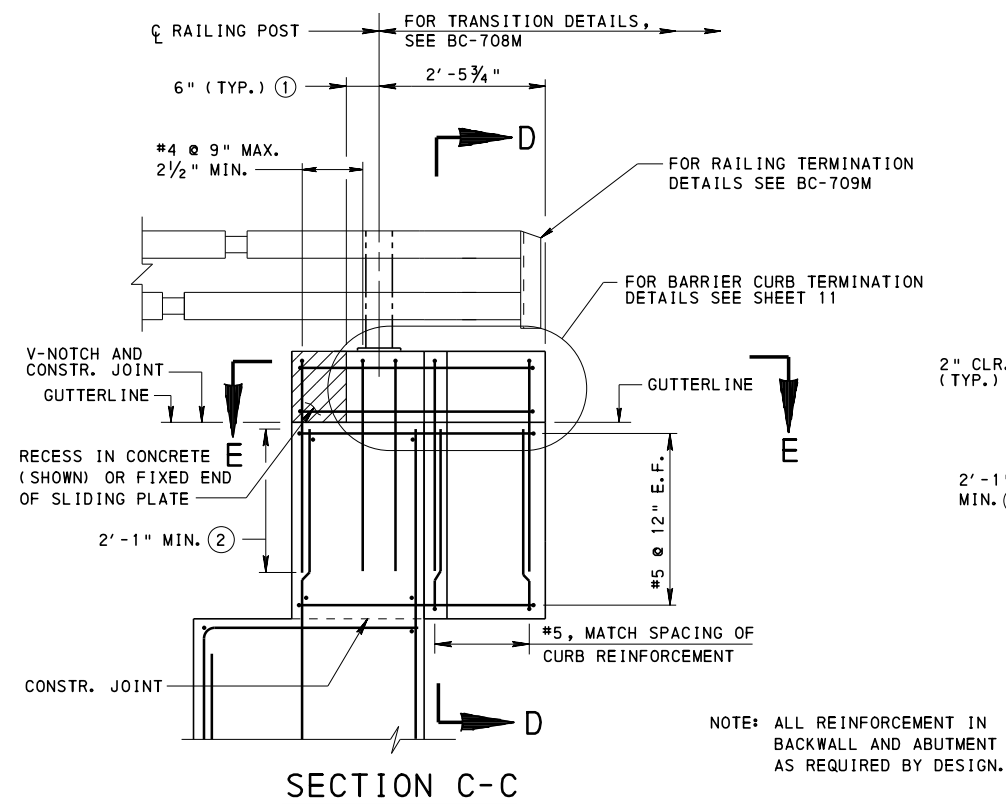
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CHIEF BRIDGE ENGINEER

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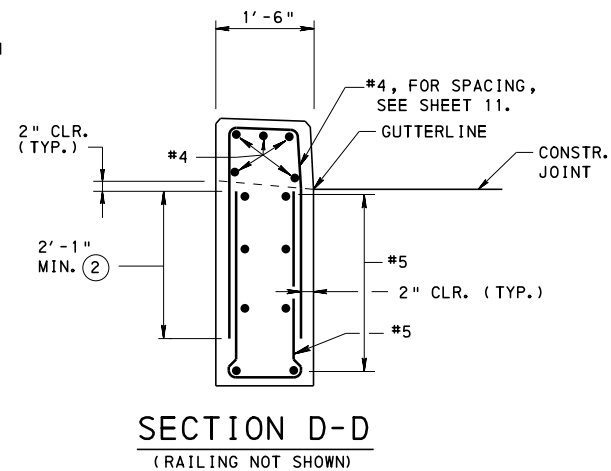
Brian S. Thompson
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SHEET 2 OF 17

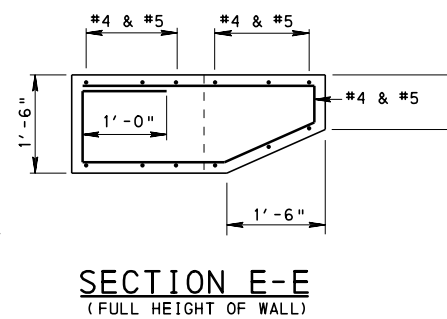
BD-617M



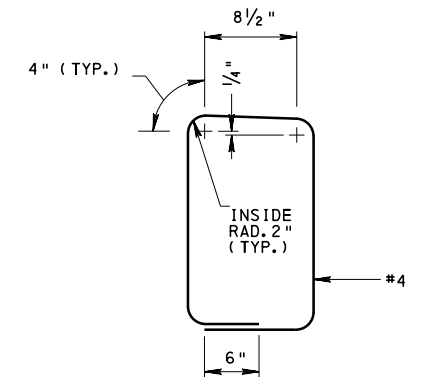
SECTION C-C



SECTION D-D
(RAILING NOT SHOWN)



SECTION E-E
(FULL HEIGHT OF WALL)

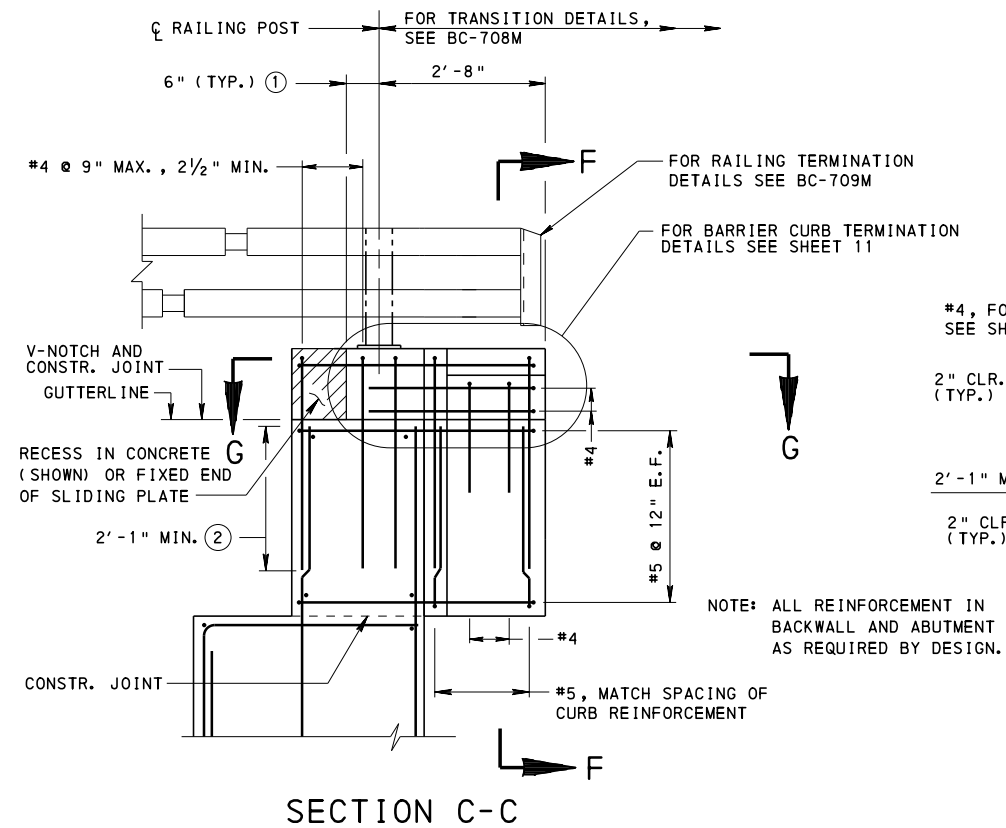


ALTERNATE REINFORCEMENT
DETAIL

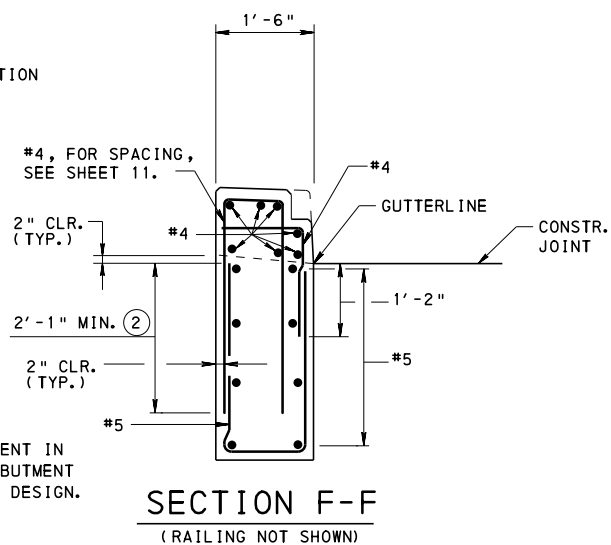
REINFORCEMENT BAR NOTES:

1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

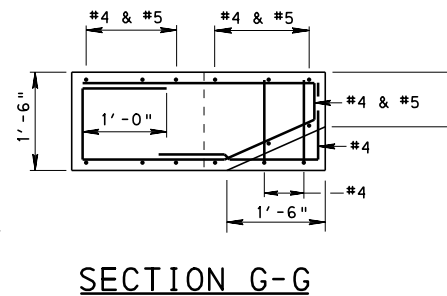
- ① \bar{C} RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR \bar{C} RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE.
- ② FOR SUPERSTRUCTURES WHICH ARE TOO SHALLOW TO ACCOMMODATE THE 2'-1" MIN. LAP USE SINGLE HOOP BAR. SEE ALTERNATE REINFORCEMENT DETAIL.



SECTION C-C



SECTION F-F
(RAILING NOT SHOWN)



SECTION G-G

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 2.
2. OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 2'-1".
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

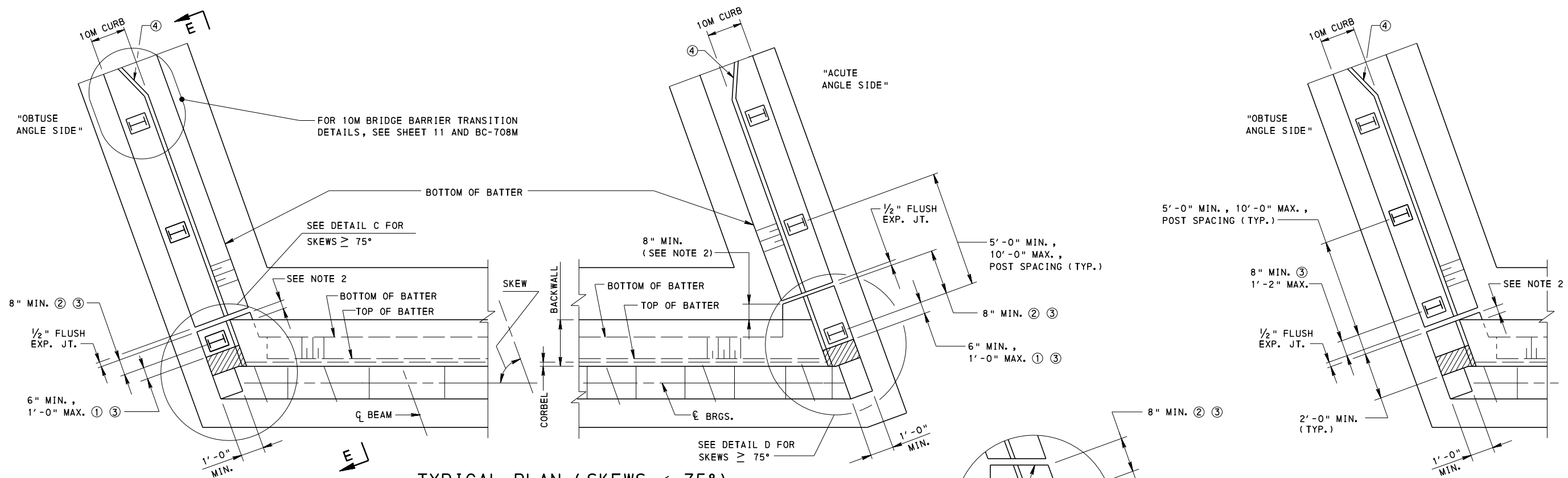
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
PA TYPE 10M BRIDGE BARRIER
R.C. ABUTMENTS WITH BACKWALL
FLARED WINGS

RECOMMENDED NOV. 21, 2014
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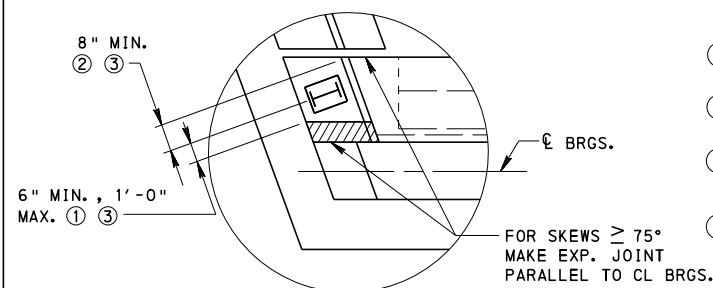
SHEET 3 OF 17
BD-617M



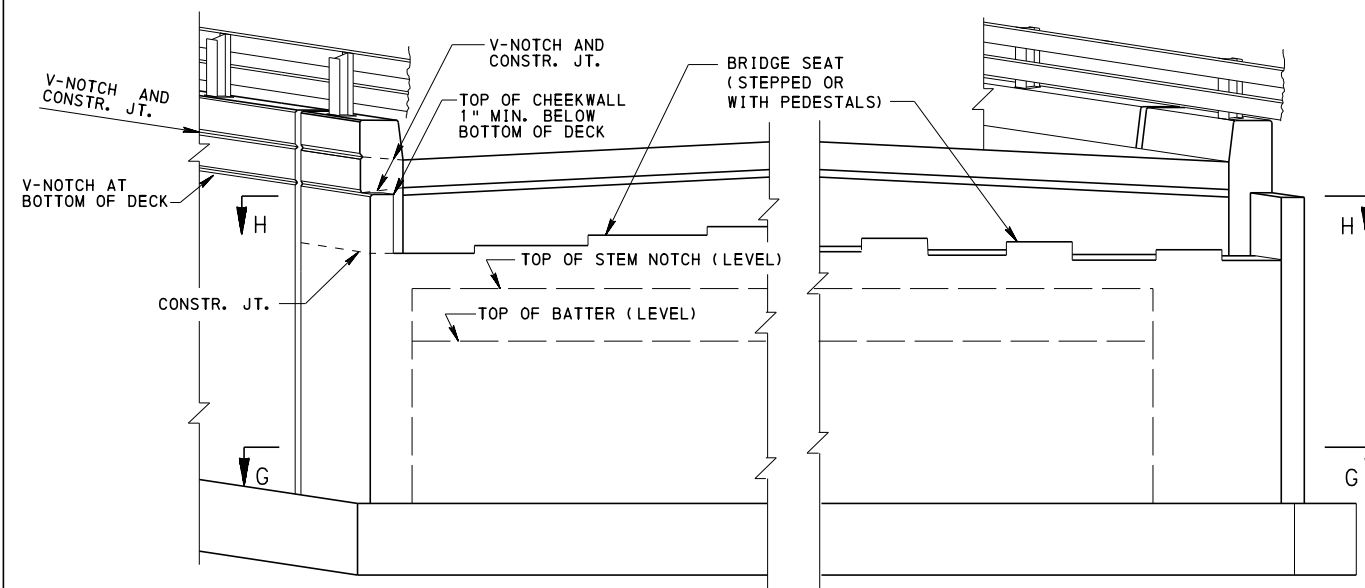
TYPICAL PLAN (SKEWS < 75°)

(FOR SPREAD BEAMS)
TUBE RAIL NOT SHOWN

- ① CL RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR CL RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE.
- ② NO POST REQUIRED ADJACENT TO FLUSH JOINTS AT WINGWALL. IF POSTS LOCATED AT EXPANSION JOINT
- ③ IF MINIMUM CLEARANCES CAN NOT BE ACCOMMODATED, POST MAY BE PLACED ON WINGWALL, 8" MIN., 1'-2" MAX. FROM FLUSH EXPANSION JOINT. SEE ALTERNATE POST LOCATION DETAIL THIS SHEET.
- ④ SECTION SHOWN WITHOUT INLET PLACEMENT. WITH INLET PLACEMENT THE WALL THICKNESS TO BE 1'-6" FULL HEIGHT TO TOP OF CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR CURB AND BEVEL DETAILS.



DETAIL C

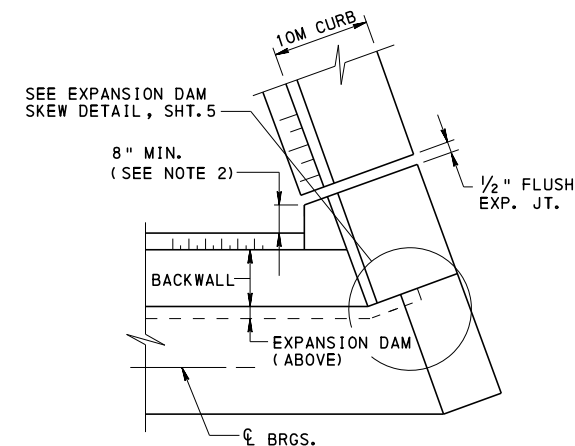


TYPICAL ELEVATION

FOR SECTIONS G-G AND H-H,
SEE BD-622M, SHEET 4

FOR SKEWS ≥ 75°
MAKE EXP. JOINT
PARALLEL TO CL BRGS.

DETAIL D



TYPICAL CORNER DETAIL FOR EXPANSION DAM (SKEWS < 75°)

NOTE: ACUTE SIDE WITH PA TYPE 10M CONCRETE CURB IS SHOWN FOR NEOPRENE STRIP SEAL DAM. TOOTH EXPANSION DAM ARE SIMILAR.

NOTE: BARRIER POSTS NOT SHOWN.

NOTES:

1. FOR SECTION E-E, SEE SHEET 6.
2. 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 IN SECTION H-H.
3. FOR RAILING DETAILS AT EXPANSION JOINTS, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
PA TYPE 10M BRIDGE BARRIER
R. C. ABUTMENTS WITH BACKWALL
U-WING LAYOUT AND DETAILS
FOR SPREAD BEAMS

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

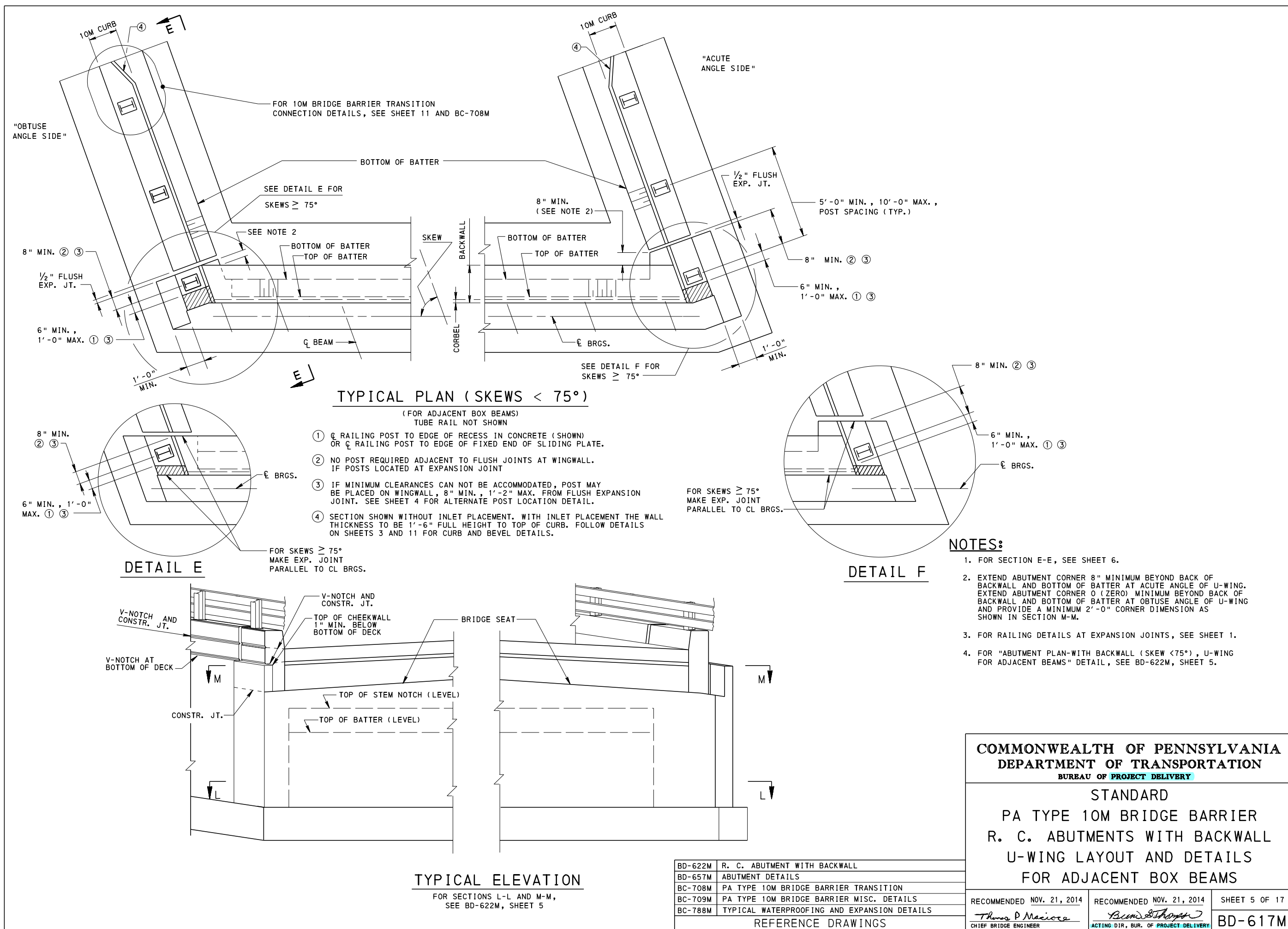
RECOMMENDED NOV. 21, 2014

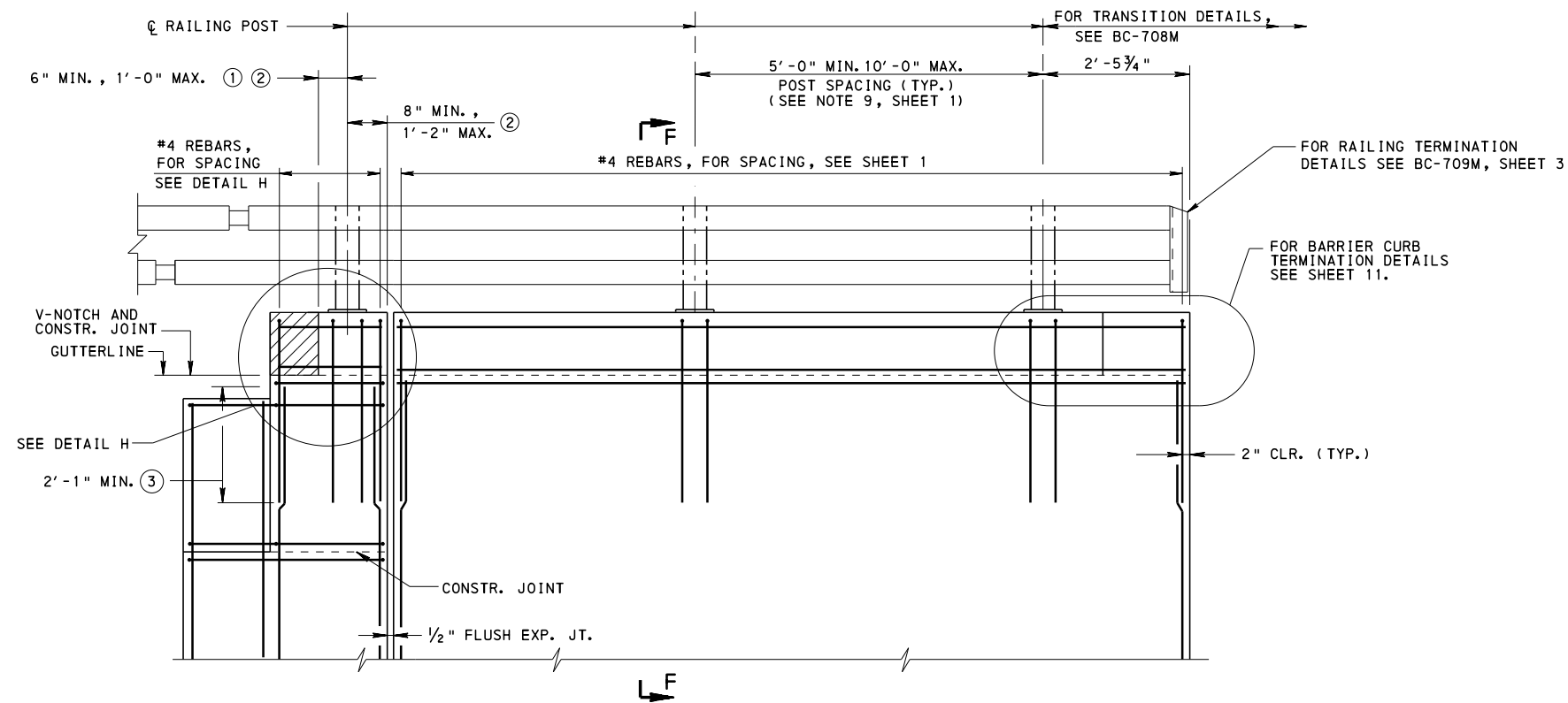
Brian S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 4 OF 17

BD-617M

BD-622M	R. C. ABUTMENT WITH BACKWALL
BD-657M	ABUTMENT DETAILS
BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	



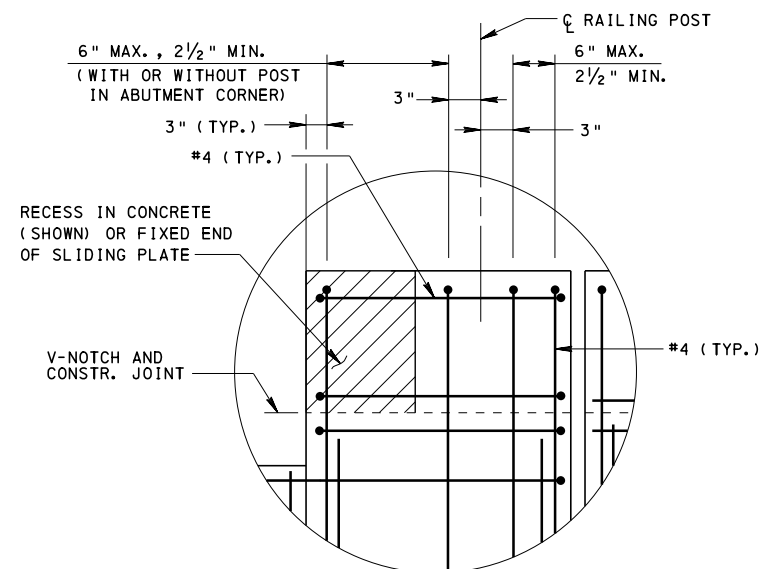


SECTION E-E

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

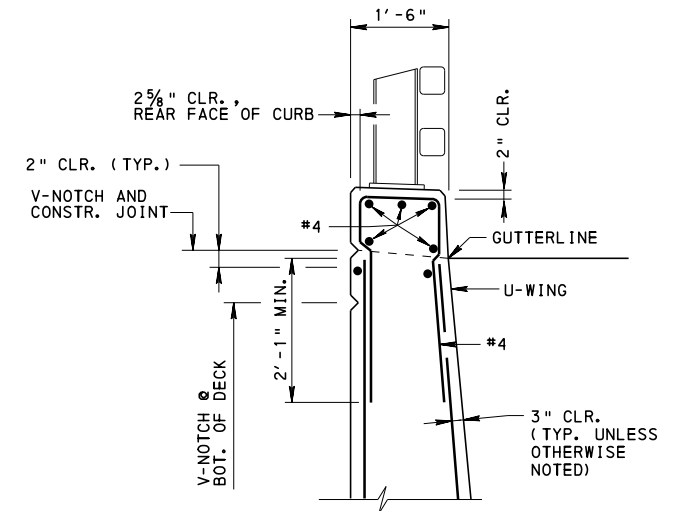
NOTE: FOR REINFORCEMENT IN ABUTMENT CORNER, CHEEKWALL AND BACKWALL BELOW BARRIER, SEE BD-622M, SHEETS 4 AND 5.

- ① \varnothing RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR \varnothing RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE.
- ② IF MINIMUM CLEARANCES CAN NOT BE ACCOMMODATED, POST MAY BE PLACED ON THE WINGWALL 8" MIN., 1'-2" MAX. FROM FLUSH EXPANSION JOINT. SEE SHEET 4 FOR ALTERNATE POST LOCATION DETAIL
- ③ FOR SUPERSTRUCTURES WHICH ARE TOO SHALLOW TO ACCOMMODATE THE 2'-1" MIN. LAP USE SINGLE HOOP BAR. SEE ALTERNATE REINFORCEMENT DETAIL, SHEET 3.



DETAIL H

NOTE: RAILING POST NOT SHOWN.



SECTION F-F

(WITH OR WITHOUT BATTER)

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 4 AND SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PA TYPE 10M BRIDGE BARRIER
R. C. ABUTMENTS WITH BACKWALL
U-WINGS

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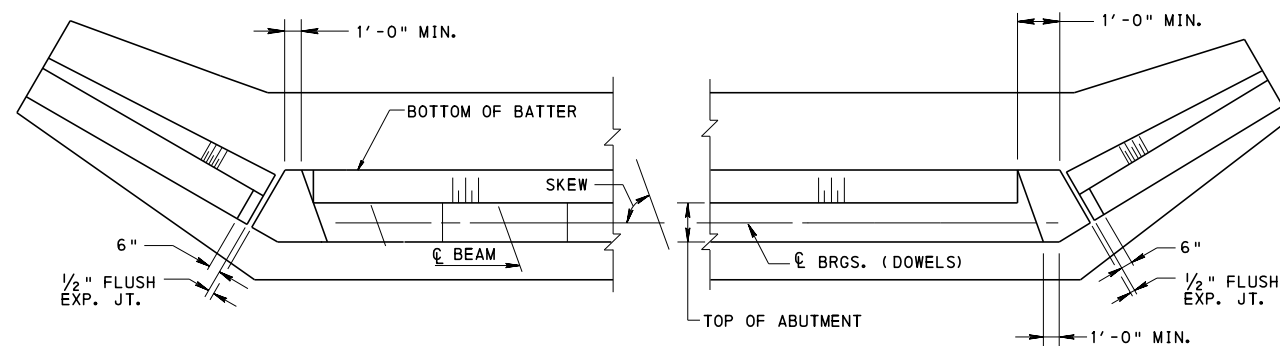
RECOMMENDED NOV. 21, 2014
Brenda Thompson
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SHEET 6 OF 17

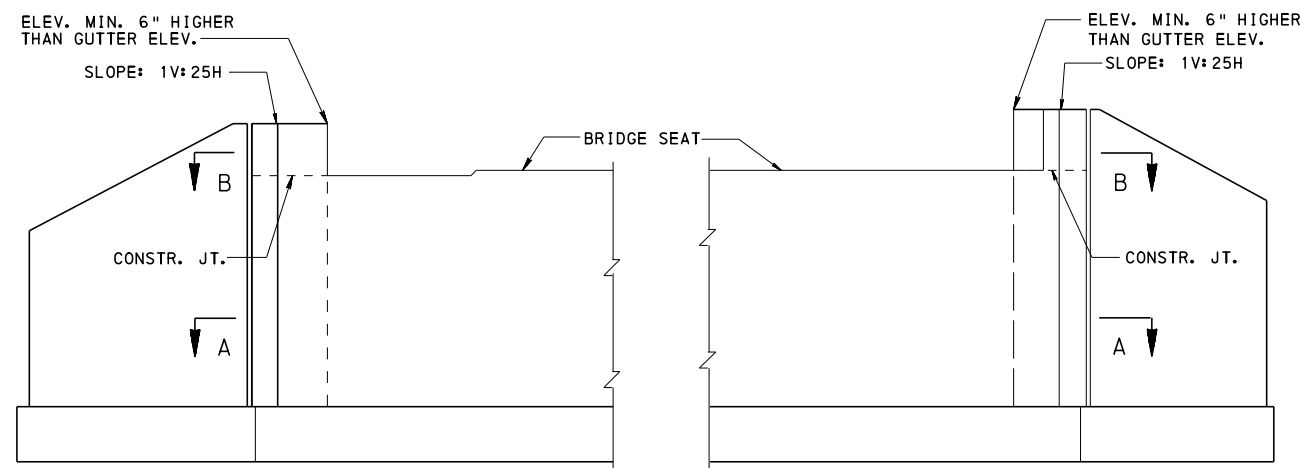
BD-617M

BD-622M R. C. ABUTMENT WITH BACKWALL

REFERENCE DRAWINGS



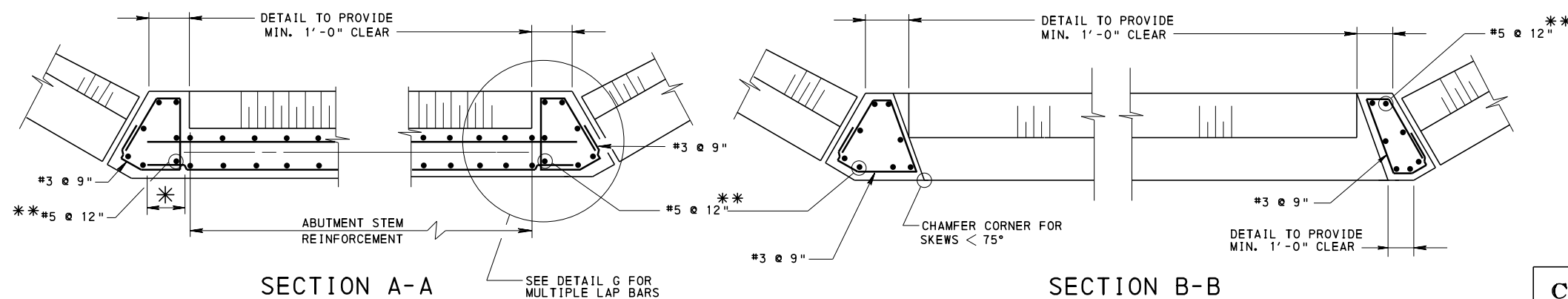
TYPICAL PLAN



TYPICAL ELEVATION

NOTES:

1. 10M BRIDGE BARRIER TERMINATES AT END OF BRIDGE DECK SLAB. FOR CURB TERMINATION DETAILS, SEE SHEET 11. FOR TRANSITION DETAILS, SEE BC-708M.

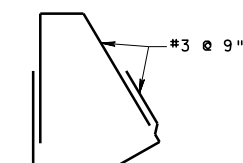


SECTION A-A

SECTION B-B

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. SEE DETAIL G.



DETAIL G

* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED TO OBTAIN MINIMUM DEVELOPMENT LENGTH. (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-621M	REINFORCED CONCRETE ABUTMENTS
BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BD-657M	ABUTMENT DETAILS
BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

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

**STANDARD
PA TYPE 10M BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
FLARED WINGS
LAYOUT AND DETAILS**

RECOMMENDED NOV. 21, 2014

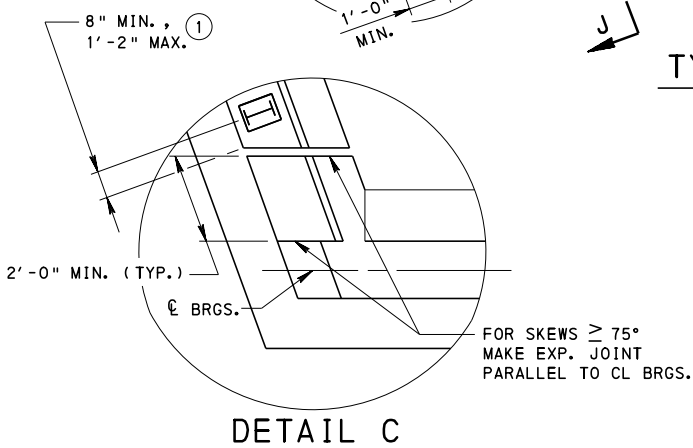
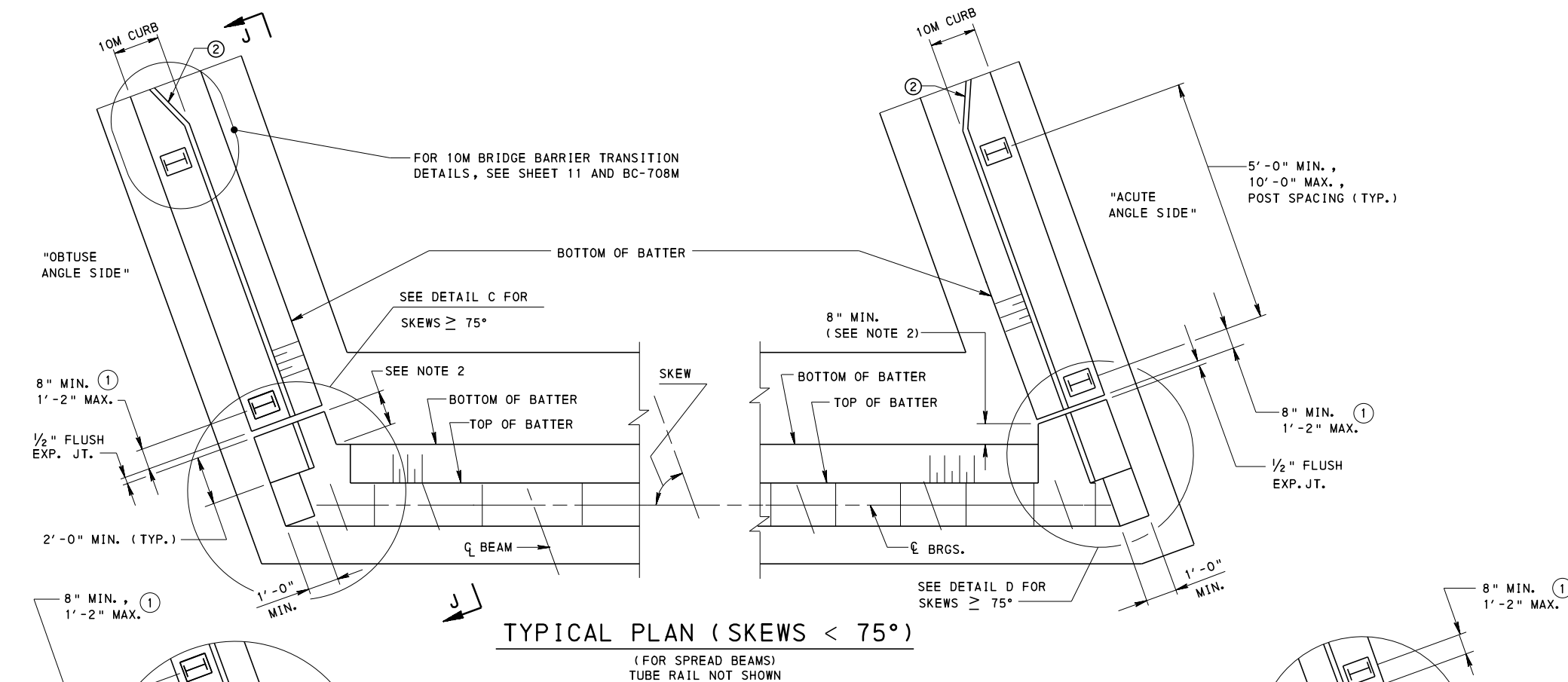
Thomas P. Maciore
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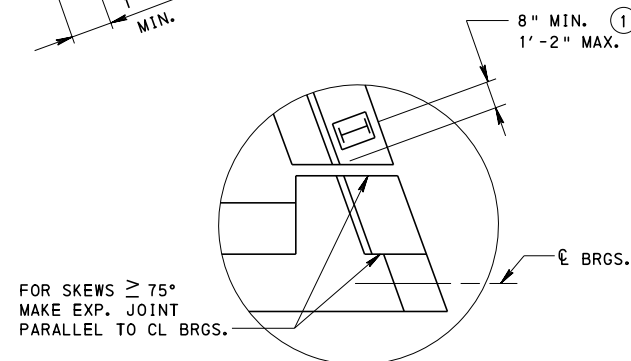
Brian J. Thompson
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SHEET 7 OF 17

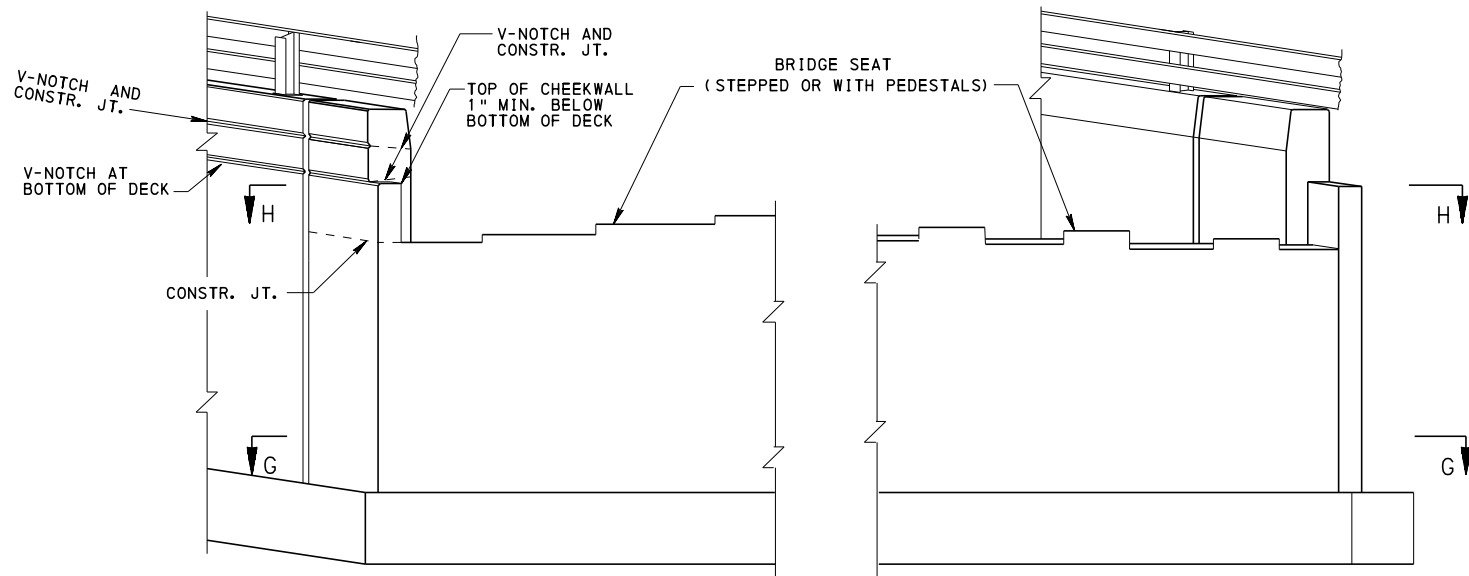
BD-617M



- ① IF THE ABUTMENT CORNER IS OF SUFFICIENT SIZE TO ACCOMMODATE MINIMUM CLEARANCES A RAILING POST MAY BE LOCATED ON THE CORNER. SEE TYPICAL PLAN, SHEET 4.
- ② SECTION SHOWN WITHOUT INLET PLACEMENT. WITH INLET PLACEMENT THE WALL THICKNESS TO BE 1'-6\"/>



- NOTES:**
1. FOR SECTION J-J, SEE SHEET 10.
 2. EXTEND ABUTMENT CORNER 8\"/>



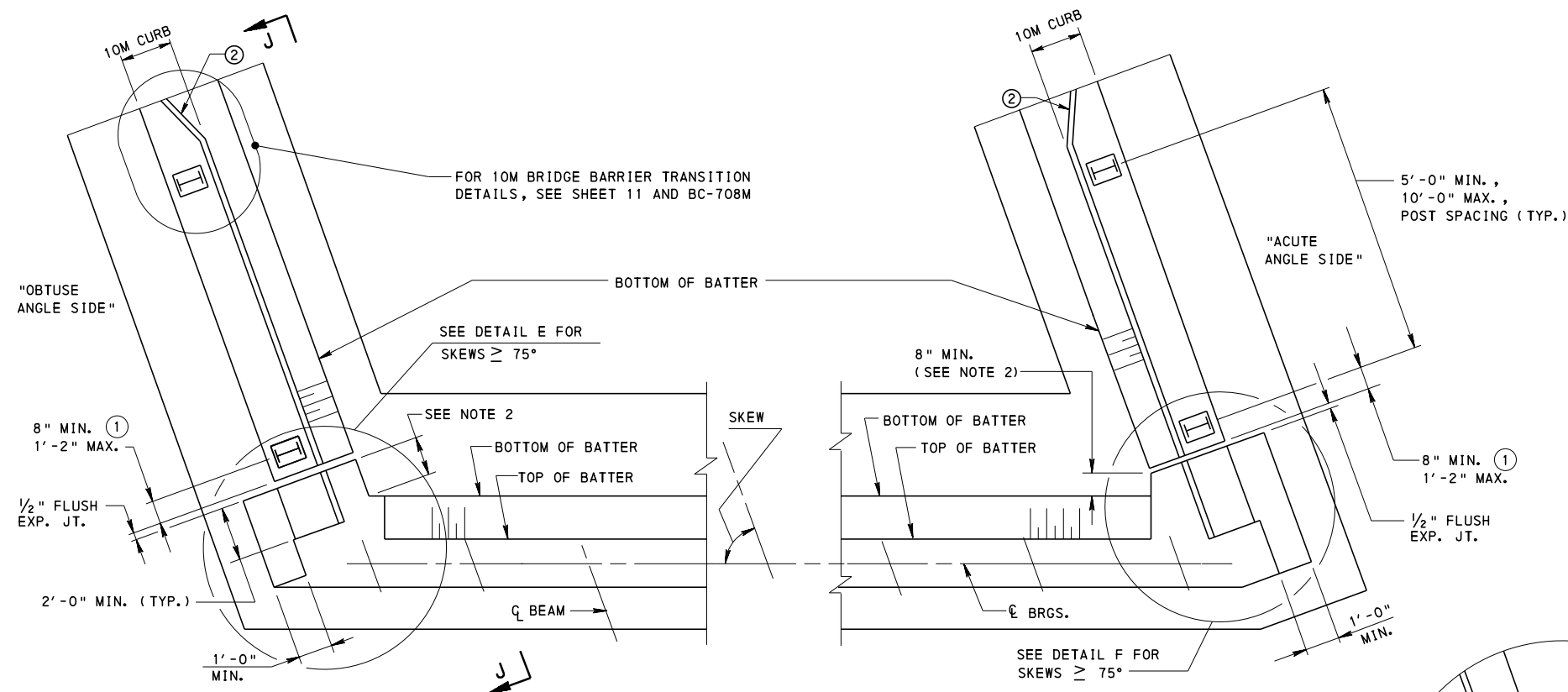
TYPICAL ELEVATION
FOR SECTIONS G-G AND H-H,
SEE BD-622M, SHEET 4

BD-624M	R. C. ABUTMENTS WITHOUT BACKWALL
BD-657M	ABUTMENT DETAILS
BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD
PA TYPE 10M BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
U-WING LAYOUT AND DETAILS
FOR SPREAD BEAMS

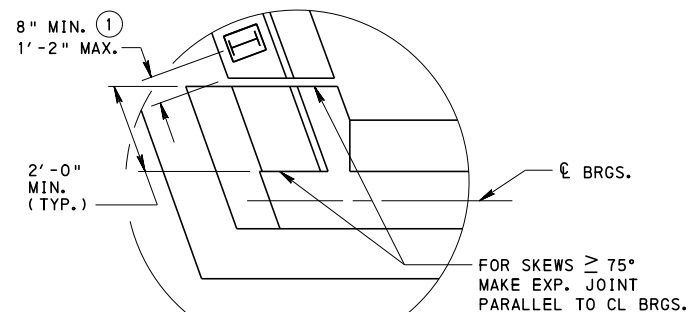
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 8 OF 17 BD-617M
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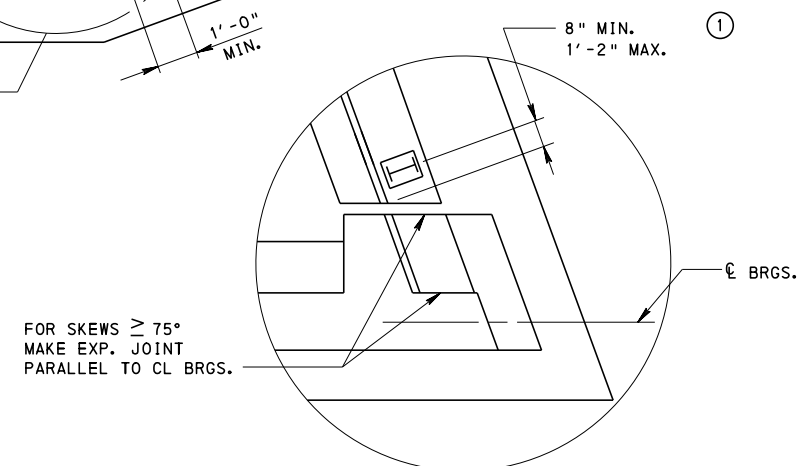
TYPICAL PLAN (SKEWS < 75°)

(FOR ADJACENT BOX BEAMS)
TUBE RAIL NOT SHOWN

- ① IF THE ABUTMENT CORNER IS OF SUFFICIENT SIZE TO ACCOMMODATE MINIMUM CLEARANCES A RAILING POST MAY BE LOCATED ON THE CORNER. SEE TYPICAL PLAN, SHEET 4.
- ② SECTION SHOWN WITHOUT INLET PLACEMENT. WITH INLET PLACEMENT THE WALL THICKNESS TO BE 1'-6" FULL HEIGHT TO TOP OF CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR CURB AND BEVEL DETAILS.



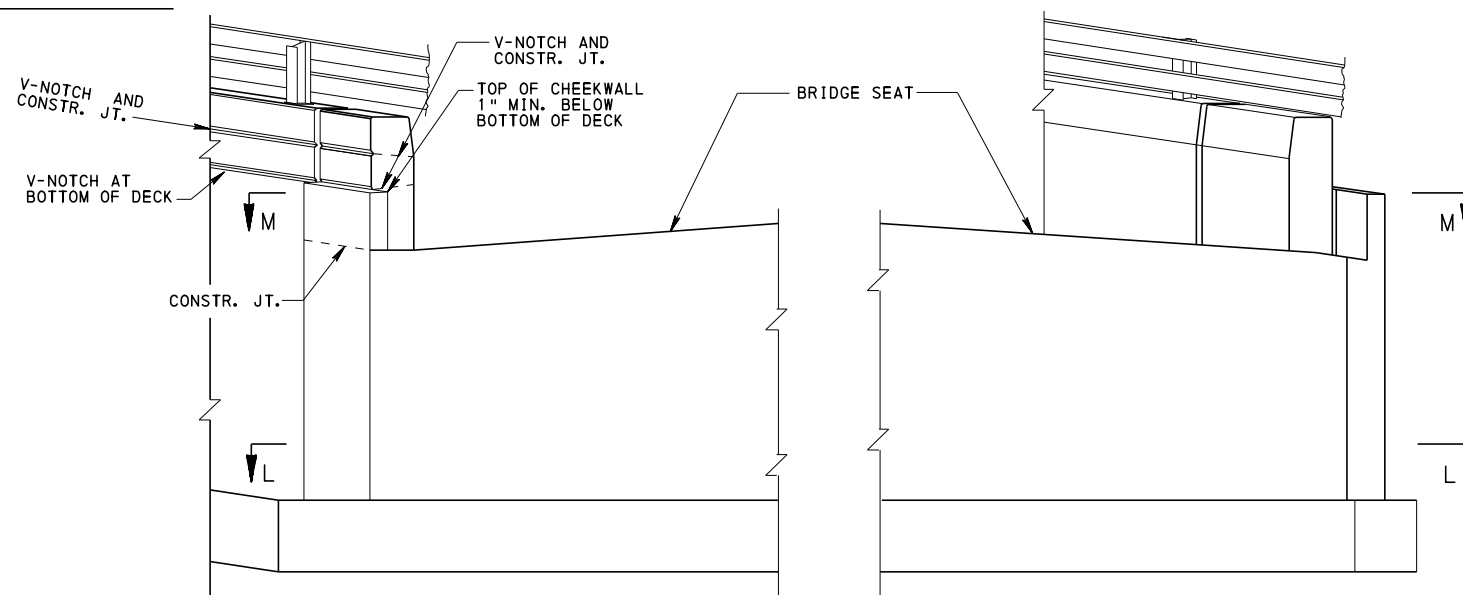
DETAIL E



DETAIL F

NOTES:

1. FOR SECTION J-J, SEE SHEET 10.
2. 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.
3. FOR RAILING DETAILS AT EXPANSION JOINTS, SEE SHEET 1.
4. FOR THE "ABUTMENT PLAN - WITHOUT BACKWALL (SKEWS < 75°), U-WINGS FOR ADJACENT BEAMS" DETAIL, SEE BD-624M, SHEET 5.

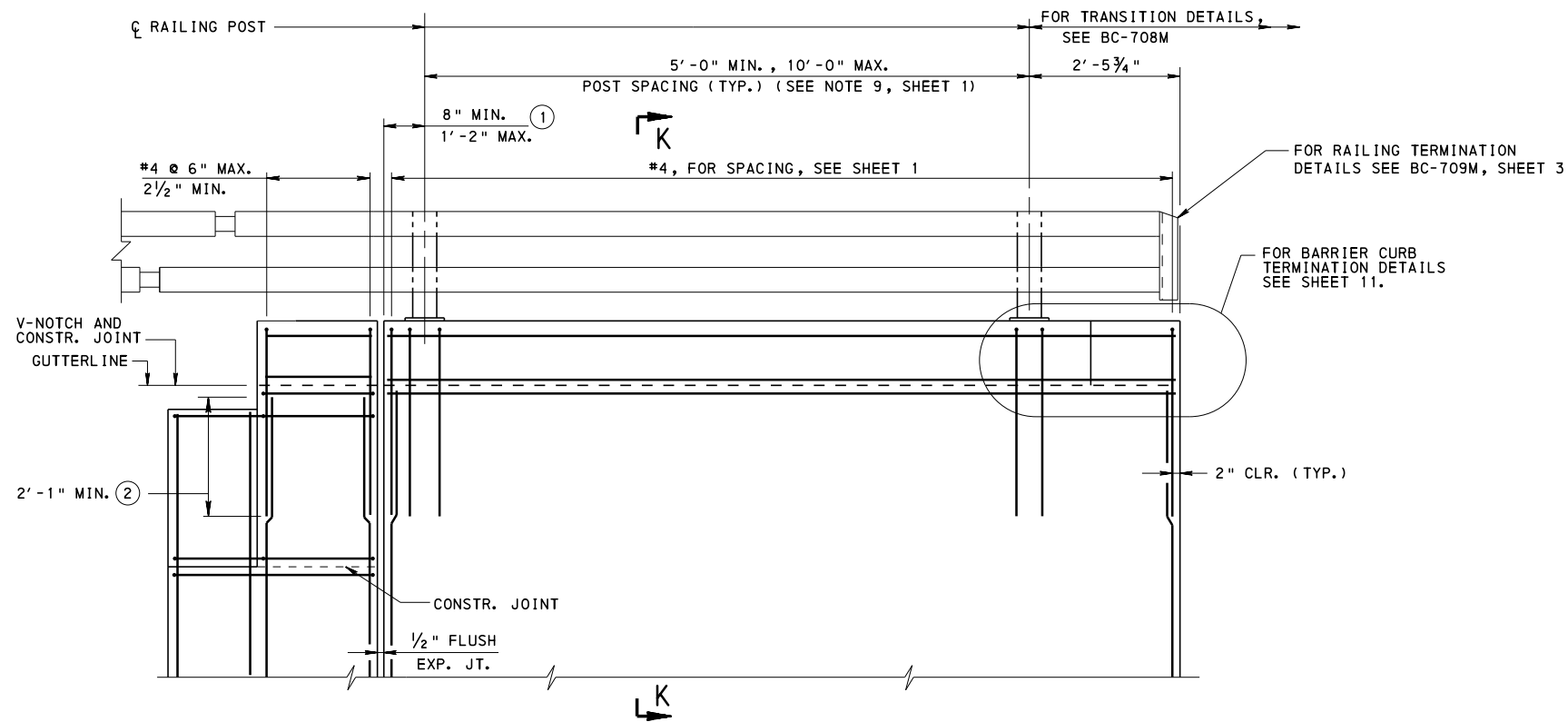


TYPICAL ELEVATION

FOR SECTIONS L-L AND M-M,
SEE BD-624M, SHEET 5

BD-624M	R. C. ABUTMENTS WITHOUT BACKWALL
BD-657M	ABUTMENT DETAILS
BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD PA TYPE 10M BRIDGE BARRIER R. C. ABUTMENTS WITHOUT BACKWALL U-WING LAYOUT AND DETAILS FOR ADJACENT BEAMS		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 9 OF 17 BD-617M

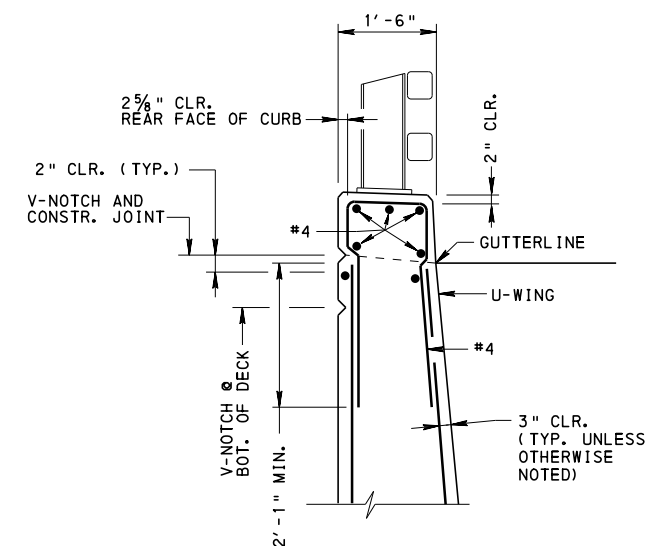


SECTION J-J

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

NOTE: FOR REINFORCEMENT IN ABUTMENT CORNER, CHEEKWALL, AND BACKWALL BELOW BARRIER, SEE BD-624M, SHEETS 4 AND 5.

- ① IF THE ABUTMENT CORNER IS OF SUFFICIENT SIZE TO ACCOMMODATE MINIMUM CLEARANCES A RAILING POST MAY BE LOCATED ON THE CORNER. SEE TYPICAL PLAN, SHEET 4.
- ② FOR SUPERSTRUCTURES WHICH ARE TOO SHALLOW TO ACCOMMODATE THE 2'-1" MIN. LAP USE SINGLE HOOP BAR. SEE ALTERNATE REINFORCEMENT DETAIL, SHEET 3.



SECTION K-K

(WITH OR WITHOUT BATTER)

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER AS REQUIRED BY DESIGN.

NOTES:

1. FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 8 AND SHEET 9.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

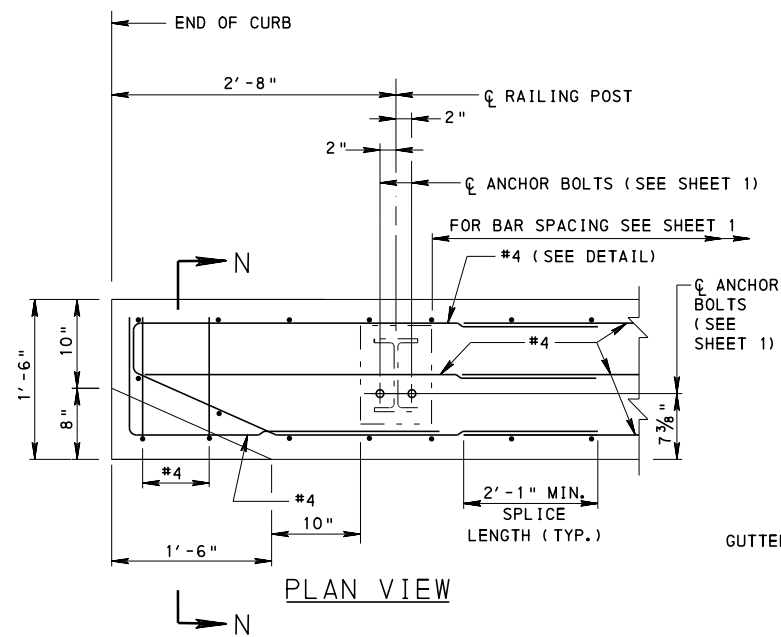
STANDARD
PA TYPE 10M BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
U-WINGS

BD-624M R.C. ABUTMENTS WITHOUT BACKWALL
REFERENCE DRAWINGS

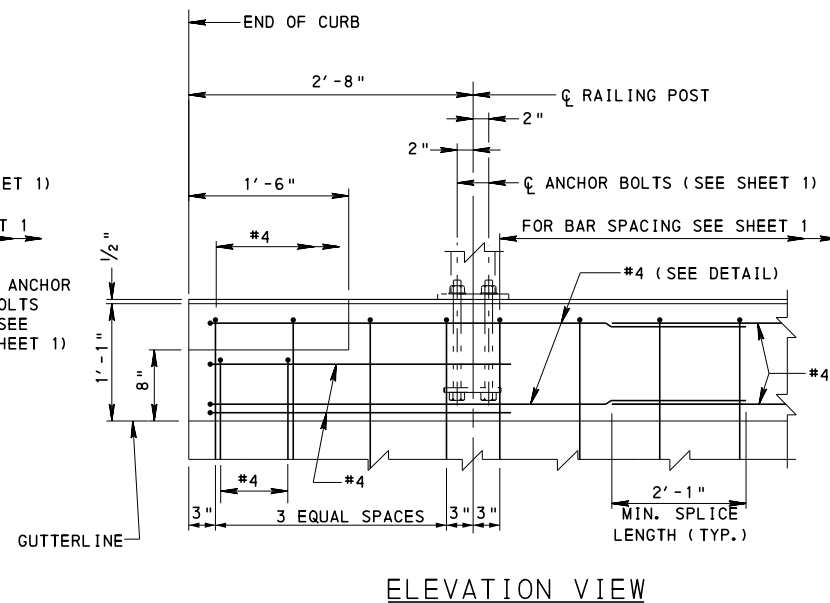
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SHEET 10 OF 17
BD-617M

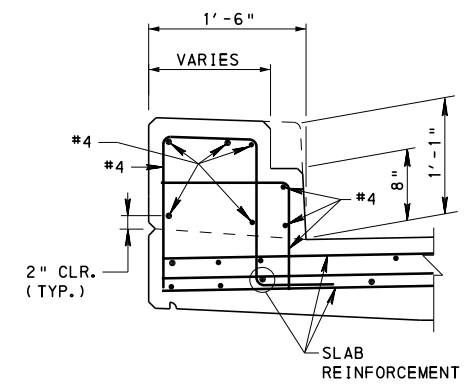


PLAN VIEW

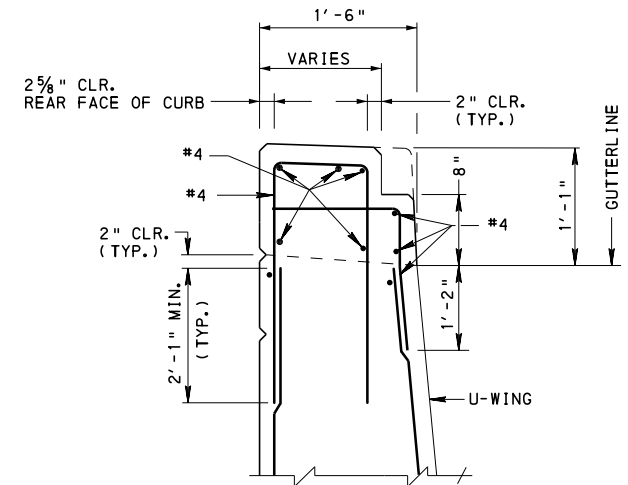


ELEVATION VIEW

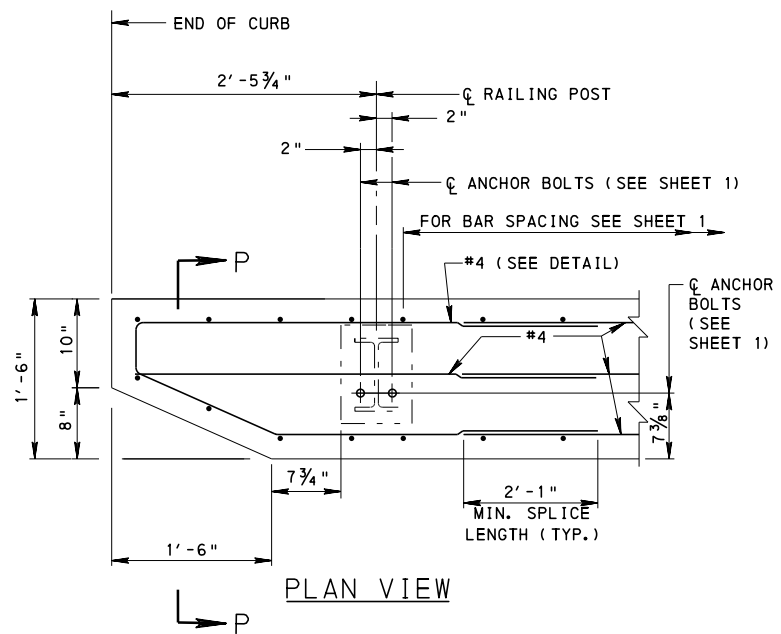
BARRIER CURB TERMINATION SECTION
(WITH INLET PLACEMENT)



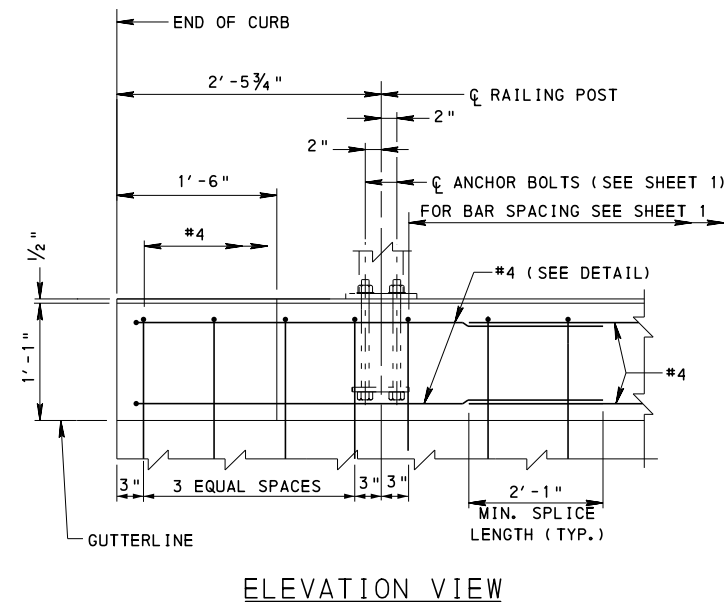
SECTION N-N
(BARRIER ON STRUCTURE)



SECTION N-N
(BARRIER ON U-WING)
(WITH OR WITHOUT BATTER)
(SECTION ON BACKWALL SIMILAR)

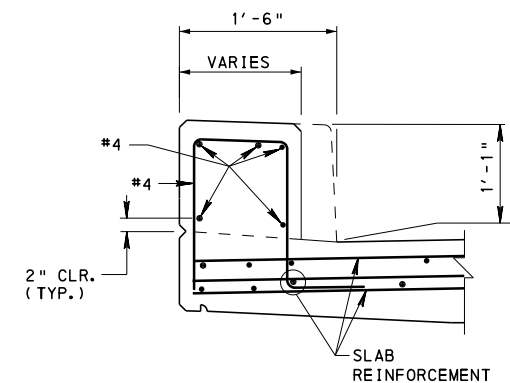


PLAN VIEW

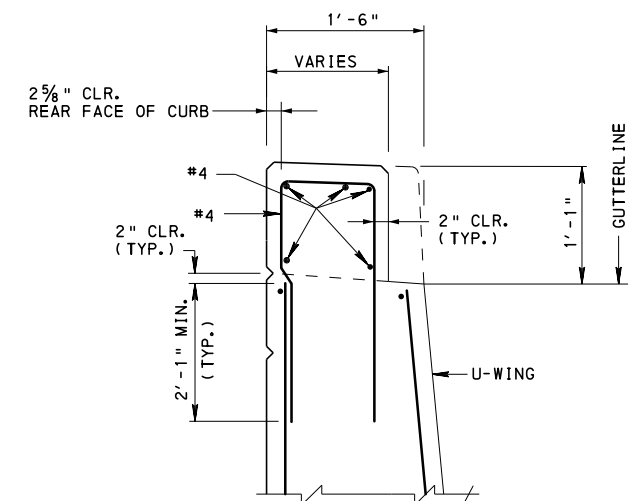


ELEVATION VIEW

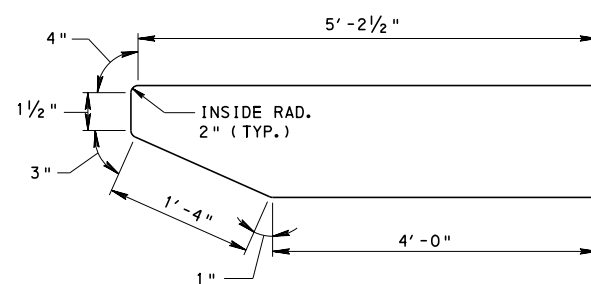
BARRIER CURB TERMINATION SECTION
(WITHOUT INLET PLACEMENT)



SECTION P-P
(BARRIER ON STRUCTURE)



SECTION P-P
(BARRIER ON U-WING)
(WITH OR WITHOUT BATTER)
(SECTION ON BACKWALL SIMILAR)



REINFORCEMENT DETAILS
(AT END OF CURB)

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. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

NOTES:

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

BC-708M	PA TYPE 10M BRIDGE BARRIER TRANSITION
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
RC-50M	GUIDE RAIL TRANSITION AT END OF STRUCTURE
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

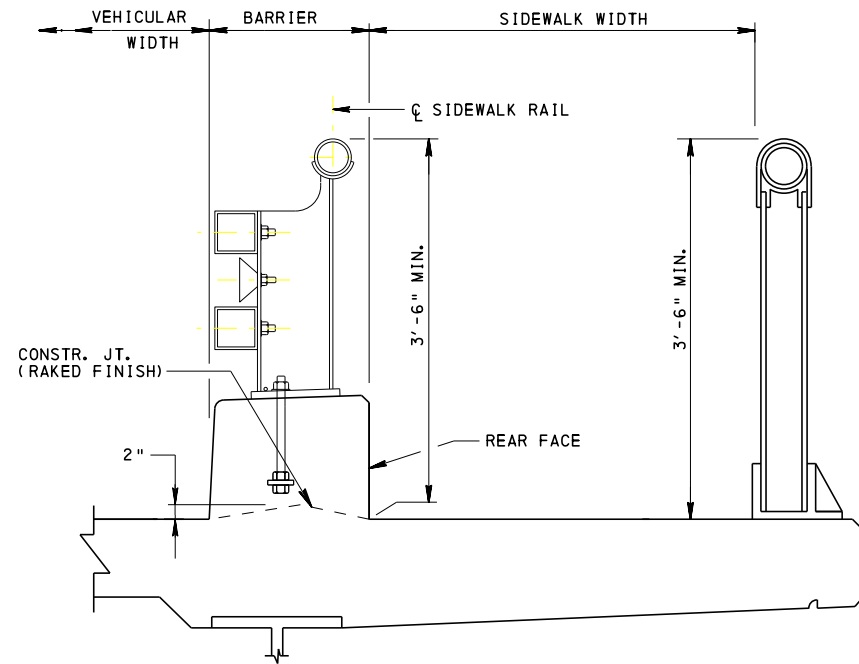
STANDARD

PA TYPE 10M BRIDGE BARRIER BARRIER TERMINATION DETAILS

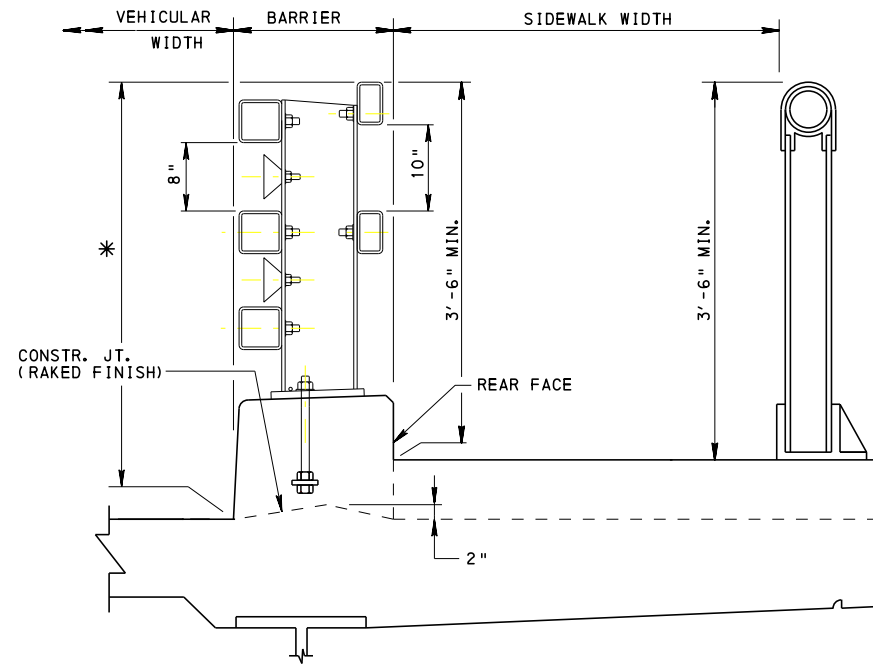
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SHEET 11 OF 17
BD-617M

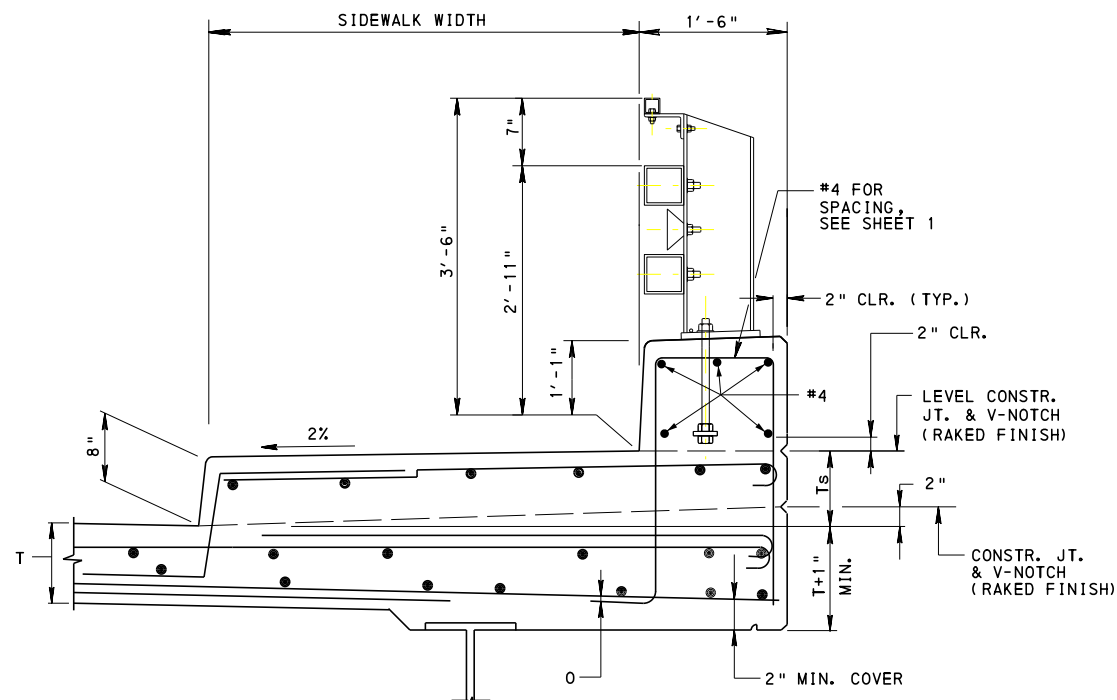


SIDEWALK DETAIL
(FOR GEOMETRIC AND REINFORCEMENT DETAILS
OF THE DECK SLAB, SEE BD-601M)

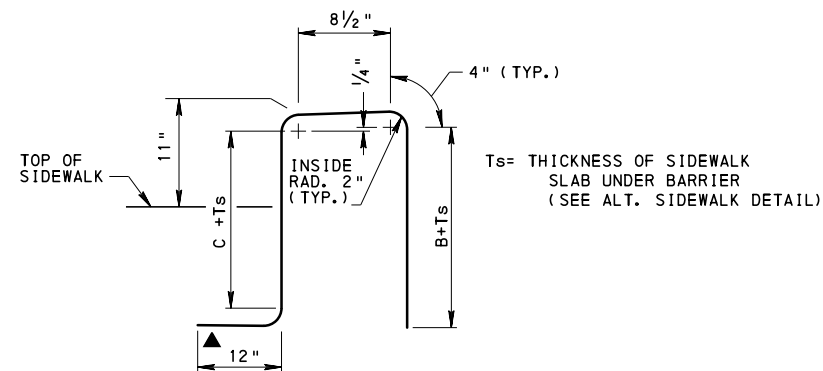


RAISED SIDEWALK DETAIL
(FOR GEOMETRIC AND REINFORCEMENT DETAILS
OF THE SIDEWALK AND DECK SLAB, SEE BD-601M)

* 4'-2" ASSUMING RAISED SIDEWALK 8" HIGH



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



VERTICAL REINFORCEMENT
(FOR DIMENSIONS "B" AND "C", SEE TABLE 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.
3. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

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

TABLE 1		
B AND C DIMENSIONS		
FOR PA TYPE 10M BRIDGE BARRIER		
T	AT ALTERNATE SIDEWALK	
	B	C
8.0 "	1' - 3 3/4 "	1' - 1 "
8.5 "	1' - 4 1/4 "	1' - 1 1/2 "
9.0 "	1' - 4 3/4 "	1' - 2 "
9.5 "	1' - 5 1/4 "	1' - 2 1/2 "
10.0 "	1' - 5 3/4 "	1' - 3 "
10.5 "	1' - 6 1/4 "	1' - 3 1/2 "
11.0 "	1' - 6 3/4 "	1' - 4 "
11.5 "	1' - 7 1/4 "	1' - 4 1/2 "

NOTES:

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

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

PA TYPE 10M BRIDGE BARRIER
MISCELLANEOUS DETAILS

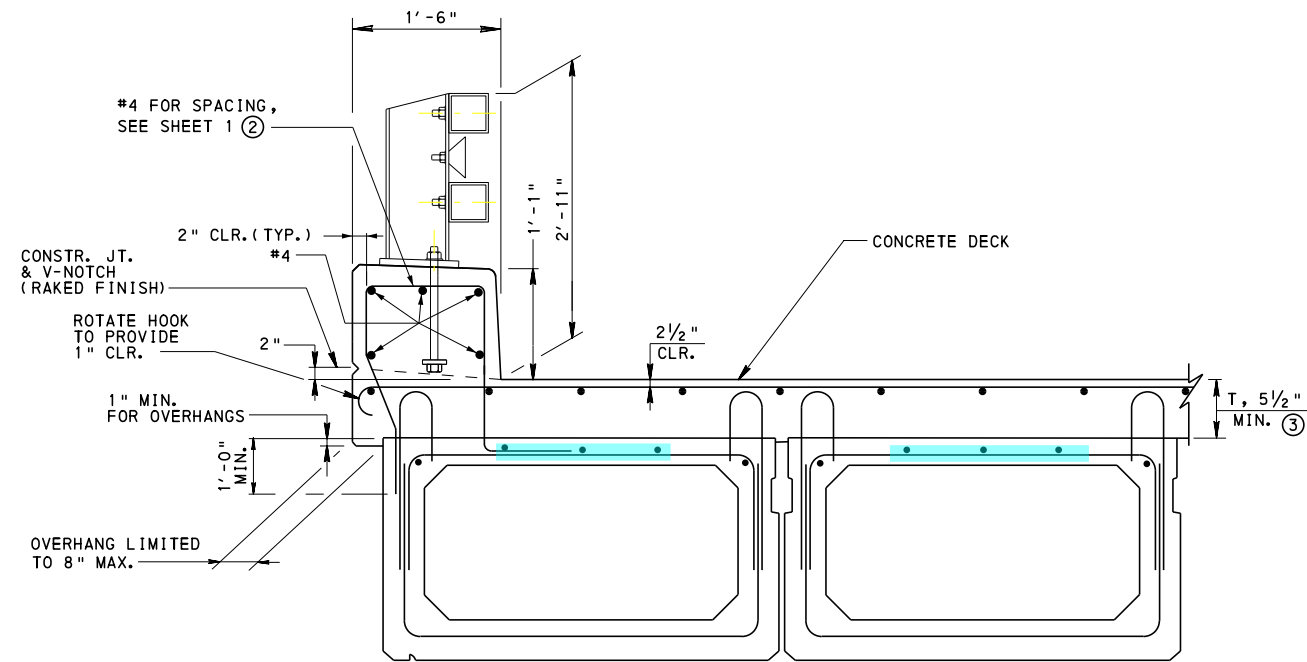
BD-601M	CONCRETE DECK SLAB
BC-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-734M	ANCHOR SYSTEMS

REFERENCE DRAWINGS

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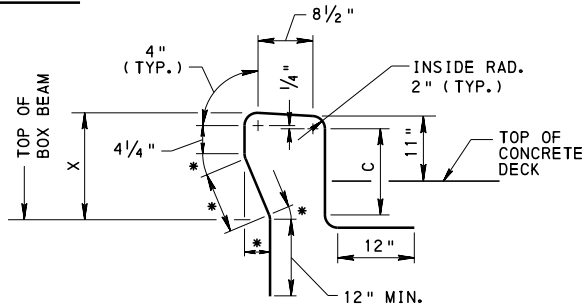
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SHEET 12 OF 17
BD-617M



36 " & 48 " COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING BARRIER

TABLE 1 U.S. CUSTOMARY UNITS X AND C DIMENSIONS FOR PA TYPE 10M BRIDGE BARRIER		
T	AT COMP. ADJ. BOX BEAMS SUPPORTING BARRIER	
	X	C
5.5 "	1'-4 3/4 "	1'-1 1/2 "
6.0 "	1'-5 1/4 "	1'-2 "
6.5 "	1'-5 3/4 "	1'-2 1/2 "
7.0 "	1'-6 1/4 "	1'-3 "
7.5 "	1'-6 3/4 "	1'-3 1/2 "
8.0 "	1'-7 1/4 "	1'-4 "



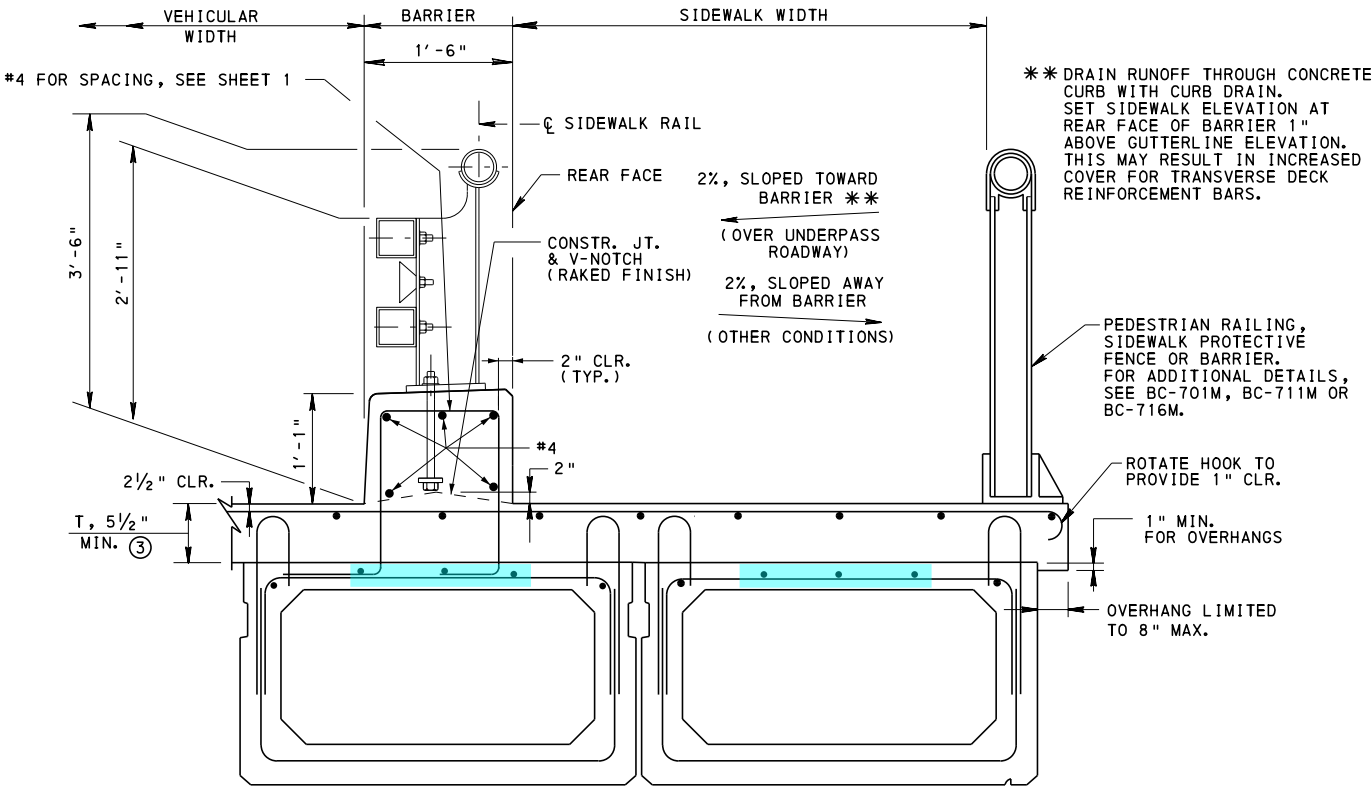
VERTICAL REINFORCEMENT
(FOR DIMENSIONS "X" AND "C", SEE TABLE 1)

REINFORCEMENT BAR NOTES:

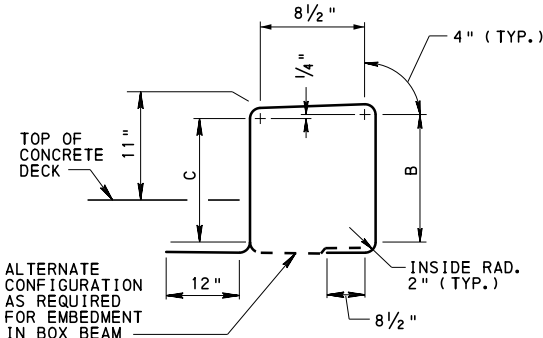
1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

LEGEND

- ① 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.
- ② BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.
- ③ INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD.



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



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

TABLE 2 B AND C DIMENSIONS FOR PA TYPE 10M BRIDGE BARRIER		
T	AT COMP. ADJ. BOX BEAMS SUPPORTING SIDEWALK OR RAISED SIDEWALK	
	B	C
5.5 "	1'-1 3/4 "	1'-1 1/2 "
6.0 "	1'-2 1/4 "	1'-2 "
6.5 "	1'-2 3/4 "	1'-2 1/2 "
7.0 "	1'-3 1/4 "	1'-3 "
7.5 "	1'-3 3/4 "	1'-3 1/2 "
8.0 "	1'-4 1/4 "	1'-4 "

NOTES:

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

BC-701M	STANDARD PROTECTIVE FENCE
BC-711M	STANDARD ALUMINUM PROTECTIVE BARRIER
BC-716M	STANDARD ALUMINUM PROTECTIVE RAILING
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

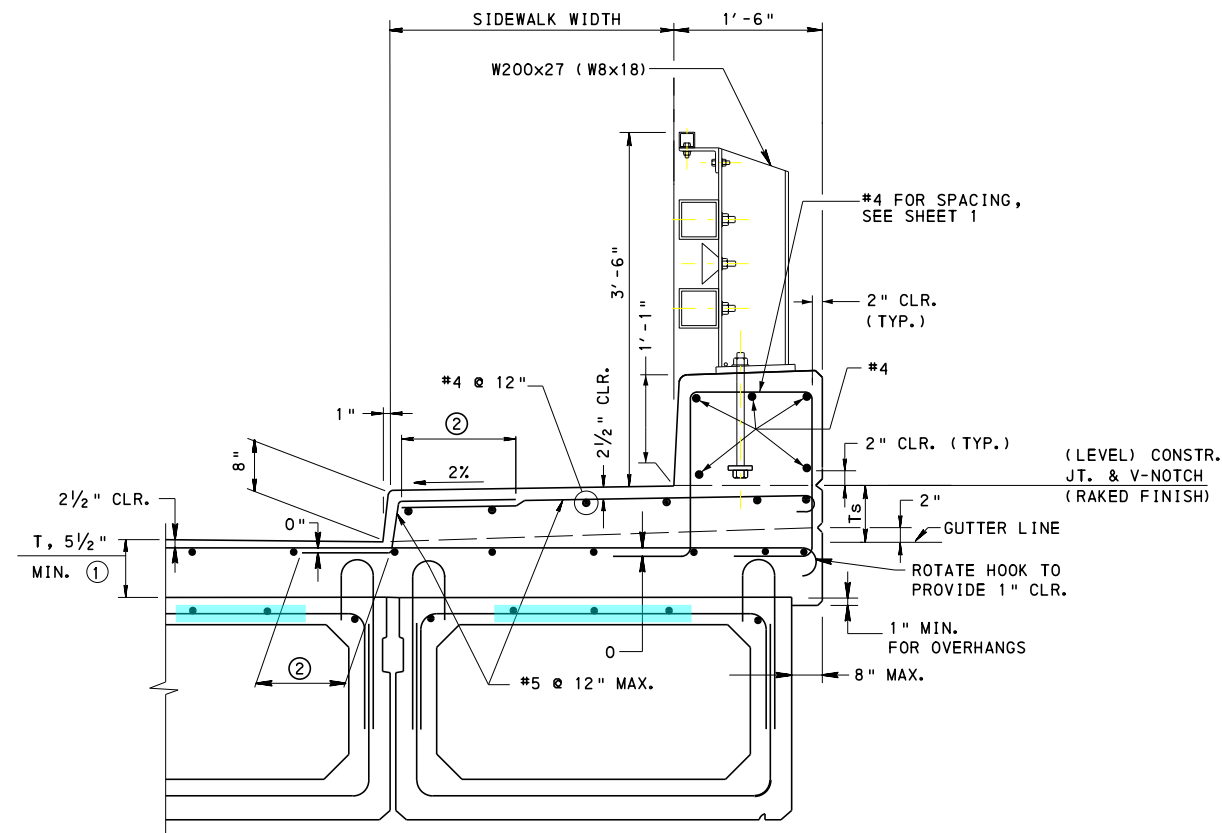
STANDARD

PA TYPE 10M BRIDGE BARRIER
MISCELLANEOUS DETAILS

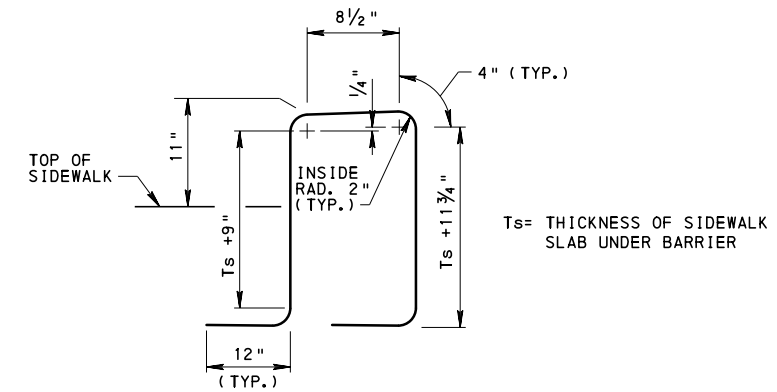
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SHEET 13 OF 17
BD-617M



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



VERTICAL REINFORCEMENT

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. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

NOTES:

1. FOR GEOMETRY AND REINFORCEMENT DETAILS OF THE PA TYPE 10M BRIDGE 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 DIMENSION, SEE BD-601M, SHEET 4.

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STANDARD

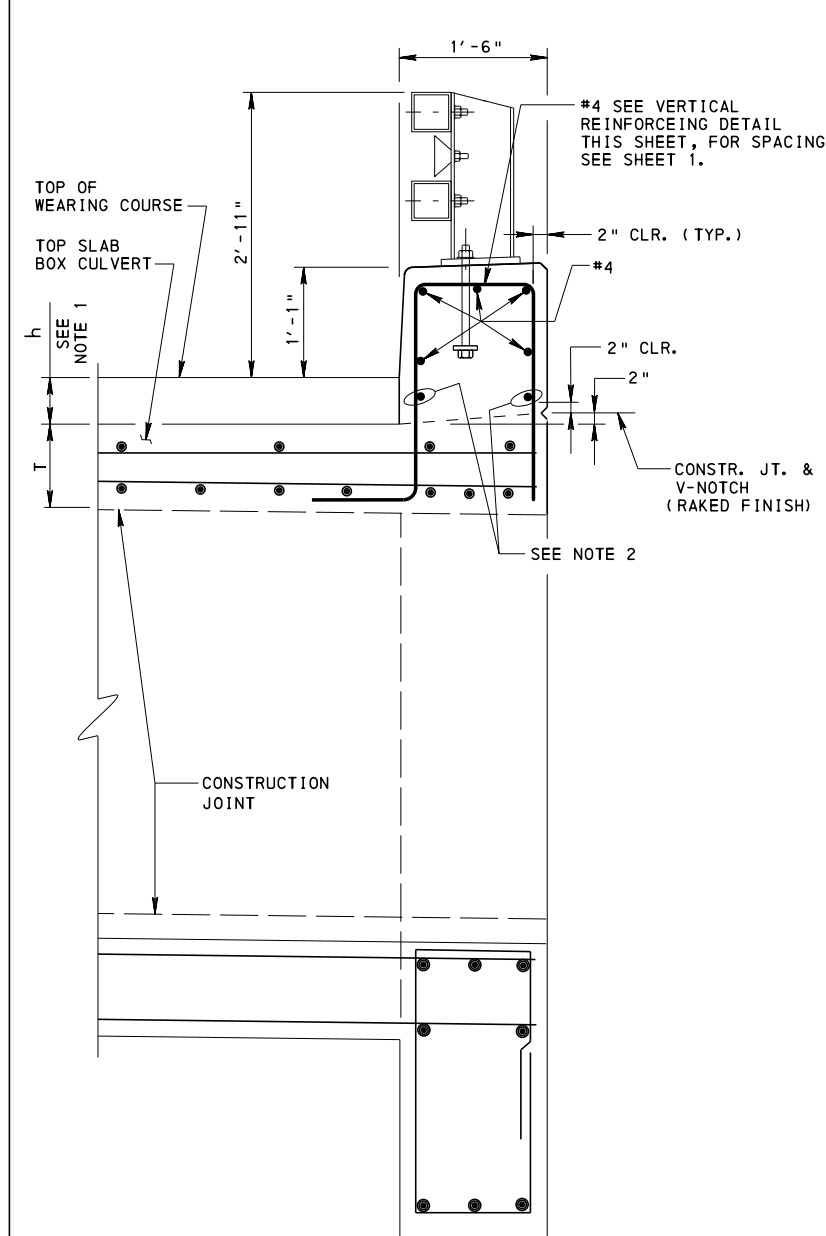
PA TYPE 10M BRIDGE BARRIER
MISCELLANEOUS DETAILS

BD-601M	CONCRETE DECK SLAB
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
REFERENCE DRAWINGS	

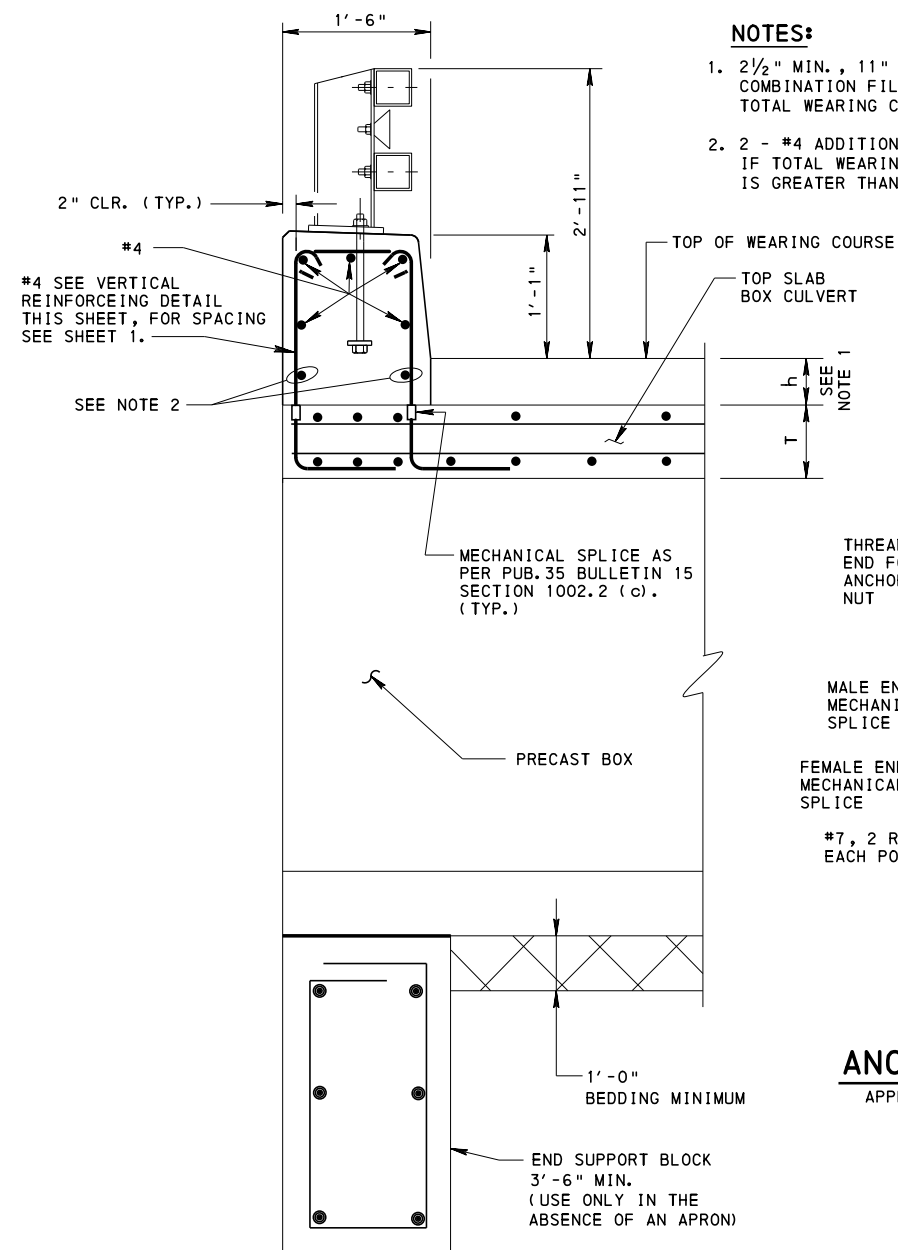
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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SHEET 14 OF 17
BD-617M



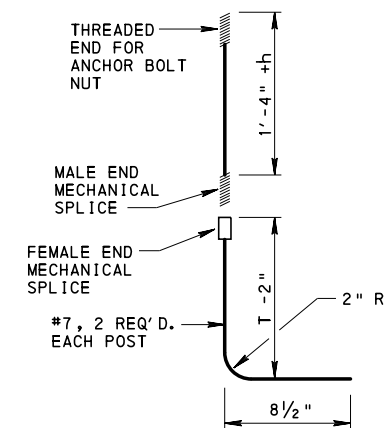
SECTION - C.I.P.



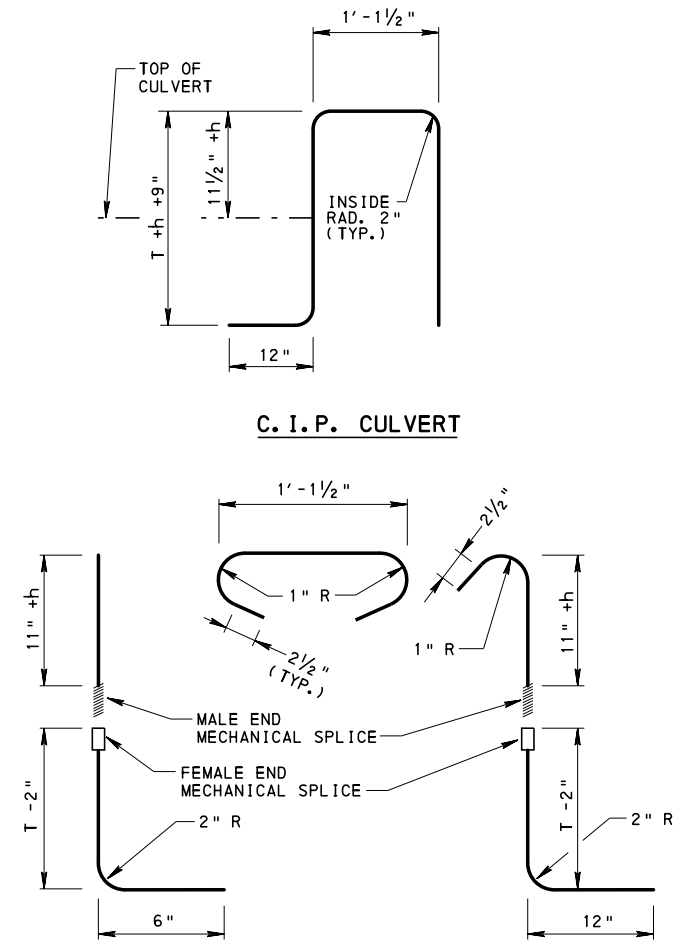
SECTION - PRECAST

NOTES:

1. 2½" MIN. , 11" MAX. COMBINATION FILL AND OVERLAY TOTAL WEARING COURSE THICKNESS (h)
2. 2 - #4 ADDITIONAL BARS REQUIRED IF TOTAL WEARING COURSE THICKNESS (h) IS GREATER THAN 6"



**OPTIONAL
ANCHOR BOLT DETAIL**
APPLIES TO PRECAST CULVERT ONLY



C. I. P. CULVERT

PRECAST CULVERT

VERTICAL REINFORCEMENT
ALL VERTICAL REINFORCEMENT #4

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. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.
4. FOR ADDITIONAL NOTES, SEE SHEET 1.

R.C. CULVERT AT GRADE

- FOR R.C. CULVERT DETAILS, SEE BD-632M.
- FOR POST AND REINFORCEMENT BAR SPACING SEE SHT. 1.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD

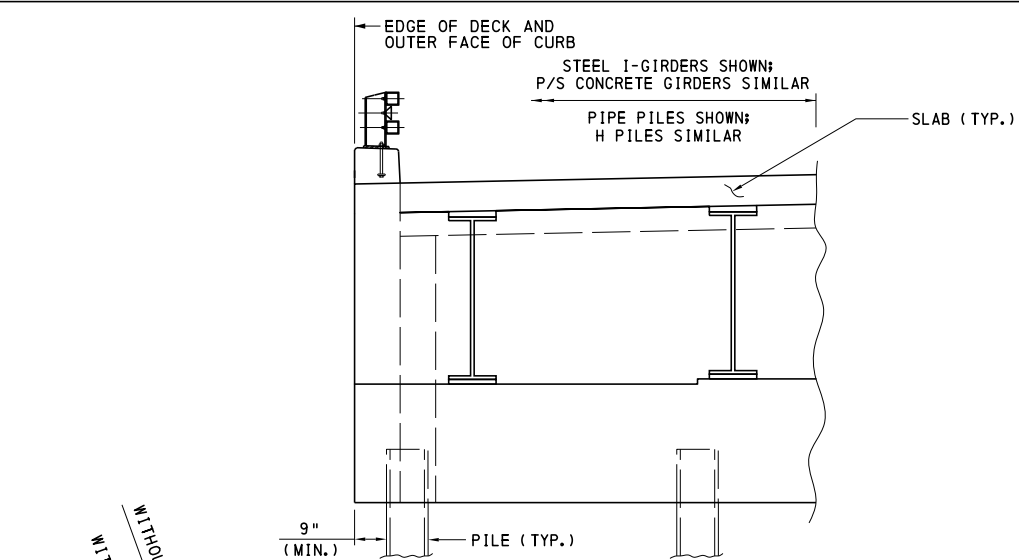
PA TYPE 10M BRIDGE BARRIER
MISCELLANEOUS DETAILS

BD-632M R.C. BOX CULVERT
REFERENCE DRAWINGS

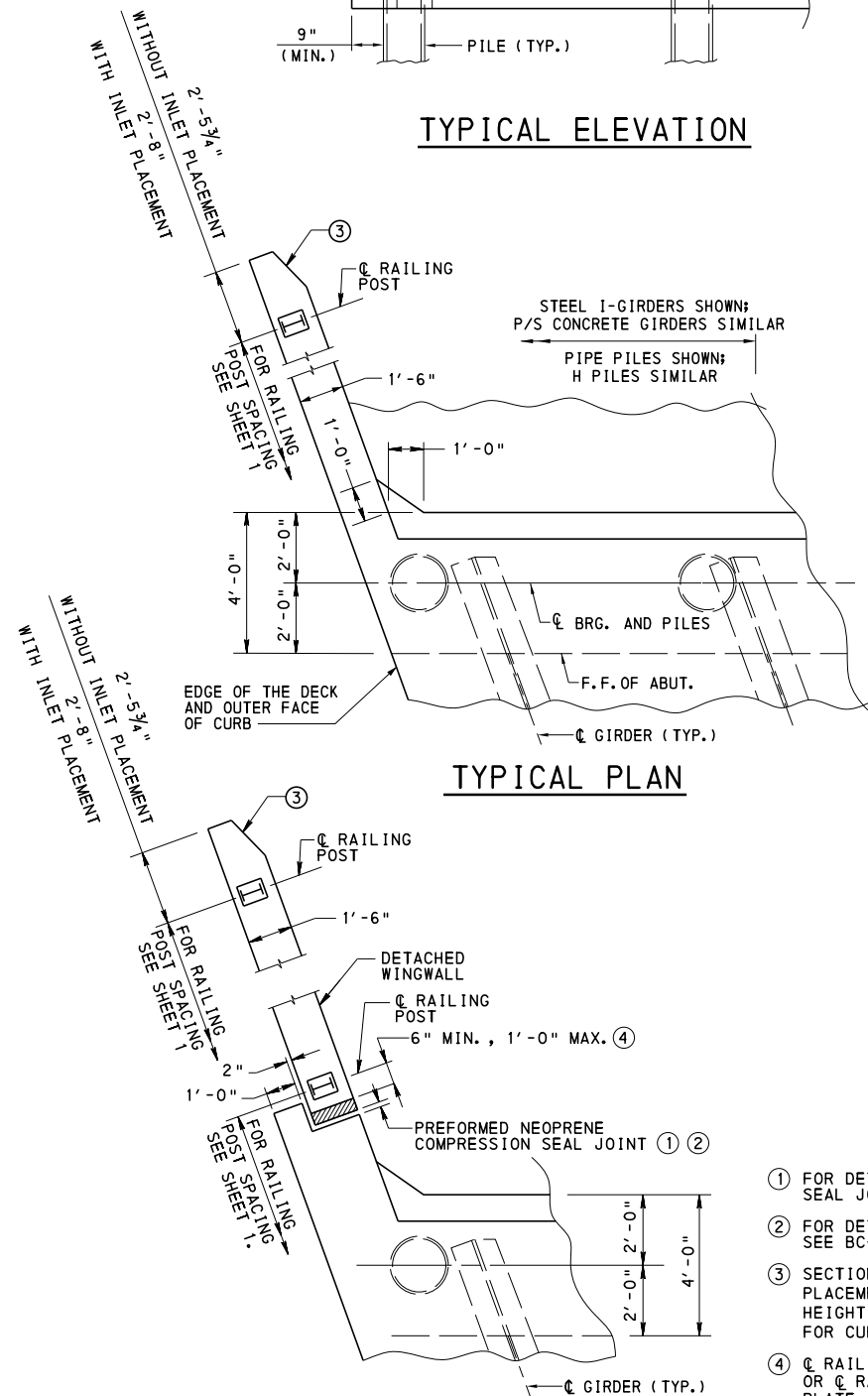
RECOMMENDED NOV. 21, 2014
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SHEET 15 OF 17
BD-617M



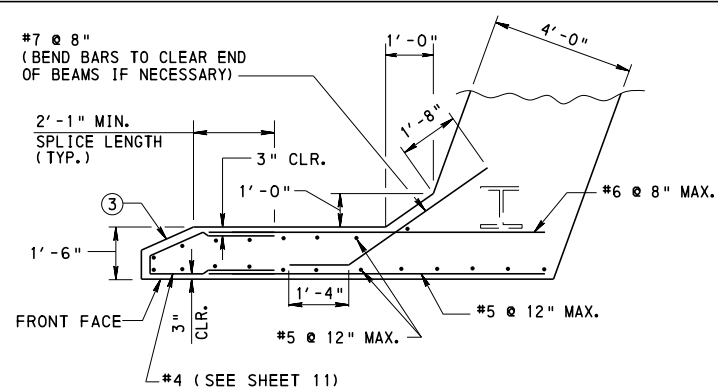
TYPICAL ELEVATION



DETACHED WINGWALL PLAN

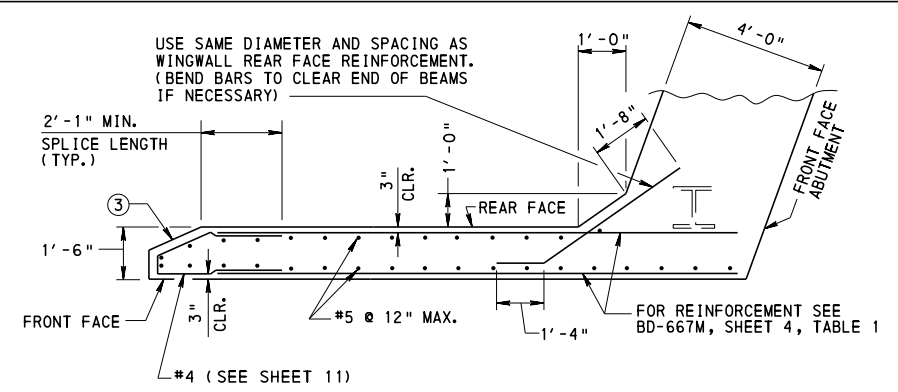
(FOR DIMENSIONS AND CALL OUTS NOT SHOWN, SEE TYPICAL PLAN)

- ① FOR DETAILS OF THE PREFORMED NEOPRENE COMPRESSION SEAL JOINT AND SLIDING PLATE, SEE BD-667M, SHEET 4.
- ② FOR DETAILS OF THE BENT PLATE ON CONCRETE CURB, SEE BC-709M.
- ③ SECTION SHOWN WITHOUT INLET PLACEMENT. WITH INLET PLACEMENT THE WALL THICKNESS TO BE 1'-6" FULL HEIGHT TO TOP OF CURB. FOLLOW DETAILS ON SHEETS 3 AND 11 FOR CURB AND BEVEL DETAILS.
- ④ RAILING POST TO EDGE OF RECESS IN CONCRETE (SHOWN) OR RAILING POST TO EDGE OF FIXED END OF SLIDING PLATE



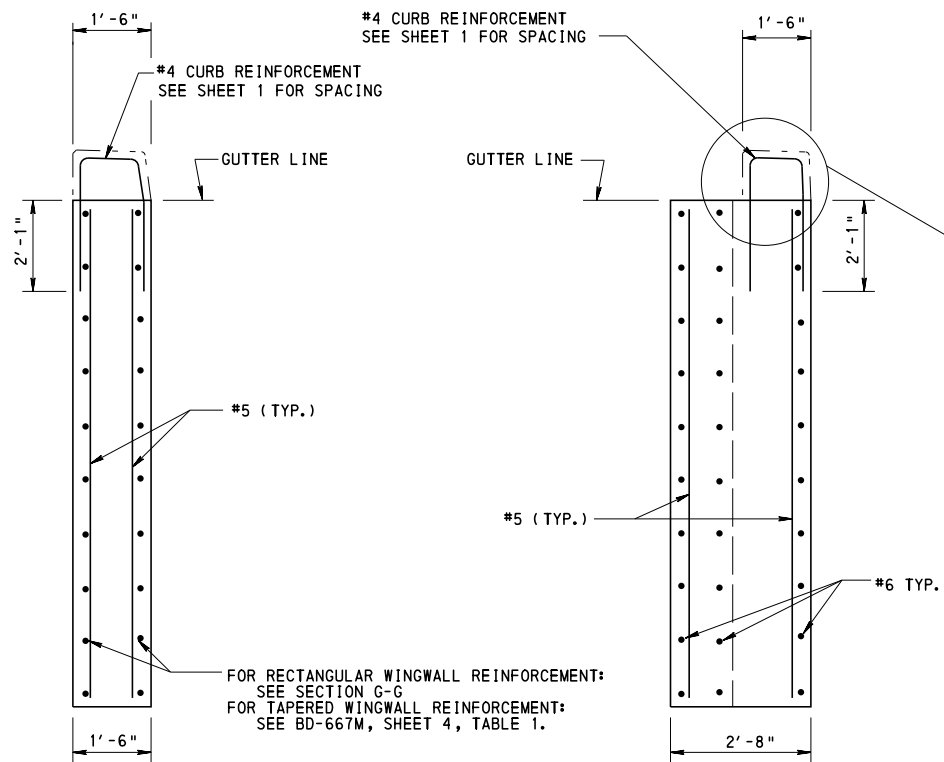
SECTION G-G

SEE BD-667M SHEET 4 OF 6 FOR LOCATION OF SECTIONS G-G AND H-H.



SECTION H-H

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



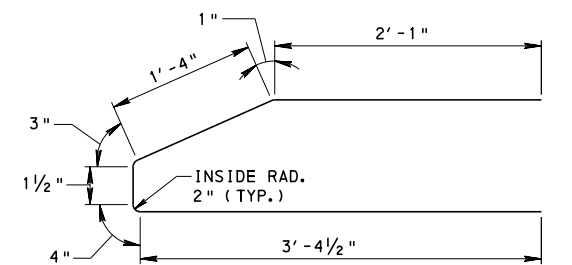
SECTION J-J

(RECTANGULAR OR TAPERED WING)

SECTION K-K

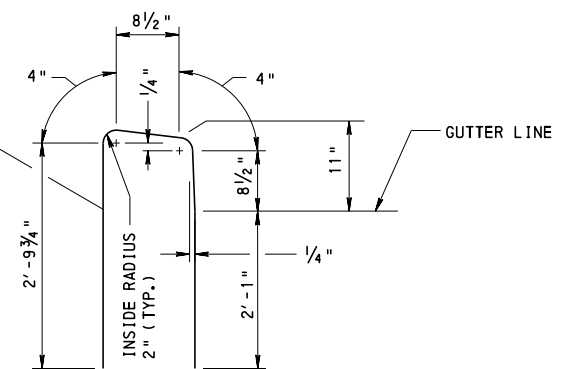
(DETACHED WING)

SEE BD-667M SHEET 4 OF 6 FOR LOCATION OF SECTIONS J-J AND K-K.



LONGITUDINAL REINFORCEMENT

(AT END OF ATTACHED WINGWALL)



VERTICAL CURB REINFORCEMENT

NOTE:

SEE BD-667M FOR ALL OTHER INTEGRAL ABUTMENT DETAILS.

REINFORCEMENT BAR NOTES:

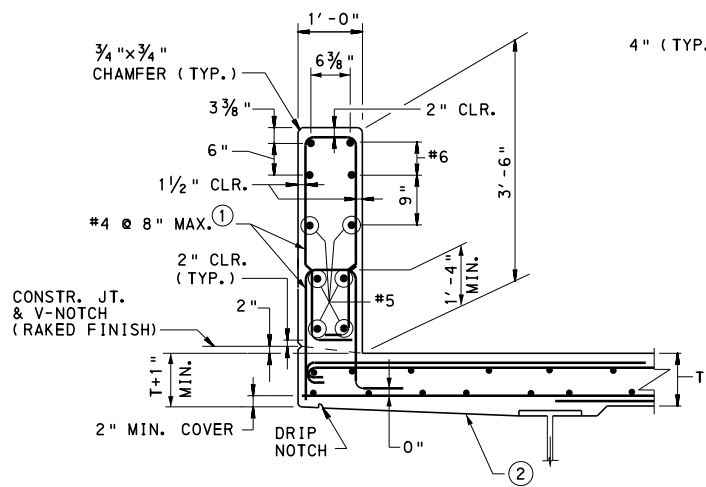
1. REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
3. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

BD-667M	INTEGRAL ABUTMENT DETAILS
BD-709M	PA TYPE 10M BRIDGE BARRIER MISC. DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
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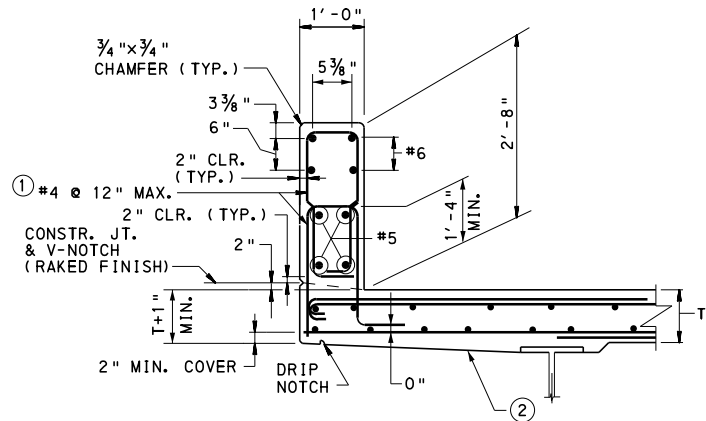
STANDARD
PA TYPE 10M BRIDGE BARRIER
INTEGRAL ABUTMENT DETAILS

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 16 OF 17 BD-617M
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TYPICAL VERTICAL WALL BARRIER DETAIL - TL5

(FOR REINFORCEMENT IN DECK
SLAB, SEE BD-601M)



ALTERNATE VERTICAL WALL BARRIER DETAIL - TL4

(FOR REINFORCEMENT IN DECK
SLAB, SEE BD-601M)

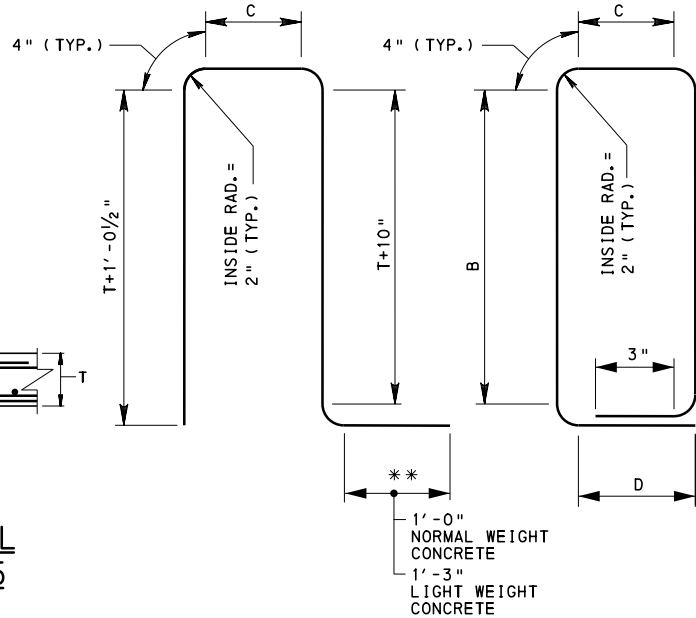
LEGEND:

- 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.
- ② UNDERSIDE OF DECK SLAB MAY BE CONSTRUCTED LEVEL.

NOTES:

1. PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH PUBLICATION 408.
2. THE TYPICAL VERTICAL WALL BARRIER HAS BEEN ACCEPTED BY FHWA AS A TL-5 BARRIER DESIGNATION.
3. THE ALTERNATE VERTICAL WALL BARRIER HAS BEEN ACCEPTED BY FHWA AS A TL-4 BARRIER DESIGNATION.
4. VERTICAL WALL BARRIER DEFLECTION JOINT CRITERIA SAME AS SHOWN ON BD-660M AND BC-752M
5. VERTICAL WALL BARRIER DRAINAGE CRITERIA SAME AS SHOWN ON BC-751M.
6. FOR DEAD LOAD CALCULATIONS, THE MASS OF VERTICAL WALL BARRIERS ARE AS FOLLOWS:

TYP. VERTICAL WALL	530 LB./FT.
ALT. VERTICAL WALL	400 LB./FT.
SIDEWALK VERTICAL WALL	530 LB./FT.
RAISED SIDEWALK VERTICAL WALL	540 LB./FT.



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.

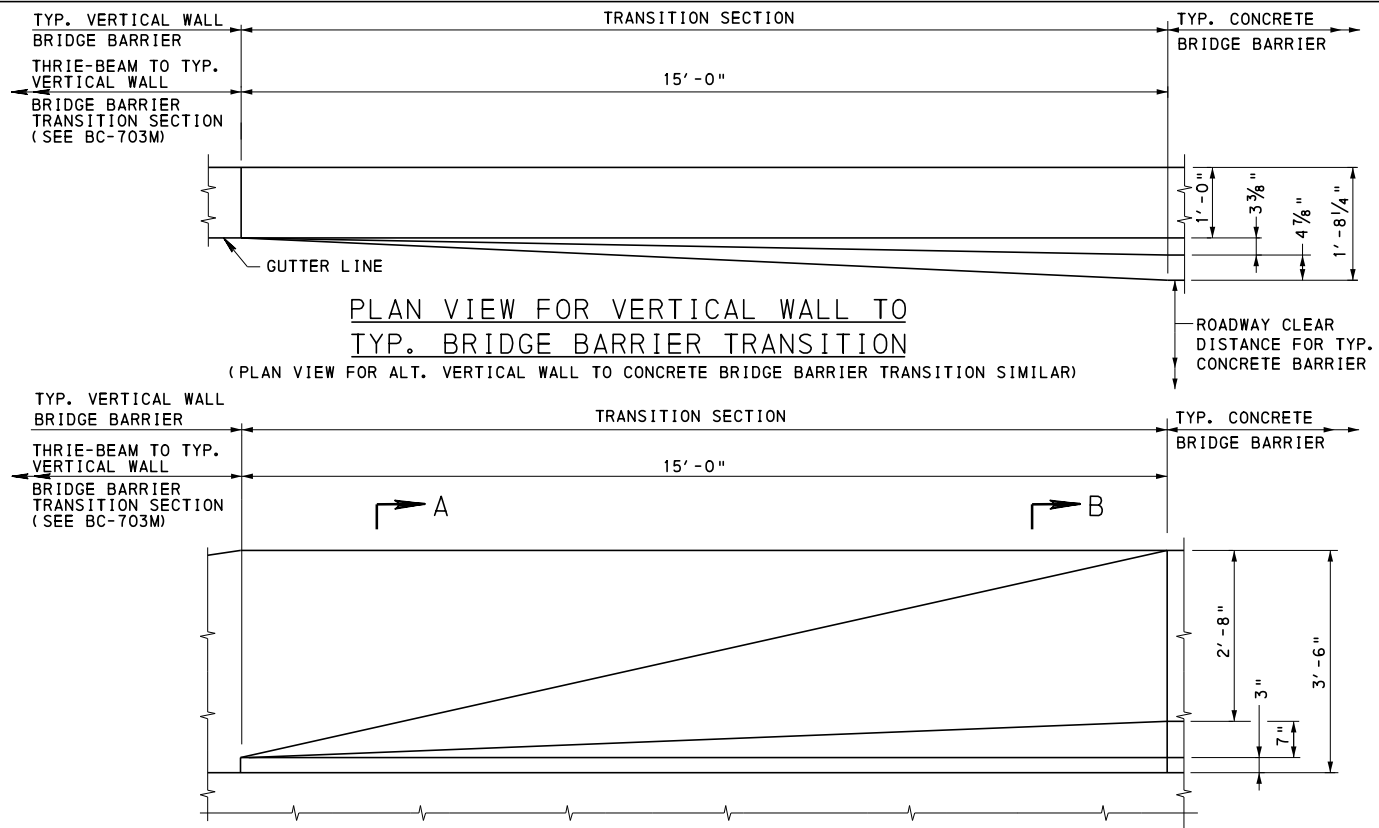
TABLE 1 VERTICAL REINFORCEMENT DIMENSIONS			
	B	C	D
TYP. VERTICAL WALL BARRIER	2'-7"	4"	6 1/2"
ALT. VERTICAL WALL BARRIER	1'-9"	3"	5 1/2"

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. PROVIDE REINFORCEMENT BARS, EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

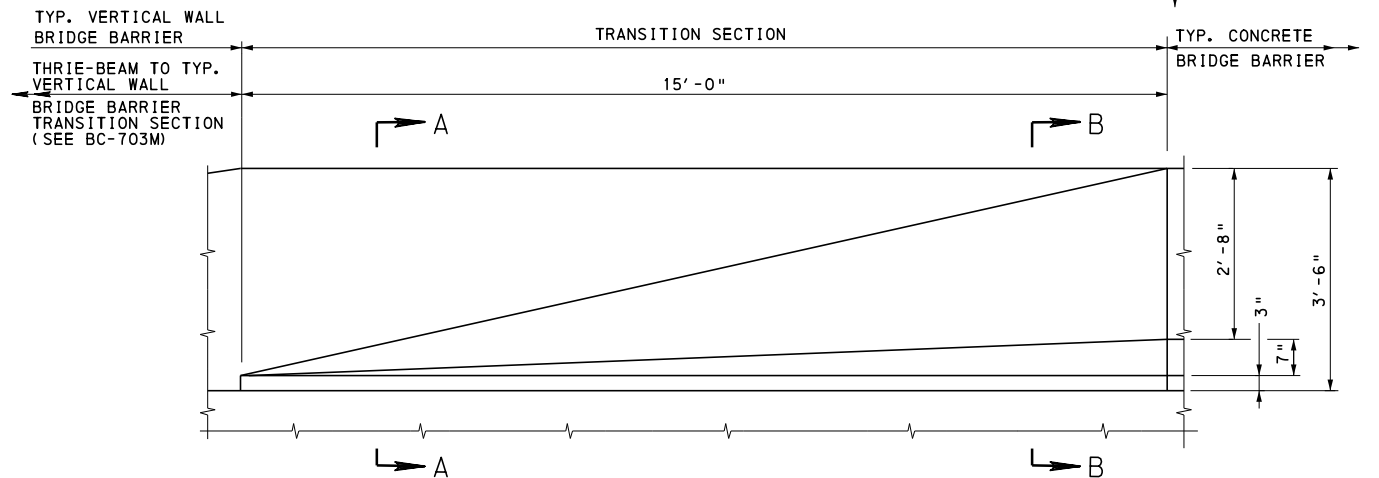
NOTES: (CONTINUED)

7. THE VERTICAL WALL BRIDGE BARRIER IS ONLY TO BE USED IN REHABILITATION PROJECTS. IT IS TO BE USED TO PROVIDE A TL-4 DESIGNATED TRANSITION WHERE PROVIDING NEW SUBSTRUCTURE SAFETY WINGS IS BEYOND THE SCOPE OF WORK. IN THESE CASES, THE THRIE-BEAM TO BRIDGE BARRIER TRANSITION SHOWN ON BC-703M IS PERMITTED IN PLACE OF FLARED END TRANSITIONS.
 - FOR STRUCTURES LESS THAN 100 FT. LENGTH THE VERTICAL WALL BARRIER CAN BE USED ACROSS THE ENTIRE STRUCTURE.
 - FOR STRUCTURES GREATER THAN 100 FT. THE VERTICAL WALL BARRIER MUST BE TRANSITIONED TO THE TYPICAL CONCRETE BARRIER AS DETAILED ABOVE.
8. NO JOINTS ARE PERMITTED FROM THE END OF THE BARRIER THROUGH THE END OF THE TRANSITION. FOR SHORT U-WINGS WHERE THIS CONDITION IS NOT PRACTICAL, CONTINUE THE VERTICAL WALL BARRIER THROUGH THE JOINT BEFORE BEGINNING THE TRANSITION.
9. NO JOINTS ARE PERMITTED IN THE VERTICAL WALL TERMINATION SECTION.
10. THE VERTICAL WALL BARRIER CAN NOT BE USED WITH ABUTMENTS WITH BACKWALLS WITH FLARED WINGS.



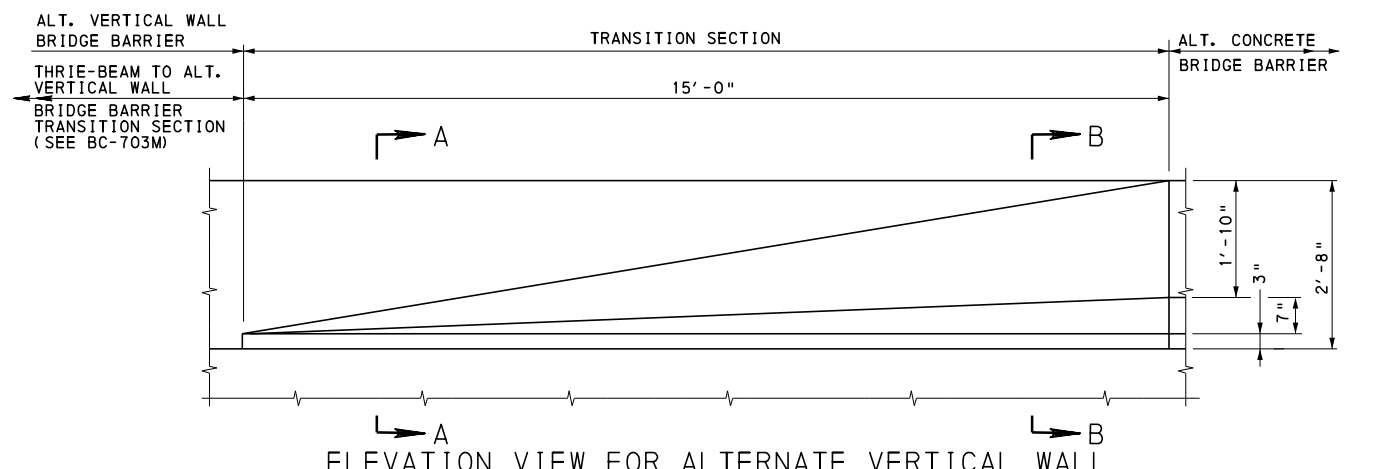
PLAN VIEW FOR VERTICAL WALL TO TYP. BRIDGE BARRIER TRANSITION

(PLAN VIEW FOR ALT. VERTICAL WALL TO CONCRETE BRIDGE BARRIER TRANSITION SIMILAR)



ELEVATION VIEW FOR VERTICAL WALL TO TYP. BRIDGE BARRIER TRANSITION

(FOR SECTIONS AND REINFORCEMENT DETAILS, SEE SHEET 2)



ELEVATION VIEW FOR ALTERNATE VERTICAL WALL TO ALTERNATE BRIDGE BARRIER TRANSITION

(FOR SECTIONS AND REINFORCEMENT DETAILS, SEE SHEET 2)

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

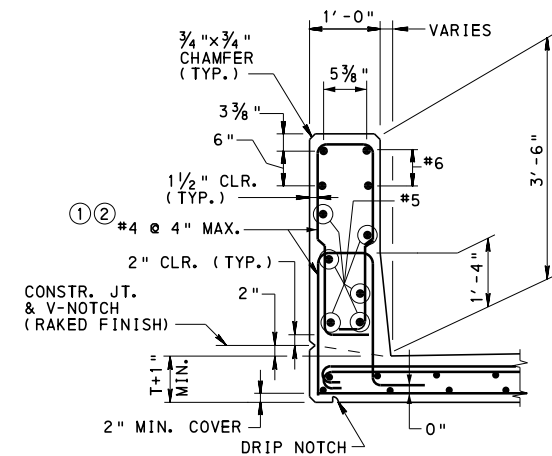
STANDARD CONCRETE VERTICAL WALL BRIDGE BARRIER

BD-601M	CONCRETE DECK SLAB
BD-660M	DECK SLAB AND STEEL REINFORCEMENT PLACEMENT
BC-703M	THRIE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION
BC-751M	BRIDGE DRAINAGE
BC-752M	CONCRETE DECK SLAB DETAILS
REFERENCE DRAWINGS	

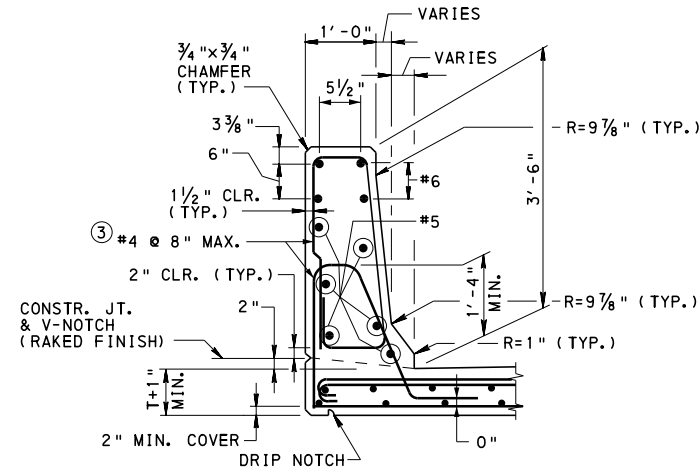
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SHEET 1 OF 12
BD-618M



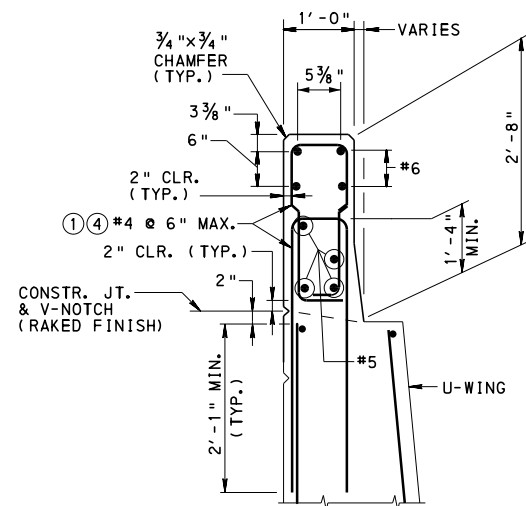
SECTION A-A



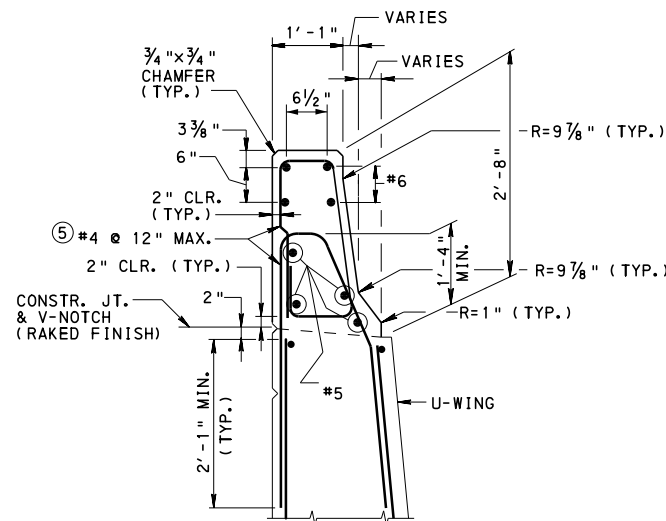
SECTION B-B

BARRIER TRANSITION ON STRUCTURE

(TYP. VERTICAL WALL TO TYP. BRIDGE BARRIER SHOWN,
ALT. VERTICAL WALL TO ALT. BRIDGE BARRIER SIMILAR)



SECTION A-A
(WITH OR WITHOUT BATTER)



SECTION B-B
(WITH OR WITHOUT BATTER)

BARRIER TRANSITION ON U-WING

(ALT. VERTICAL WALL TO ALT. BRIDGE BARRIER SHOWN,
TYP. VERTICAL WALL TO TYP. BRIDGE BARRIER SIMILAR)

LEGEND:

- ① BEYOND 10 FT. OF THE END OF BARRIER, INCREASE THE SPACING OF REINFORCEMENT BARS TO TWICE THE SHOWN SPACING.
- ② FOR ALTERNATE VERTICAL WALL TO ALTERNATE CONCRETE BARRIER TRANSITION USE #4 @ 6" WITH 2" CONCRETE COVER.
- ③ FOR ALTERNATE VERTICAL WALL TO ALTERNATE CONCRETE BARRIER TRANSITION USE #4 @ 12" WITH 2" CONCRETE COVER.
- ④ FOR TYPICAL VERTICAL WALL TO TYPICAL CONCRETE BARRIER TRANSITION USE #4 @ 4" WITH 1 1/2" CONCRETE COVER.
- ⑤ FOR TYPICAL VERTICAL WALL TO TYPICAL CONCRETE BARRIER TRANSITION USE #4 @ 8" WITH 1 1/2" CONCRETE COVER.

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DEPARTMENT OF TRANSPORTATION
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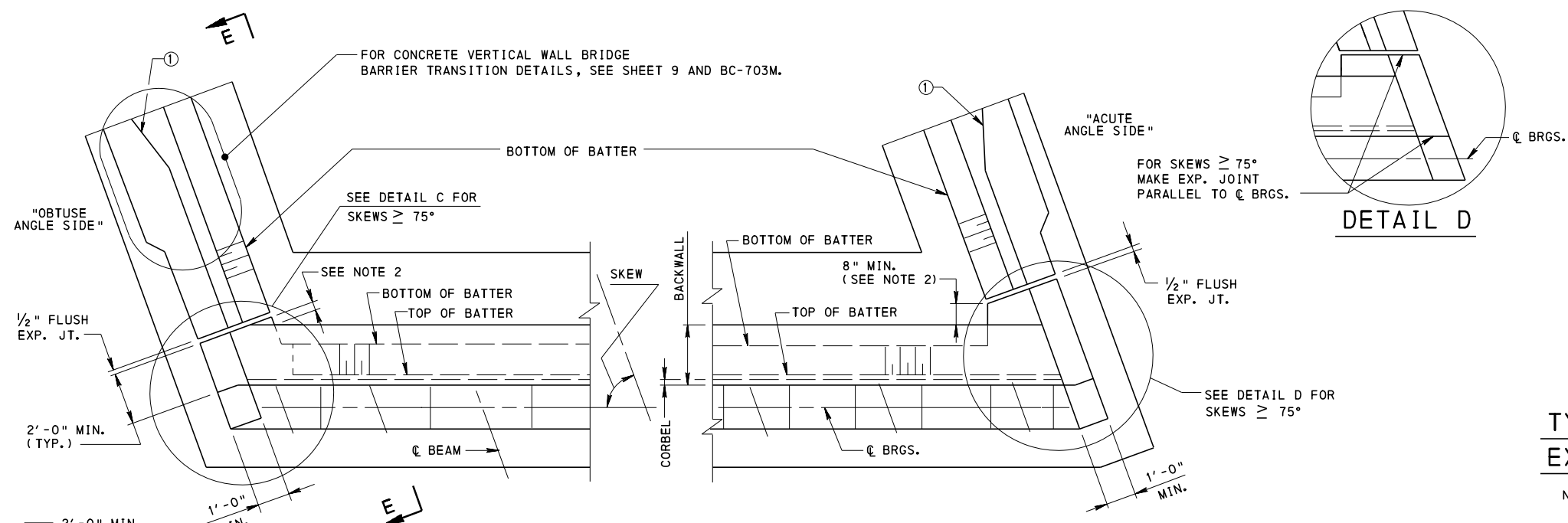
STANDARD

CONCRETE VERTICAL WALL
BRIDGE BARRIER
TRANSITION DETAILS

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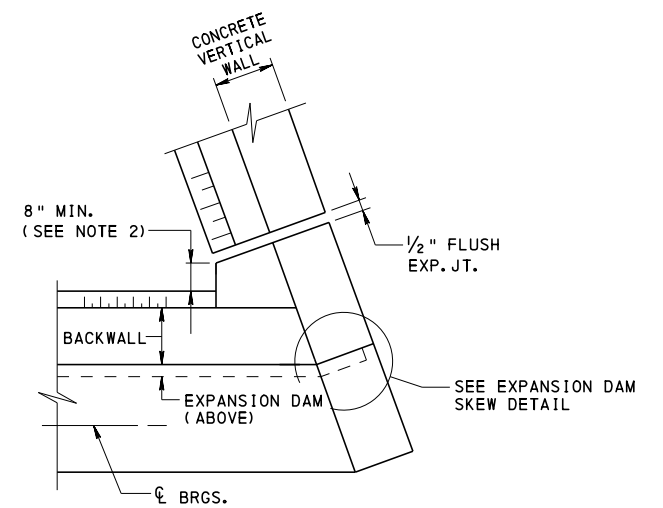
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SHEET 2 OF 12
BD-618M



DETAIL C

DETAIL D

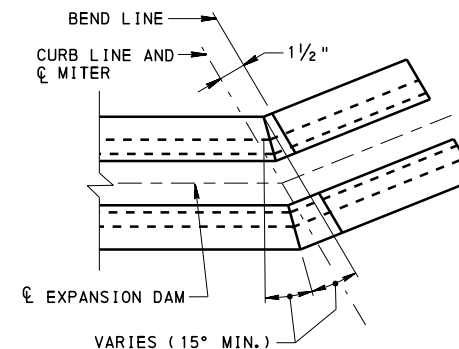


TYPICAL CORNER DETAIL FOR
EXPANSION DAM (SKEWS < 75°)

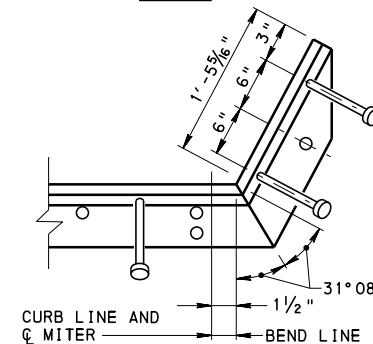
NOTE: ACUTE SIDE WITH TYPICAL OR ALTERNATE CONCRETE VERTICAL WALL IS SHOWN FOR NEOPRENE STRIP SEAL DAM. TOOTH EXPANSION DAM IS SIMILAR.

TYPICAL PLAN (SKEWS < 75°)

(FOR SPREAD BEAMS)
① SECTION SHOWN WITHOUT INLET PLACEMENT. WITH INLET PLACEMENT THE WALL THICKNESS TO BE 1'-8" FULL HEIGHT TO TOP OF CURB. FOLLOW DETAILS ON SHEET 9 FOR CURB AND BEVEL DETAILS.



PLAN

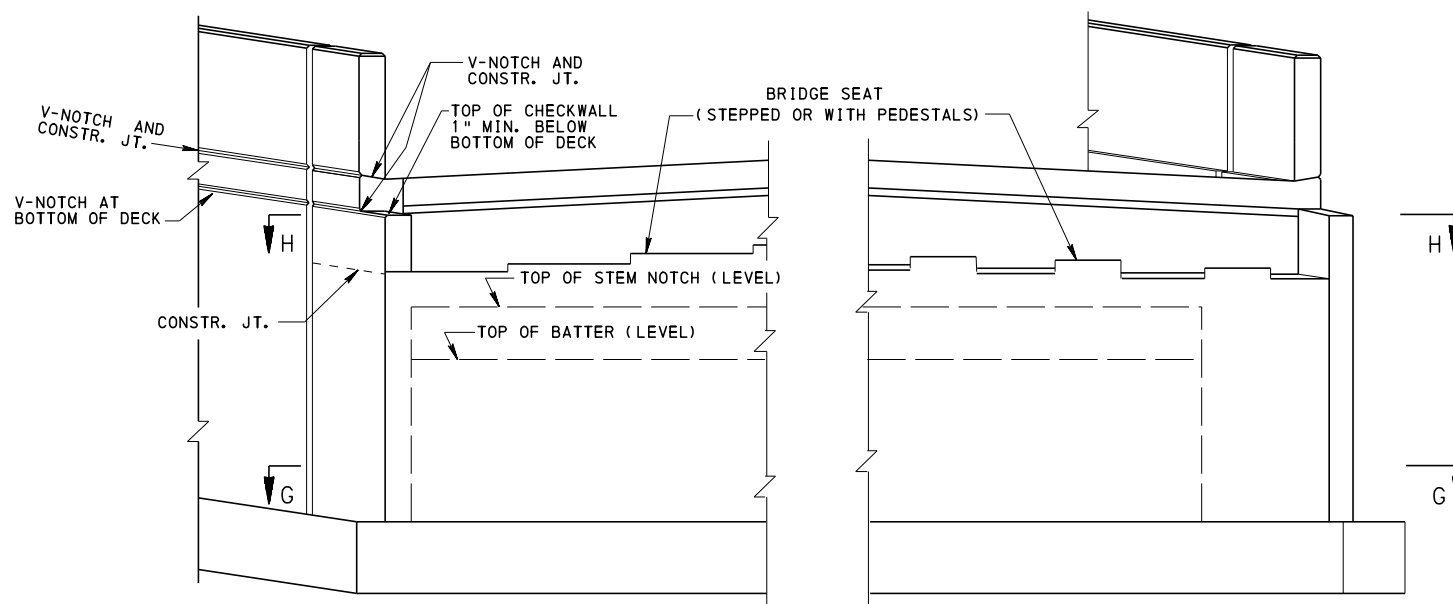


ELEVATION

EXPANSION DAM
SKEW DETAIL

NOTES:

1. FOR SECTION E-E, SEE SHEET 5.
2. 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.

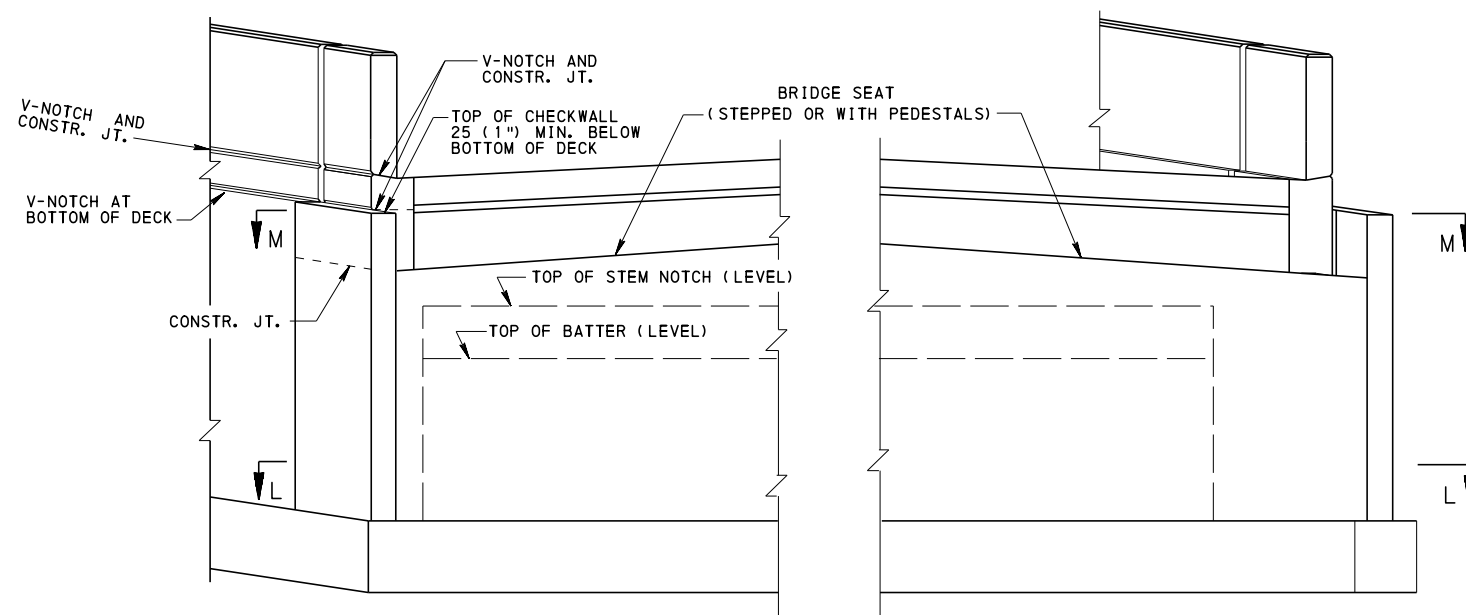
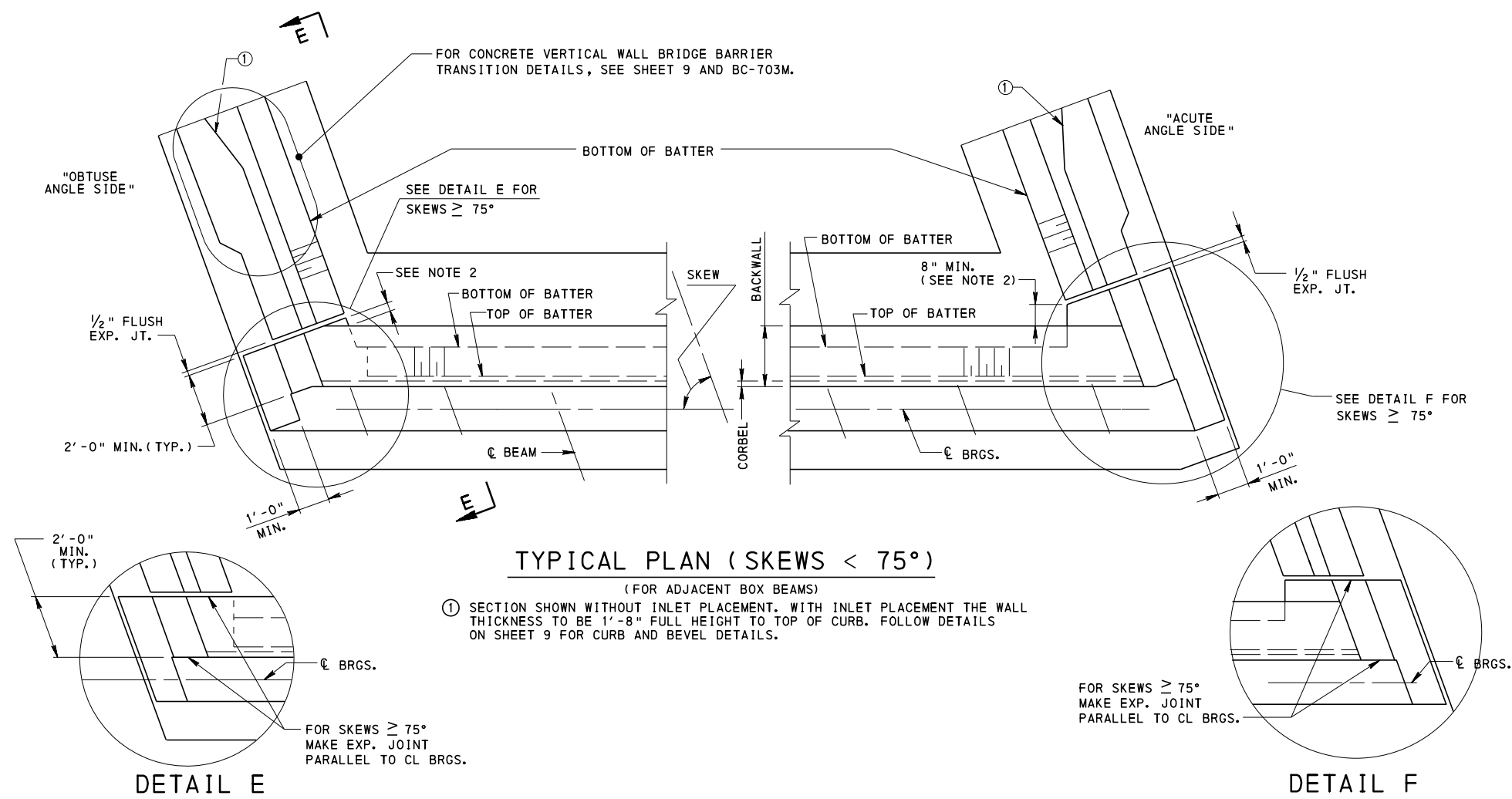


TYPICAL ELEVATION

FOR SECTIONS G-G AND H-H,
SEE BD-622M, SHEET 4

BD-622M	R. C. ABUTMENT WITH BACKWALL
BD-657M	ABUTMENT DETAILS
BC-703M	THREE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY			
STANDARD CONC. VERTICAL WALL BRIDGE BARRIER R. C. ABUTMENTS WITH BACKWALL U-WING LAYOUT AND DETAILS FOR SPREAD BEAMS			
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian D. Thompson</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 3 OF 12	
		BD-618M	

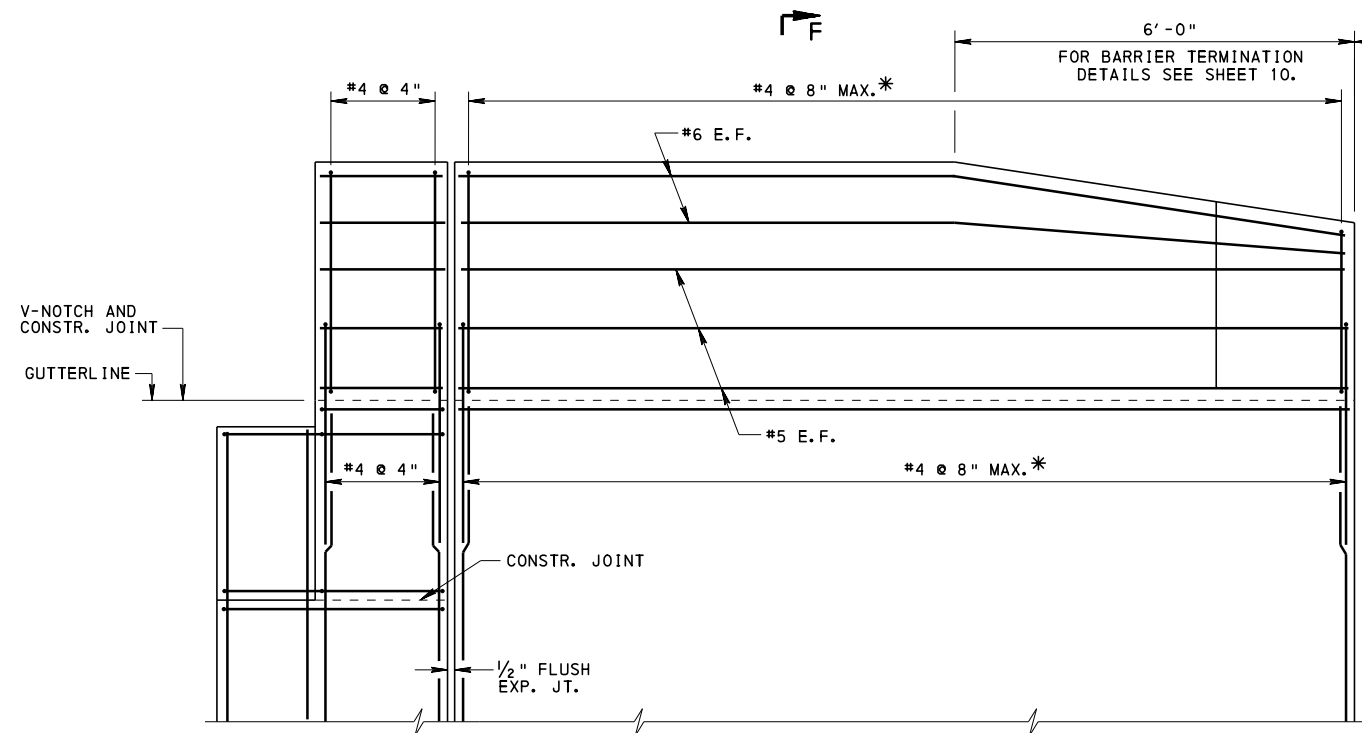


TYPICAL ELEVATION
FOR SECTIONS L-L AND M-M,
SEE BD-622M, SHEET 5

NOTES:

1. FOR SECTION E-E, SEE SHEET 5.
2. 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.
3. FOR "ABUTMENT PLAN-WITH BACKWALL (SKEW < 75°), U-WINGS FOR ADJACENT BEAMS" DETAIL, SEE BD-622M, SHEET 5.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY			
STANDARD CONC. VERTICAL WALL BRIDGE BARRIER R. C. ABUTMENTS WITH BACKWALL U-WING LAYOUT AND DETAILS FOR ADJACENT BOX BEAMS			
BD-622M	R. C. ABUTMENT WITH BACKWALL	RECOMMENDED NOV. 21, 2014	SHEET 4 OF 12
BD-657M	ABUTMENT DETAILS	RECOMMENDED NOV. 21, 2014	
BC-703M	THREE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION		
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS		
REFERENCE DRAWINGS		<i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	<i>Brian S. Thompson</i> ACTING DIR., BUREAU OF PROJECT DELIVERY
			BD-618M

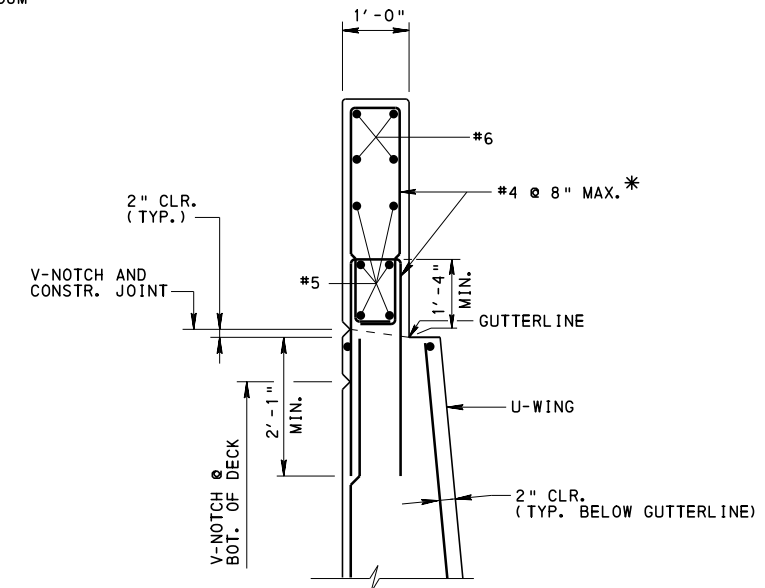


SECTION E-E
(TYPICAL VERTICAL WALL BRIDGE BARRIER SHOWN;
ALTERNATE VERTICAL BRIDGE BARRIER SIMILAR)

NOTE: ALL REINFORCEMENT IN U-WING BELOW
BARRIER AS REQUIRED BY DESIGN.

NOTE: FOR REINFORCEMENT IN ABUTMENT CORNER, CHEEKWALL AND BACKWALL
BELOW BARRIER, SEE BD-622M SHEETS 4 AND 5 AND BD-624M, SHEETS 4 AND 5.

* WITHIN 10 FT. 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.



SECTION F-F
(WITH OR WITHOUT BATTER)

NOTE: ALL REINFORCEMENT IN U-WING BELOW BARRIER
AS REQUIRED BY DESIGN.

NOTE:

1. FOR TYPICAL PLAN AND ELEVATION,
SEE SHEET 2 AND SHEET 3.

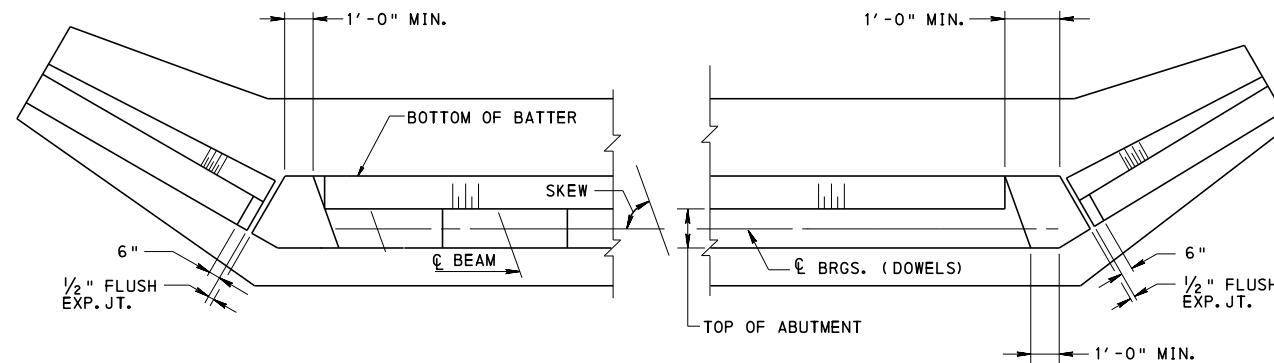
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONC. VERTICAL WALL BRIDGE BARRIER
R. C. ABUTMENTS WITH BACKWALL
U-WINGS

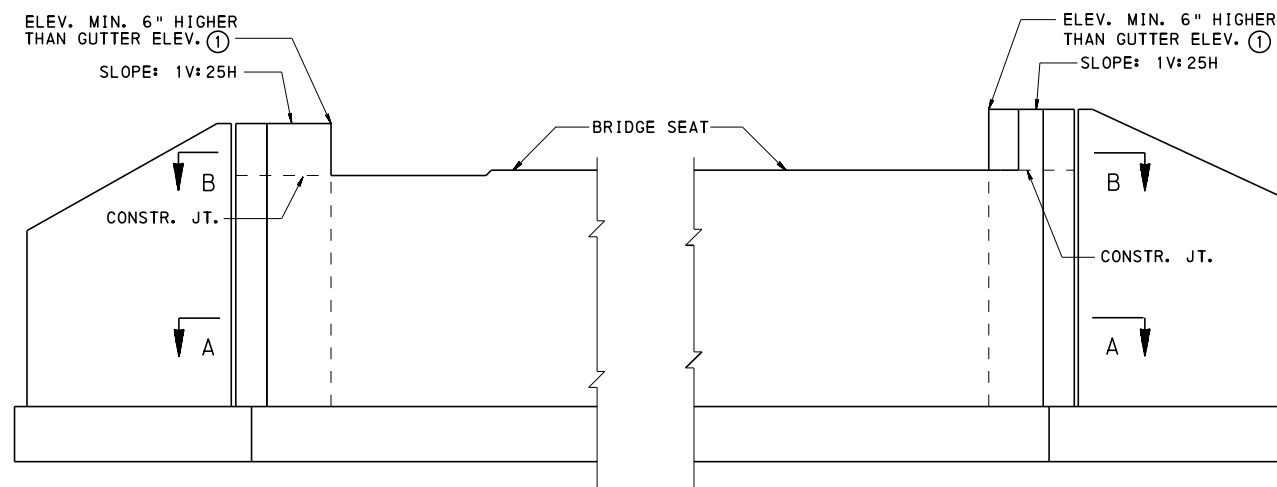
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CHIEF BRIDGE ENGINEER

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SHEET 5 OF 12
BD-618M

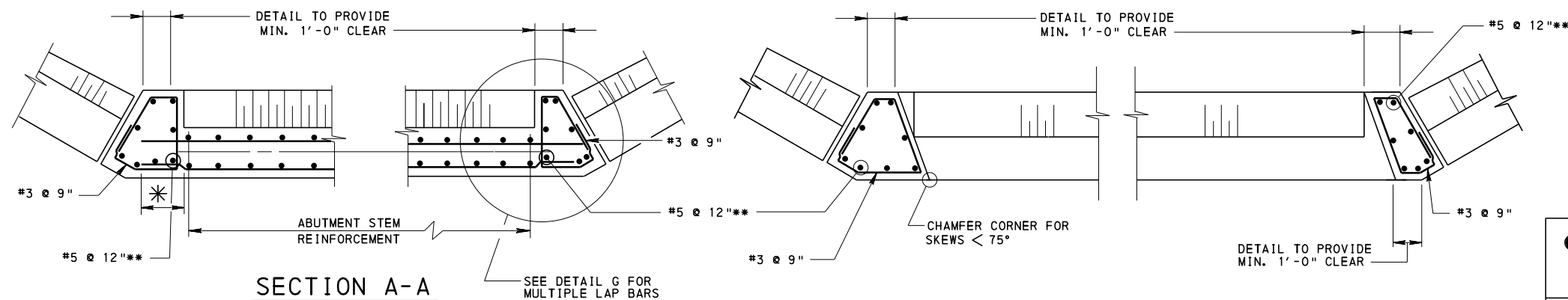


TYPICAL PLAN



TYPICAL ELEVATION

① CHEEKWALLS MAY BE LOWERED TO ACCOMMODATE THE EXTRA WIDTH OF THE TERMINATION SECTION OF THE VERTICAL WALL BRIDGE BARRIER. SEE DETAILS BC-703M, SHEET 3.

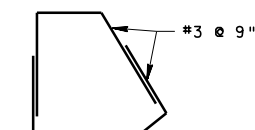


SECTION A-A

SECTION B-B

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. SEE DETAIL G.



DETAIL G

* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED TO OBTAIN MINIMUM DEVELOPMENT LENGTH. (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-621M	REINFORCED CONCRETE ABUTMENTS
BD-624M	R. C. ABUTMENTS WITHOUT BACKWALL
BD-657M	ABUTMENT DETAILS
BC-703M	THREE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONC. VERTICAL WALL BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED NOV. 21, 2014

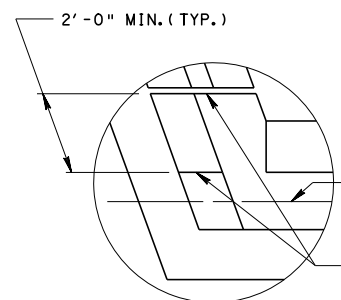
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian D. Thompson
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 6 OF 12

BD-618M

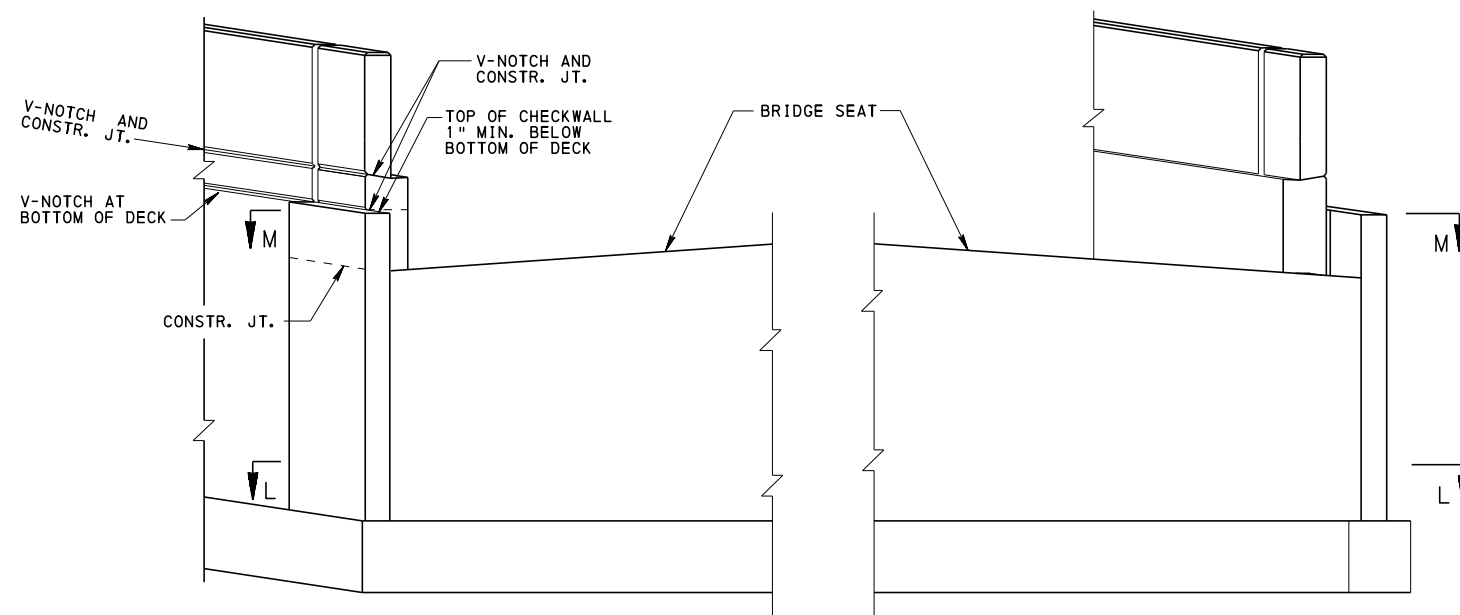
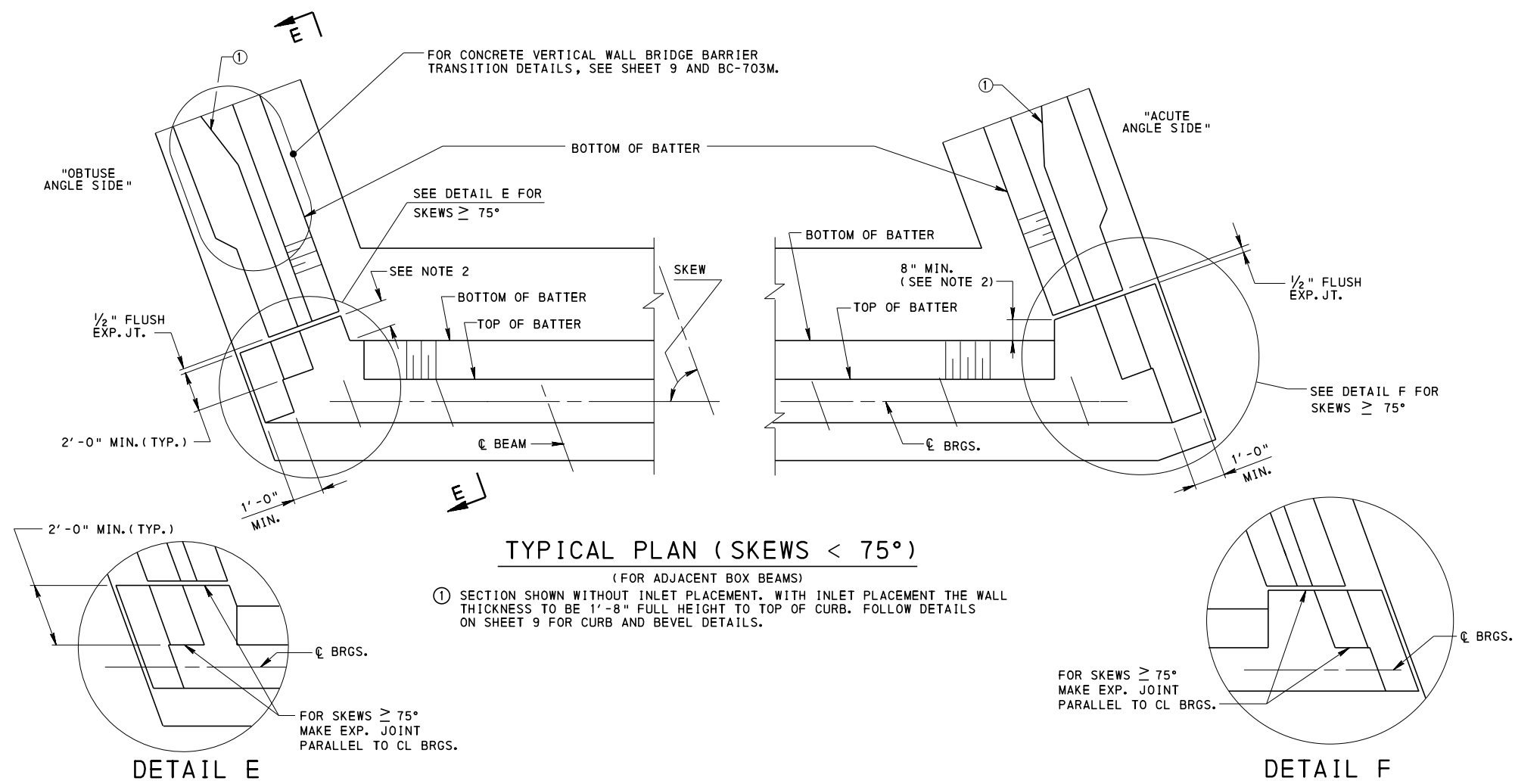


1. FOR SECTION E-E, SEE SHEET 5.
2. EXTEND ABUTMENT CORNER 8" MINIMUM BEYOND BOTTOM OF BATTER AT ACUTE ANGLE OF U-WING. EXTEND ABUTMENT CORNER 0 (ZERO) MINIMUM BEYOND BOTTOM OF BATTER AT OBTUSE ANGLE OF U-WING AND PROVIDE A MINIMUM 2'-0" CORNER DIMENSION AS SHOWN.

STANDARD CONC. VERTICAL WALL BRIDGE BARRIER R. C. ABUTMENTS WITHOUT BACKWALL U-WING LAYOUT AND DETAILS FOR SPREAD BEAMS

ON	RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciara</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Bruce B. Thompson</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 7 OF 12 BD-618M
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BD-622M	R. C. ABUTMENT WITH BACKWALL
BD-657M	ABUTMENT DETAILS
BC-703M	THRIE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	



TYPICAL ELEVATION

FOR SECTIONS L-L AND M-M,
SEE BD-624M, SHEET 5

NOTES:

1. FOR SECTION E-E, SEE SHEET 5.
2. 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.
3. FOR "ABUTMENT PLAN-WITHOUT BACKWALL (SKEWS < 75°), U-WINGS FOR ADJACENT BEAMS" DETAIL, SEE BD-624M, SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

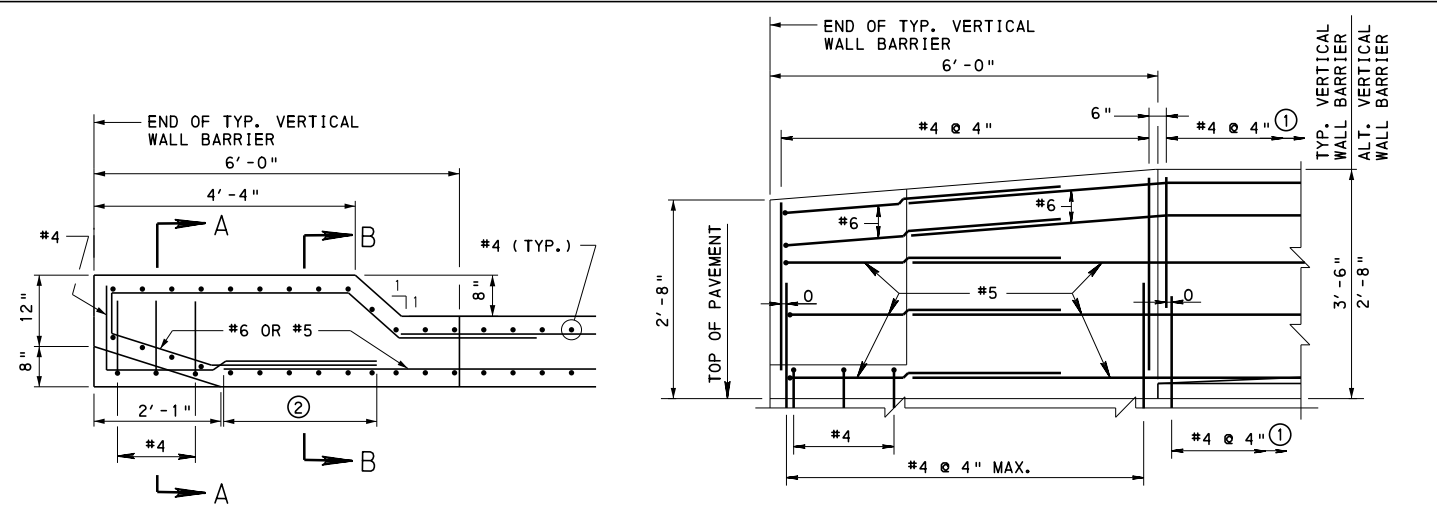
STANDARD
CONC. VERTICAL WALL BRIDGE BARRIER
R. C. ABUTMENTS WITHOUT BACKWALL
U-WING LAYOUT AND DETAILS
FOR ADJACENT BOX BEAMS

BD-622M	R. C. ABUTMENT WITH BACKWALL
BD-657M	ABUTMENT DETAILS
BC-703M	THREE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
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SHEET 8 OF 12
BD-618M

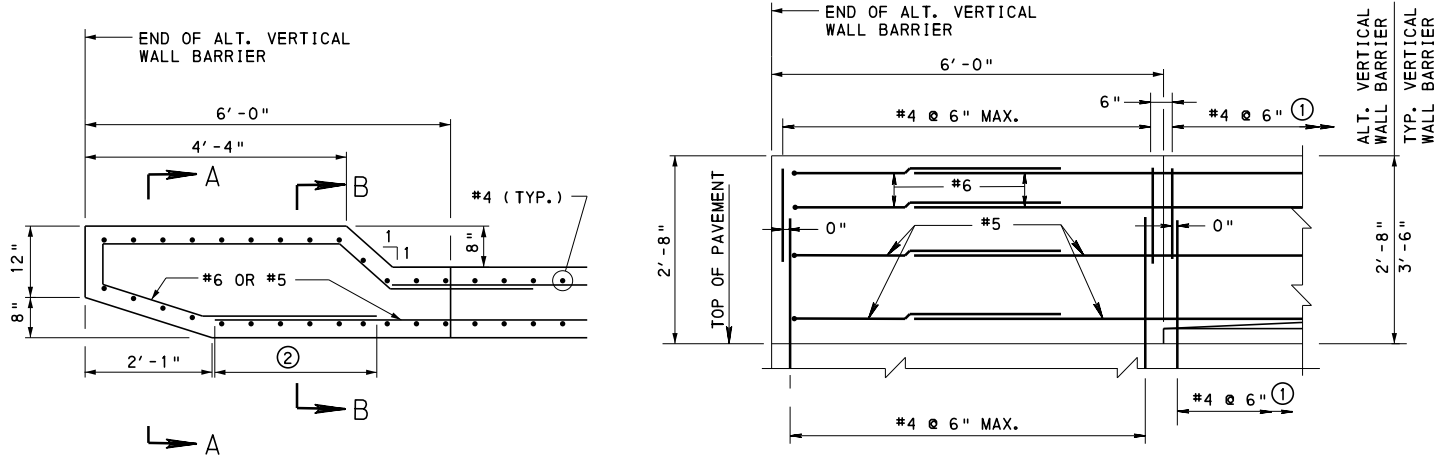


PLAN VIEW

ELEVATION VIEW

VERTICAL WALL BARRIER TERMINATION SECTION

(WITH INLET PLACEMENT)
(TYP. VERTICAL WALL BARRIER SHOWN; ALT. VERTICAL WALL BARRIER SIMILAR)

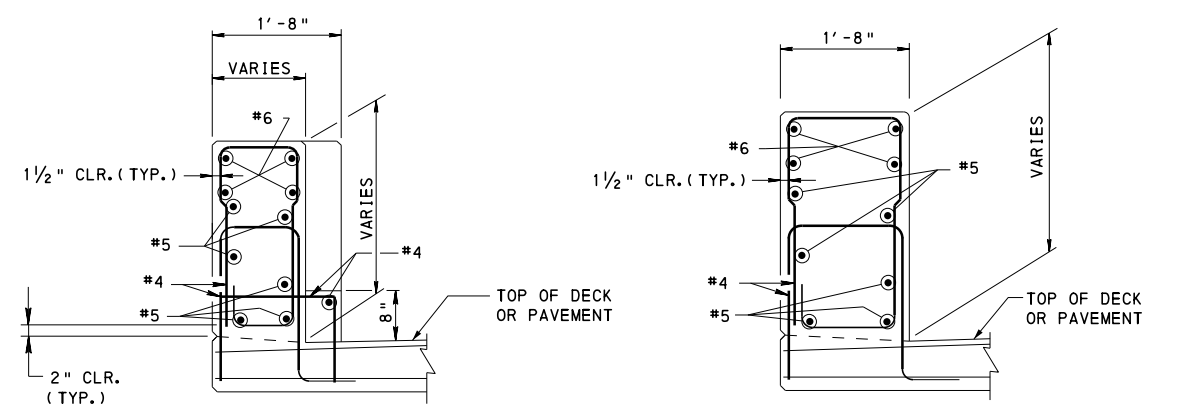


PLAN VIEW

ELEVATION VIEW

VERTICAL WALL BARRIER TERMINATION SECTION

(WITHOUT INLET PLACEMENT)
(ALT. VERTICAL WALL BARRIER SHOWN; TYP. VERTICAL WALL BARRIER SIMILAR)

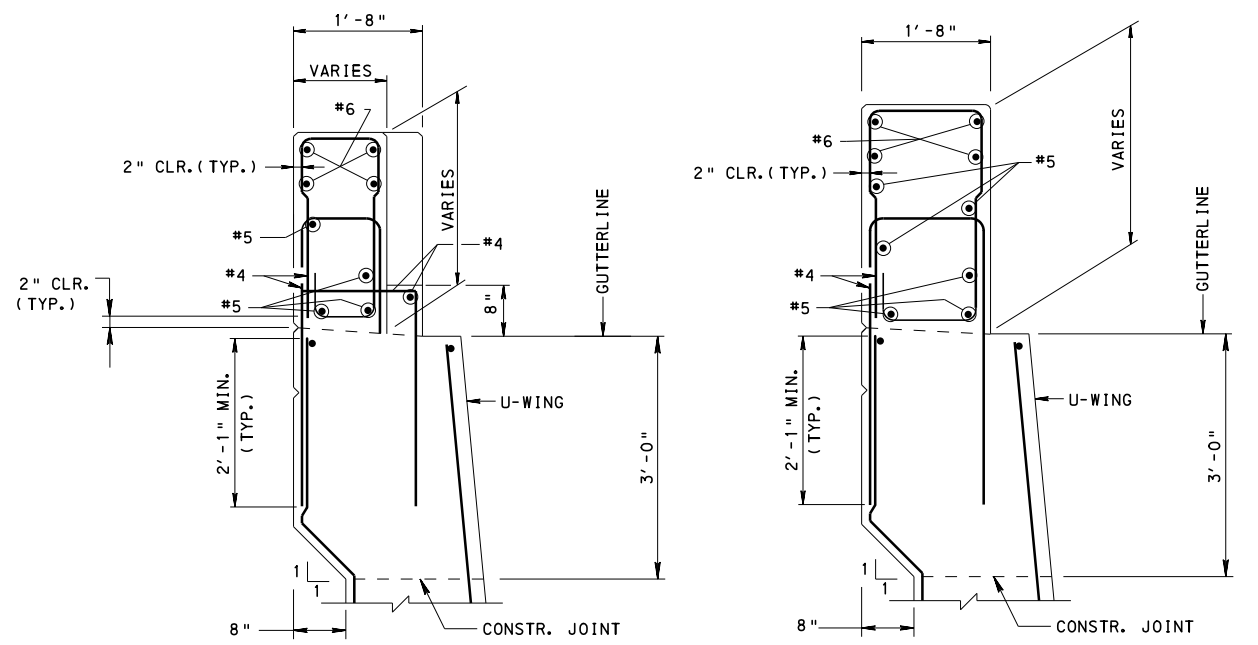


SECTION A-A

SECTION B-B

VERTICAL WALL BRIDGE BARRIER ON STRUCTURE ③

(TYP. VERTICAL WALL BARRIER SHOWN; ALT. VERTICAL WALL BARRIER SIMILAR)



SECTION A-A

SECTION B-B

(WITH OR WITHOUT BATTER)

(WITH OR WITHOUT BATTER)

VERTICAL WALL BRIDGE BARRIER ON U-WING ③

(ALT. VERTICAL WALL BARRIER SHOWN; TYP. VERTICAL WALL BARRIER SIMILAR)

LEGEND:

- ① BEYOND 10'-0" OF THE END OF BARRIER, INCREASE THE SPACING OF REINFORCEMENT BARS TO TWICE THE SHOWN SPACING.
- ② LAP SPLICE LENGTH: NORMAL WEIGHT CONCRETE: 2'-7" #5 BARS
3'-1" #6 BARS
LIGHTWEIGHT CONCRETE: 3'-5" #5 BARS
4'-1" #6 BARS
- ③ LONGITUDINAL BARS SHOWN IN STAGGERED POSITION FOR TRANSITION TO TYPICAL CONCRETE BARRIER. IF VERTICAL WALL BARRIER IS USED ACROSS THE STRUCTURE, LONGITUDINAL BARS SHOULD BE EQUALLY SPACED IN PAIRS.

NOTES:

- 1. FOR GEOMETRIC AND REINFORCEMENT DETAILS NOT SHOWN, SEE SHEET 1.
- 2. FOR ADDITIONAL NOTES, SEE SHEET 1.

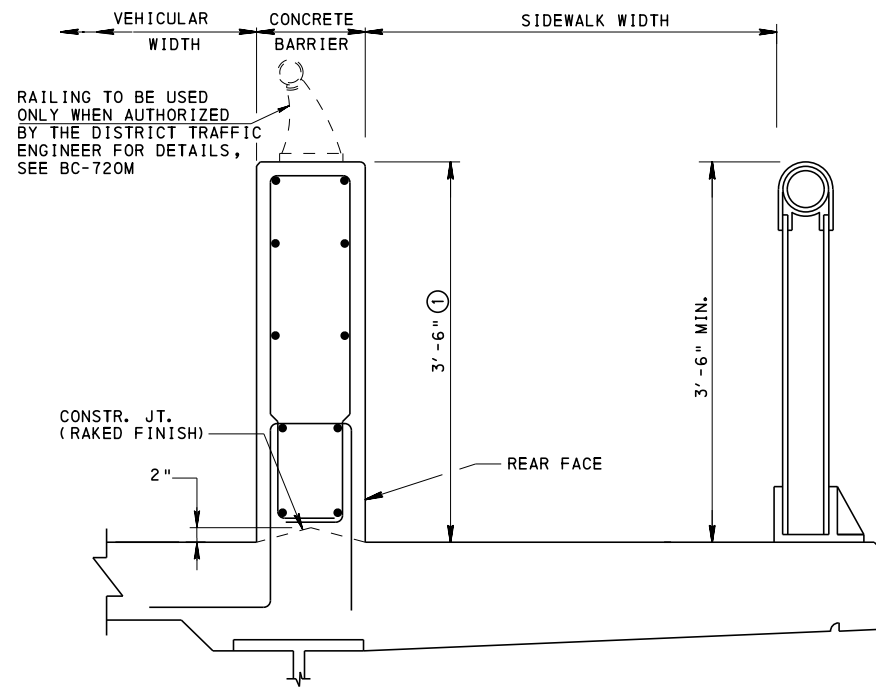
BC-703M	THRIE-BEAM TO BRIDGE VERTICAL WALL BARRIER TRANSITION CONNECTION
RC-50M	GUIDE RAIL TRANSITION AT END OF STRUCTURE
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

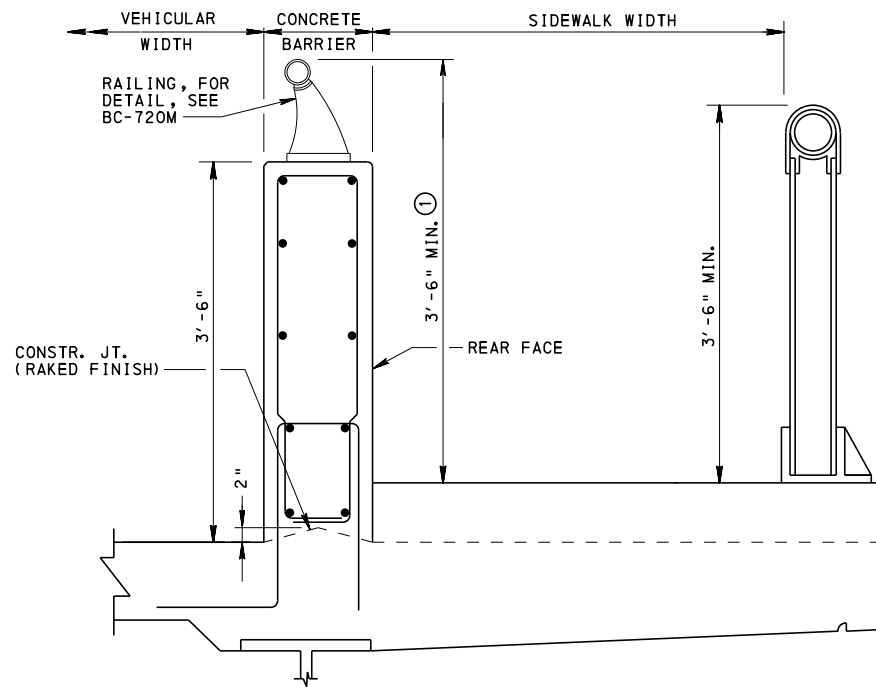
STANDARD

CONCRETE VERTICAL WALL
BRIDGE BARRIER
BARRIER TERMINATION DETAILS

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 9 OF 12 BD-618M
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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.)

- ① 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.

NOTES:

1. FOR VERTICAL WALL BARRIER DETAILS AT ALTERNATE SIDEWALK, SEE BD-601M.
2. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE VERTICAL WALL BARRIER NOT SHOWN, SEE SHEET 1.
3. FOR ADDITIONAL NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD

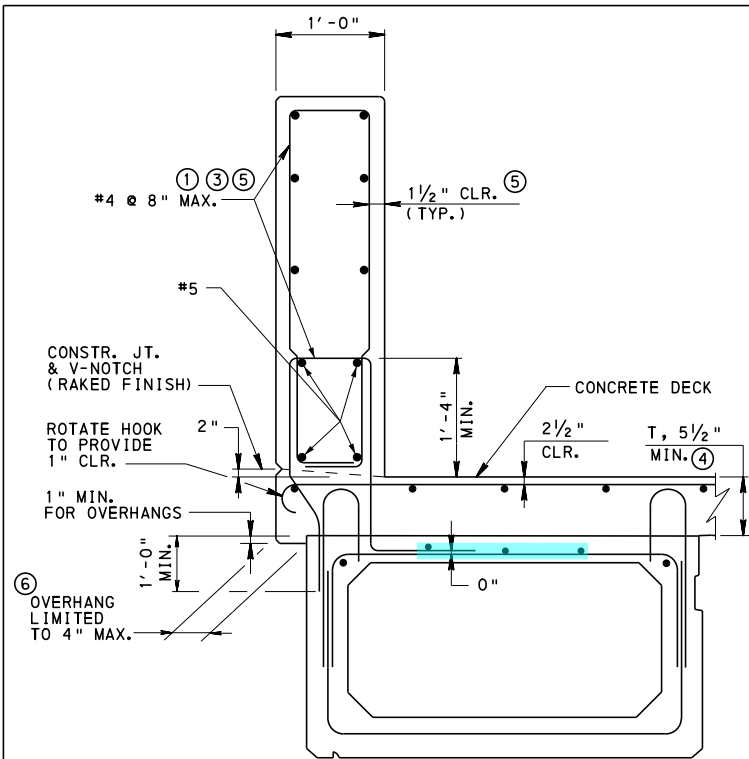
**CONCRETE VERTICAL WALL
BRIDGE BARRIER
MISCELLANEOUS DETAILS**

BD-601M	CONCRETE DECK SLAB
BC-703M	THREE-BEAM TO BRIDGE BARRIER TRANSITION CONNECTION
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-718M	ALTERNATE RAILING DETAILS
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
REFERENCE DRAWINGS	

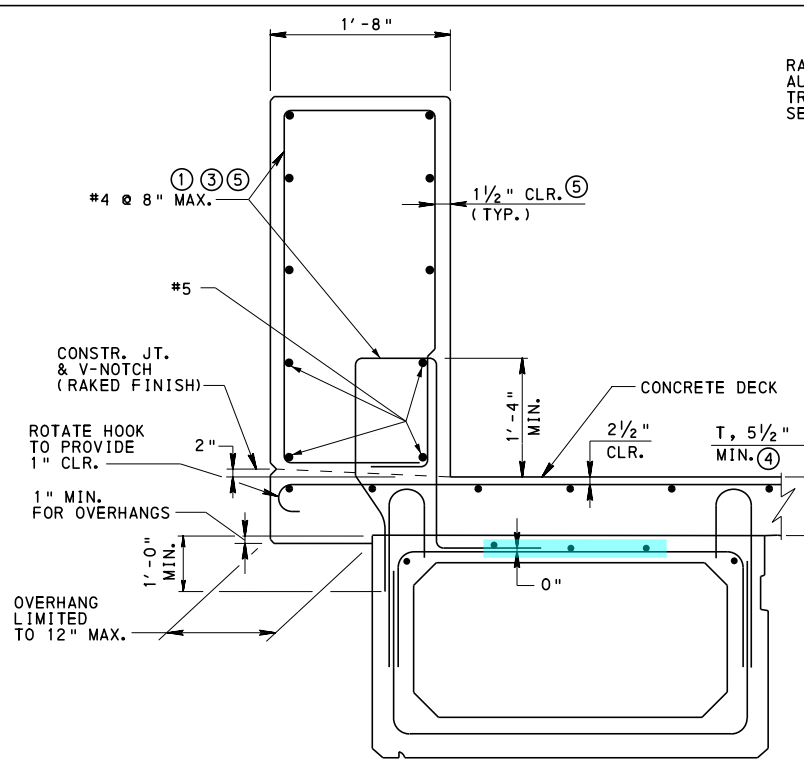
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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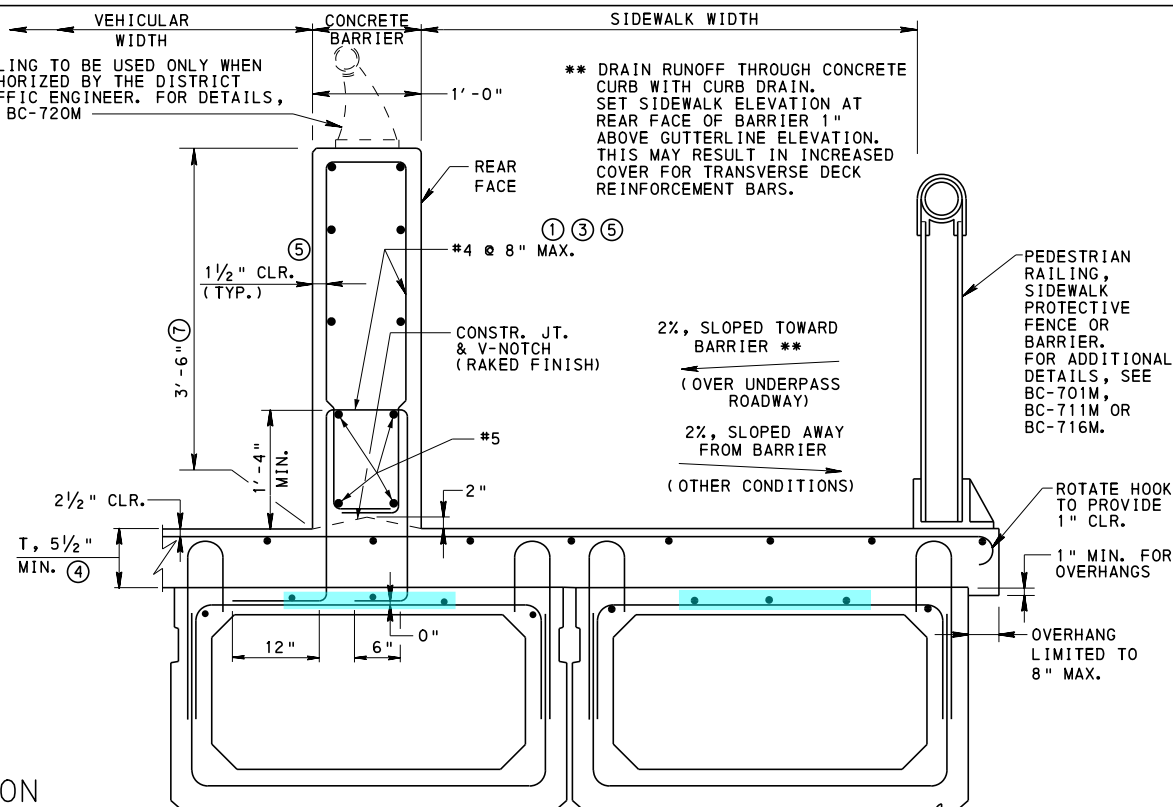
SHEET 10 OF 12
BD-618M



AT TYPICAL BARRIER SECTION



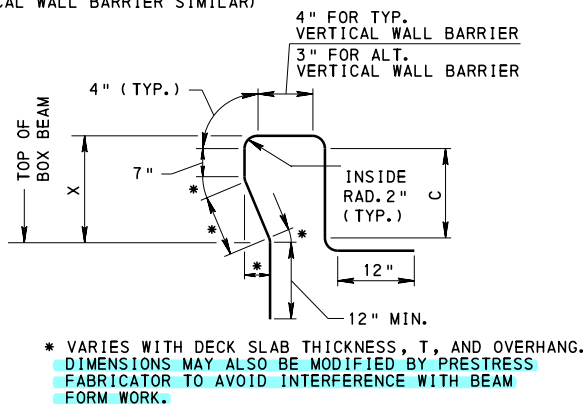
AT BARRIER TERMINATION SECTION



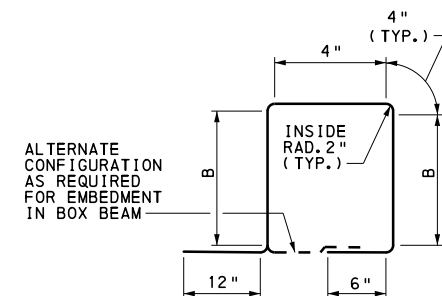
36" & 48" COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING SIDEWALK @
(RAISED SIDEWALK DETAIL SIMILAR)

36" & 48" COMPOSITE
ADJACENT BOX BEAMS
SUPPORTING BARRIER
(TYP. VERTICAL WALL BARRIER SHOWN, ALT. VERTICAL WALL BARRIER SIMILAR)

T	AT COMP. ADJ. BOX BEAMS SUPPORTING BARRIER	
	X	C
5.5"	1'-9 1/2"	1'-6"
6.0"	1'-10"	1'-6 1/2"
6.5"	1'-10 1/2"	1'-7"
7.0"	1'-11"	1'-7 1/2"
7.5"	1'-11 1/2"	1'-8"
8.0"	2'-0"	1'-8 1/2"



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



VERTICAL REINFORCEMENT
(FOR DIMENSION "B", SEE TABLE 2)

T	AT COMP. ADJ. BOX BEAMS SUPPORTING SIDEWALK OR RAISED SIDEWALK
	B
5.5"	1'-5 1/2"
6.0"	1'-6"
6.5"	1'-6 1/2"
7.0"	1'-7"
7.5"	1'-7 1/2"
8.0"	1'-8"

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 REINFORCING BARS TO HALF THE SPACING SHOWN.
- 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.
- FOR ALTERNATE VERTICAL WALL USE #4 @ 12" WITH 2" CONCRETE COVER.
- THE 4" MAX. OVERHANG DOES NOT APPLY AT THE VERTICAL WALL TERMINATION SECTION.
- 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.

REINFORCEMENT BAR NOTES:

- REINFORCEMENT BAR DIMENSIONS ARE OUT TO OUT OF BAR.
- DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
- ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

NOTES:

- FOR VERTICAL WALL BARRIER DETAILS AT 36" AND 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING ALTERNATE SIDEWALK, SEE BD-661M.
- FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE VERTICAL WALL BARRIER NOT SHOWN, SEE SHEET 1.
- FOR ADDITIONAL NOTES, SEE SHEET 1.

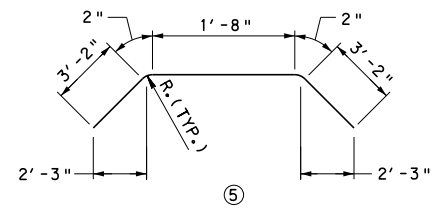
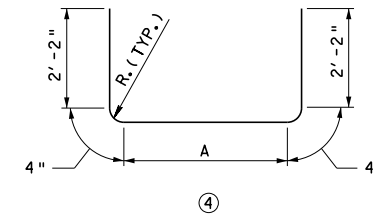
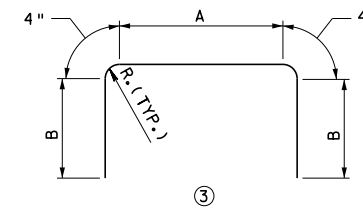
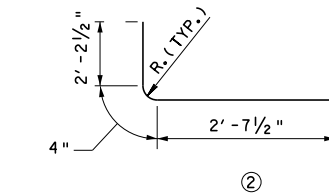
BD-661M	BOX BEAM REINFORCEMENT DETAILS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS BOX BEAMS
BC-701M	PROTECTIVE FENCE
BC-711M	ALUMINUM PROTECTIVE BARRIER
BC-716M	ALUMINUM PEDESTRIAN RAILING
BC-720M	ALUMINUM OR STEEL BRIDGE HAND RAILING
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONCRETE VERTICAL WALL
BRIDGE BARRIER
MISCELLANEOUS DETAILS

RECOMMENDED NOV. 21, 2014 Thomas P. Maciore CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 Brenda Thompson ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 11 OF 12 BD-618M
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1. DIMENSIONS ALONG CURVED PORTIONS OF BAR ARE MEASURED ALONG THE OUTSIDE EDGE.
2. ALL REINFORCEMENT BARS SHALL BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.
3. RADIUS, $R=2"$, IS MEASURED TO THE INSIDE EDGE OF THE REINFORCEMENT BAR.



NOTES:

1. PROVIDE MATERIALS AND WORKMANSHIP 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 TO 1101.4 PUB. 408 EXCEPT DO NOT GALVANIZE ANCHOR ANGLES.
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. LIGHTING POLE SUPPORT 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.
10. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE VERTICAL WALL BARRIER NOT SHOWN, SEE SHEET 1.



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

BD-601M	CONCRETE DECK SLAB
BD-657M	ABUTMENT DETAILS, I-BEAM AND BOX BEAM BRIDGES
BD-658M	PIER DETAILS, I-BEAM AND BOX BEAM BRIDGES
BC-721M	ELECTRICAL DETAILS
BC-722M	LIGHTING POLE ANCHORAGE
BC-734M	ANCHOR SYSTEMS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
CONCRETE VERTICAL WALL
BRIDGE BARRIER
LIGHTING POLE ANCHORAGE DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P Macioce
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
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SHEET 12 OF 12

BD-618M

* 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".

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 , JUNE 22 , 2010 (AISC SPEC).
- b) FEDERAL HIGHWAY ADMINISTRATION , STEEL BRIDGE DESIGN HANDBOOK , VOLUME 13 , BRACING DESIGN , PUBLICATION NO. FHWA-IF-12-052-VOL 13 , NOVEMBER 2012 (FHWA SBDH).

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 = RADIUS OF CURVATURE AT BRIDGE CENTERLINE.

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

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

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 _s ≤ 0.30 +/-			
	RECOMMENDED	ACCEPTABLE	AVOID
ANY SPAN LENGTH	TDLF OR SDLF		NLF

SKEWED BRIDGES WITH SKEW < 70 DEGREES +/- AND I _s > 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)_{MAX} ≥ 0.03 +/-]¹

BRIDGES WITH RADIAL OR SKEWED SUPPORTS			
	RECOMMENDED	ACCEPTABLE	AVOID
LARGE SPAN LENGTHS > 250 FEET +/- AND (L/R) _{MAX} > 0.1 +/-	NLF ²	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 UP TO ABOUT 250' FOR HORIZONTALLY CURVED BRIDGES IS BASED ON MANY YEARS OF PRACTICE; USE OF SDLF HAS BEEN ALMOST UNIVERSAL FOR LONG SPAN CURVED I-GIRDER BRIDGES. THE RECOMMENDATION TRANSITIONS TO NLF ABOVE THIS LENGTH BECAUSE A LIMITED STUDY OF THESE BRIDGES SHOWS CROSS FRAME FORCES CAN BECOME SIGNIFICANT AS SPANS GET LONGER AND RADII GET SMALLER. 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_s) , 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 ANGLES OF 70° TO 90° , OR NORMAL TO THE GIRDER FOR SKEWS 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(f) OF PENNDOT PUB 408 FOR MINIMUM BENT RADII.
- 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	

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian D. Thompson
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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 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.
- 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_S" IS CALCULATED AS FOLLOWS:

I_S= W_G/ { L_S TAN (Ø_P) }

WHERE:

- W_G= BRIDGE WIDTH PERPENDICULAR TO THE CENTERLINE, FASCIA GIRDER TO FASCIA GIRDER (FT)
- Ø_P= 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_S= 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_S > 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_T = (2.4 L M_f²) / (Ø n E I_{eff} C_{db}²)

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

M_{br} = (0.005 L_b L M_f²) / (n E I_{eff} C_{db}² h_o)

- 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_f).

- THE ULTIMATE MOMENT (M_f) 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 + 1.4 WS
- STRENGTH III, CONSTRUCTION CONDITION, NONCOMPOSITE, POSITIVE OR NEGATIVE MOMENT REGIONS: 1.25 DC + 1.25 DW + 1.25 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 + 0.4 WS + 1.0 WL
- SPECIAL STEEL CONSTRUCTION LIMIT STATE: 1.4 DC + 1.4 CONSTRUCTION LOADS (INCLUDING DYNAMIC EFFECTS IF APPLICABLE)

- IN THE ABOVE-LISTED LIMIT STATES, THE STRENGTH I, CONSTRUCTION CONDITION, LIMIT STATE 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 LIMIT STATES, THE STRENGTH III, CONSTRUCTION CONDITION, LIMIT STATE 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 LIMIT STATES, FOR CONSTRUCTION CONDITION LIMIT STATE CHECKS, DW SHOULD ONLY INCLUDE ANY APPLICABLE UTILITY LOADS, BUT NOT FUTURE WEARING SURFACE LOADING.

- ONCE THE STABILITY BRACING FORCES HAVE BEEN CALCULATED USING THESE APPROPRIATELY FACTORED ULTIMATE MOMENT (M_f) VALUES, THEY SHOULD BE MULTIPLIED BY A 1.0 LOAD FACTOR FOR COMBINATION WITH OTHER FORCE EFFECTS IN THE APPROPRIATE LIMIT STATES 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_S < 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_S > 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 DIAPRAGMS 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
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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 NOV. 21, 2014

Thomas P. Maciore
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RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

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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 ($I_s < 0.30$) 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 ($I_s > 0.30$) 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 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 LIMIT STATE AS DEFINED IN THE AASHTO LRFD. FOR OTHER BRIDGES, DESIGN DIAPHRAGMS FOR THE FATIGUE II LIMIT STATE 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, INCLUDING SECTIONS 6.13.4 AND 6.13.5), 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 LIMIT STATES. INVESTIGATE SLIP OF BOLTED CONNECTIONS UNDER THE SERVICE II LIMIT STATE.

● USE 7/8" DIAMETER ASTM A325 BOLTS WHENEVER POSSIBLE. 1" DIAMETER ASTM 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 A325 BOLTS LARGER THAN 1" DIAMETER, OR THE USE OF ANY SIZE ASTM A490 BOLTS, REQUIRES APPROVAL FROM THE CHIEF BRIDGE ENGINEER.

● DESIGN BOLTED CONNECTIONS ASSUMING A CLASS B CONSTANT SURFACE SLIP RESISTANCE.

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

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

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 WIND FORCE 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 WIND FORCE 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 WORKMANSHIP 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.a 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 DESIGNATION 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 NOV. 21, 2014

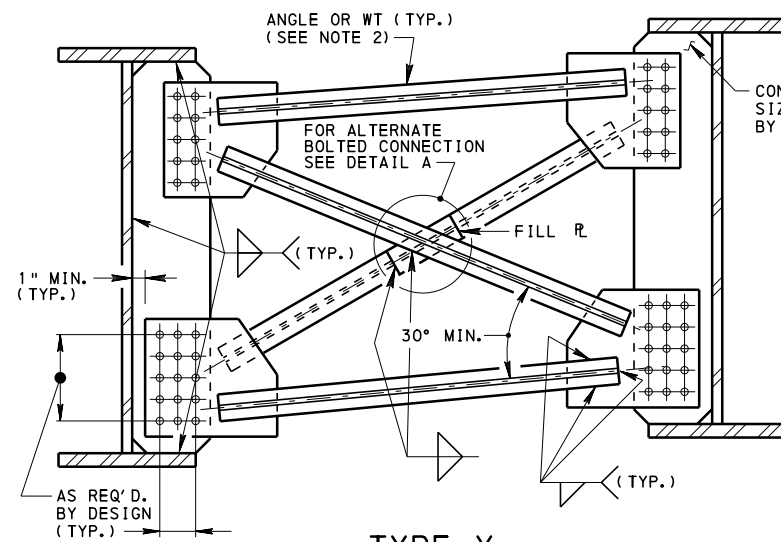
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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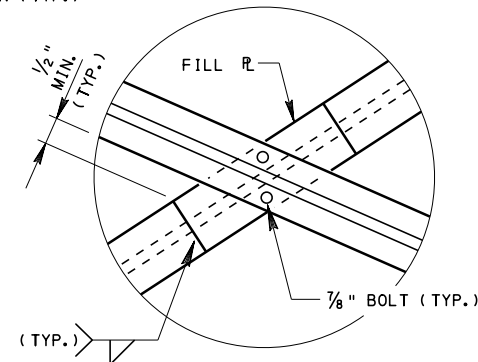
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SHEET 3 OF 5

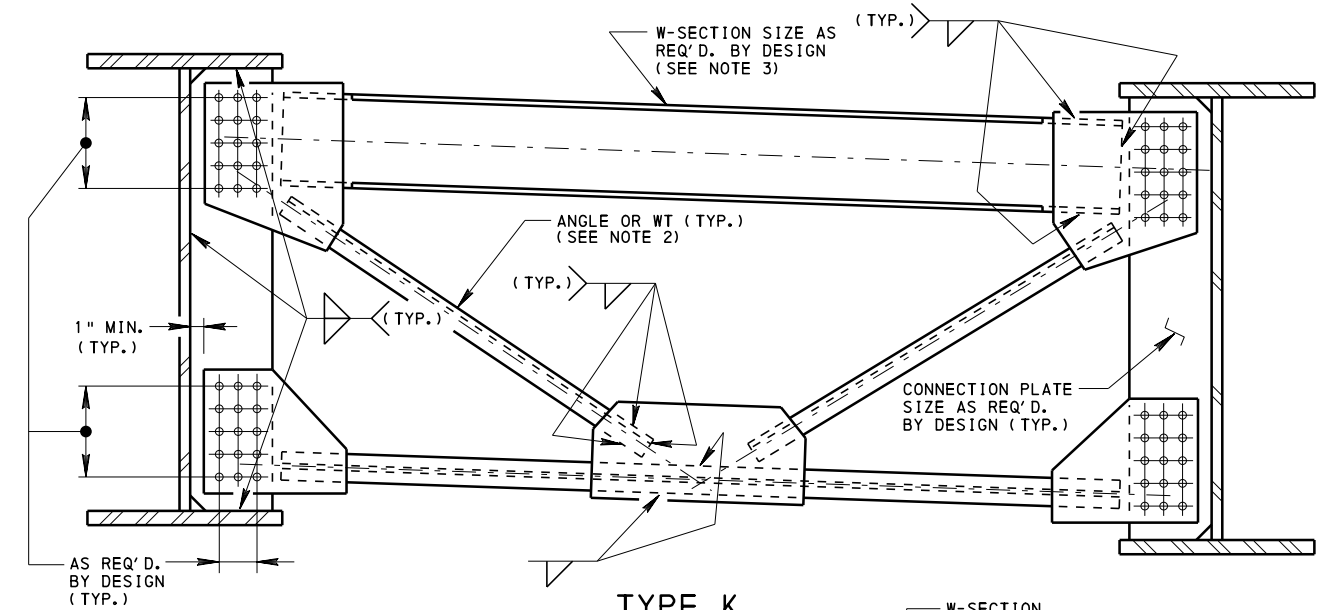
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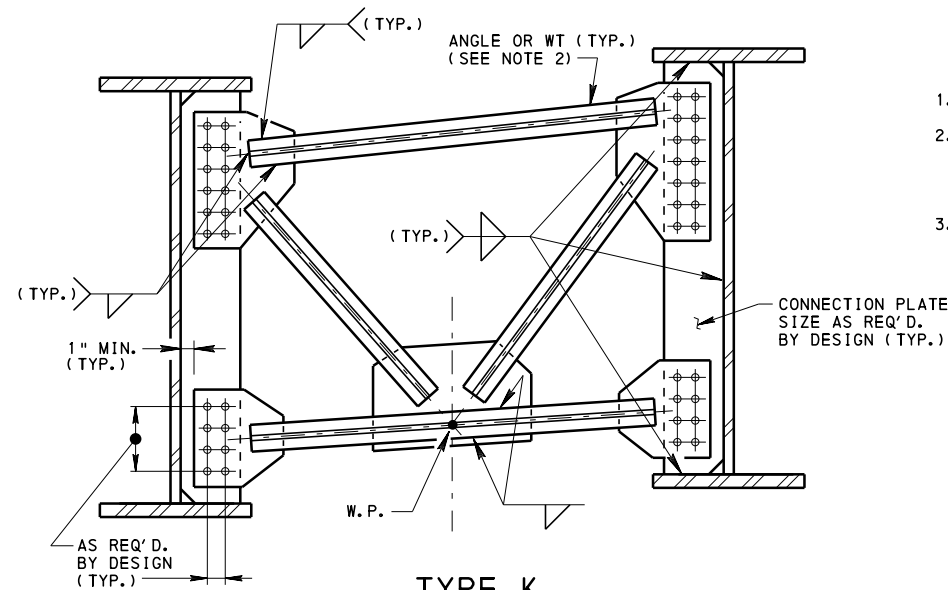
TYPE X



DETAIL A



TYPE K

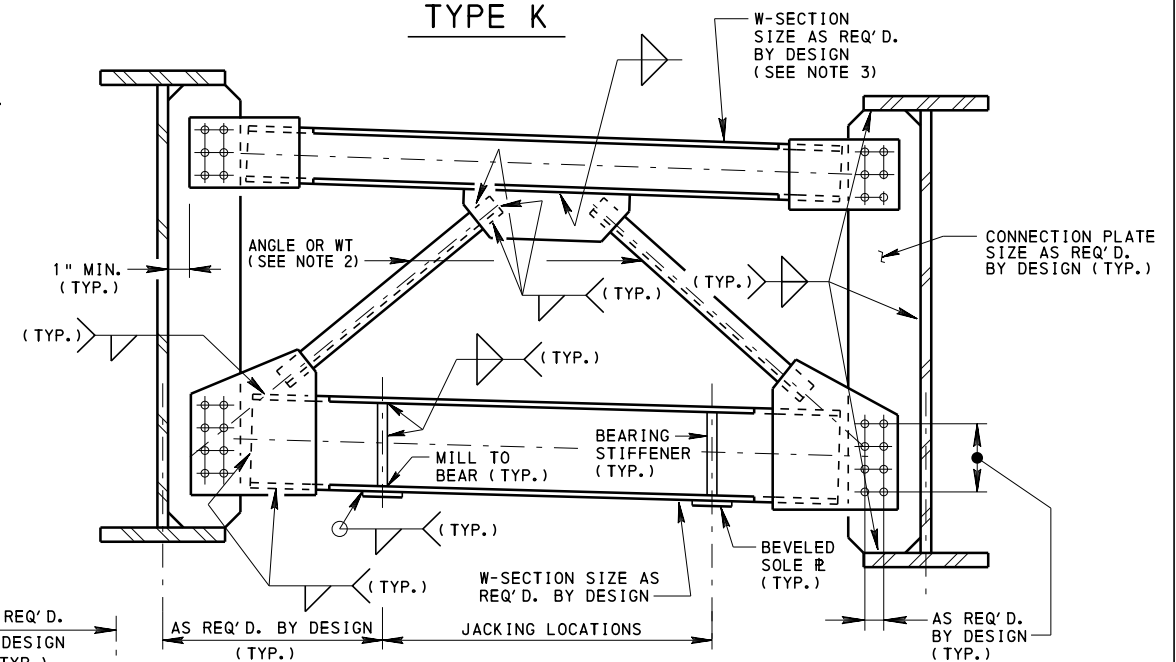


TYPE K

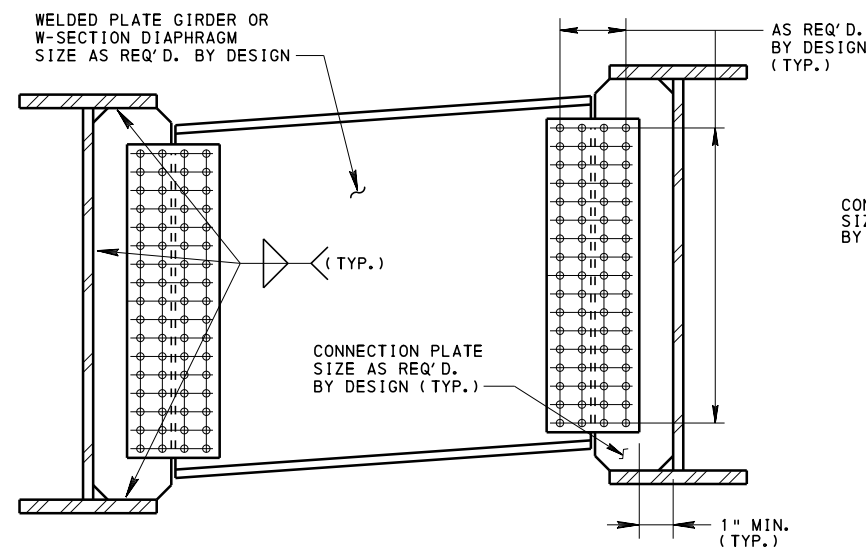
NOTES:

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 $\frac{3}{4}$ " ϕ 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.

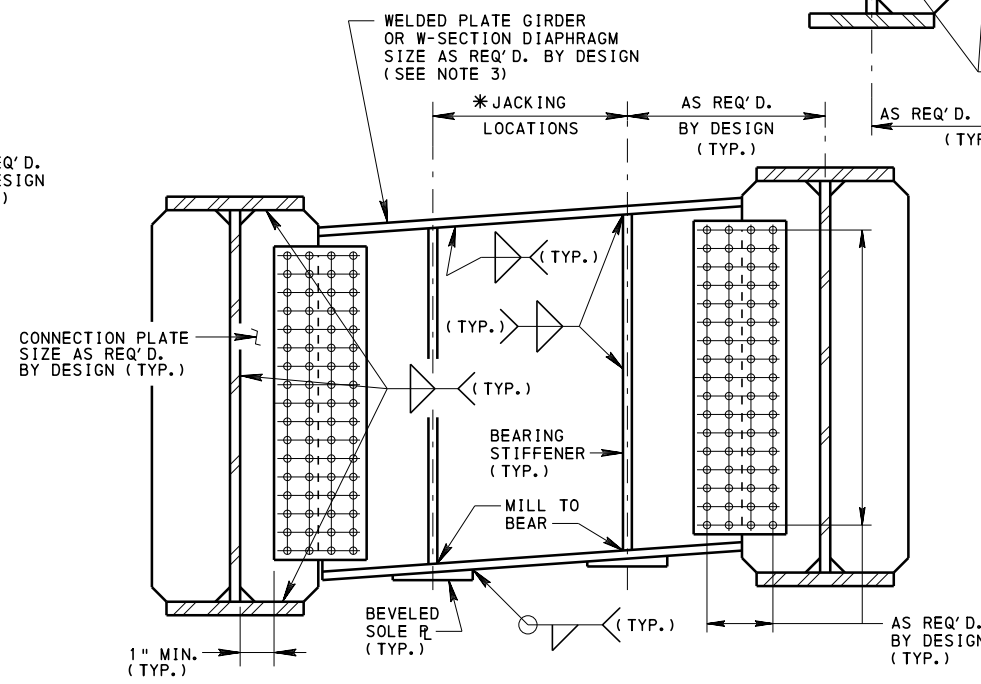


TYPE K INVERTED



SOLID PLATE

INTERMEDIATE DIAPHRAGMS



SOLID PLATE

END DIAPHRAGMS

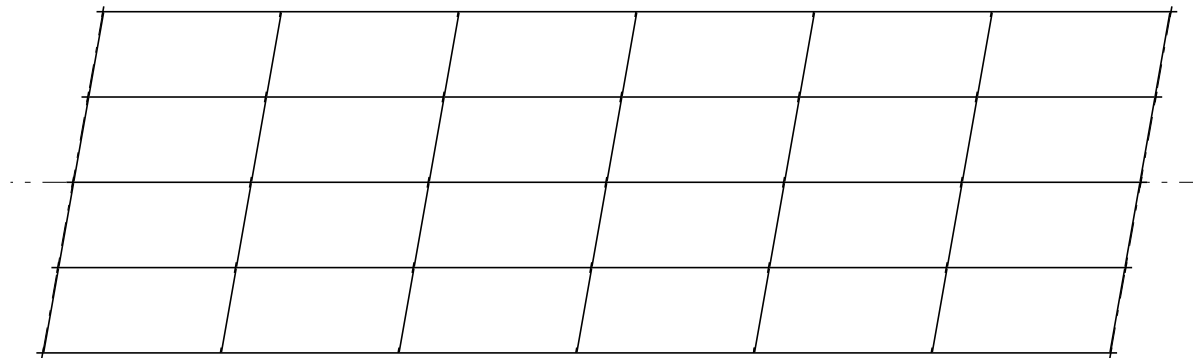
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STANDARD
CROSS FRAME AND SOLID PLATE
DIAPHRAGMS FOR STEEL BEAM/GIRDER
BRIDGES DESIGNED
WITH REFINED METHODS OF ANALYSIS

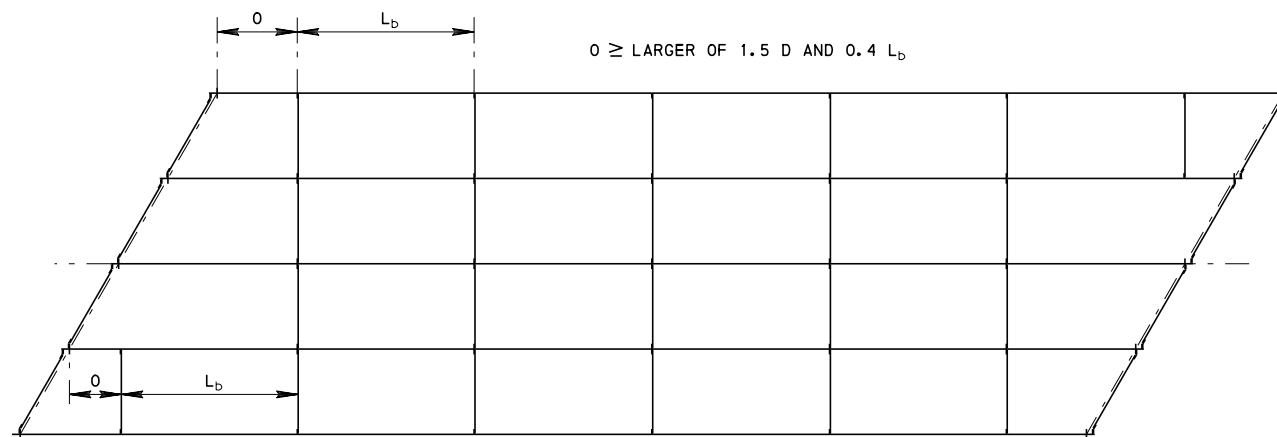
RECOMMENDED NOV. 21, 2014
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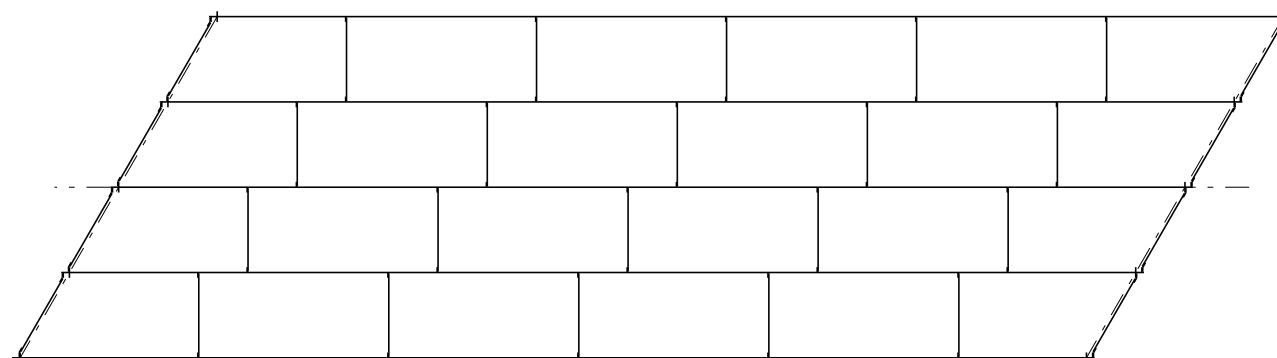
SHEET 4 OF 5
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SKewed SUPPORTS WITH CONTIGUOUS CROSS-FRAME LINES
PARALLEL TO THE SKEW (SKEW $\geq 70^\circ$)



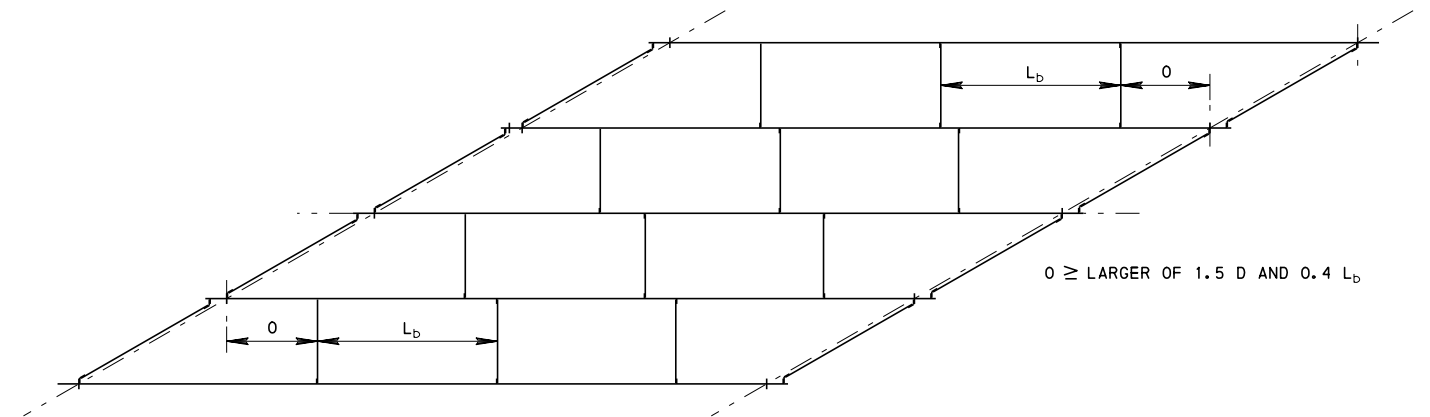
CONTIGUOUS CROSS-FRAME LINES (WITHIN THE SPAN)
NORMAL TO THE GIRDER TANGENTS (SKEW $< 70^\circ$)



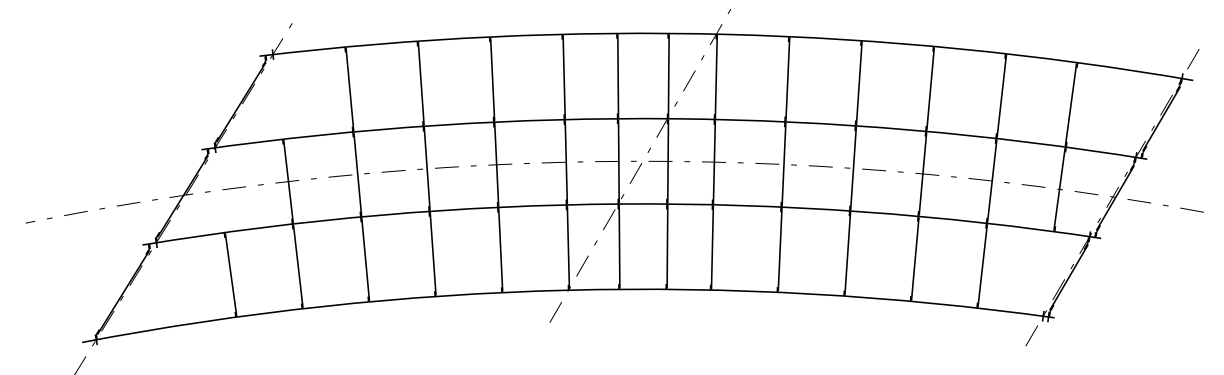
DISCONTINUOUS (STAGGERED) CROSS-FRAME LINES ALONG THE
ENTIRE SPAN NORMAL TO THE GIRDER TANGENTS (SKEW $< 70^\circ$)

NOTE:

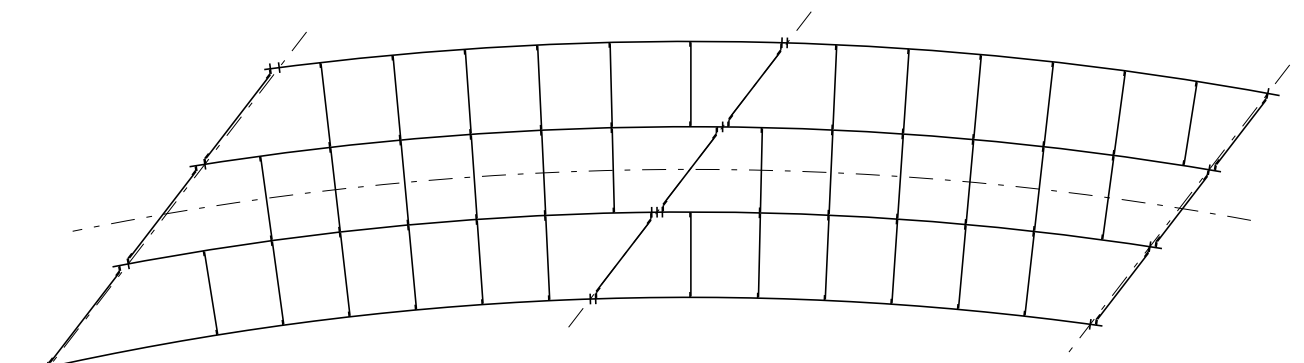
THESE FRAMING PLANS ARE CONCEPTUAL ONLY AND ARE PROVIDED ONLY TO ILLUSTRATE
POTENTIAL FRAMING ARRANGEMENTS FOR VARIOUS CURVED AND/OR SKEWED BRIDGE GEOMETRIES.
DESIGNERS SHALL ESTABLISH A STRUCTURE SPECIFIC FRAMING PLAN, CONSIDERING ECONOMY
OF FABRICATION AND CONSTRUCTION AS WELL AS CONTROL OF FORCE EFFECTS.



SEVERELY SKEWED SUPPORTS WITH STAGGERED CROSS-FRAME LINES



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



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.

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**STANDARD
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BRIDGES DESIGNED
WITH REFINED METHODS OF ANALYSIS**

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SHEET 5 OF 5
BD-619M

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.)

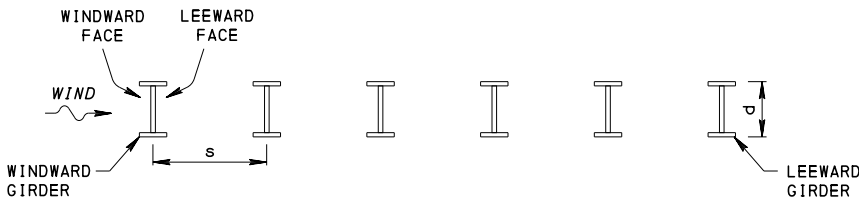
1. PROVIDE LATERAL BRACING FOR BRIDGES WITH SPANS IN EXCESS OF 300 FT. TO AID IN CONSTRUCTION OF THE BRIDGE. DESIGN BRACING FOR THE SPECIFIED WIND LOADS.
2. EVALUATE THE NEED FOR LATERAL BRACING FOR SPANS IN EXCESS OF 200 FT. BASED ON LATERAL DEFLECTION.
3. GIRDERS SHALL BE DESIGNED SO THAT NO LATERAL 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 - $1.25 \times (DC) + 1.5 \times (CDL) + 1.5 \times (CLL)$
STRENGTH III - $1.25 \times (DC) + 1.25 \times (CDL) + 1.0 \times (CW)$
STRENGTH IV - $1.4 \times (DC) + 1.4 \times (CDL) + 1.4 \times (CLL)$
SERVICE - $1.0 \times (DC) + 1.0 \times (CDL) + 1.0 \times (CLL) + 1.0 \times (CW)$
UPLIFT (MIN.) - $0.9 \times (DC) + 0.9 \times (CDL) + 1.0 \times (CW)$
UPLIFT (MAX.) - $1.35 \times (DC) + 1.35 \times (CDL) + 1.0 \times (CW)$
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. ONLY THE FASCIA GIRDER WILL BE LOADED.

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.

MINIMUM DESIGN WIND PRESSURE(PSF)
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 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.

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

- 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 SUPERSTUCTURE 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**

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STANDARD
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA
AND DETAILS

BC-732M	PERMANENT METAL DECK FORMS
BC-753M	STEEL GIRDER DETAILS
BC-754M	STEEL DIAPHRAGMS
REFERENCE DRAWINGS	

RECOMMENDED NOV. 21, 2014
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RECOMMENDED NOV. 21, 2014
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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.

COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD

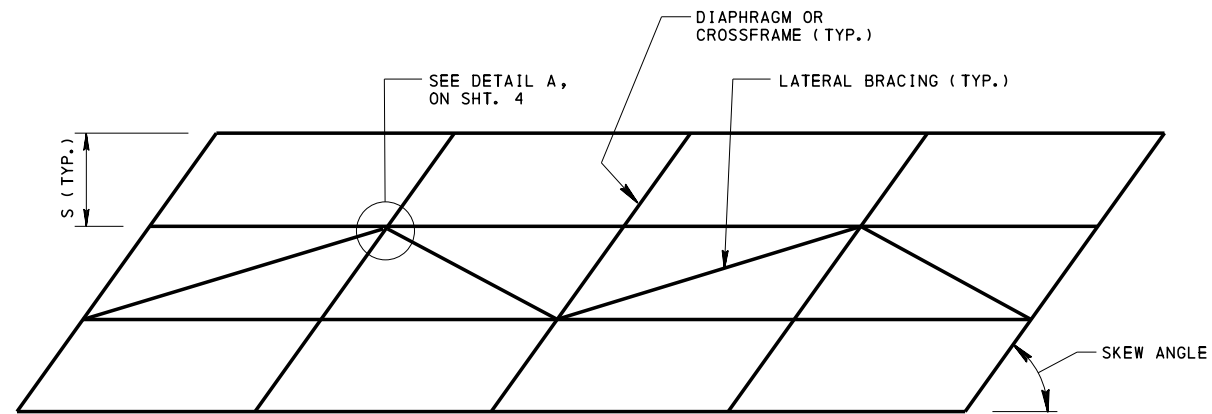
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA
AND DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 2 OF 6

BD-620M

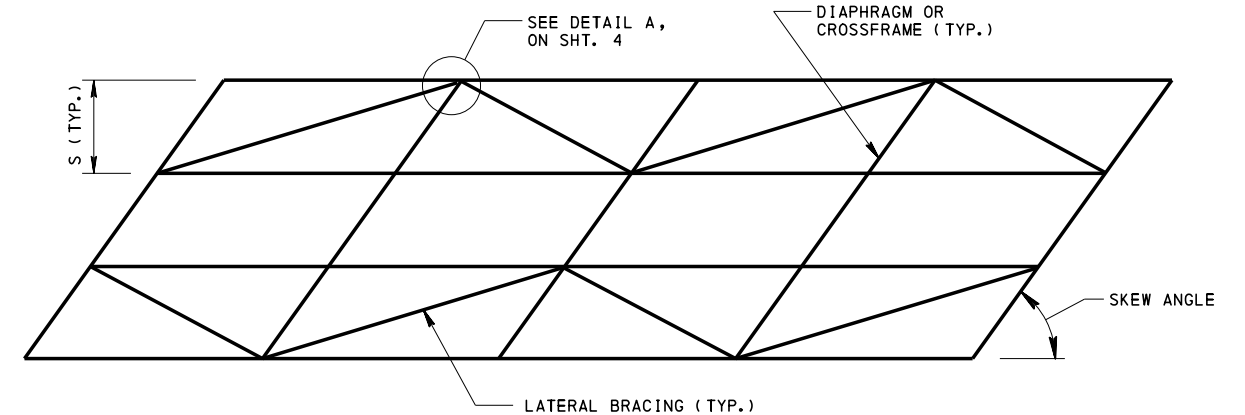


PLAN

**LATERAL BRACING
(PREFERRED)**

FOR ODD NUMBER OF GIRDERS, OFFSET BRACING ONE BAY.

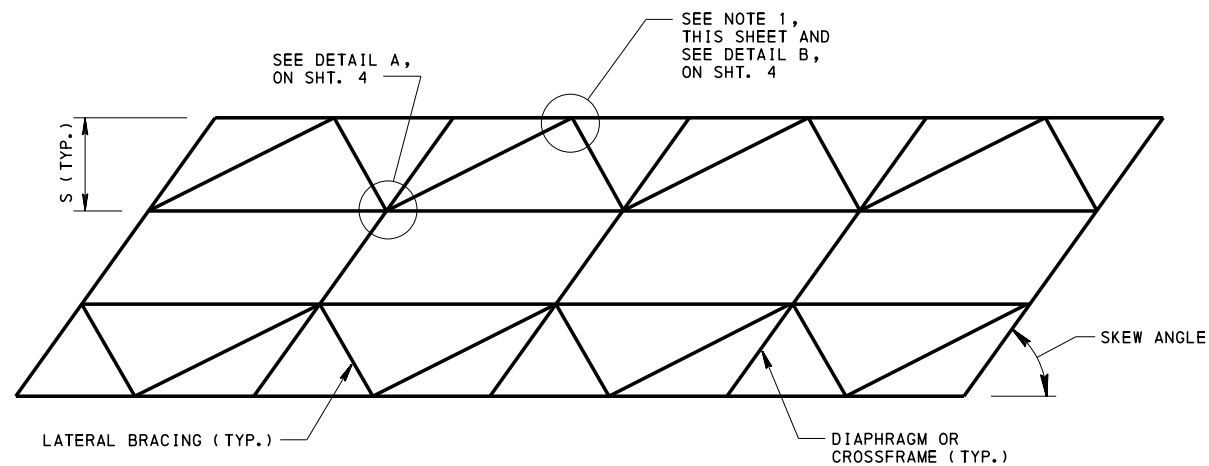
TYPICAL SKEWED STRUCTURE WHEN DESIGN IS NOT
CONTROLLED BY WIND LOADING OF FLANGE.



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 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.

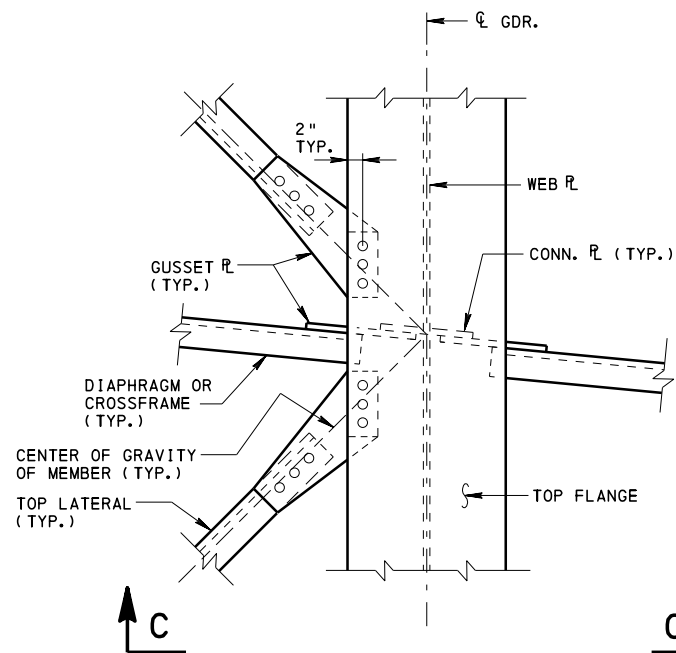
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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STANDARD
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(STRAIGHT GIRDERS)

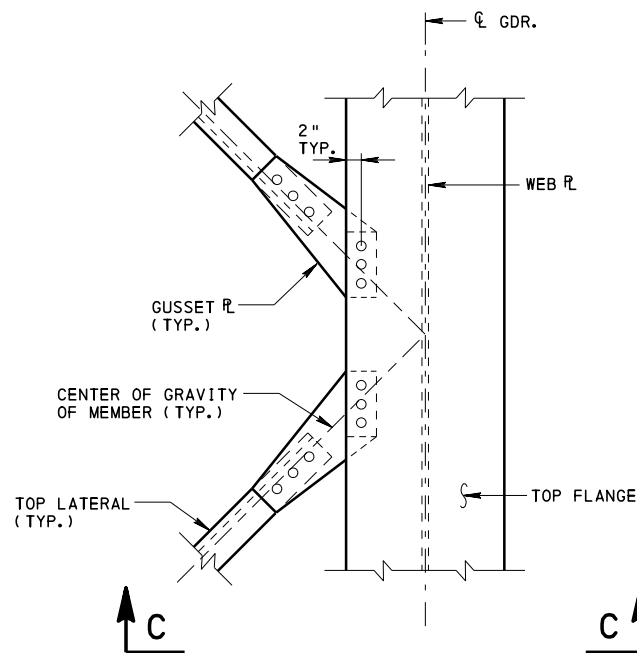
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
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RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

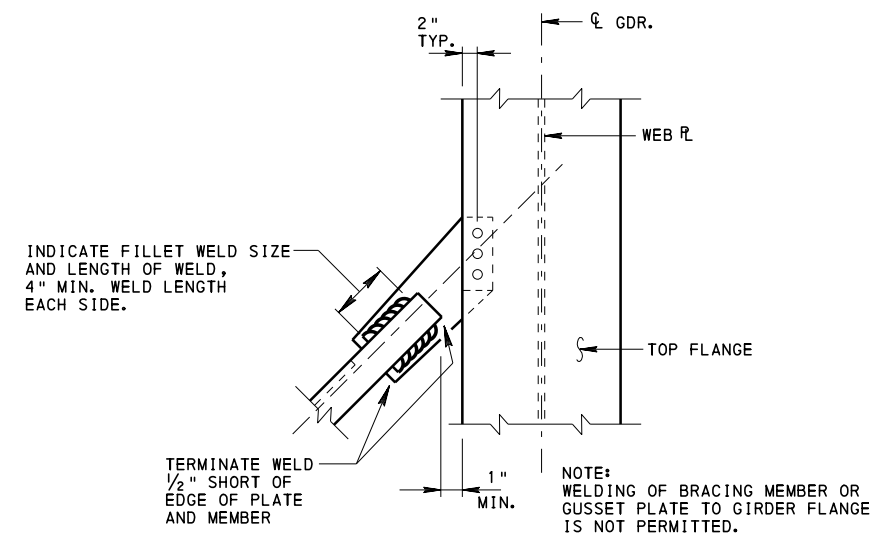
SHEET 3 OF 6
BD-620M



PLAN
DETAIL A
TYPICAL AT CROSSFRAME



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



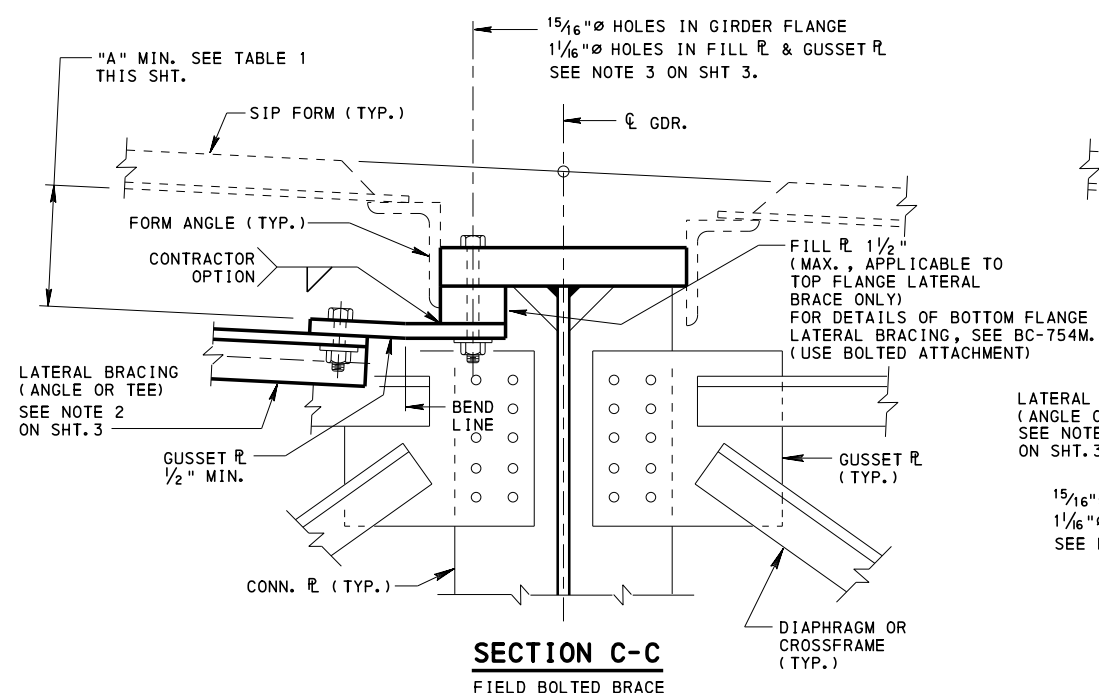
PLAN
VIEW D
SHOP WELDED OPTION
(FOR BRACING MEMBER TO GUSSET)

TOP FLANGE LATERAL BRACING CONNECTIONS

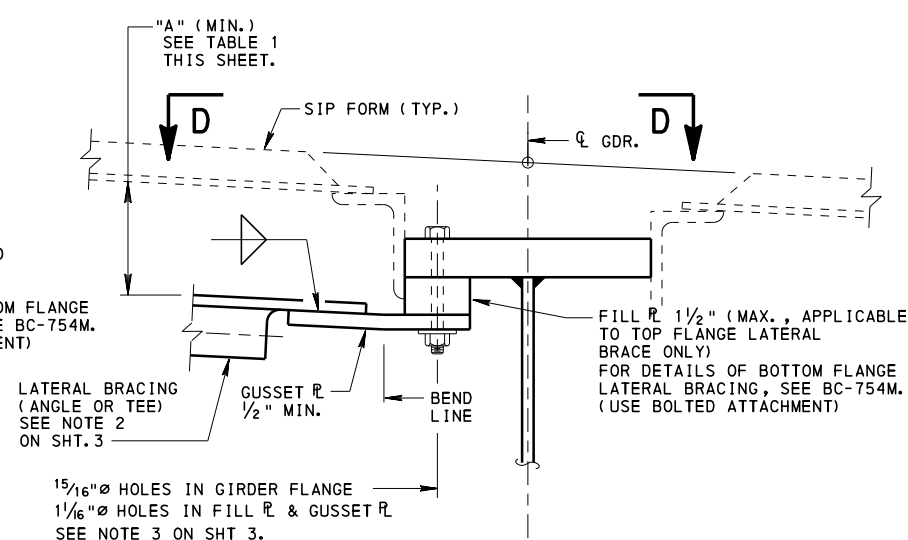
NOTE: PREFERRED ARRANGEMENT IS TO ATTACH LATERAL BRACING TO THE BOTTOM FLANGE PER BC-754M. THE TOP FLANGE ATTACHMENT DETAILS ARE SHOWN FOR THE INFREQUENT SITUATIONS THAT NECESSITATE ATTACHMENT TO THE TOP FLANGE.

TABLE 1

CLEAR DISTANCE BETWEEN GIRDER FLANGES	DIM. "A"
9' - 0"	4 1/2"
8' - 0" TO 9' - 0"	3"
6' - 0" TO 8' - 0"	2 1/2"
UNDER 6' - 0"	2"



SECTION C-C
FIELD BOLTED BRACE



ALTERNATE SECTION C-C
SHOP WELDED, FIELD BOLTED BRACE

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DEPARTMENT OF TRANSPORTATION
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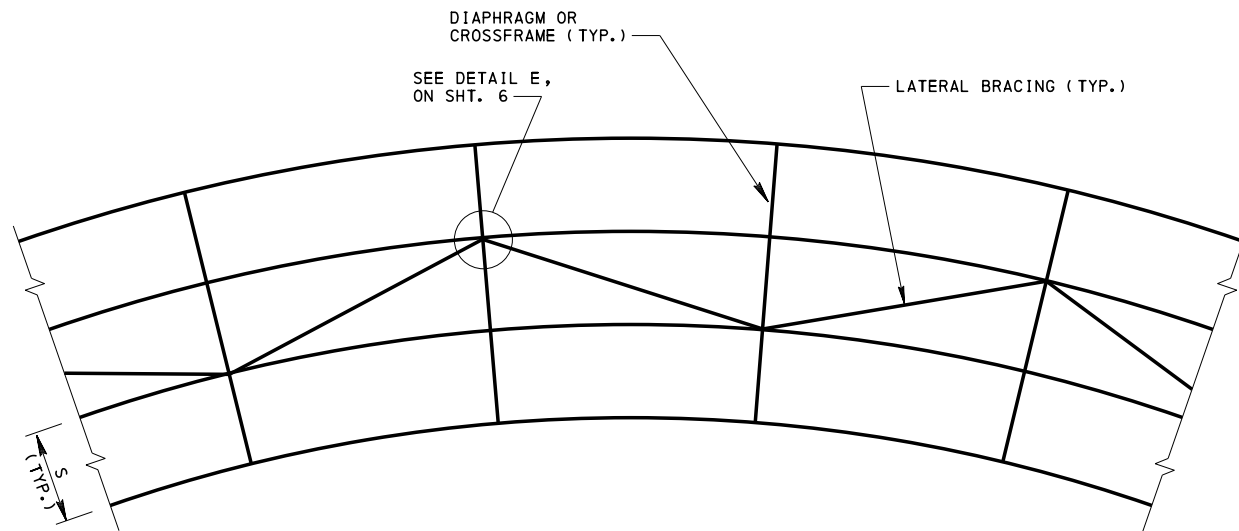
STANDARD
STEEL GIRDER BRIDGES
LATERAL BRACING CRITERIA AND DETAILS
(STRAIGHT GIRDERS)

RECOMMENDED NOV. 21, 2014
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RECOMMENDED NOV. 21, 2014
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ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 4 OF 6

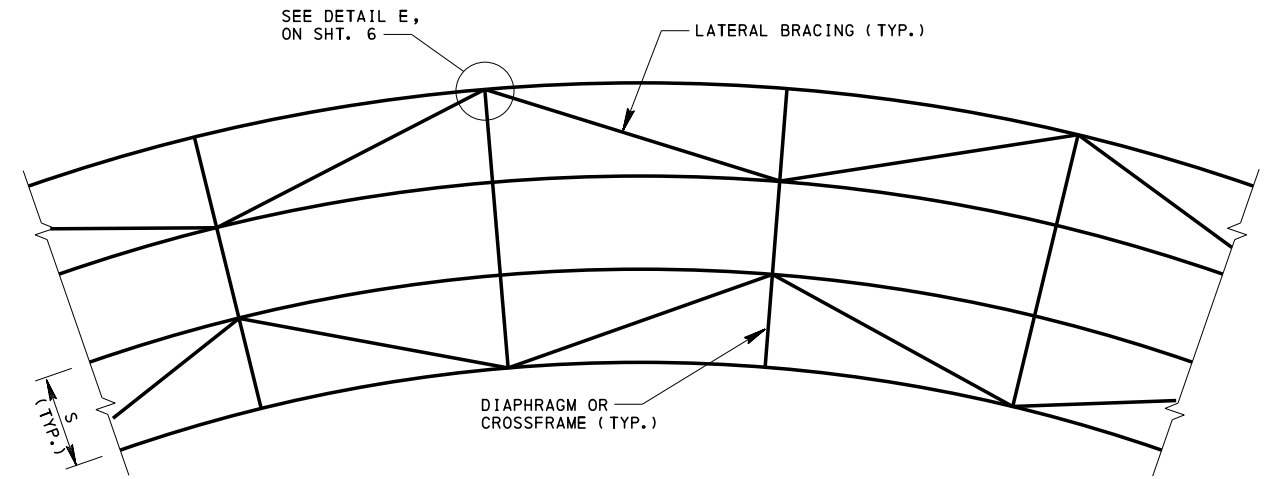
BD-620M



PLAN

LATERAL BRACING (PREFERRED)

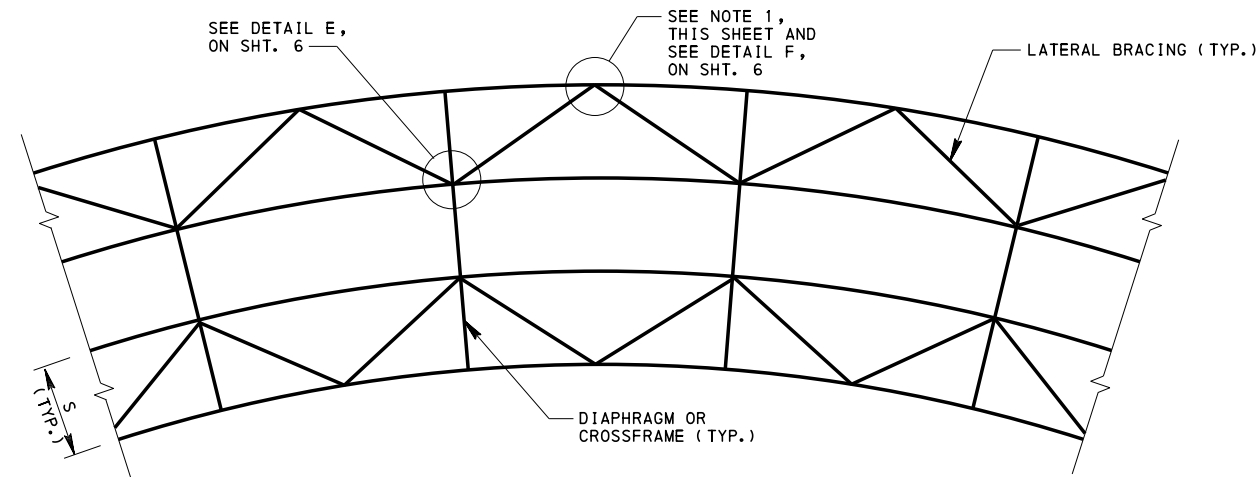
TYPICAL CURVED STRUCTURE
FOR ODD NUMBER OF GIRDERS, OFFSET BRACING ONE BAY.



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 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.

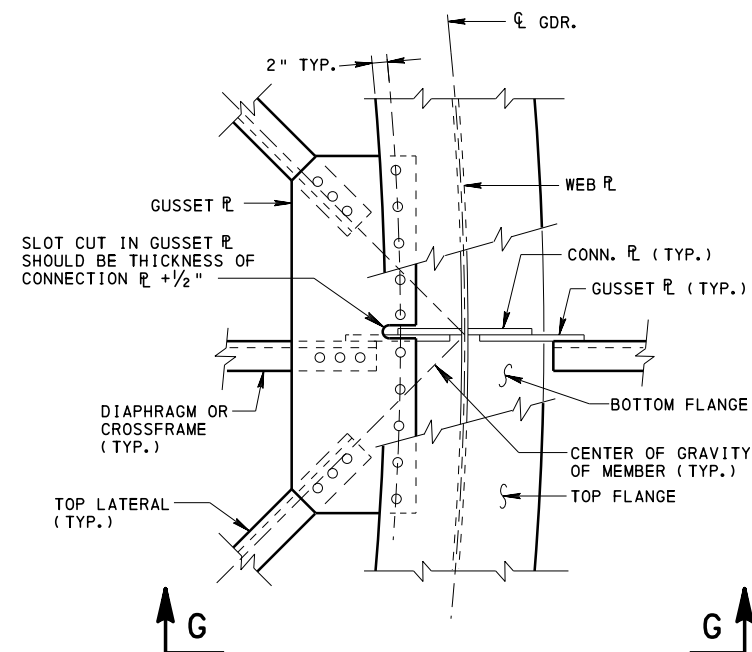
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

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

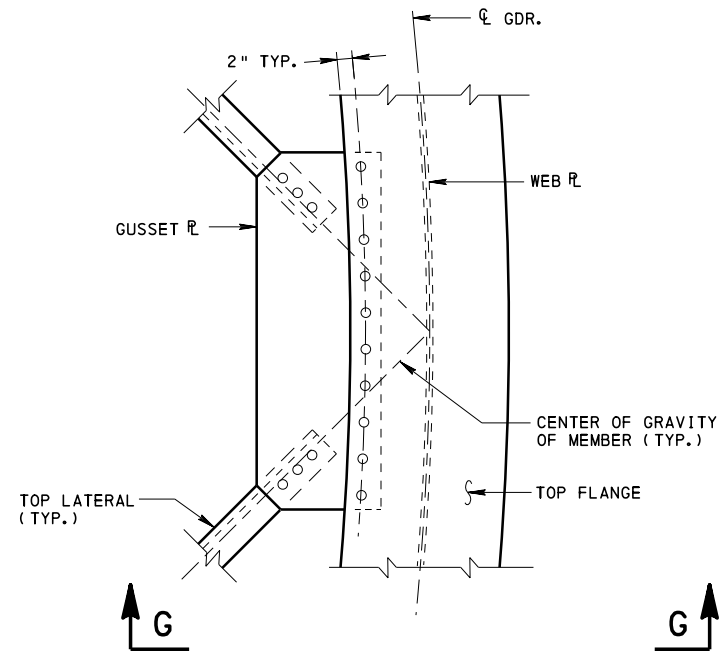
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
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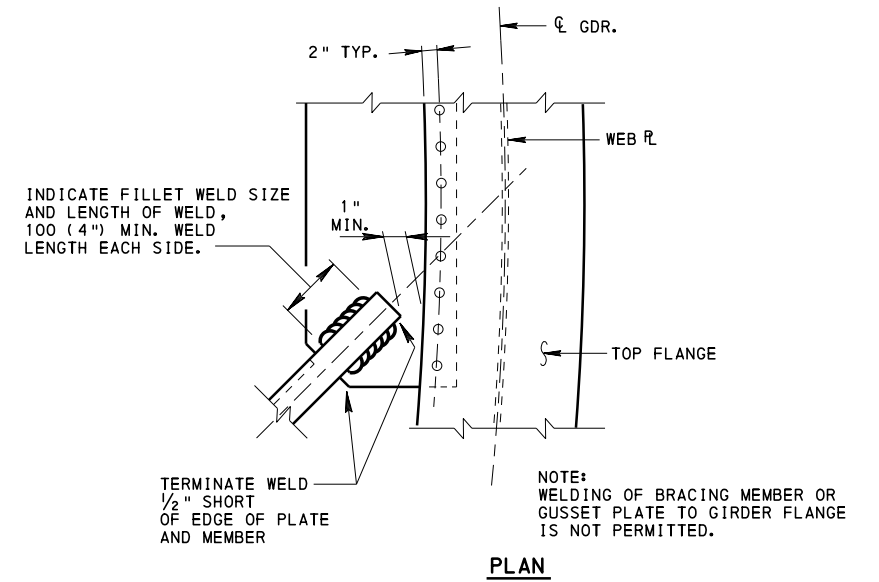
SHEET 5 OF 6
BD-620M



PLAN
DETAIL E
TYPICAL AT CROSSFRAME



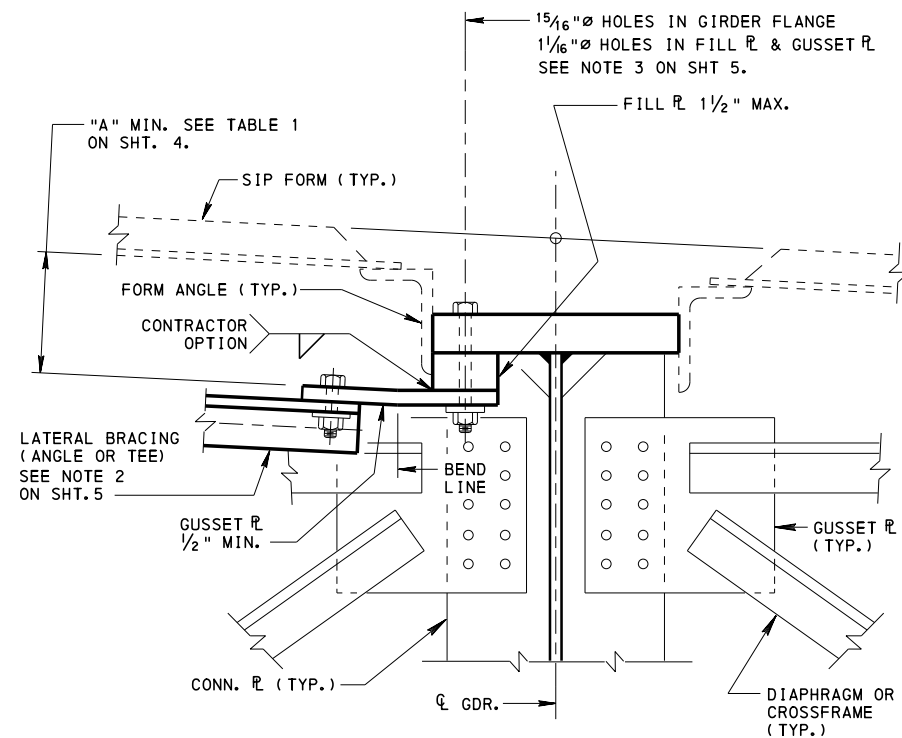
PLAN
DETAIL F
INTERMEDIATE BRACING POINT
(SEE NOTE 1, ON SHT. 5)



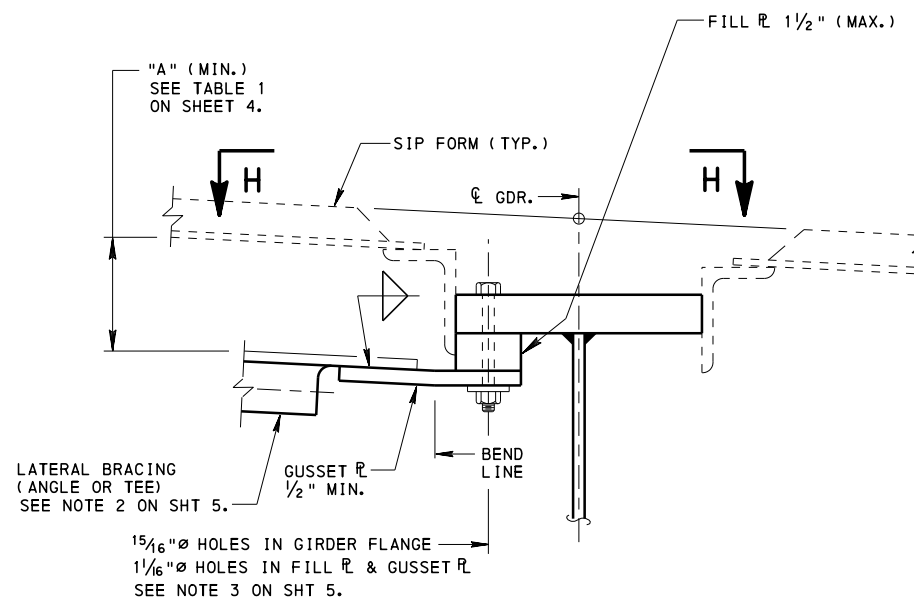
PLAN
VIEW H
SHOP WELDED OPTION
(FOR BRACING MEMBER TO GUSSET)

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
BUREAU OF PROJECT DELIVERY

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

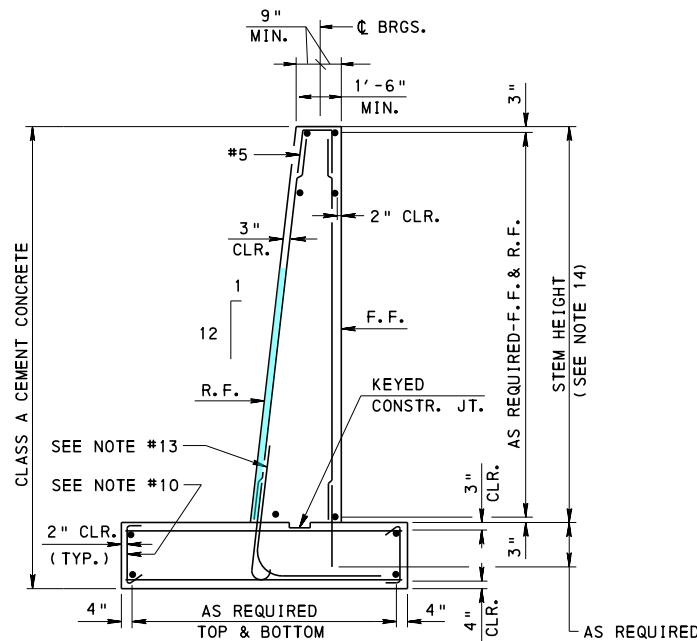
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
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RECOMMENDED NOV. 21, 2014
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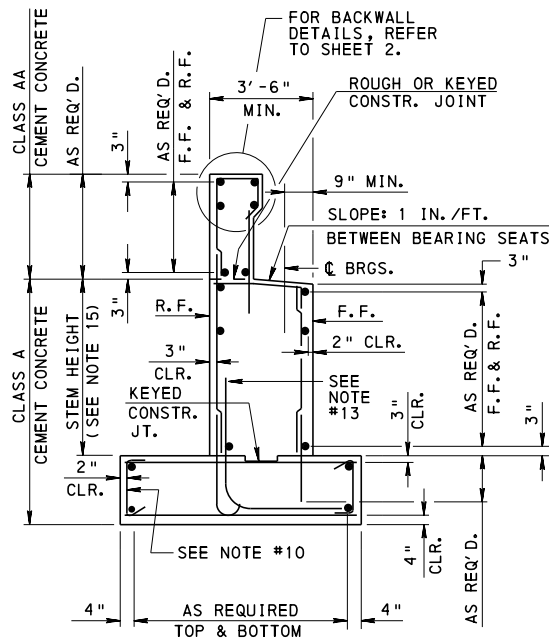
SHEET 6 OF 6
BD-620M

CHANGE 1

CHANGE 3

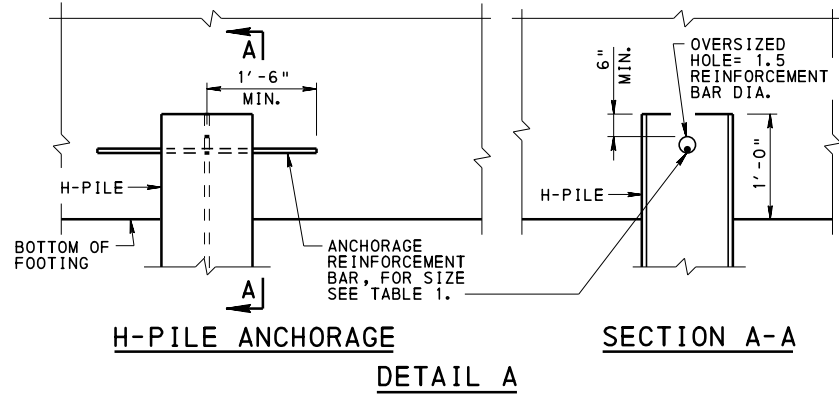


TYPICAL SECTION WITHOUT BACKWALL
(WITH OR WITHOUT BATTER)



TYPE I

TYPICAL SECTION WITH BACKWALL

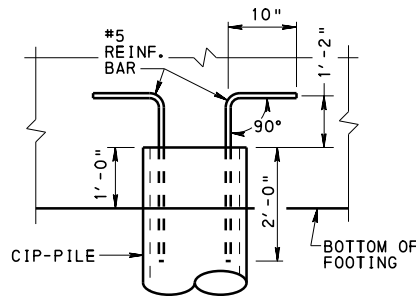


H-PILE ANCHORAGE

DETAIL A

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

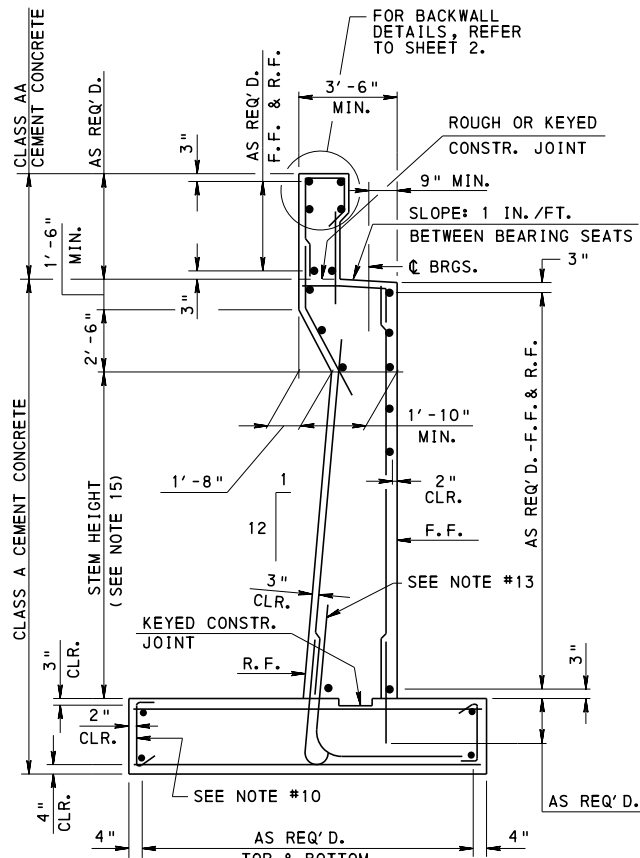


CIP-PILE ANCHORAGE

DETAIL B

PILE ANCHORAGE DETAILS

(REQUIRED FOR SEISMIC ZONE 2 ONLY)



TYPE II

NOTES:

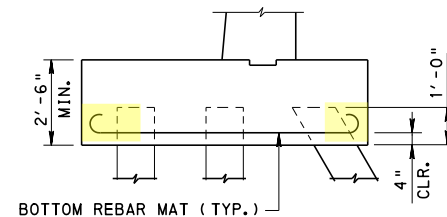
1. PROVIDE GRADE 60 DEFORMED REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615, ASTM A996, OR A706. DO NOT WELD REINFORCEMENT BARS. DO NOT USE RAIL STEEL A996 WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
2. MATERIALS AND WORKMANSHIP ARE TO BE IN ACCORDANCE WITH SPECIFICATIONS 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 2 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 = 120lb/ft³
- DENSITY OF CONCRETE = 150lb/ft³
- 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

BD-625M	R.C. ABUT. MISCELLANEOUS DETAILS
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
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE ABUTMENTS
TYPICAL SECTIONS AND DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Stroman
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 1 OF 3
BD-621M

**ROUGH OR KEYS
CONSTR.**

CLASS AA CEMENT CONCRETE

AS REQ'D.

BACKWALL

3' - 9" MIN.

1' - 3" MIN.

2' - 6" MIN.

END OF BEAM

9" MIN.

SLOPE: 1 IN./FT.

BETWEEN BEARING SEATS

3"

R.F.

F.F.

2" CLR.

SEE NOTE #13

3" CLR.

AS REQ'D.

F.F. & R.F.

3"

CLASS A CEMENT CONCRETE

STEM HEIGHT (SEE NOTE 15)

3"

R.F.

3"

CLR.

KEYED CONSTR. JT.

SEE NOTE #10

4"

AS REQUIRED TOP & BOTTOM

4"

CLR.

AS REQ'D.

TYPE I

CLASS A CEMENT CONCRETE

1' - 6" MIN.

2' - 6"

STEM HEIGHT
(SEE NOTE 15)

3" CLR.

2" CLR.

4" CLR.

1' - 3" MIN. BACKWALL

3' - 9" MIN.

2' - 6" MIN.

9" MIN.

SLOPE: 1 IN./FT. BETWEEN BEARING SEATS

Q BRGS.

2' - 1" MIN.

2" CLR.

F.F.

SEE NOTE #13

3" CLR.

KEYED CONSTR. JOINT

R.F.

SEE NOTE #10

AS REQ'D.

TOP & BOTTOM

TYPE II

STEM HEIGHT LESS THAN 12'-0"

STEM HEIGHT GREATER THAN 12' - 0"

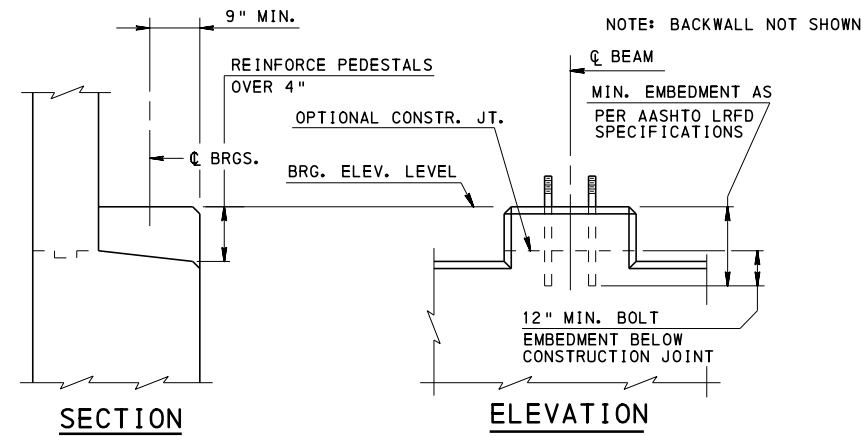
NOTES:

1. REFER TO BD-628M FOR APPROACH SLAB DETAILS.
2. DO NOT USE A CORBEL WHEN THE BEAM DEPTHS ARE GREATER THAN INDICATED.

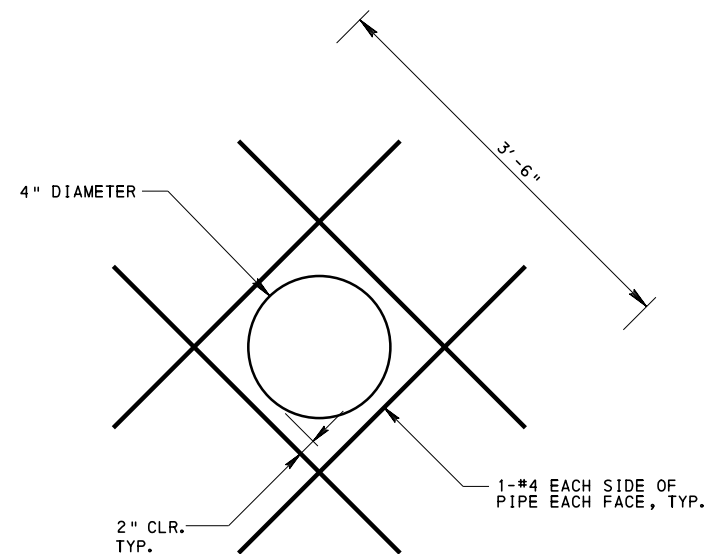


1. FOR NOTES, SEE SHEET 1.

<p align="center">COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY</p>		
<p align="center">STANDARD REINFORCED CONCRETE ABUTMENTS TYPICAL SECTIONS AND DETAILS</p>		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciocco</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brenda S. Thompson</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 2 OF 3 BD-621M



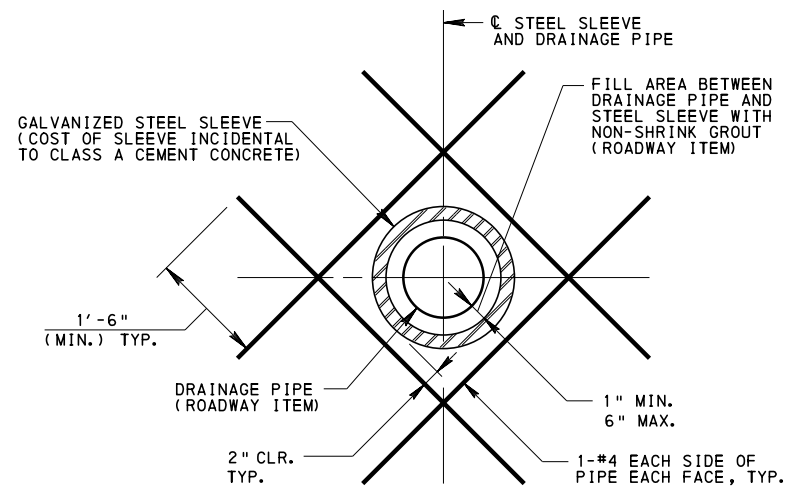
ABUTMENT WITH BACKWALL



WEEP HOLE REINFORCEMENT DETAIL

NOTES:

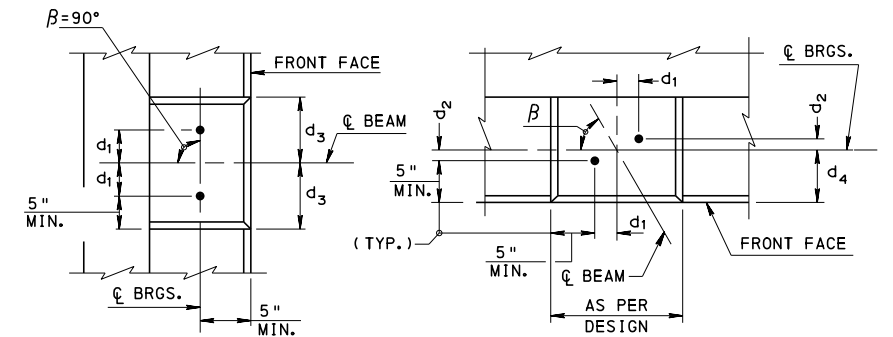
- REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A DIAGONAL FASHION AS SHOWN.
- LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.



DRAINAGE THROUGH WALL STEM

NOTES:

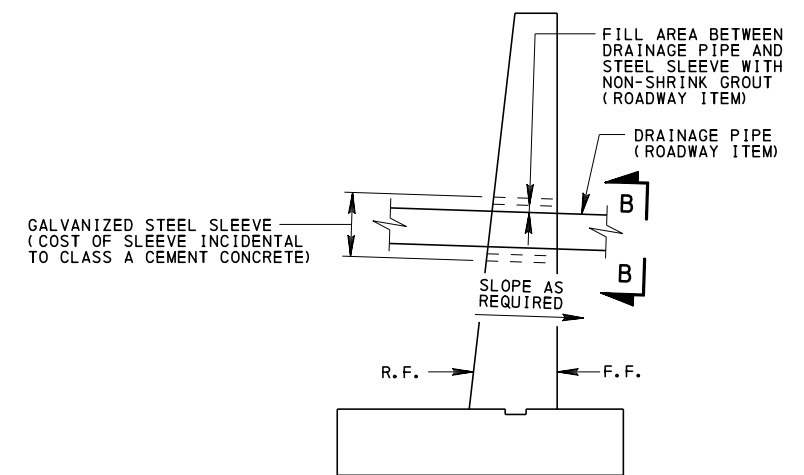
- INDICATE SIZE AND LOCATION OF THE GALVANIZED STEEL SLEEVE AND DRAINAGE PIPE ON THE CONTRACT PLANS.
- INDICATE STEEL SLEEVE INVERT ELEVATION AND SLOPE ON THE CONTRACT PLANS.
- DETERMINE SIZE OF STEEL SLEEVE BASED ON THE OUTSIDE DIMENSION OF THE DRAINAGE PIPE.



ANCHOR BOLT PLAN

INSTRUCTIONS

- SHOW SKEW ANGLE β 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:

- FOR NOTES, SEE SHEET 1.

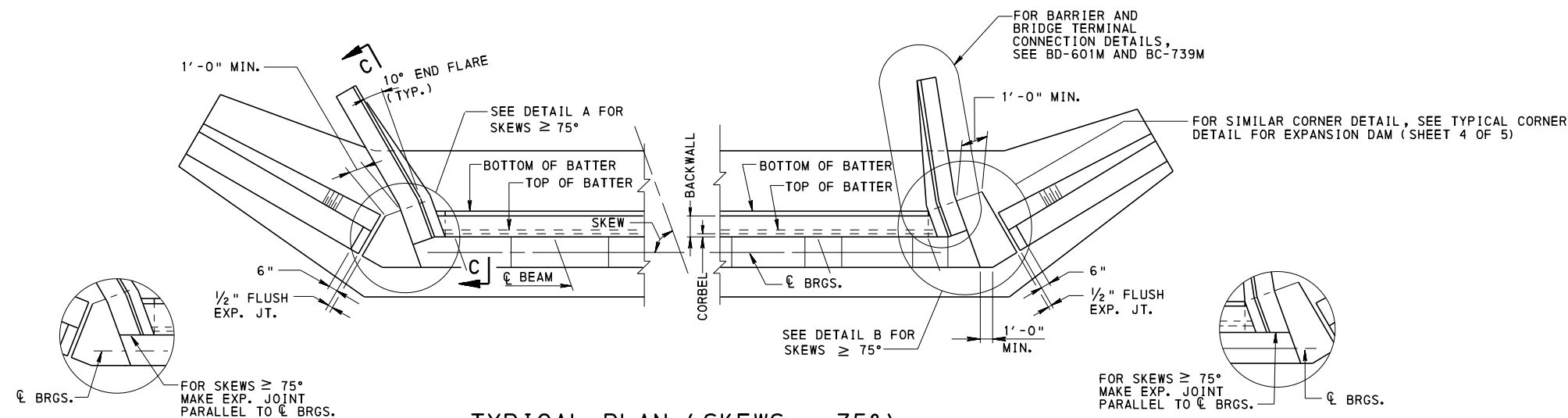
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE ABUTMENTS
ANCHOR BOLT AND DRAINAGE DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

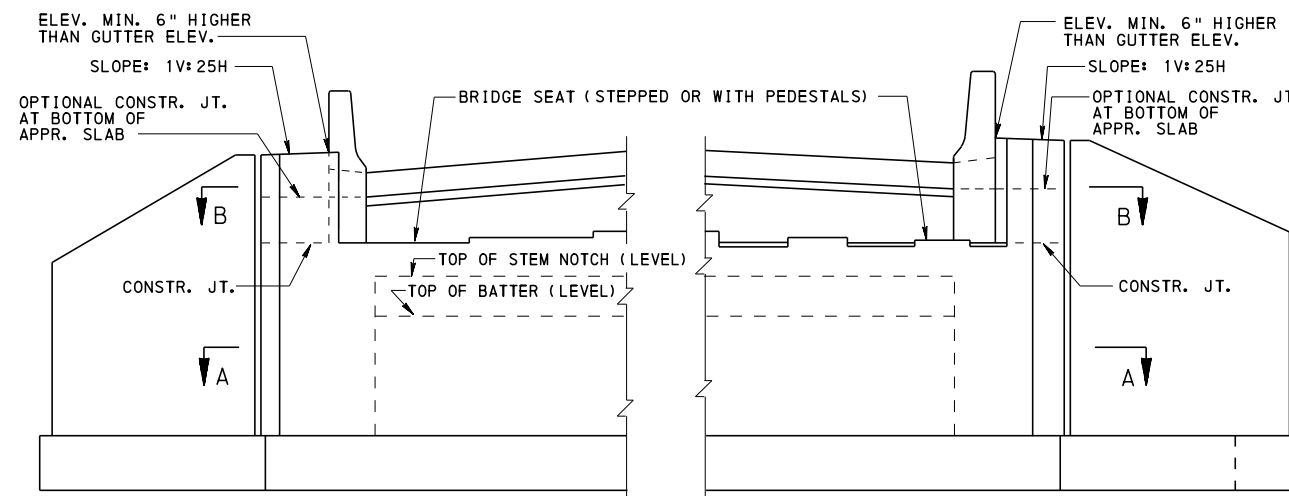
SHEET 3 OF 3
BD-621M



DETAIL A

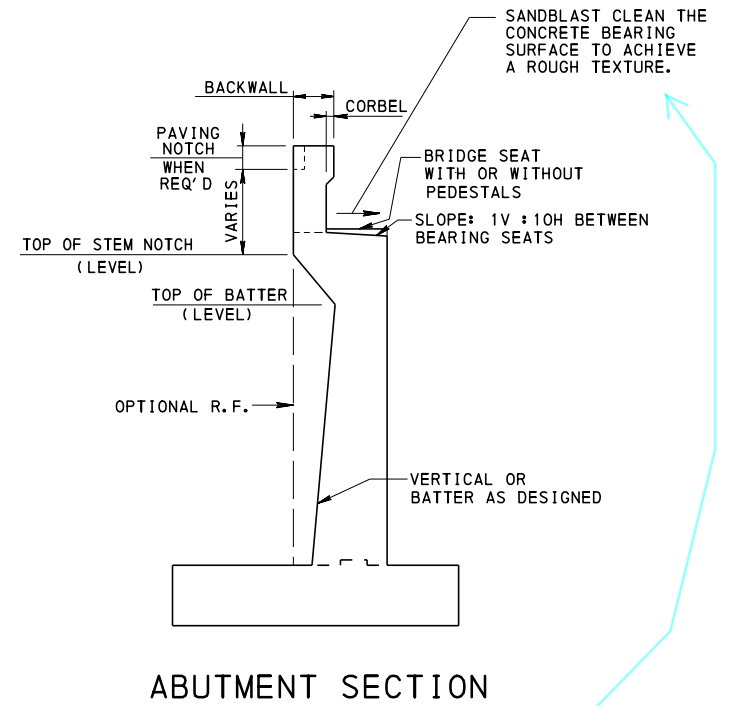
TYPICAL PLAN (SKEWS < 75°)

DETAIL B



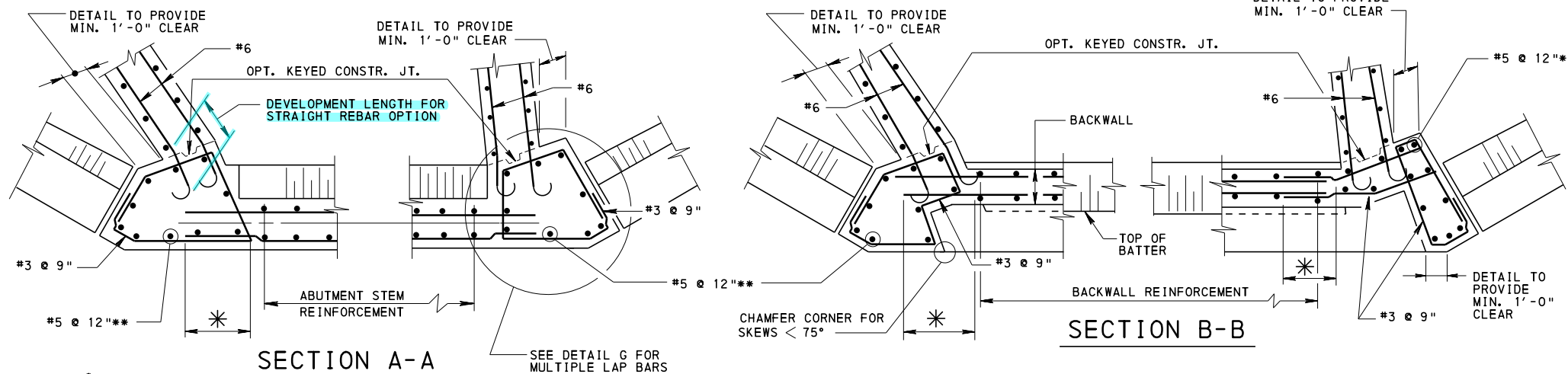
TYPICAL ELEVATION

- GENERAL NOTES:
1. ALL REINFORCEMENT STEEL BARS SHOWN ARE SOFT CONVERTED METRIC SIZES THAT MEET THE REQUIREMENTS OF ASTM A 615M, A 996M OR A 706M.
 2. FOR SECTION C-C, SEE SHEET 2.
 3. HOOKS ON BARS EXTENDING FROM BARRIER TRANSITION INTO THE BACKWALL OR STEM MAY BE TURNED IN ANY DIRECTION.



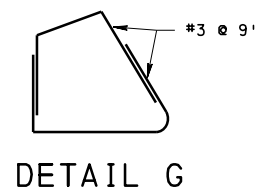
ABUTMENT SECTION

NOTE:
NO LAPS FOR LONGITUDINAL BARS IN SAFETY WING



SECTION A-A

SECTION B-B



DETAIL G

ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. 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-621M	REINFORCED CONCRETE ABUTMENTS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	ABUTMENT DETAILS
BC-739M	BRIDGE BARRIER TO GUIDE RAIL TRANSITION
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

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
R. C. ABUTMENTS WITH BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED NOV. 21, 2014

Thomas P. Maciara
CHIEF BRIDGE ENGINEER

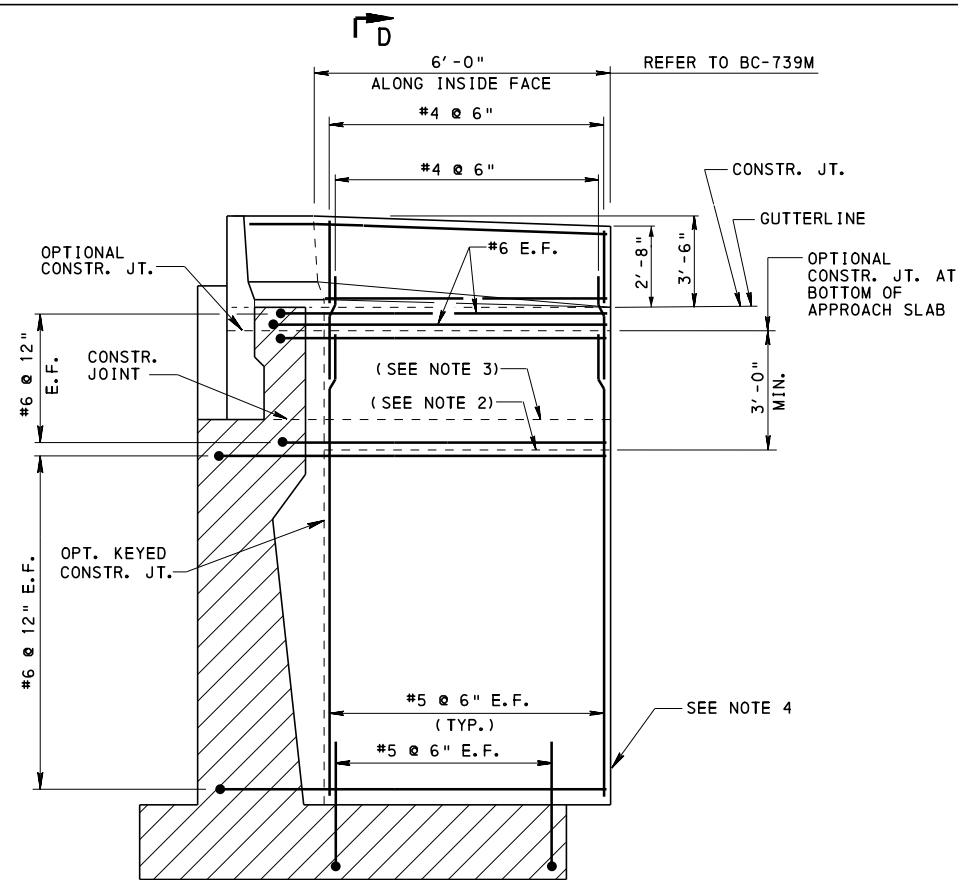
RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

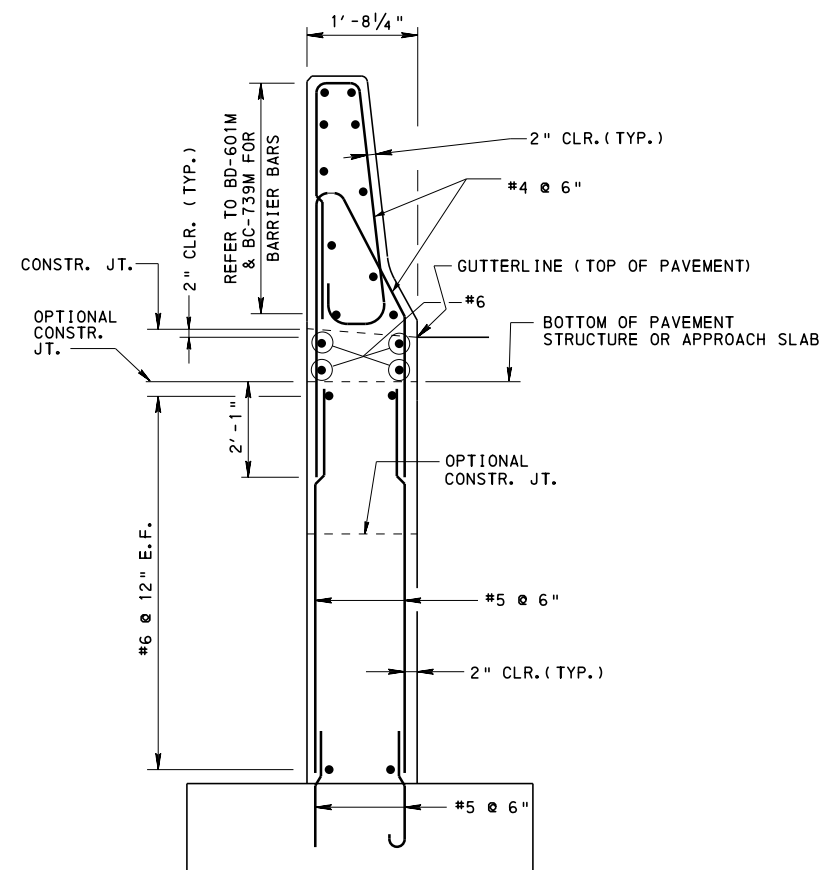
SHEET 1 OF 5

BD-622M

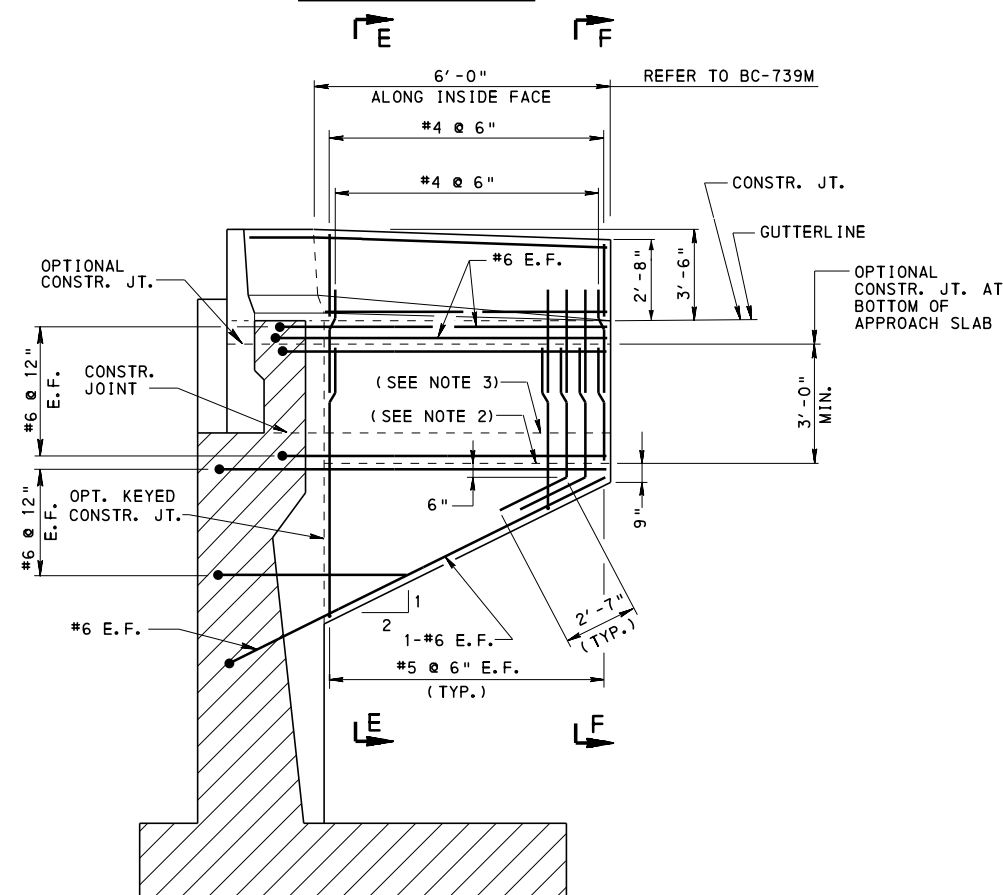
CHANGE 3



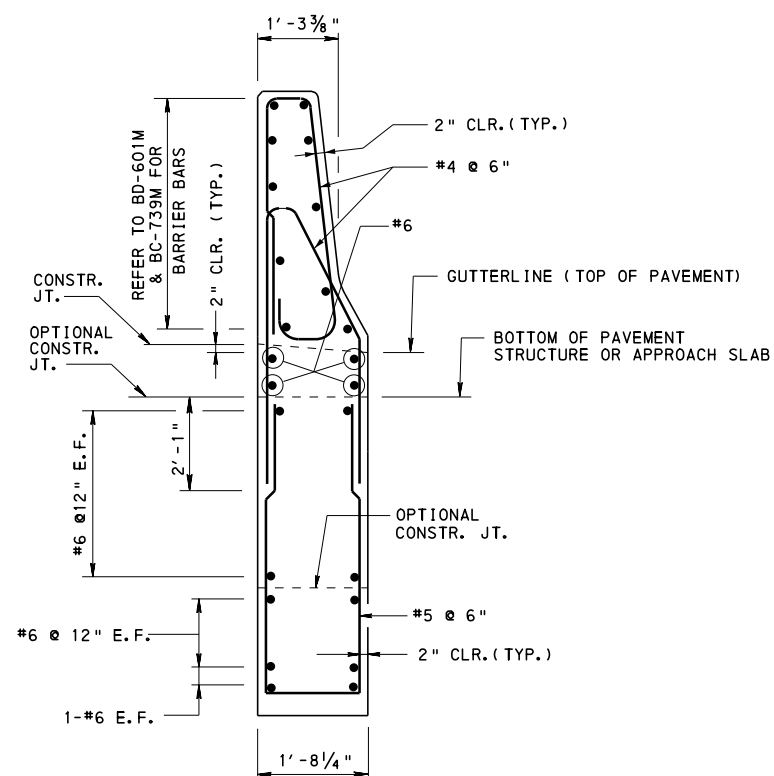
SECTION C-C



SECTION D-D



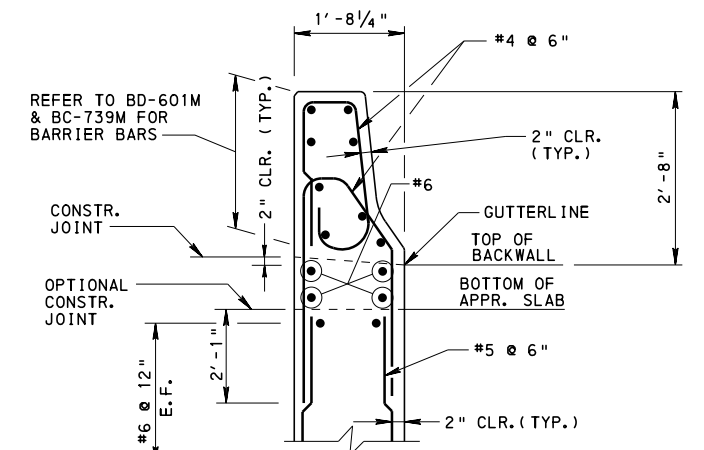
ALTERNATE SECTION C-C



SECTION E-E

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. FOR SECTION F-F, SEE SHEET 3.
6. 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.



ALTERNATE BARRIER REINFORCEMENT SECTION

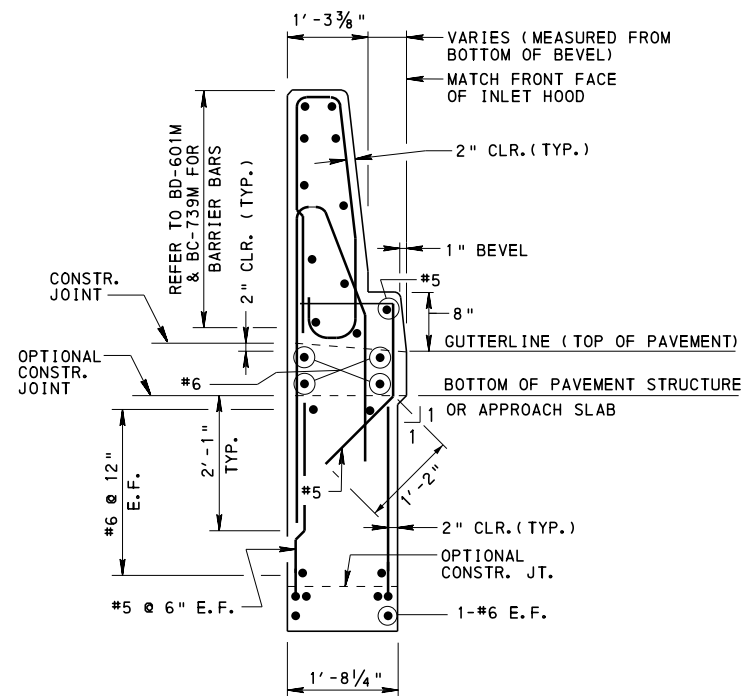
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
R. C. ABUTMENTS WITH BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

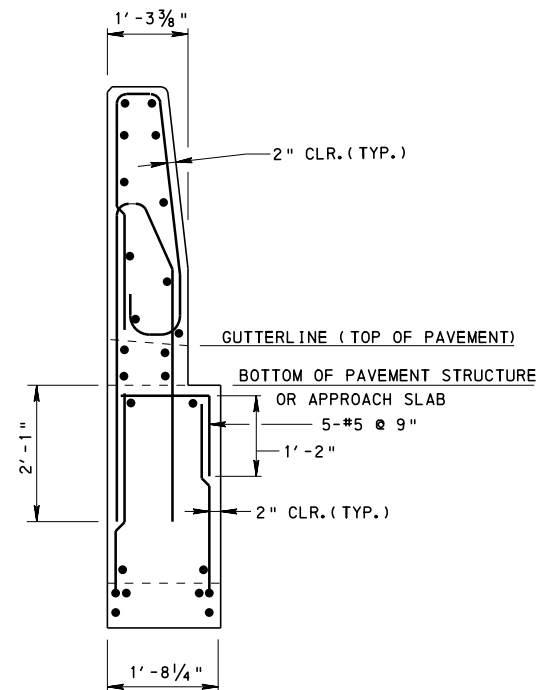
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 2 OF 5
BD-622M



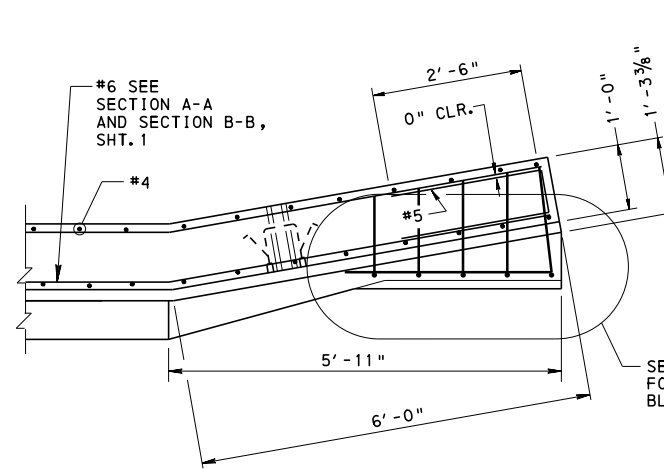
SECTION F-F

(WITH CURB BLOCK)
TYPICAL BARRIER SHOWN.
ALTERNATE BARRIER IS SIMILAR

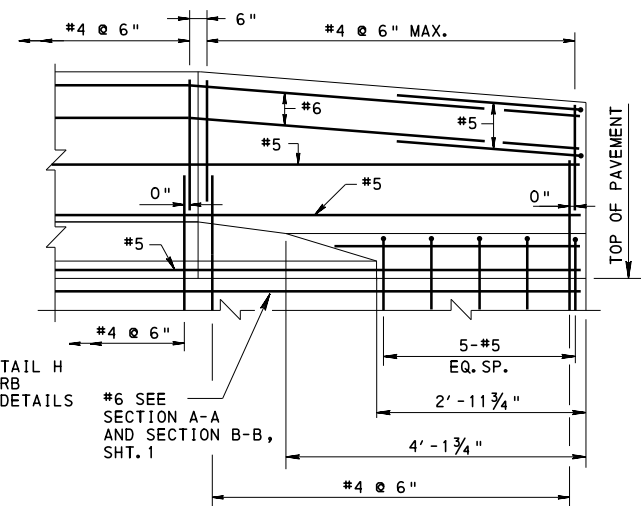


SECTION F-F

(WITHOUT CURB BLOCK)
TYPICAL BARRIER SHOWN.
ALTERNATE BARRIER IS SIMILAR.
DETAILS NOT SHOWN ON THIS SECTION
ARE SIMILAR TO SECTION F-F.
(WITH CURB BLOCK)

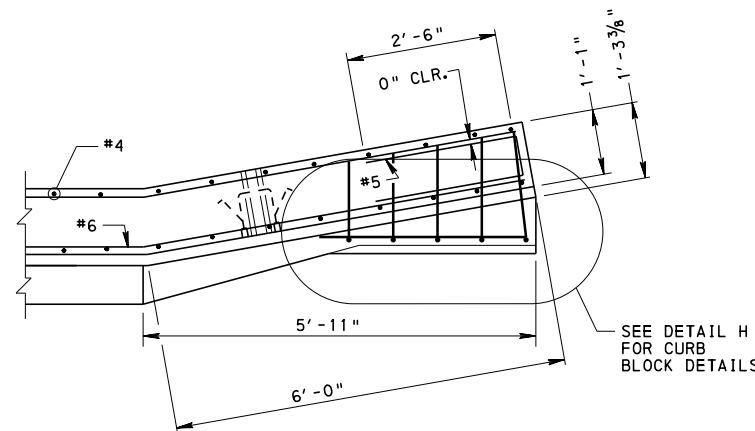


PLAN VIEW

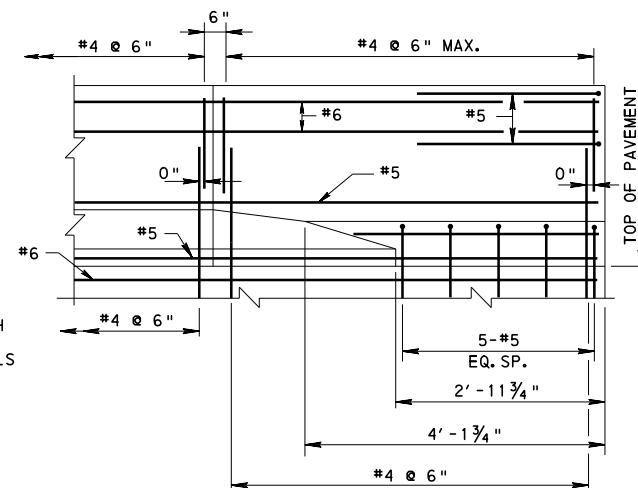


ELEVATION VIEW

END OF 42" BARRIER AND CURB BLOCK DETAILS

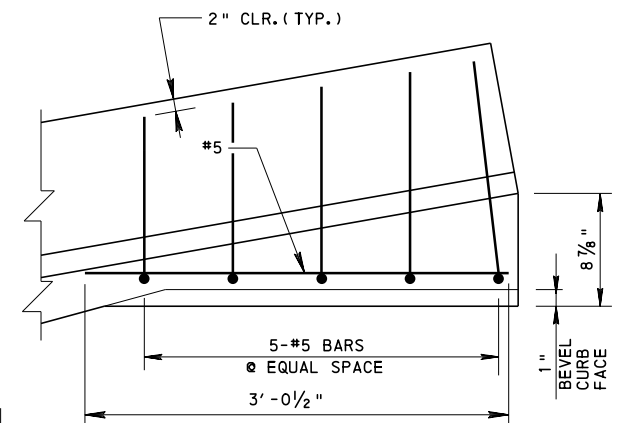


PLAN VIEW



ELEVATION VIEW

END OF 32" BARRIER AND CURB BLOCK DETAILS



DETAIL H

NOTE: BARRIER REINFORCEMENT NOT SHOWN.

NOTE:

1. FOR LOCATION OF SECTION F-F, SEE SHEET 2.

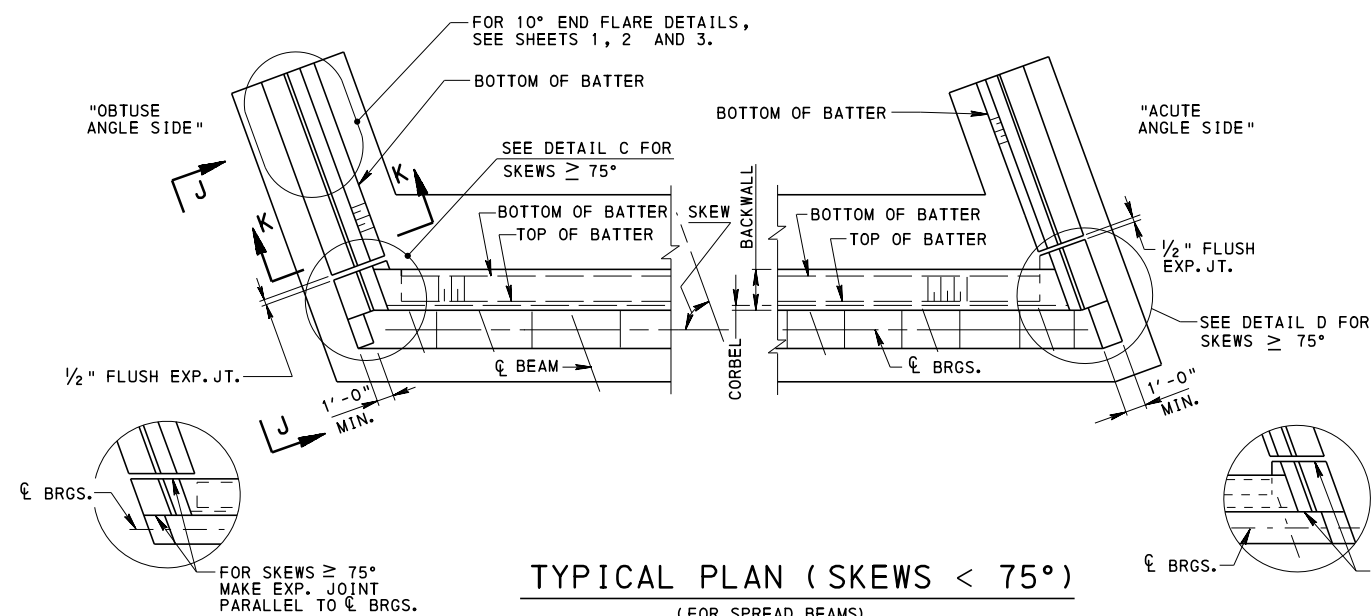
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
R. C. ABUTMENTS WITH BACKWALL
FLARED WING AND
CURB BLOCK DETAILS

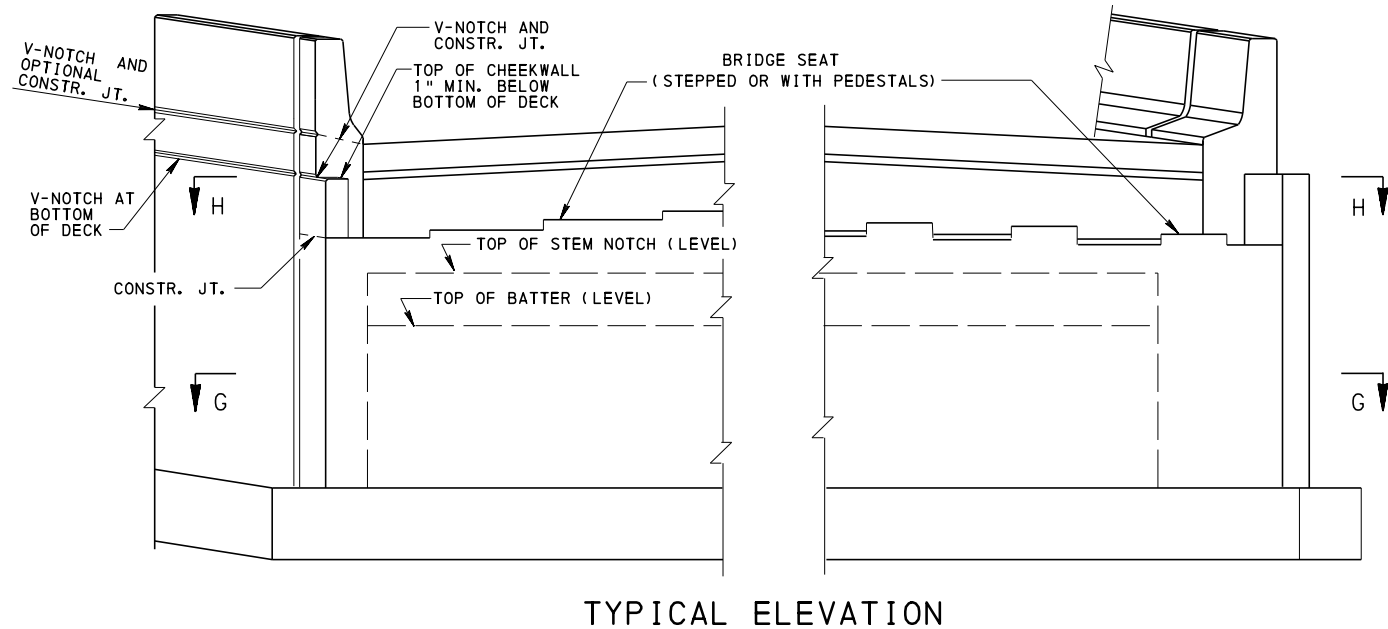
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

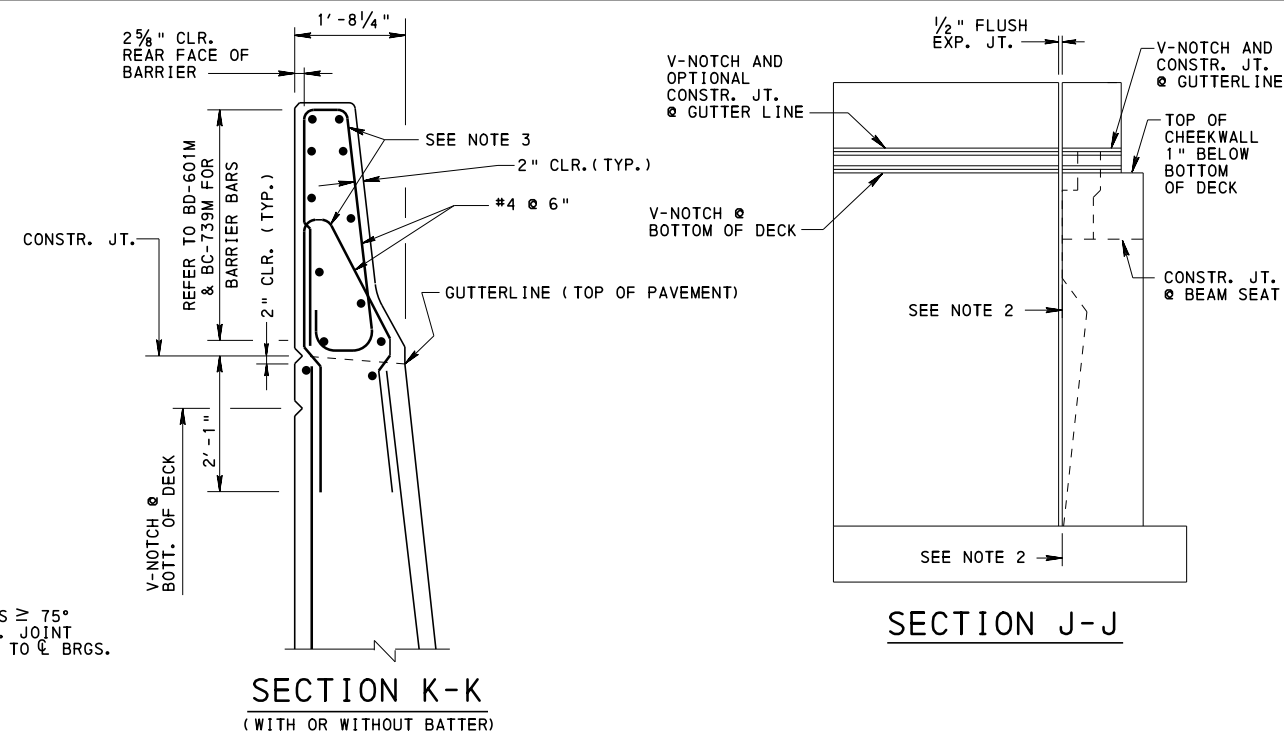
SHEET 3 OF 5
BD-622M



DETAIL C



DETAIL D



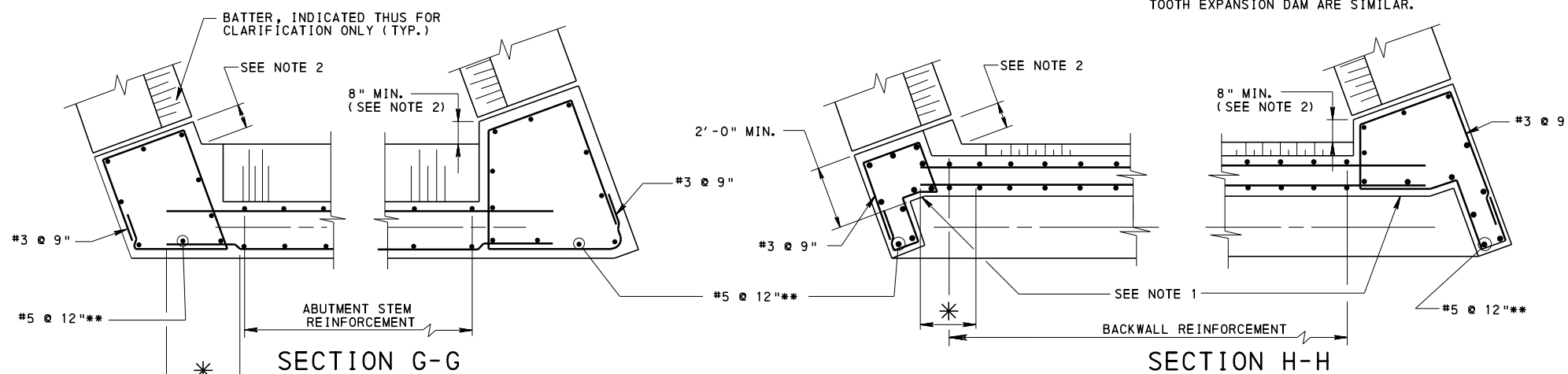
SECTION J-J

NOTES:

1. LAYOUT OF CORNER DETAILS ARE SHOWN TO ACCOMMODATE TURNING OF NEOPRENE STRIP SEAL DAM AT $90\frac{3}{4}^\circ$ TO BARRIER. SEE TYPICAL CORNER DETAIL FOR EXPANSION DAM THIS SHEET. DETAIL IS SIMILAR FOR TOOTH EXPANSION DAM.
2. 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.
3. 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 FOR A DISTANCE OF 10'-0" FROM EACH END OF AN EXPANSION JOINT. FOR U-WING SECTIONS BETWEEN THE 10'-0" SECTION, REINFORCEMENT SPACING MAY BE INCREASED TO 12".

TYPICAL CORNER DETAIL FOR EXPANSION DAM (SKEWS < 75°)

NOTE: ACUTE SIDE WITH TYPICAL CONCRETE BARRIER IS SHOWN FOR NEOPRENE STRIP SEAL DAM. ALTERNATE BARRIER AND TOOTH EXPANSION DAM ARE SIMILAR.



ABUTMENT WITH U-WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. 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.

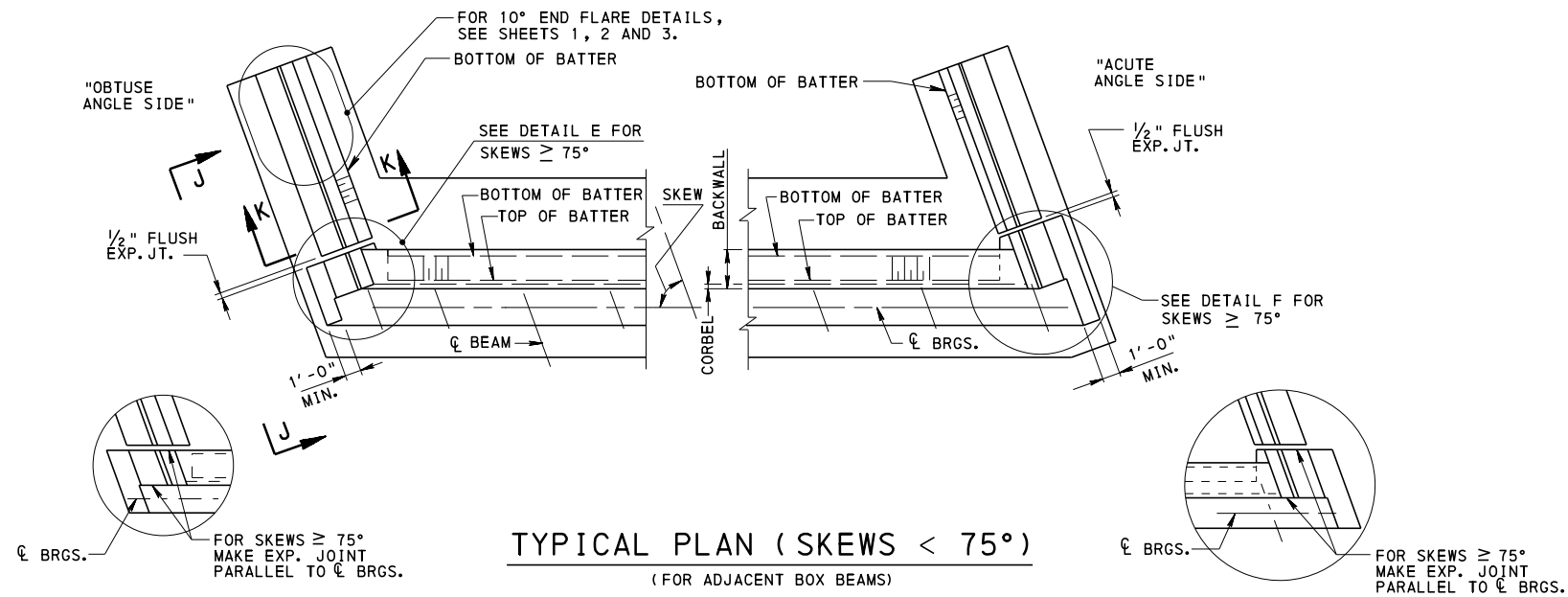
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
R. C. ABUTMENTS WITH BACKWALL
U-WING LAYOUT AND DETAILS
FOR SPREAD BEAMS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

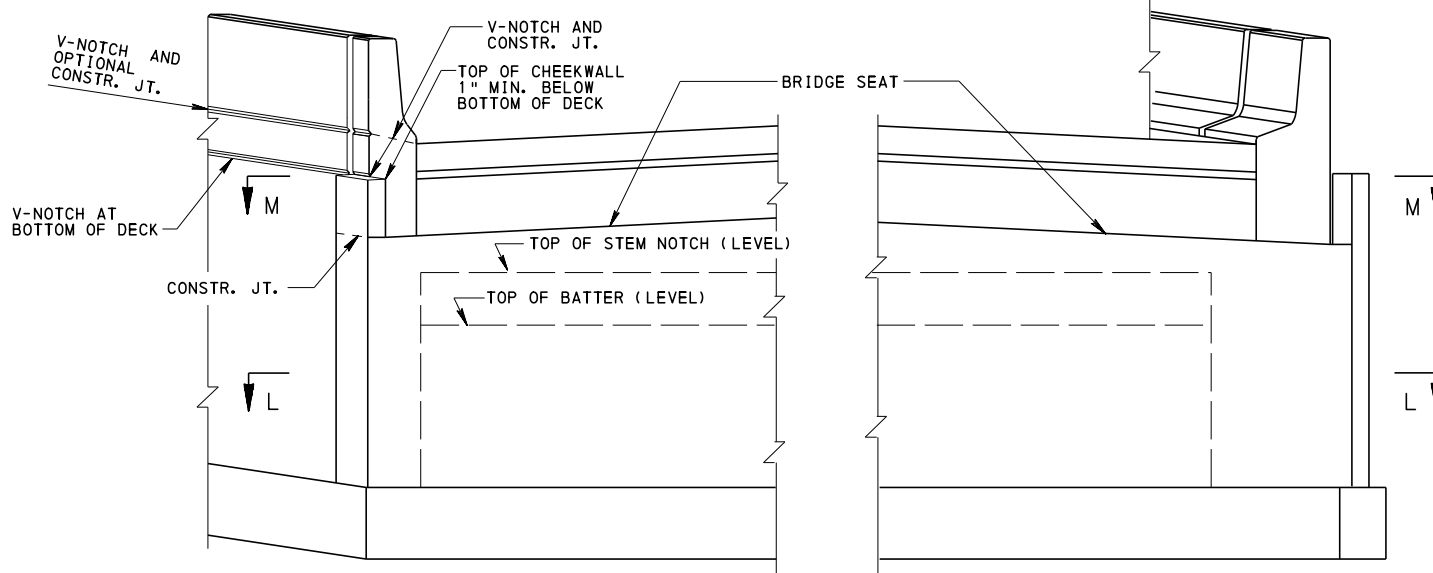
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 4 OF 5
BD-622M

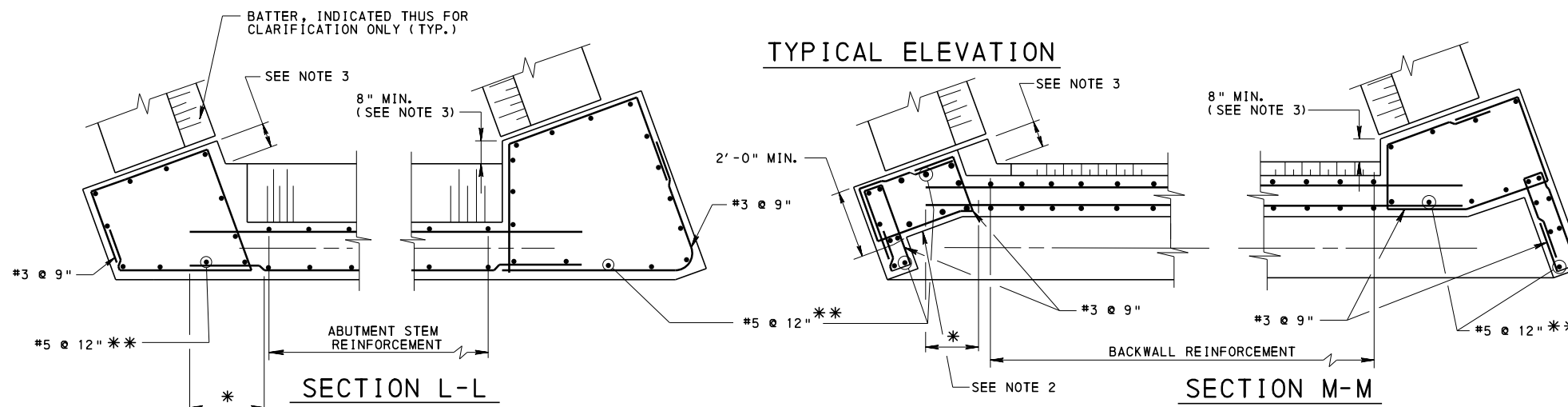


DETAIL E

DETAIL F

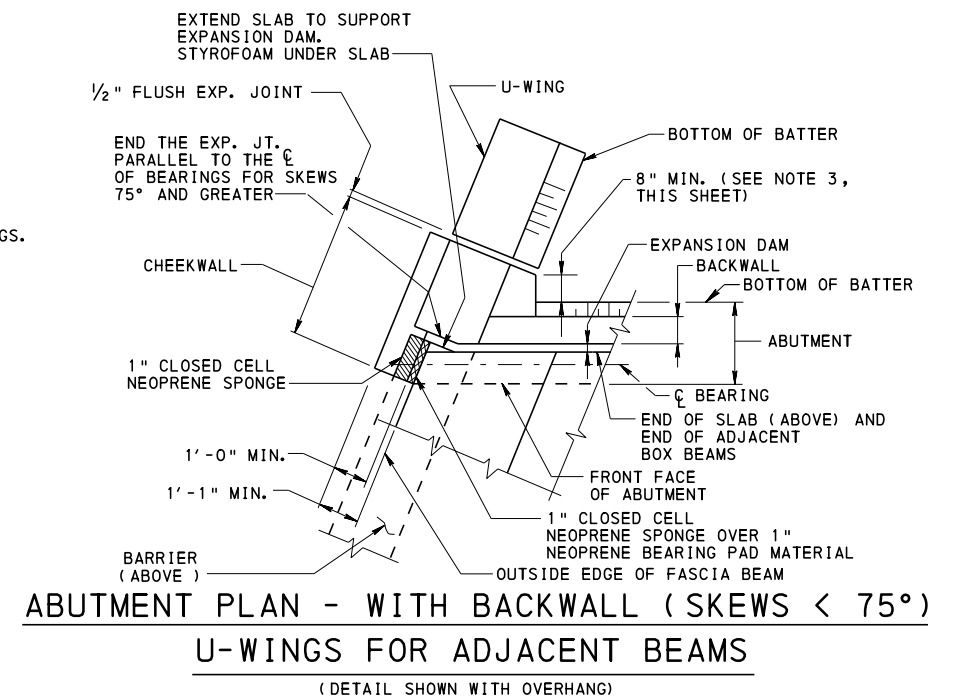


TYPICAL ELEVATION



ABUTMENT WITH U-WINGS

*** 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 J-J AND K-K, SEE SHEET 4.
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 PROJECT DELIVERY

STANDARD
R. C. ABUTMENTS WITH BACKWALL
U-WING LAYOUT AND DETAILS
FOR ADJACENT BOX BEAMS

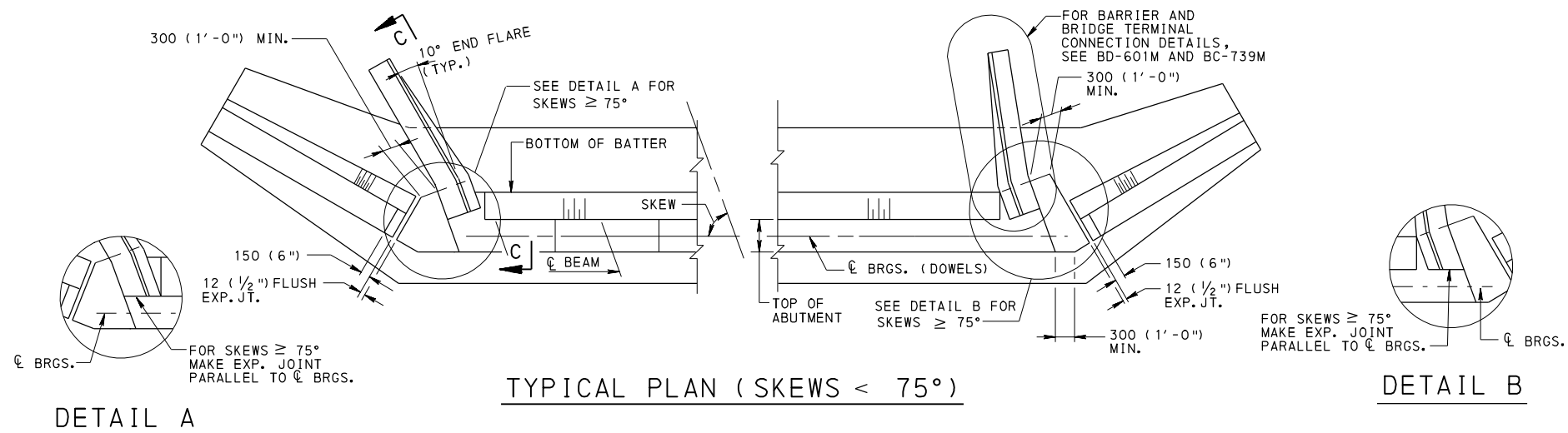
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

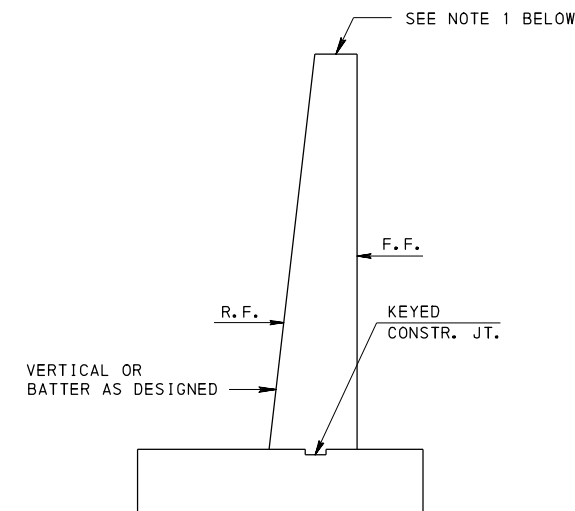
SHEET 5 OF 5
BD-622M

* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

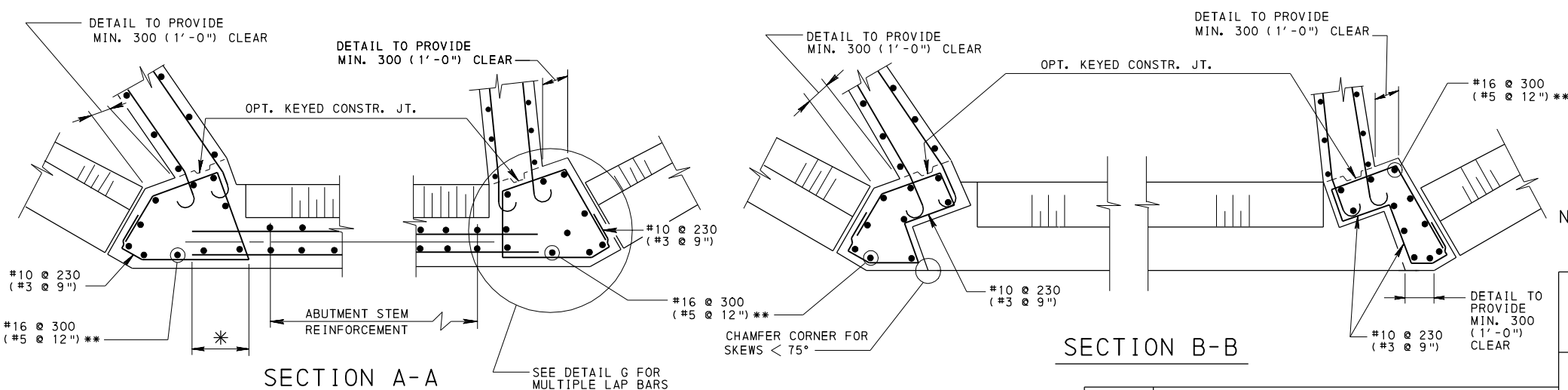
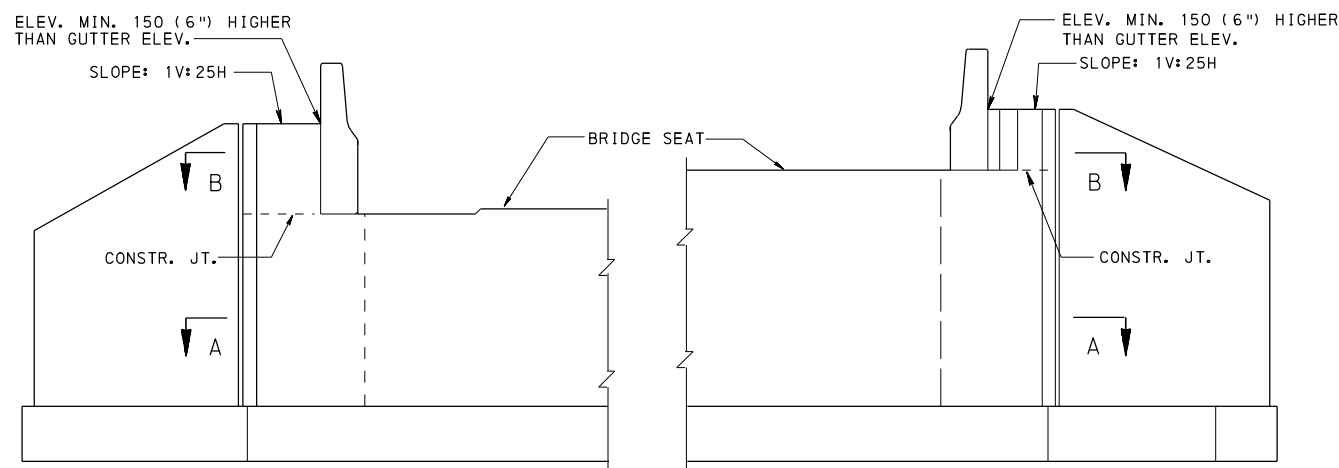
NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. SEE DETAIL G, SHEET 1.



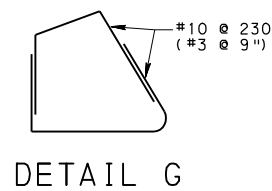
- GENERAL NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES.
 2. ALL REINFORCEMENT STEEL BARS SHOWN ARE SOFT CONVERTED METRIC SIZES THAT MEET THE REQUIREMENTS OF ASTM A 615M, A 996M OR A 706M.
 3. FOR SECTION C-C, SEE SHEET 2.
 4. HOOKS ON BARS EXTENDING FROM BARRIER TRANSITION INTO THE BACKWALL MAY BE TURNED IN ANY DIRECTION.



- ABUTMENT SECTION NOTES:**
1. SANDBLAST CLEAN THE CONCRETE BEARING SURFACE TO ACHIEVE A ROUGH TEXTURE.



NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.



ABUTMENTS WITH FLARED WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. SEE DETAIL G.

* EXTEND HORIZONTAL REINFORCEMENT INTO CORNER THE MINIMUM DEVELOPMENT LENGTH. BEND AS REQUIRED. (TYP.)

** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #19 (#6) REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

SECTION B-B

BD-601M	CONCRETE DECK SLAB
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	ABUTMENT DETAILS
BC-739M	BRIDGE BARRIER TO GUIDE RAIL TRANSITION
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD

R. C. ABUTMENTS WITHOUT BACKWALL

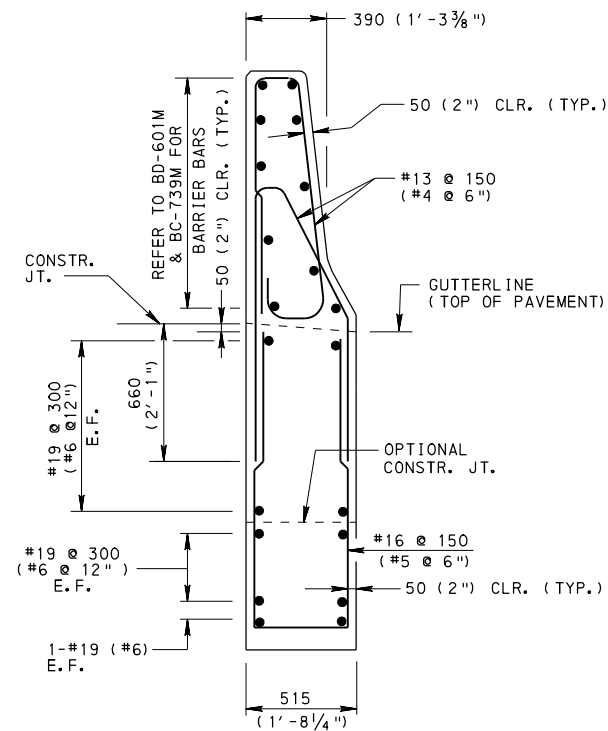
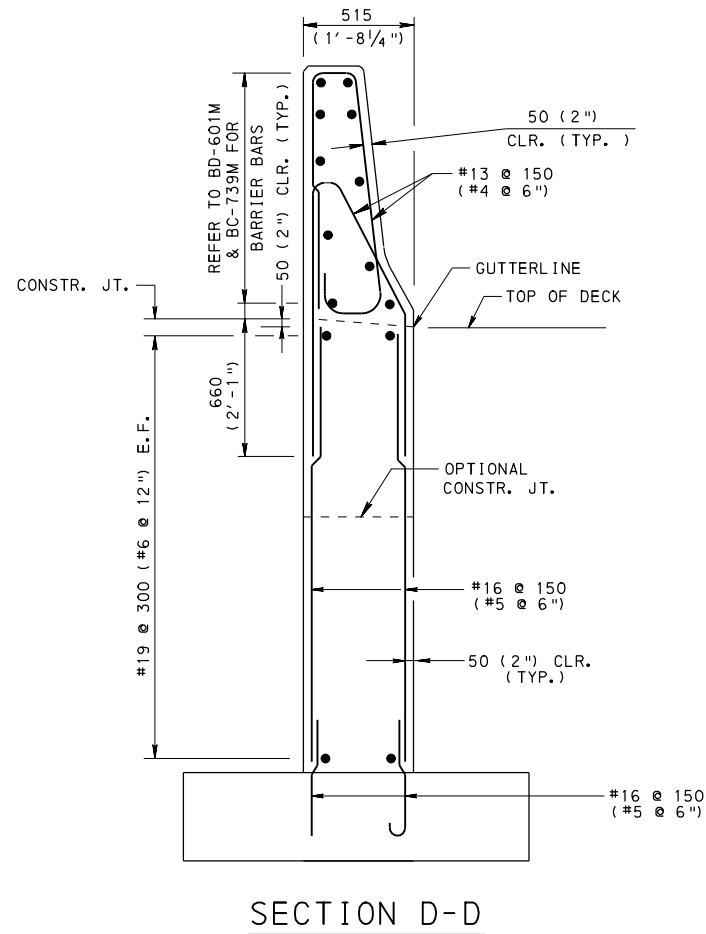
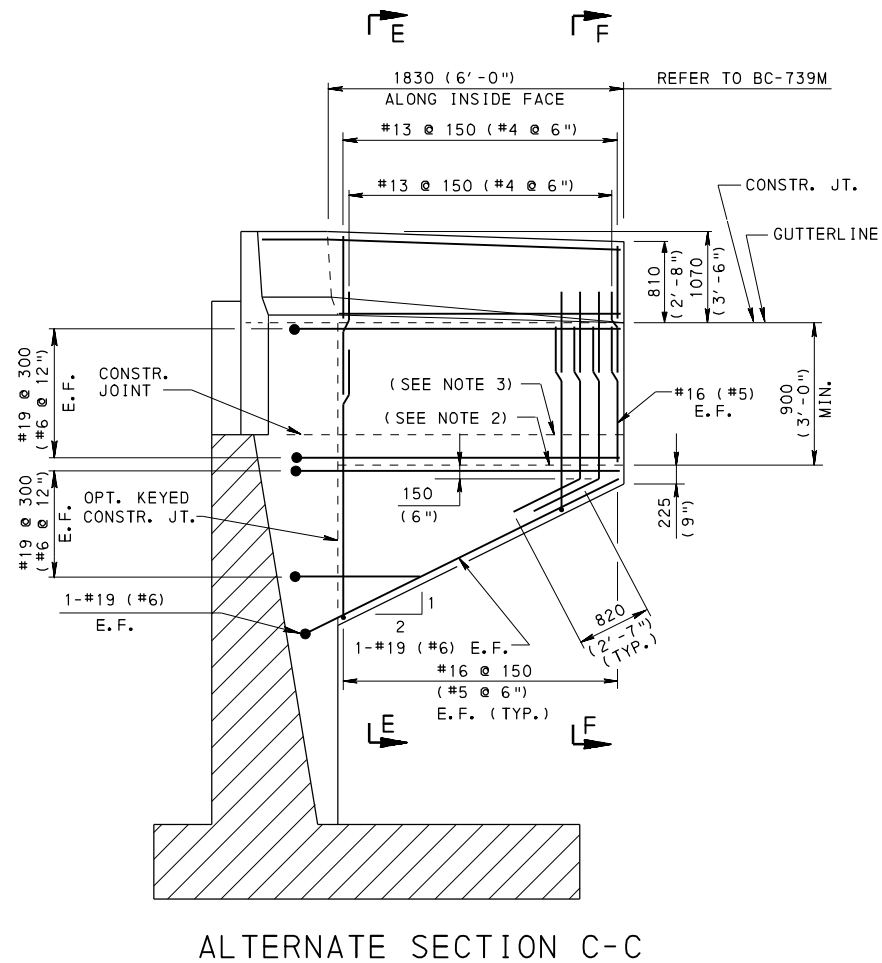
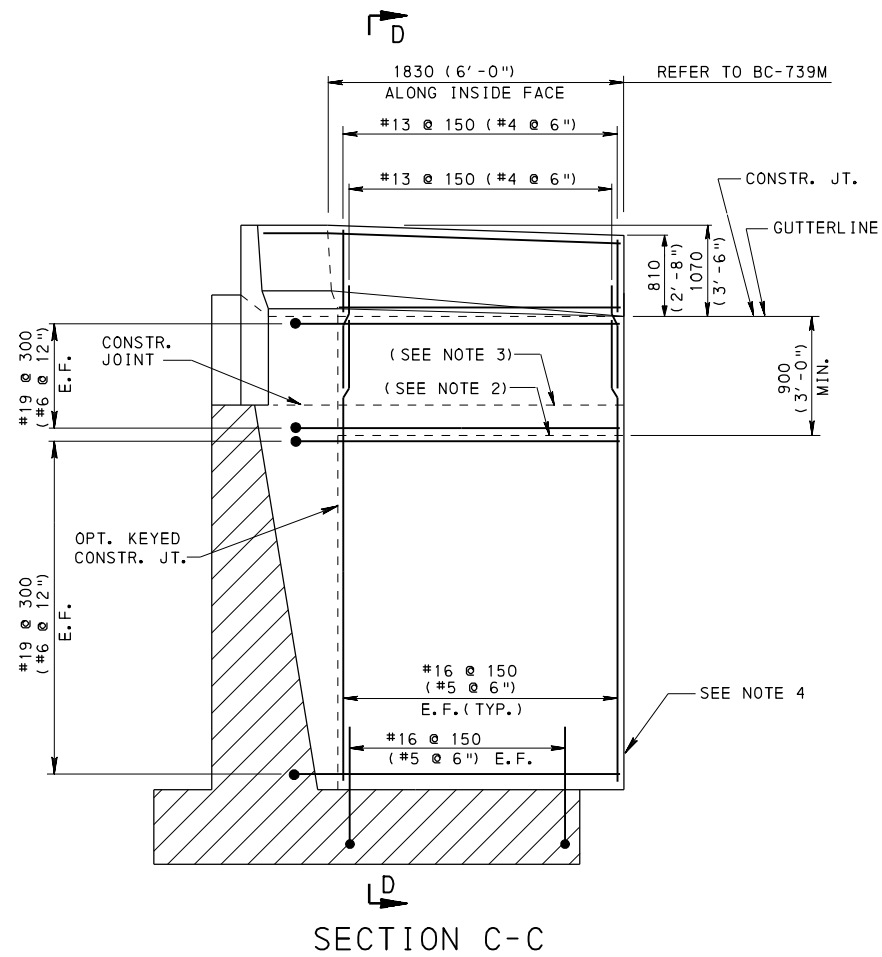
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

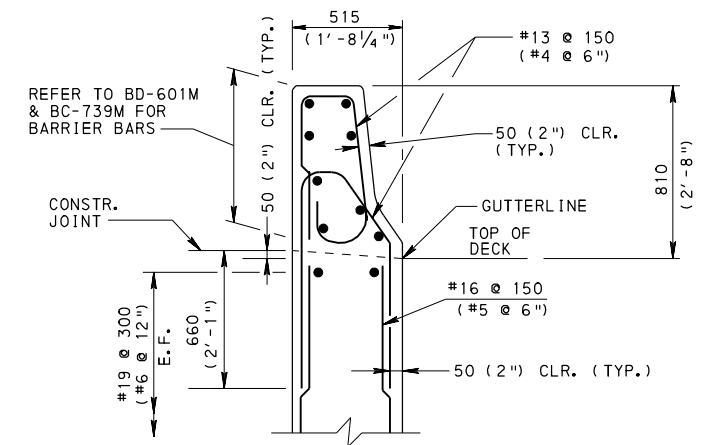
SHEET 1 OF 5

BD-624M



NOTES:

- FOR TYPICAL PLAN AND ELEVATION, SEE SHEET 1.
- OPTIONAL CONSTRUCTION JOINT LOCATED 900 (3'-0") MINIMUM FROM BOTTOM OF DECK FOR BEAM DEPTHS LESS THAN 660 (2'-1")
- OPTIONAL CONSTRUCTION JOINT LOCATED AT BEAM SEAT FOR BEAM DEPTHS GREATER THAN OR EQUAL TO 660 (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 9000 (30'-0"). ALTERNATE CONFIGURATIONS OF BARRIER WALLS ON FOOTINGS CAN BE USED ONLY WITH THE APPROVAL OF THE DISTRICT BRIDGE ENGINEER.
- FOR SECTION F-F, SEE SHEET 3.
- IF FILL HEIGHTS ON BOTH SIDES OF THE SAFETY WING WALL CAN NOT BE MAINTAINED WITHIN 1500 (5'-0") OF EACH OTHER, THEN ALL REINFORCEMENT BARS MUST BE DESIGNED.



NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

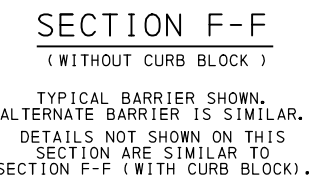
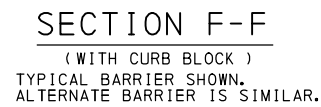
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
R. C. ABUTMENTS WITHOUT BACKWALL
FLARED WINGS
LAYOUT AND DETAILS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Bruce S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 2 OF 5
BD-624M



- NOTE:
1. FOR LOCATION OF SECTION F-F, SEE SHEET 2.
 2. FOR END OF BARRIER TRANSITION AND CURB BLOCK DETAILS, SEE BD-622M, SHEET 3.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD

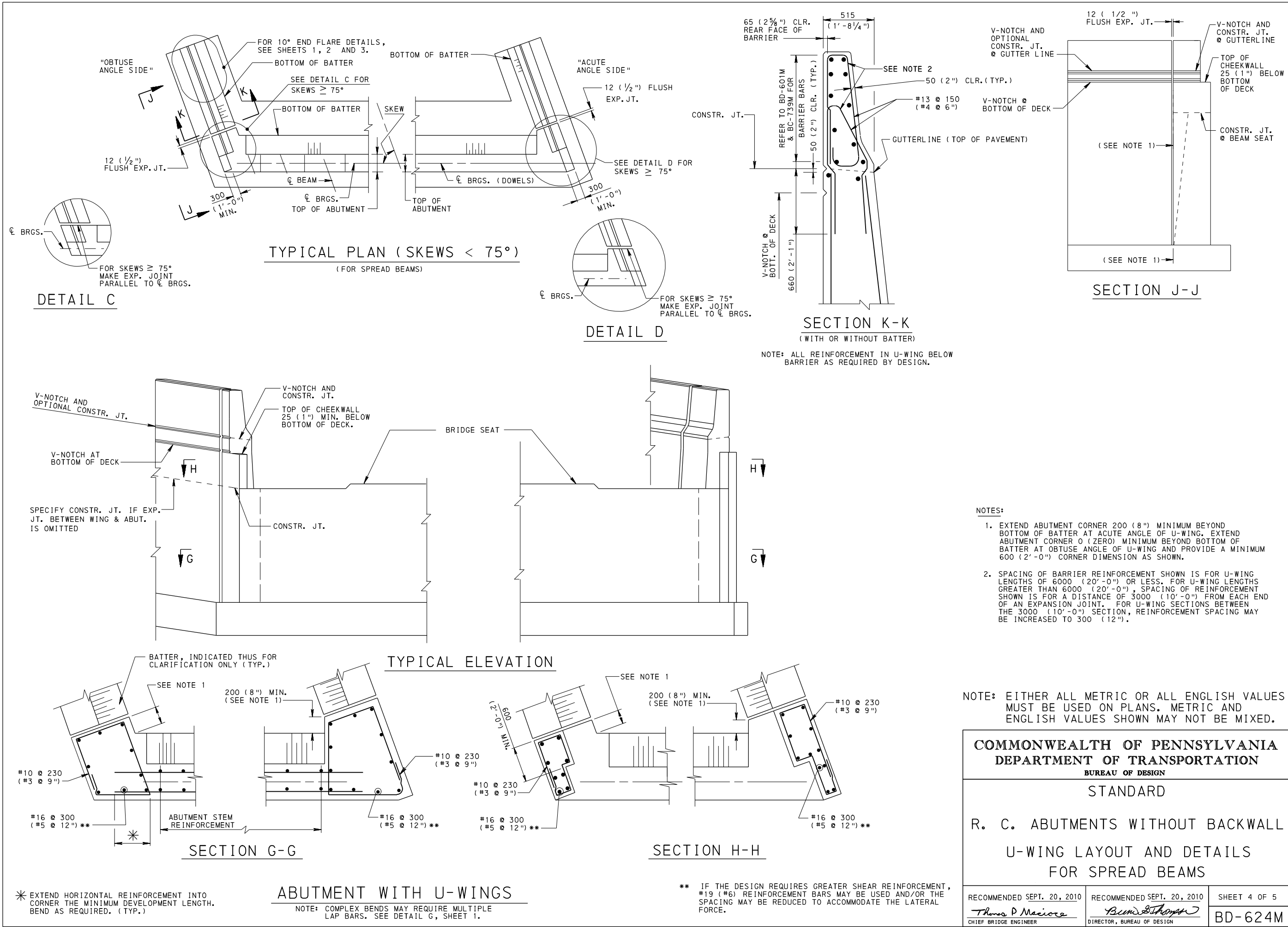
R. C. ABUTMENTS WITHOUT BACKWALL

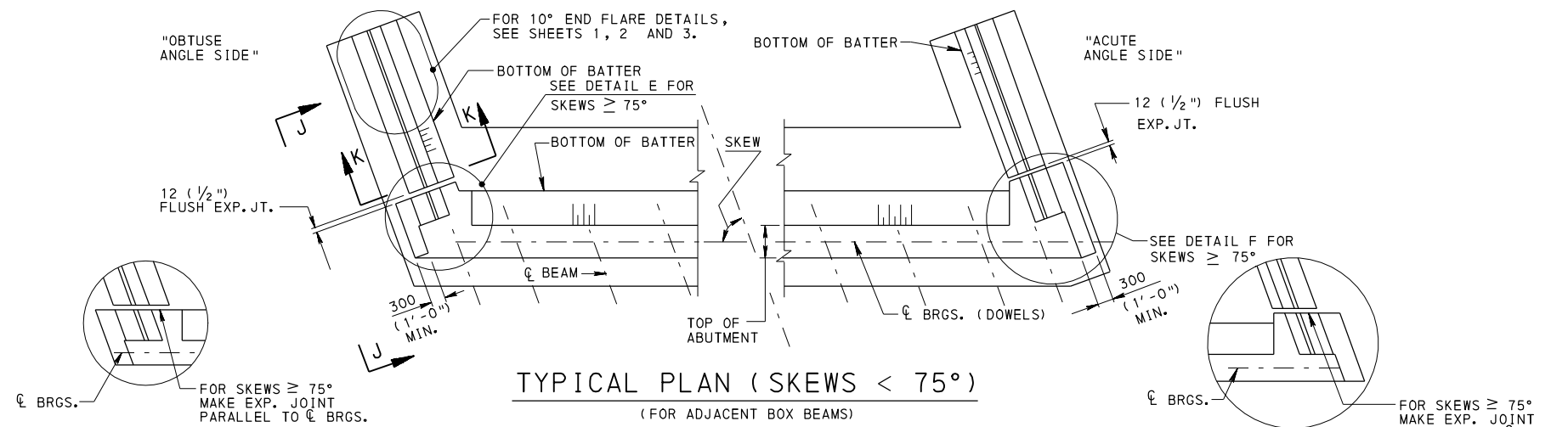
FLARED WING DETAILS

RECOMMENDED SEPT. 20, 2010
Thomas P Maciore
 CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda Thompson
 DIRECTOR, BUREAU OF DESIGN

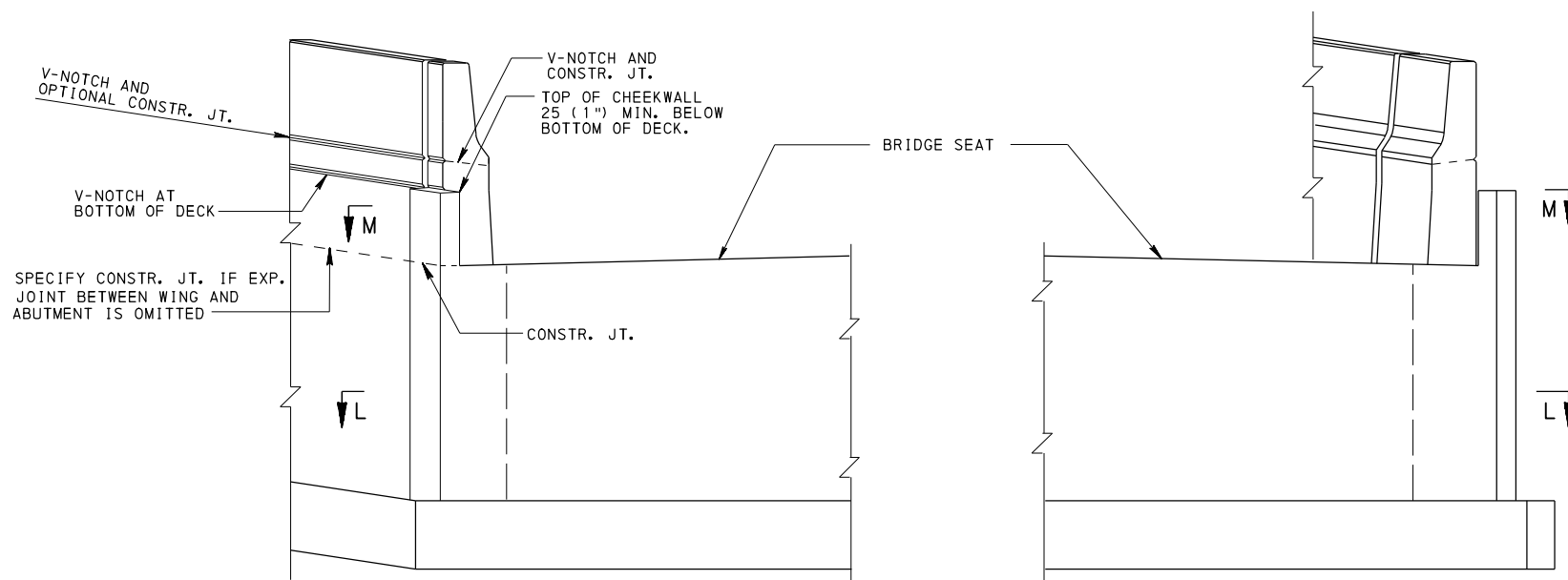
SHEET 3 OF 5
BD-624M



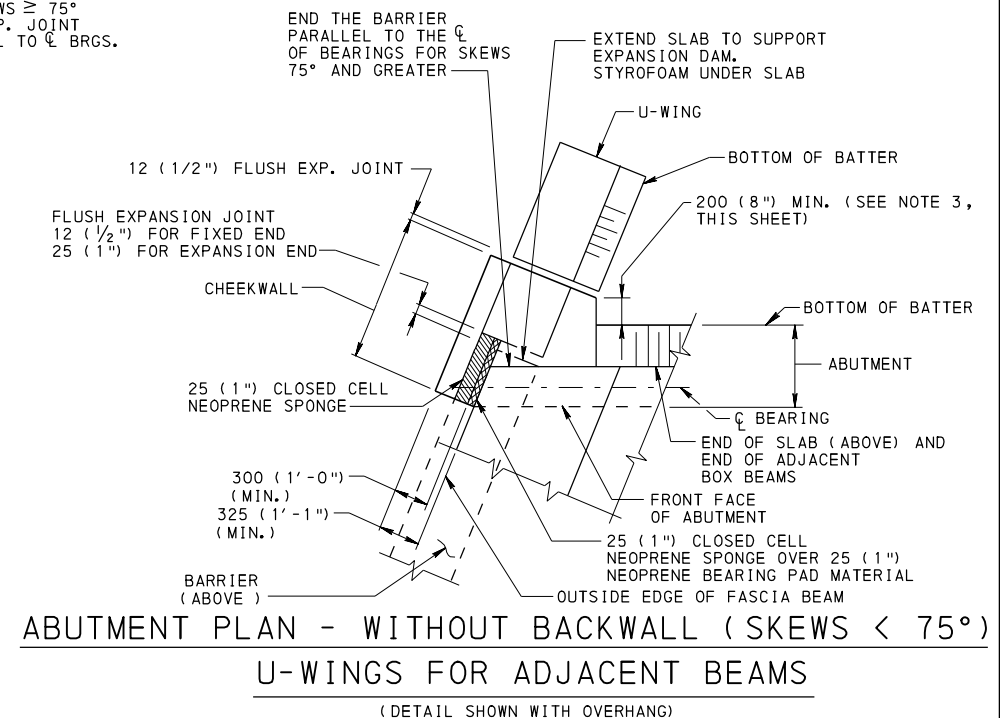


DETAIL E

DETAIL F



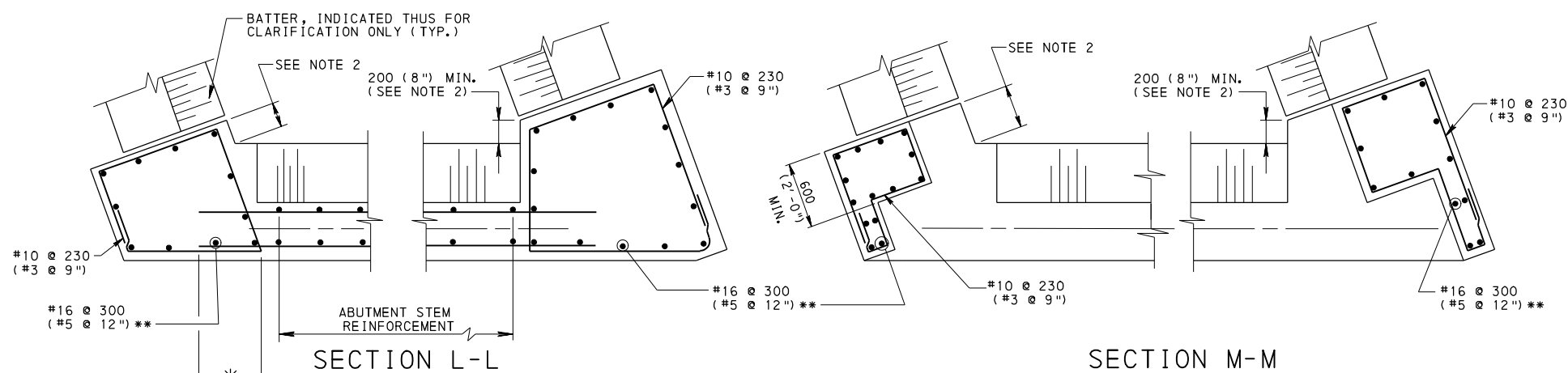
TYPICAL ELEVATION



NOTE:

1. FOR SECTIONS J-J AND K-K, SEE SHEET 4.
2. EXTEND ABUTMENT CORNER 200 (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 600 (2'-0") CORNER DIMENSION AS SHOWN.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.



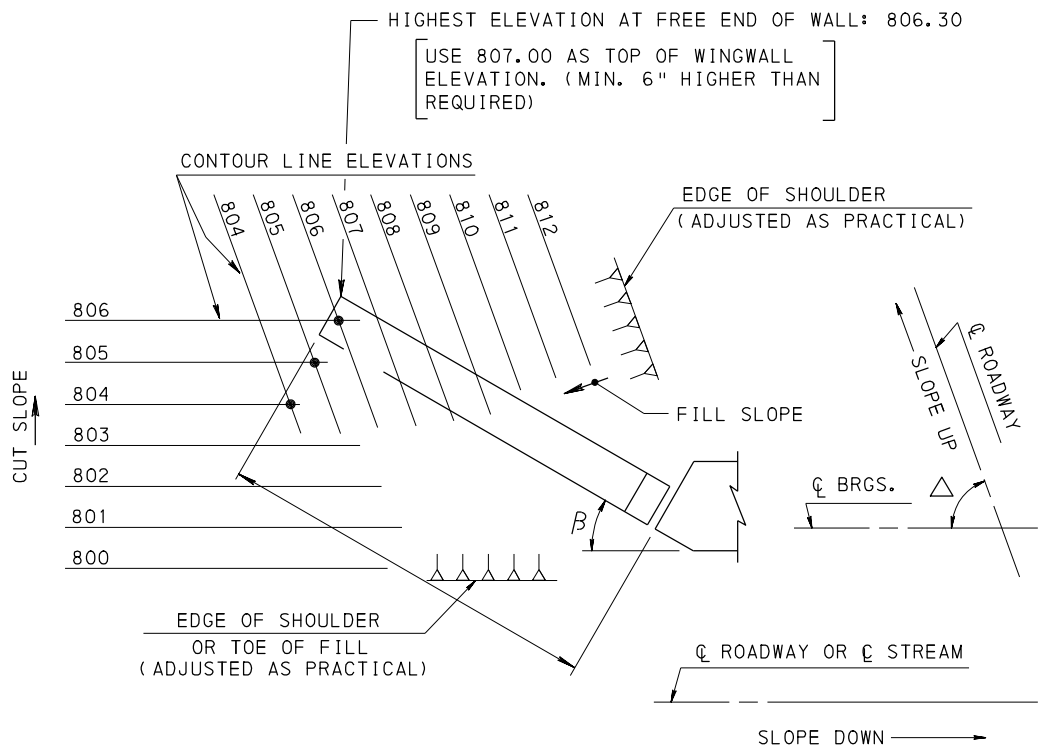
ABUTMENT WITH U-WINGS

NOTE: COMPLEX BENDS MAY REQUIRE MULTIPLE LAP BARS. SEE DETAIL G, SHEET 1.

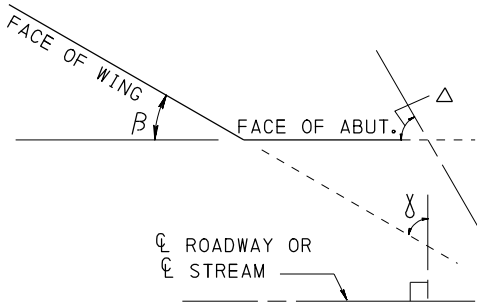
** IF THE DESIGN REQUIRES GREATER SHEAR REINFORCEMENT, #19 (#6) REINFORCEMENT BARS MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN		
STANDARD		
R. C. ABUTMENTS WITHOUT BACKWALL		
U-WING LAYOUT AND DETAILS FOR ADJACENT BOX BEAMS		
RECOMMENDED SEPT. 20, 2010 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED SEPT. 20, 2010 <i>Brian S. Thompson</i> DIRECTOR, BUREAU OF DESIGN	SHEET 5 OF 5 BD-624M

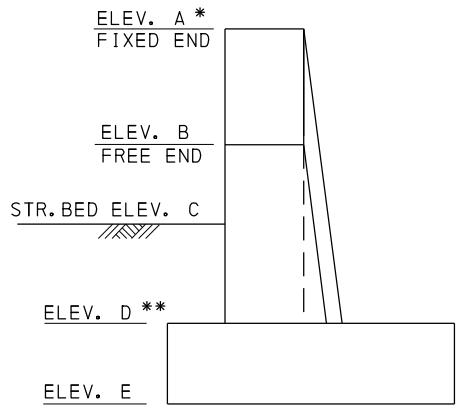
IN GENERAL, PROVIDE WINGWALLS OF SUFFICIENT LENGTH TO RETAIN THE ROADWAY EMBANKMENT TO THE REQUIRED EXTENT AND TO FURNISH PROTECTION AGAINST EROSION. COMPUTE WINGWALL LENGTHS USING THE ACTUAL CONDITION AT THE SITE. THE FOLLOWING METHOD IS PROPOSED TO COMPUTE THE REQUIRED LENGTHS.



LENGTH OF WINGWALL
SCHEME A



PLAN



TYPICAL SECTION

GIVEN:

BRIDGE SKEW (Δ) = ____° ____'; ANGLE BETWEEN FRONT FACE OF WING & FRONT FACE OF ABUTMENT (β) = ____° ____';
ANGLE BETWEEN PERPENDICULAR TO ROADWAY CENTERLINE & FRONT FACE OF WING (γ) = ____° ____';

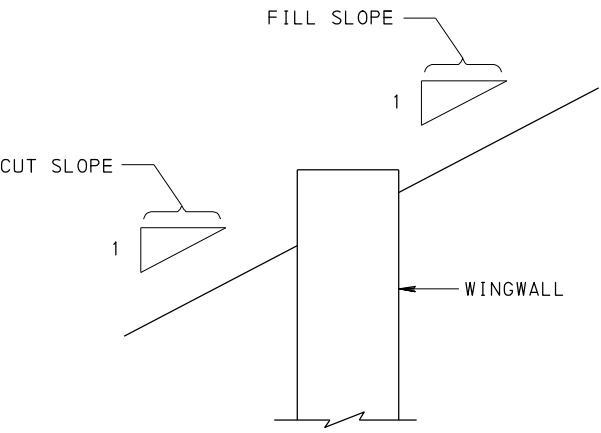
FIND WING LENGTH:

ELEV. A* - ELEV. C = $\frac{\text{WING LENGTH} \times \text{SINE } (\beta)}{\text{CUT SLOPE}} + \frac{\text{WING LENGTH} \times \text{COS } (\gamma)}{\text{FILL SLOPE}}$
(-) = 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 - $\frac{\text{WING LENGTH} \times \text{COS } (\gamma)}{\text{FILL SLOPE}}$ = ____ - ____ x ____
HENCE ELEV. B = _____
* SUBTRACT 6" TO COMPUTE WING LENGTH ONLY.
** [ELEV. C - ELEV. D] = 12" + STREAMBED SLOPE x COS (β) OR MORE ON OUTLET END ONLY.

LENGTH OF WINGWALL
SCHEME B



SLOPE DEFINITIONS

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN		
STANDARD WINGWALL LENGTH		
RC-12M BACKFILL AT STRUCTURES	RECOMMENDED SEPT. 20, 2010 Thomas P. Maciore CHIEF BRIDGE ENGINEER	RECOMMENDED SEPT. 20, 2010 Brenda S. Thomas DIRECTOR, BUREAU OF DESIGN
REFERENCE DRAWINGS		SHEET 1 OF 1 BD-625M

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 $\frac{3}{4}$ "x $\frac{3}{4}$ " 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) 2b 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. DESCRETE 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 1001.2 (k) 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 $\frac{1}{16}$ " 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, MANHOLES, 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.

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. 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.

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.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
ANCHORED WALLS
NOTES

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

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. Wayne Willey</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 1 OF 9 BD-626M
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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, TRANSFERRING 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.
- 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

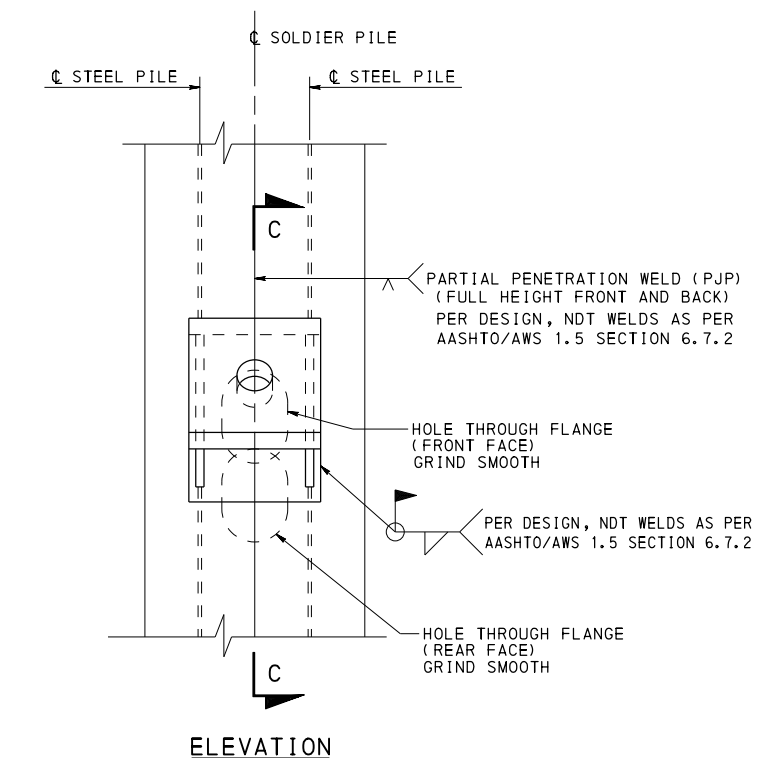
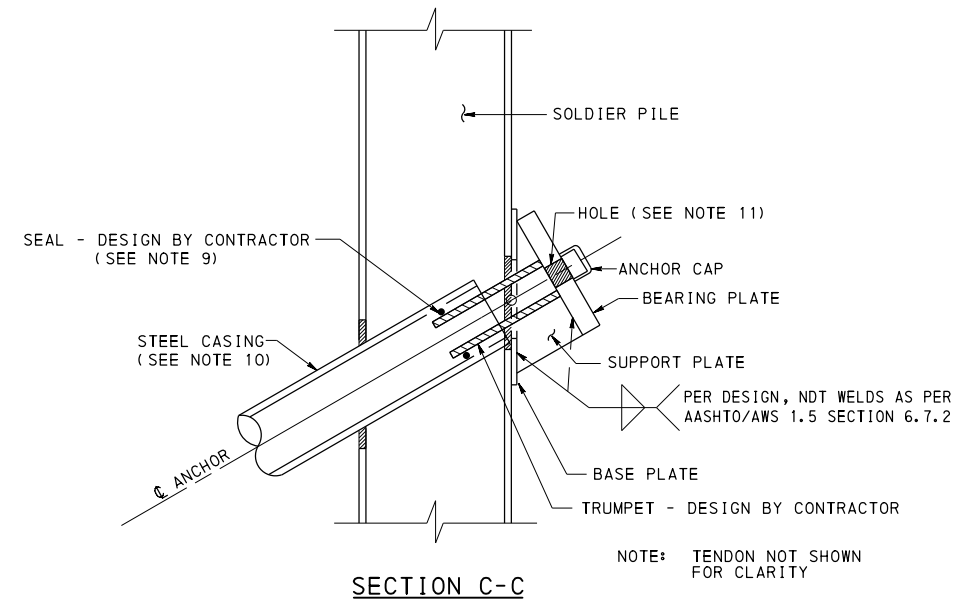
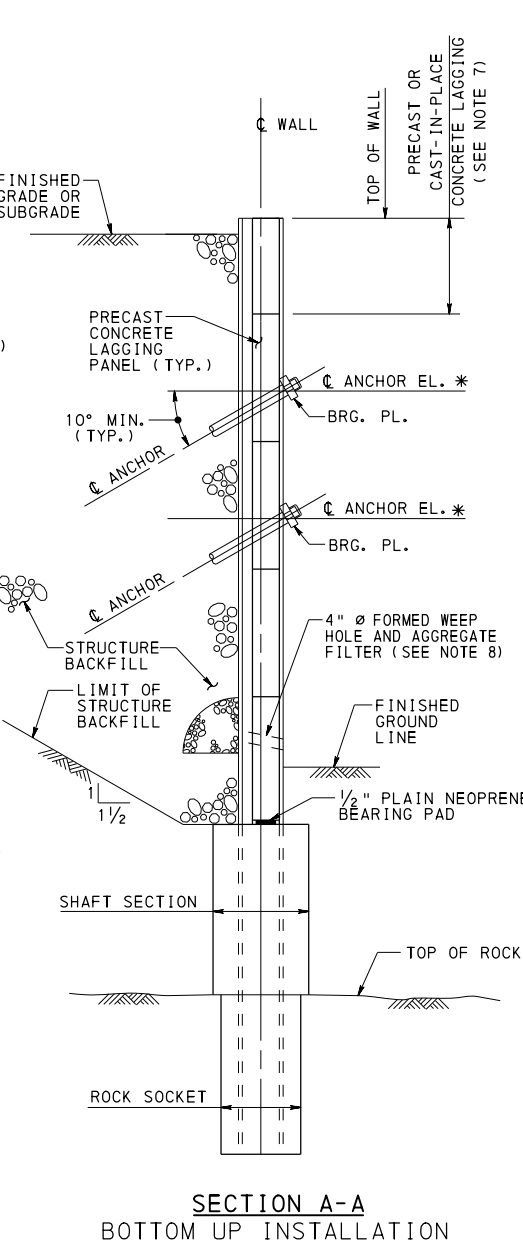
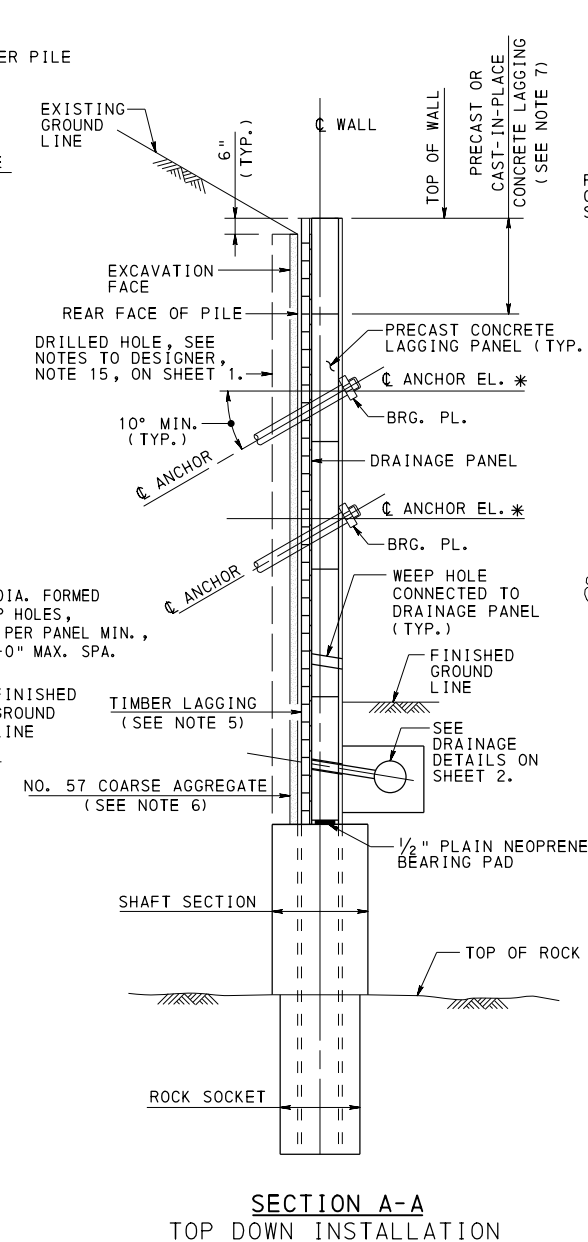
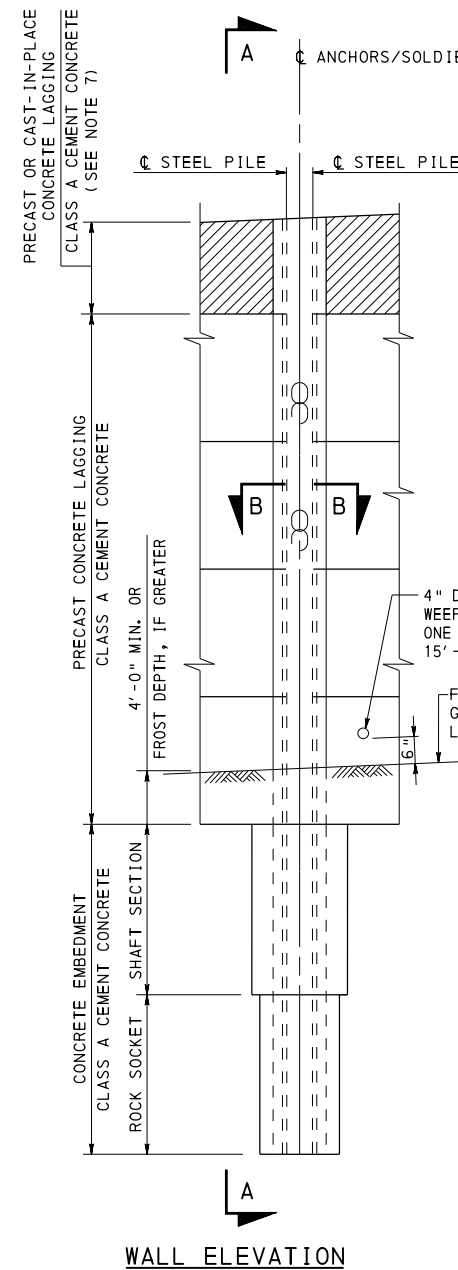
EH - HORIZONTAL EARTH PRESSURE PER DESIGN MANUAL PART 4.

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.
-
- ELEVATION AT DRAINAGE PANEL
- COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY
- STANDARD
ANCHORED WALLS
NOTES AND DRAINAGE DETAILS
- RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER
- RECOMMENDED AUG. 31, 2012
R. W. Willey
ACTING DIR. BUREAU OF PROJECT DELIVERY
- SHEET 2 OF 9
BD-626M



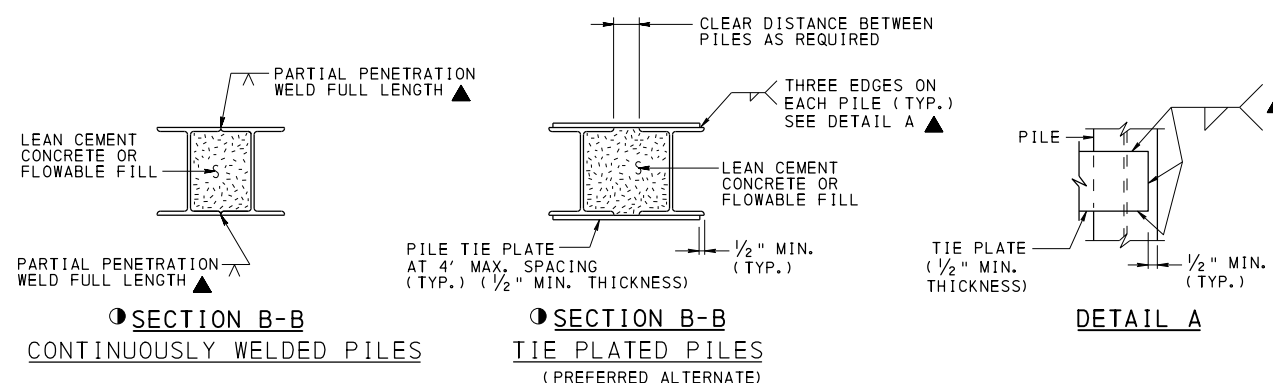
LEGEND:

- * 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).

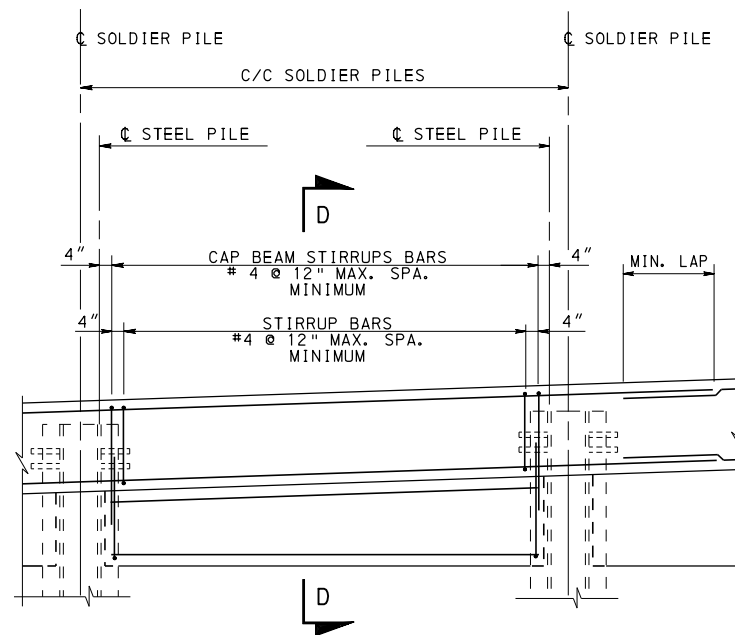
DOUBLE PILE DESIGN W/PRECAST LAGGING TOP DOWN & BOTTOM UP INSTALLATION



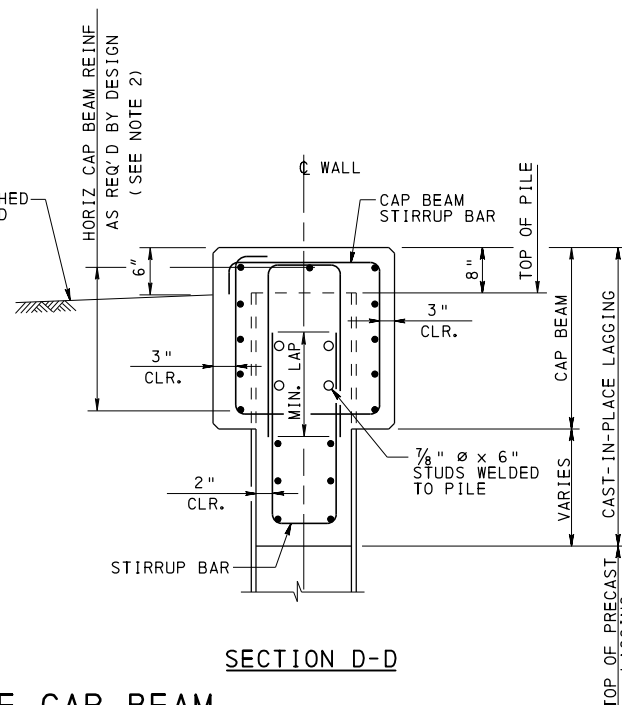
- ▲ - WELD PER DESIGN, NDT WELDS AS PER AASHTO/AWS 1.5 SECTION 6.7.2
- - WALL AND LAGGING NOT SHOWN FOR CLARITY (SEE TYPICAL SECTION AT PRECAST LAGGING ON SHEET 4.)

ANCHORAGE DETAIL (CONTINUOUSLY WELDED PILES SHOWN, TIE PLATED PILES SIMILAR)

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD ANCHORED WALLS DOUBLE PILE DESIGN W/PRECAST LAGGING		
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Kelly</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 3 OF 9 BD-626M



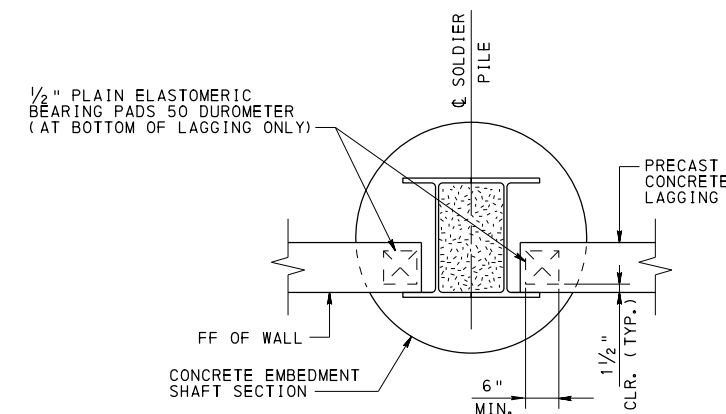
ELEVATION



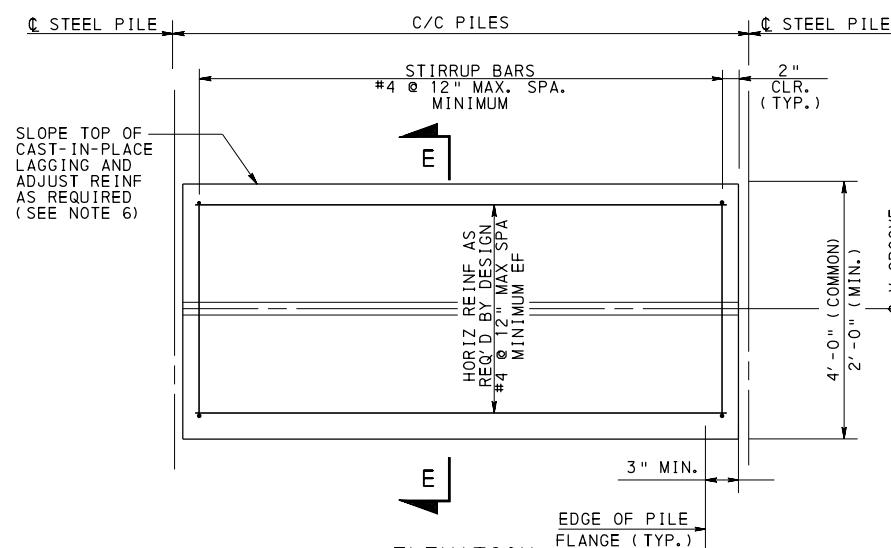
SECTION D-D

CAST-IN-PLACE CAP BEAM

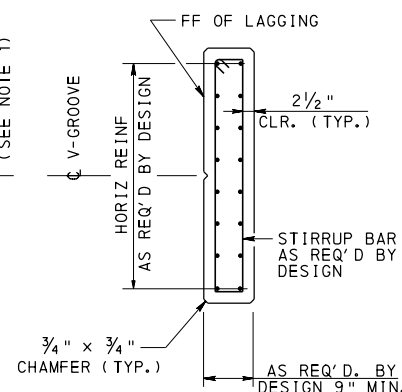
FOR USE OF CAP BEAM FOR REDUNDANCY
(SEE NOTE 2)



BEARING PAD DETAIL



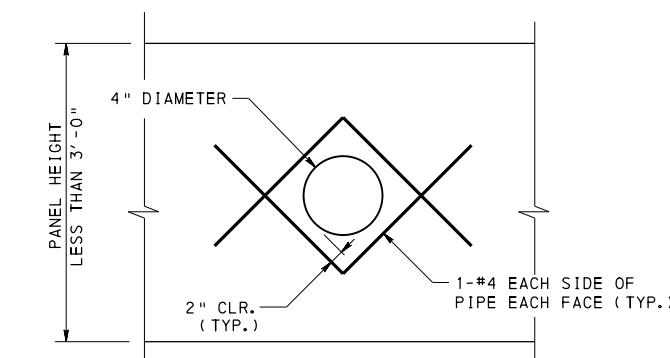
ELEVATION



SECTION E-E

PRECAST AND CAST-IN-PLACE CONCRETE LAGGING

(SEE NOTES 3 AND 6)



WEEP HOLE REINFORCEMENT DETAIL

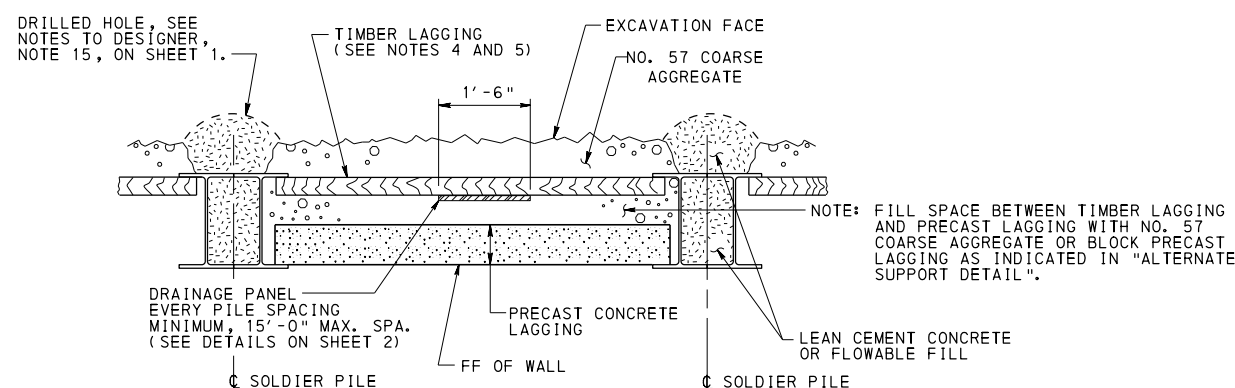
- REINFORCE WEEP HOLES WITH #4 ON EACH FACE PLACED IN A FASHION AS SHOWN.
- LOCATION OF STRUCTURE FOUNDATION DRAINS AND WEEP HOLES MUST BE SHOWN ON THE CONTRACT PLANS.

NOTES:

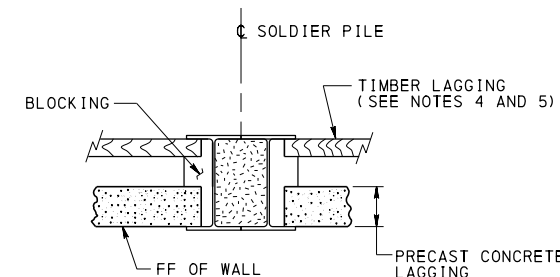
- PROVIDE A V-GROOVE MID-DEPTH IF DESIRED FOR APPEARANCE.
- IF CAP BEAM IS USED FOR REDUNDANCY, DESIGN FOR REDUNDANCY FORCES; OTHERWISE DESIGN FOR APPLICABLE EARTH PRESSURES.
- IF PRECAST CONCRETE LAGGING IS NOT FULLY DETAILED ON THE DESIGN DRAWINGS (NO REINFORCEMENT BAR SCHEDULE), THEN THE CONTRACTOR 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

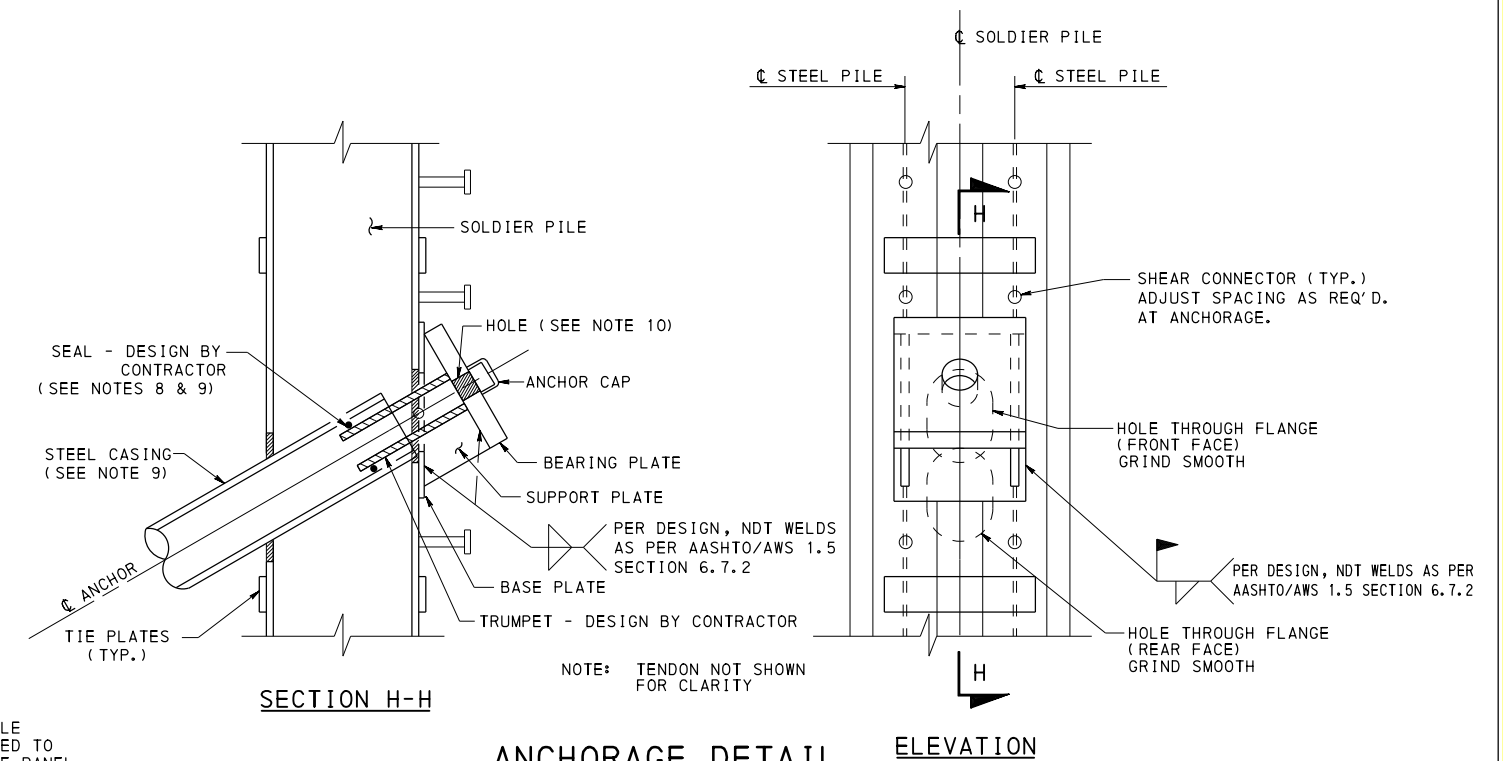
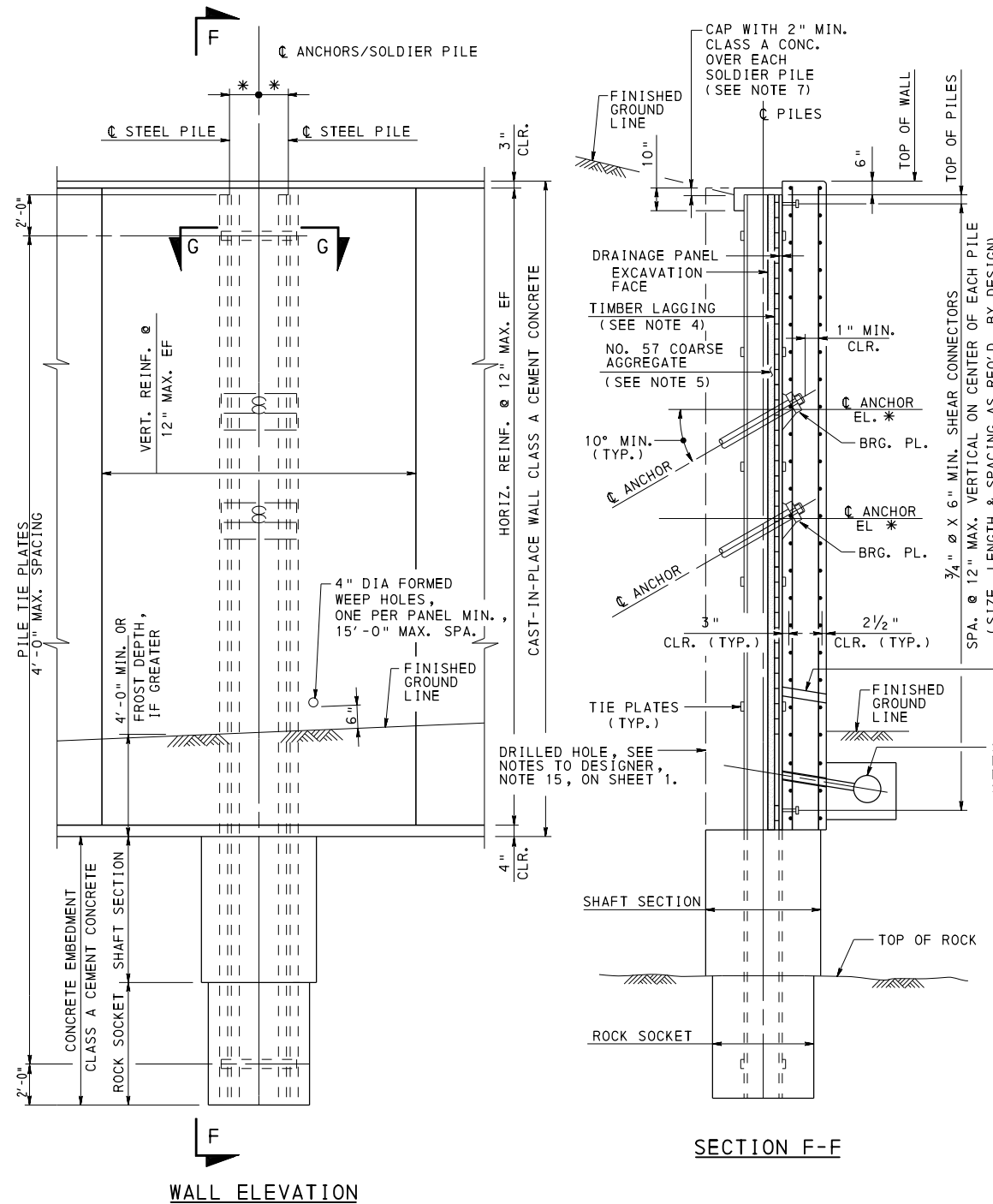
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
ANCHORED WALLS
DOUBLE PILE DESIGN WITH
PRECAST LAGGING

RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. Willey
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 4 OF 9
BD-626M



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 WEED HOLE REINFORCEMENT DETAIL SEE SHEET 6.

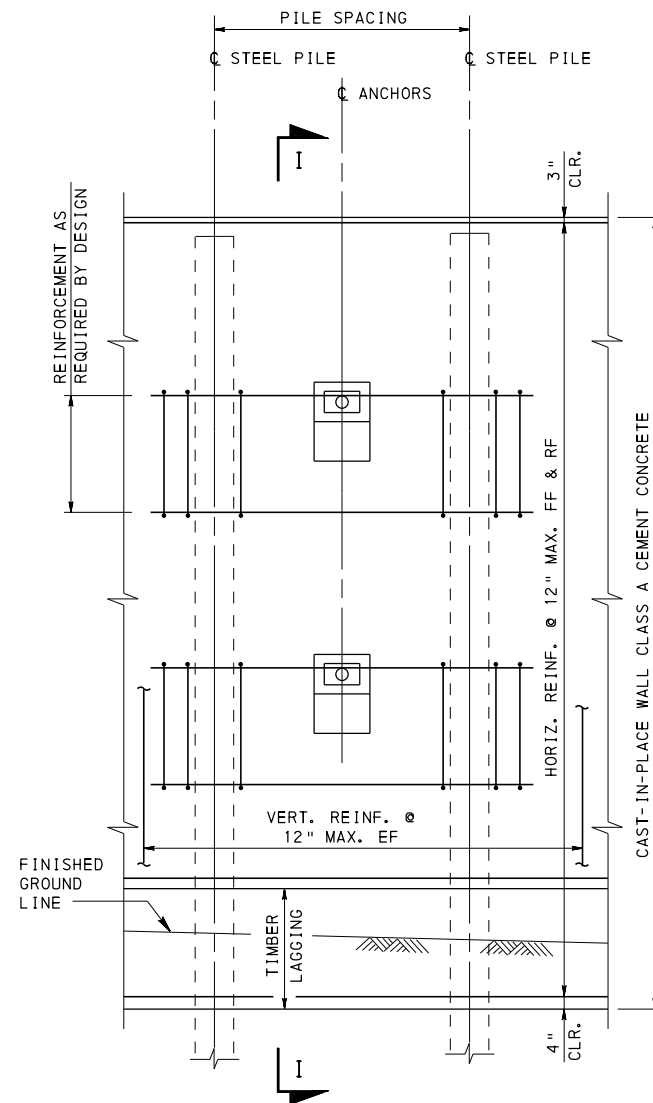
LEGEND:

- * VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

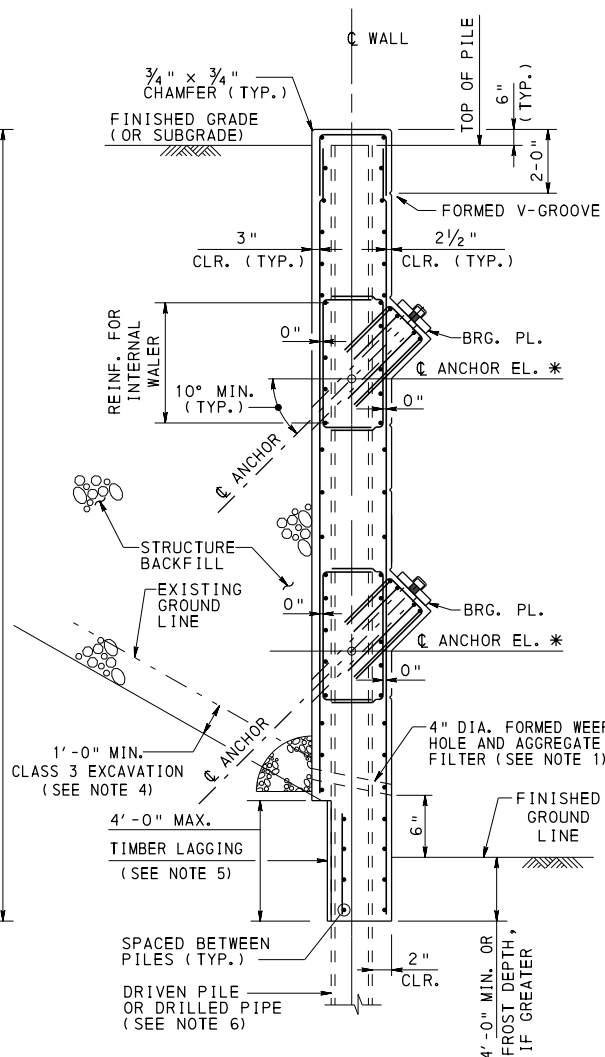
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
ANCHORED WALLS
DOUBLE PILE DESIGN W/CIP WALL

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 5 OF 9 BD-626M
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WALL ELEVATION



SECTION I-I

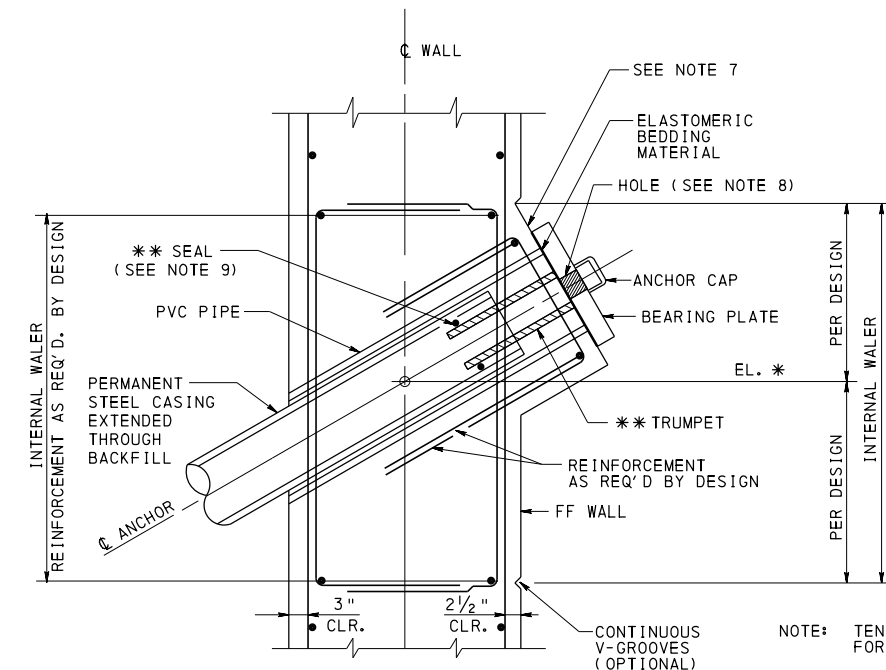
SINGLE PILE DESIGN W/ CIP WALL
BOTTOM UP INSTALLATION

LEGEND:

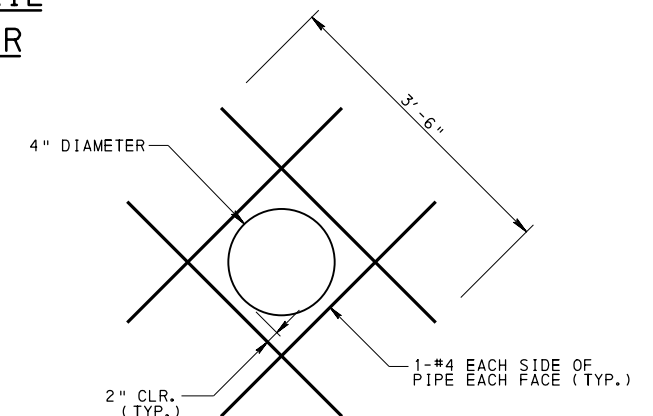
- * VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- ** CONTRACTOR DESIGN (TO BE NOTED FOR AS-DESIGNED WALLS ONLY)
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

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 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.



ANCHORAGE DETAIL
INTERNAL WALER



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.

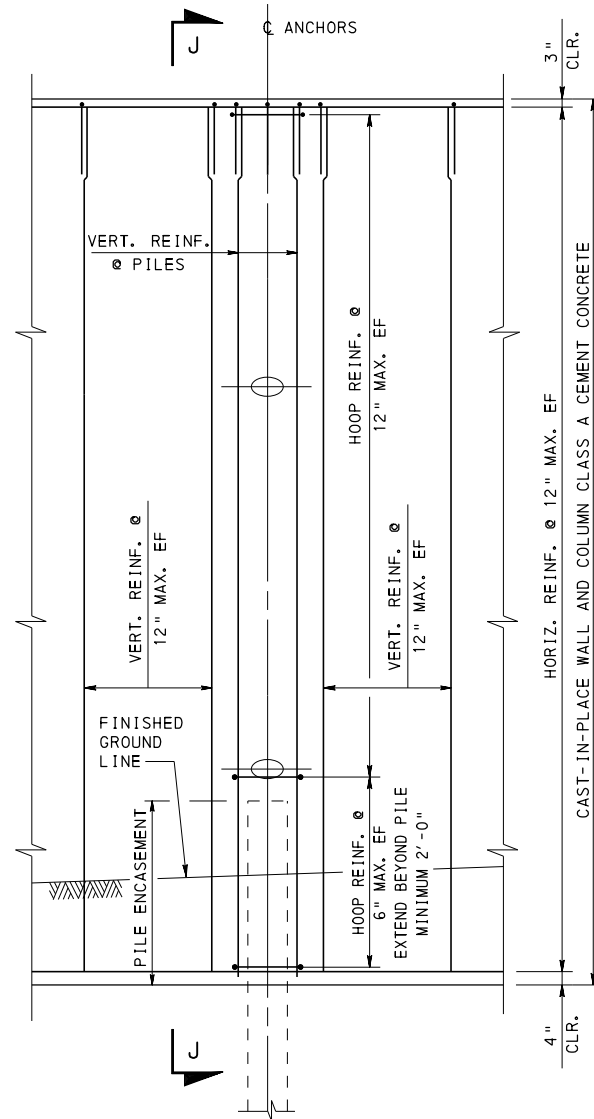
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
ANCHORED WALLS
SINGLE PILE DESIGN W/CIP WALL

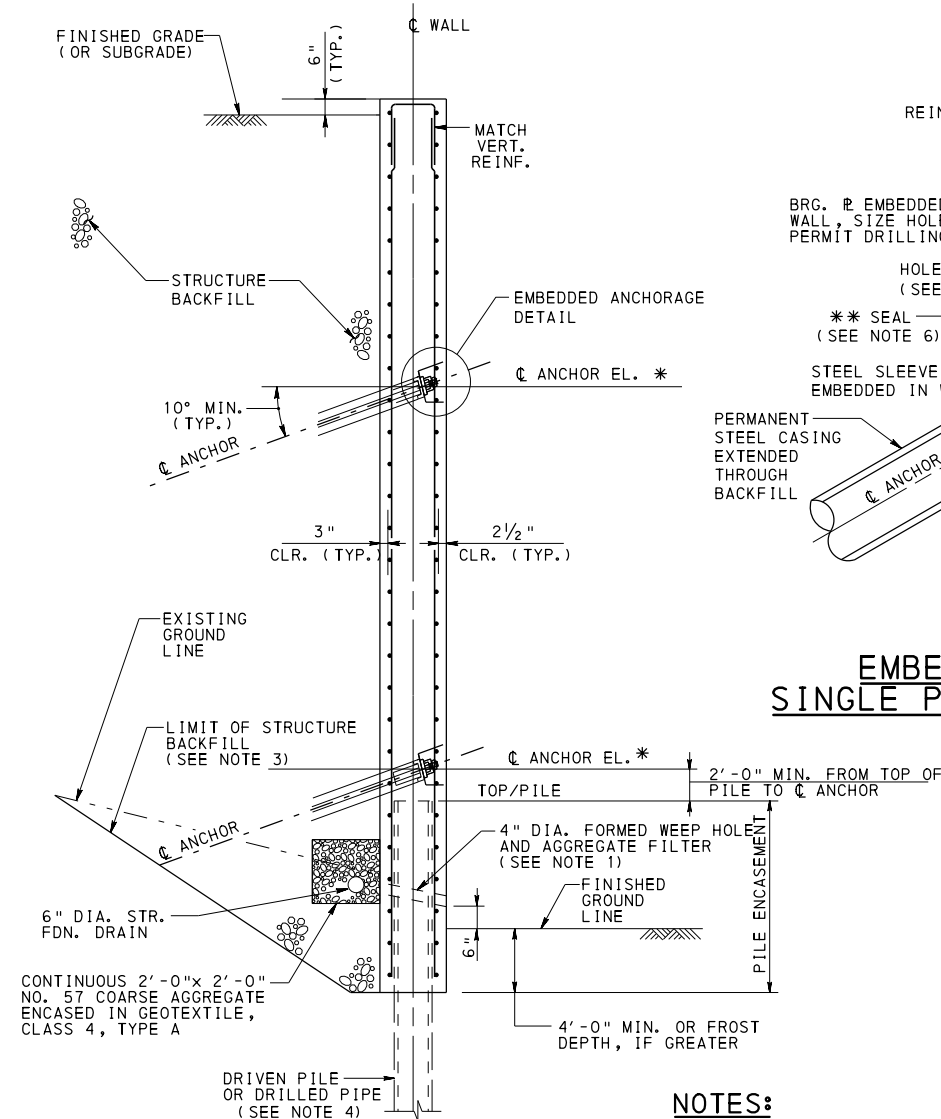
RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. Willey
ACTING DIR. OF PROJECT DELIVERY

SHEET 6 OF 9
BD-626M

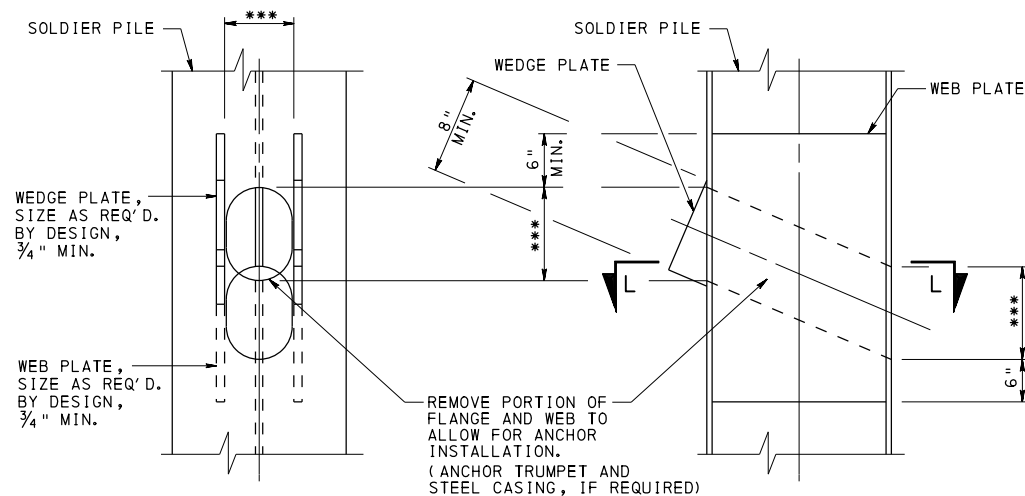


WALL ELEVATION



SECTION J-J

SINGLE PILE DESIGN W/ CIP WALL & COLUMN BOTTOM UP INSTALLATION

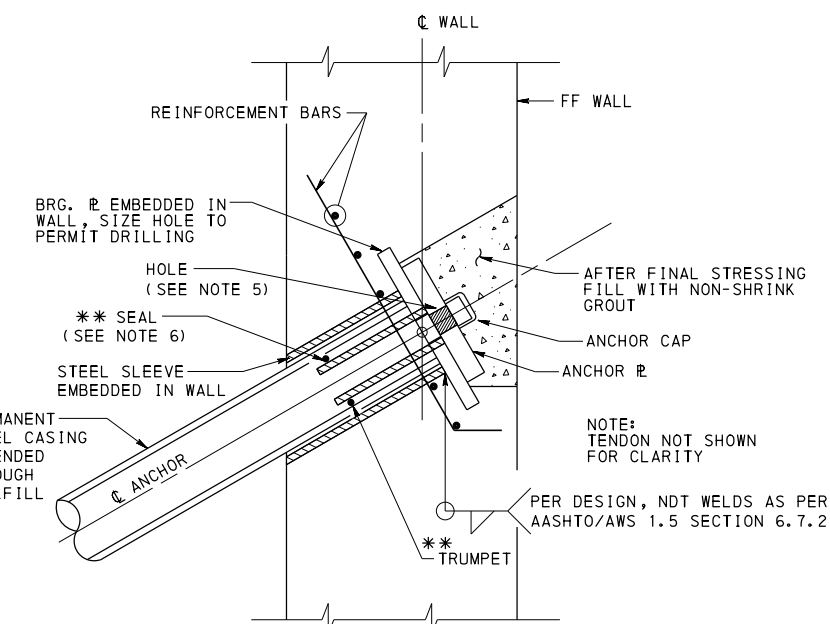


FRONT VIEW

SIDE VIEW

THRU-PILE CONNECTION

*** - SPACING AS REQUIRED BY ANCHOR TRUMPET AND STEEL CASING, IF REQUIRED



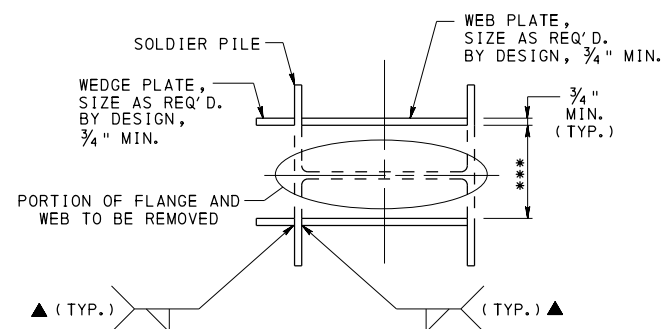
EMBEDDED ANCHORAGE DETAIL SINGLE PILE W/CIP WALL AND COLUMN

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

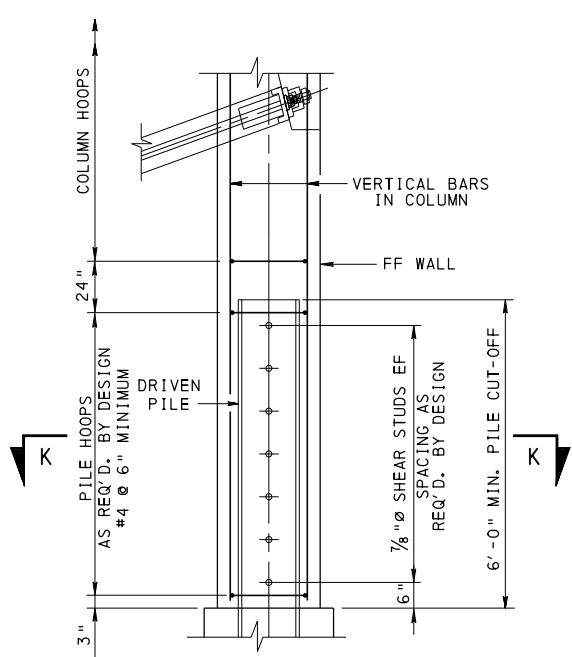
NOTES:

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.

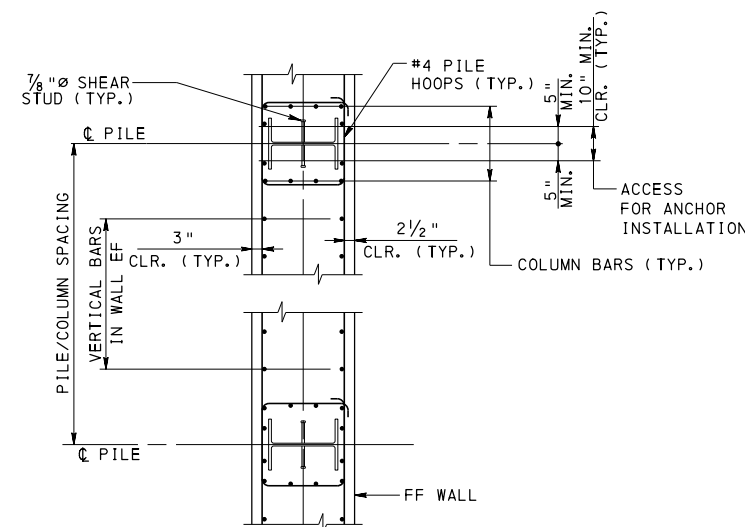


SECTION L-L

▲ - WELD PER DESIGN, NDT WELDS AS PER AASHTO/AWS 1.5 SECTION 6.7.2



PILE ENCASEMENT DETAIL



SECTION K-K

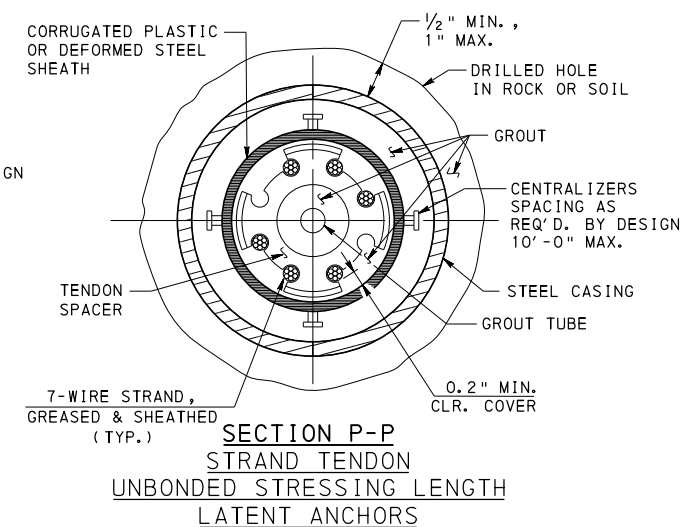
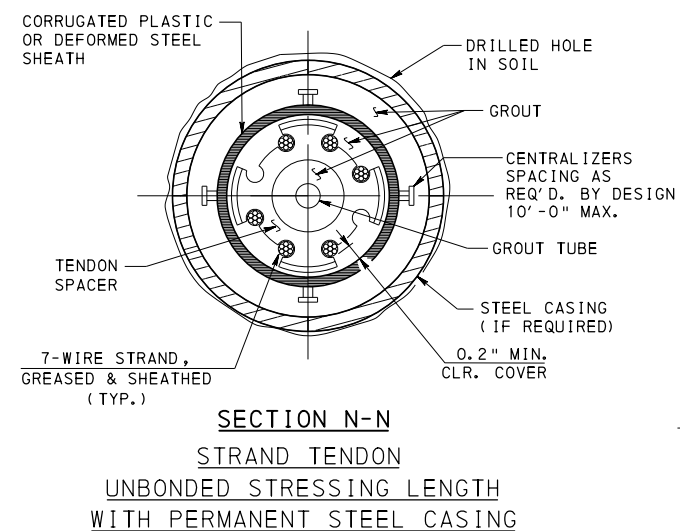
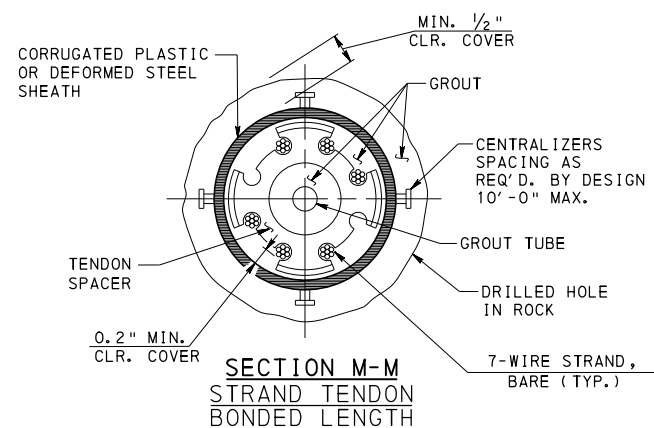
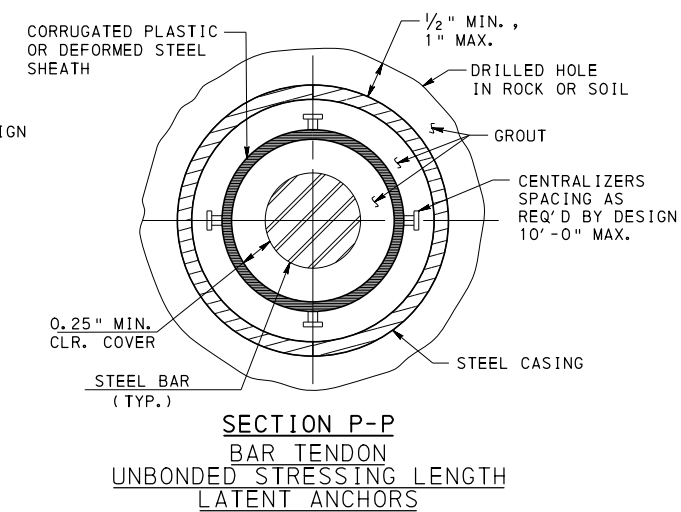
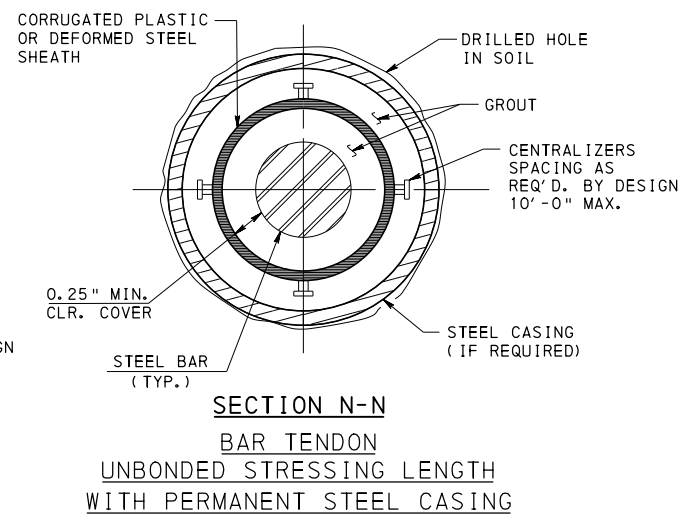
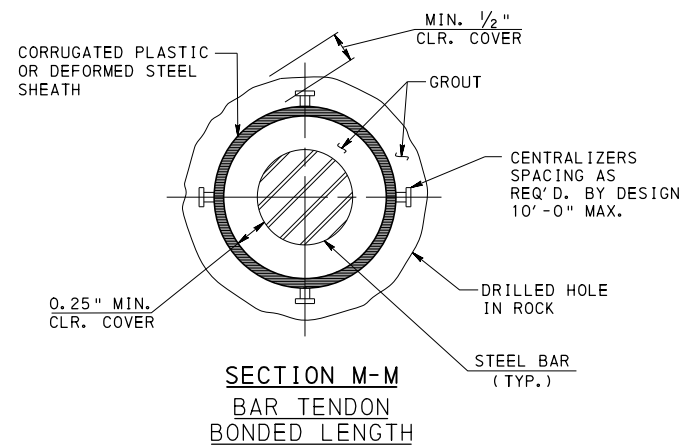
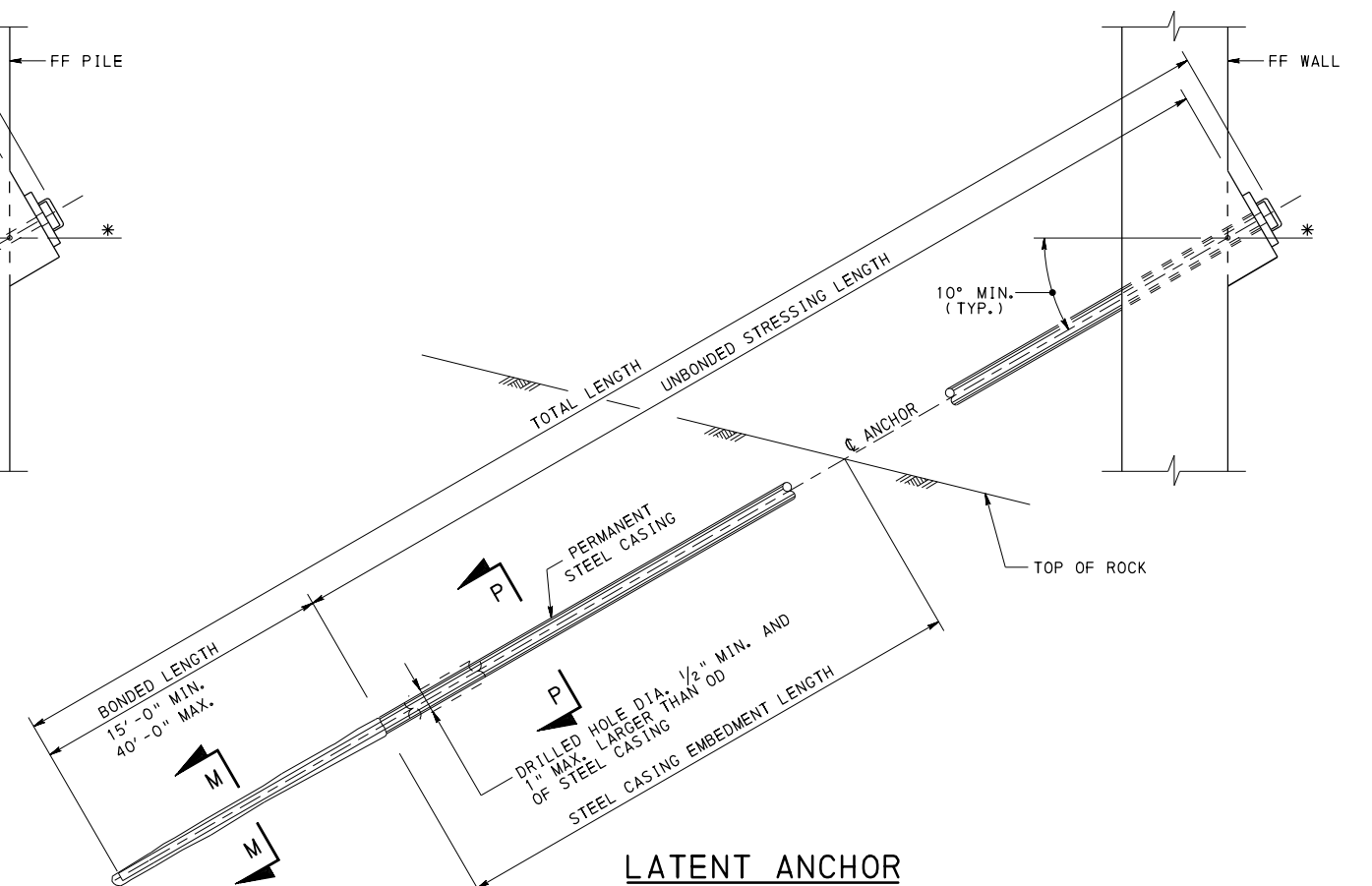
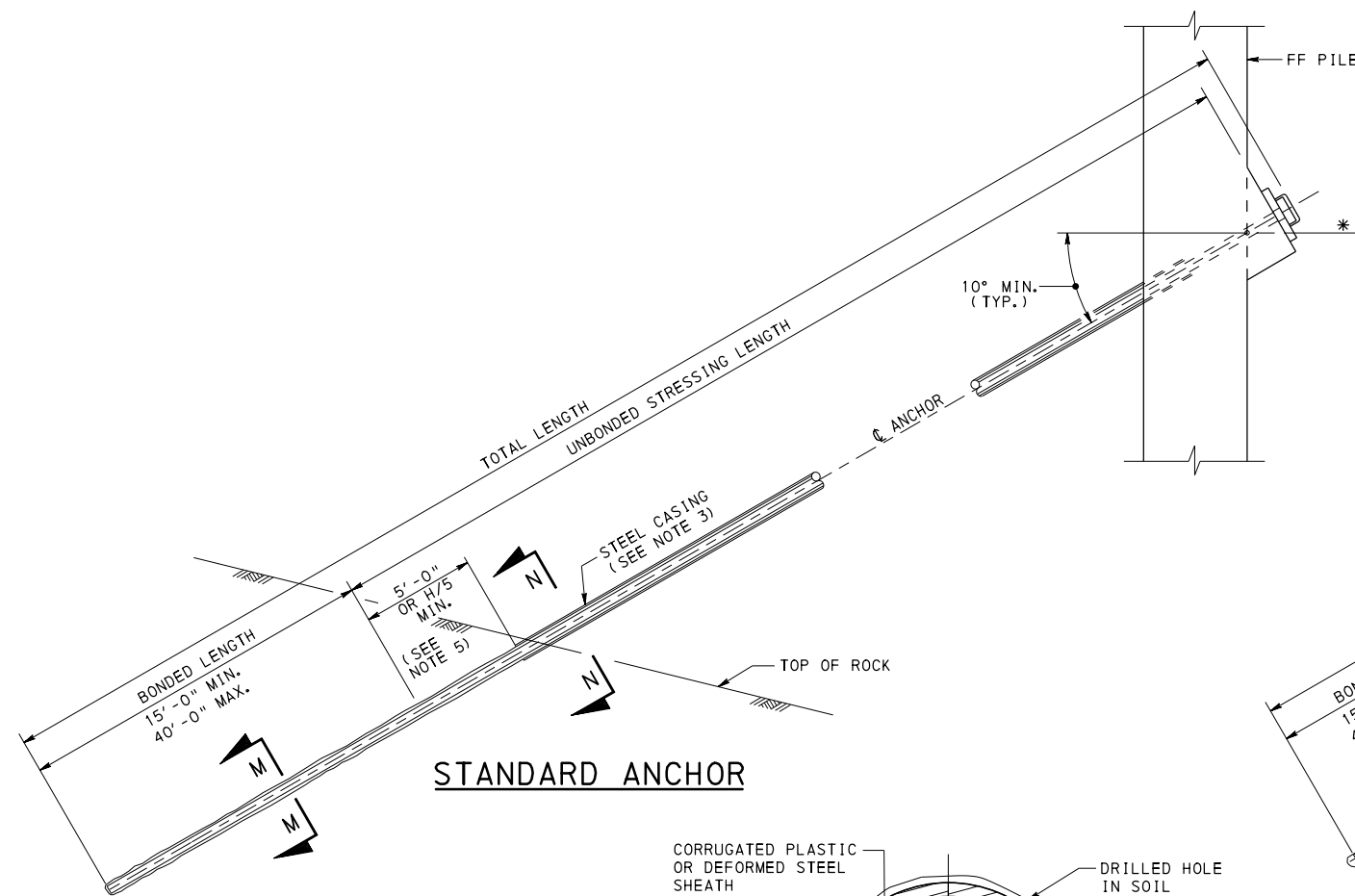
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
ANCHORED WALLS
SINGLE PILE DESIGN W/CIP WALL & COLUMN
THRU-PILE CONNECTION DETAIL

RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. H. Hilly
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 7 OF 9
BD-626M



NOTES:

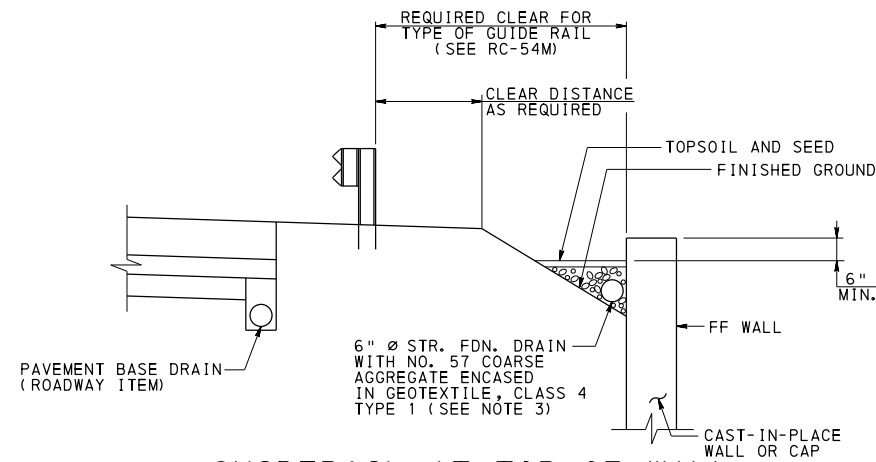
1. FOR ANCHORAGE DETAILS, SEE SHEETS 3,5,6,7, AND 9.
2. FOR USE OF LATENT ANCHORS SEE SHEET 2.
3. USE PERMANENT CASING FOR DRILLED ANCHOR HOLES WHERE REQUIRED IN SOILS OR BACKFILL SUBJECT TO CAVING. (STANDARD ANCHOR ONLY)
4. LOCATE UPPER CENTRALIZER A MAXIMUM OF 5' FROM THE TOP OF THE TENDON BOND LENGTH. LOCATE LOWER CENTRALIZER 1' FROM THE BOTTOM OF THE TENDON BOND LENGTH.
5. H = DESIGN HEIGHT OF THE WALL.

LEGEND:

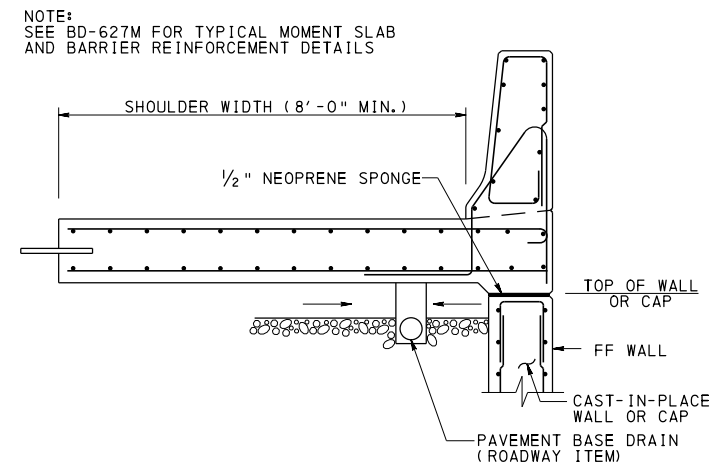
- * VALUE TO BE PROVIDED ON DESIGN DRAWINGS
- EF EACH FACE
- FF FRONT FACE
- RF REAR FACE
- CIP CAST IN PLACE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

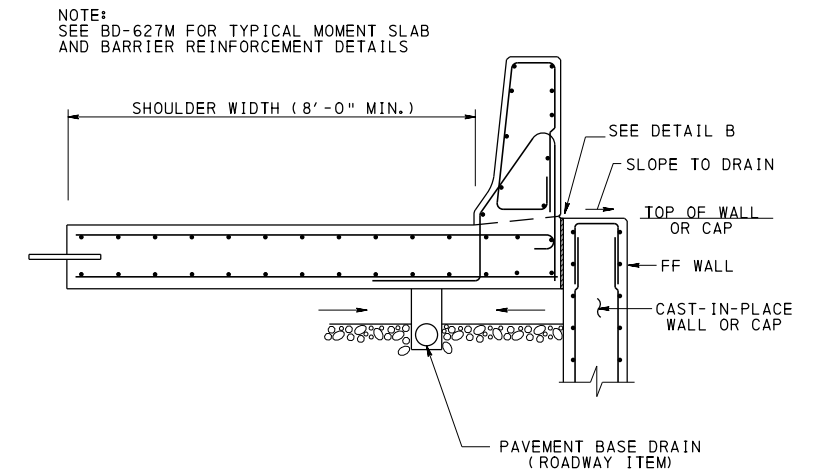
STANDARD
ANCHORED WALLS
ANCHOR DETAILS



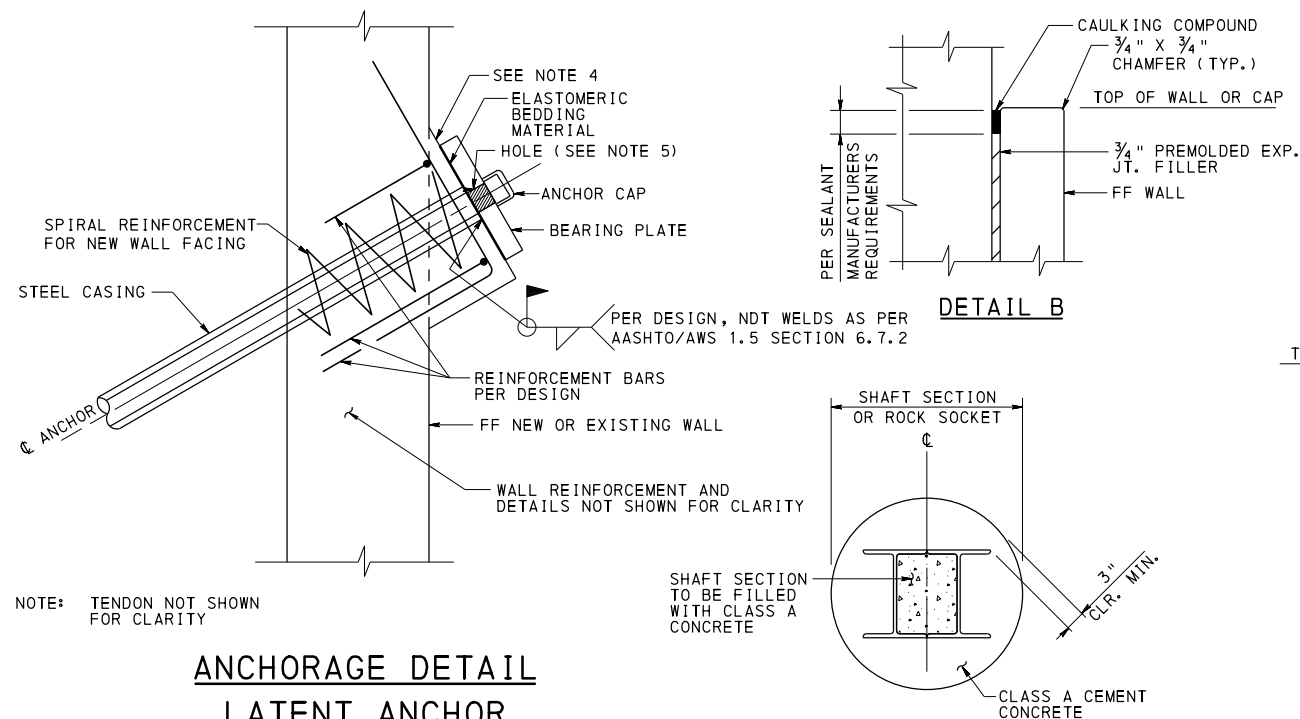
GUIDERAIL AT TOP OF WALL



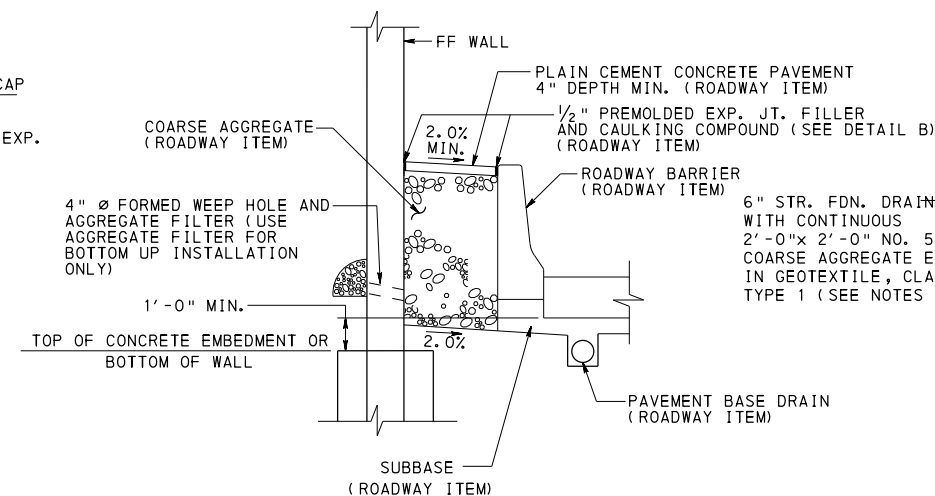
BARRIER DETAIL 1



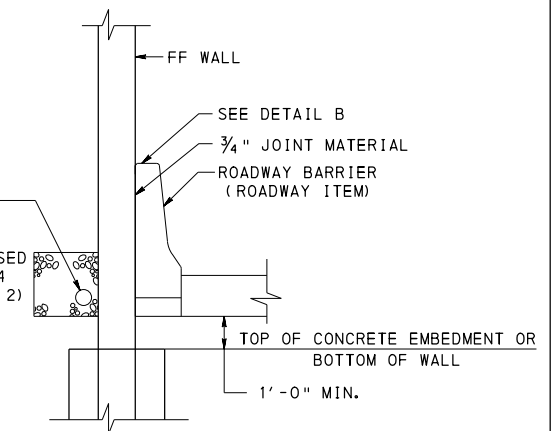
BARRIER DETAIL 2



**ANCHORAGE DETAIL
LATENT ANCHOR**

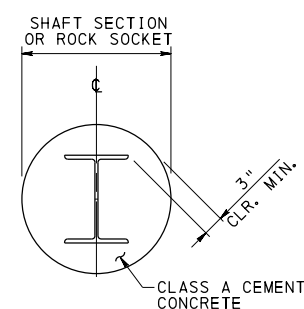


BARRIER DETAIL 3

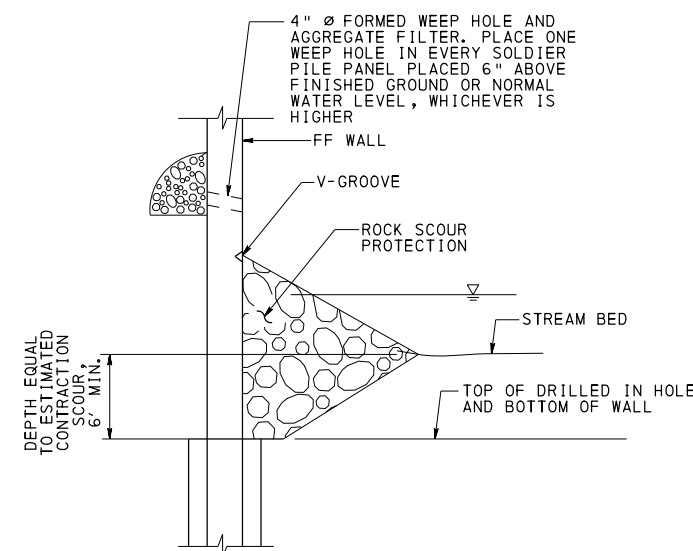


BARRIER DETAIL 4

**CONCRETE EMBEDMENT SECTION -
DOUBLE BEAM**



**CONCRETE EMBEDMENT SECTION -
SINGLE BEAM**



**TYPICAL SECTION
AT STREAM**

LEGEND:
FF FRONT FACE

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).

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

**STANDARD
ANCHORED WALLS
MISCELLANEOUS DETAILS**

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 9 OF 9 BD-626M
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GENERAL NOTES:

1. 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).
2. CONSTRUCTION SPECIFICATIONS AND WORKMANSHIP:
 - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AND THE CONTRACT SPECIAL PROVISIONS.
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.

MATERIAL NOTES:

1. CAST-IN-PLACE CONCRETE:
 - PROVIDE CLASS AA CEMENT CONCRETE IN THE MOMENT SLAB, BARRIERS, AND TOE WALLS.
2. 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.
3. 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:

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. 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.
3. MINIMUM MOMENT SLAB LENGTH = 15'-0".
4. DESIGNER TO DETAIL ONLY CAST-IN-PLACE BARRIERS ON THE CONTRACT PLANS. PRECAST BARRIER OPTION IS ONLY PERMITTED AS A CONTRACTOR ALTERNATE.
5. 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.
6. 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.
7. PROVIDE PAVEMENT BASE DRAINS IN ACCORDANCE WITH RC-30M.
8. 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.
9. SUBBASE THICKNESS BENEATH THE MOMENT SLAB AND BARRIER MUST MATCH THE ROADWAY SUBBASE THICKNESS.

CONTRACT DRAWING NOTES:

- THE FOLLOWING NOTES ARE TO BE PLACED ON THE CONTRACT DRAWINGS WHEN REQUIRED:
1. A HIGHER CLASS CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS CONCRETE AT NO ADDITIONAL COST TO THE DEPARTMENT.
2. 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. DETAIL INFORMATION IN ACCORDANCE WITH BD-629M.
 - 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.
3. 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	FLARED END TREATMENT
8	PAVEMENT RELIEF JOINT AND INLET INSTALLATION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
MOMENT SLABS
GENERAL NOTES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

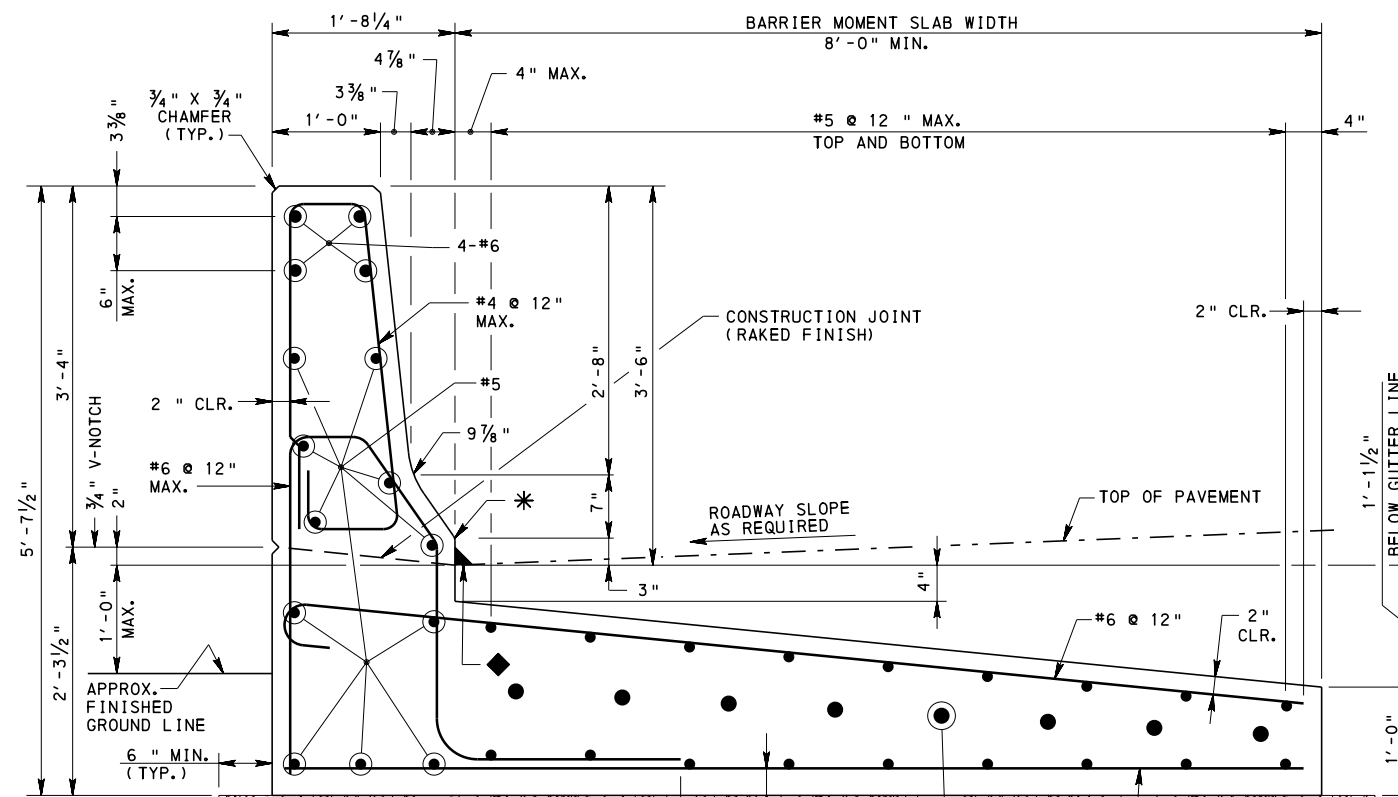
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 1 OF 8

BD-627M

REFERENCE DRAWINGS

RC-20M	CONCRETE PAVEMENT JOINTS
RC-24M	PAVEMENT RELIEF JOINT
RC-30M	SUBSURFACE DRAINS
BC-703M	THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION
BC-708M	THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION
BC-709M	PA TYPE 10M BRIDGE BARRIER
BC-712M	THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION
BC-713M	PA BRIDGE BARRIER
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-739M	BRIDGE BARRIER TO GUIDRAIL TRANSITION
BC-752M	CONCRETE DECK SLAB DETAILS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES
BD-601M	CONCRETE DECK SLAB
BD-610M	PA BRIDGE BARRIER
BD-615M	PA HT BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	PA VERTICAL WALL BRIDGE BARRIER
BD-628M	BRIDGE APPROACH SLABS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS



MOMENT SLAB (BURIED) WITH TYPICAL C.I.P. BARRIER

SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB

* R=1"

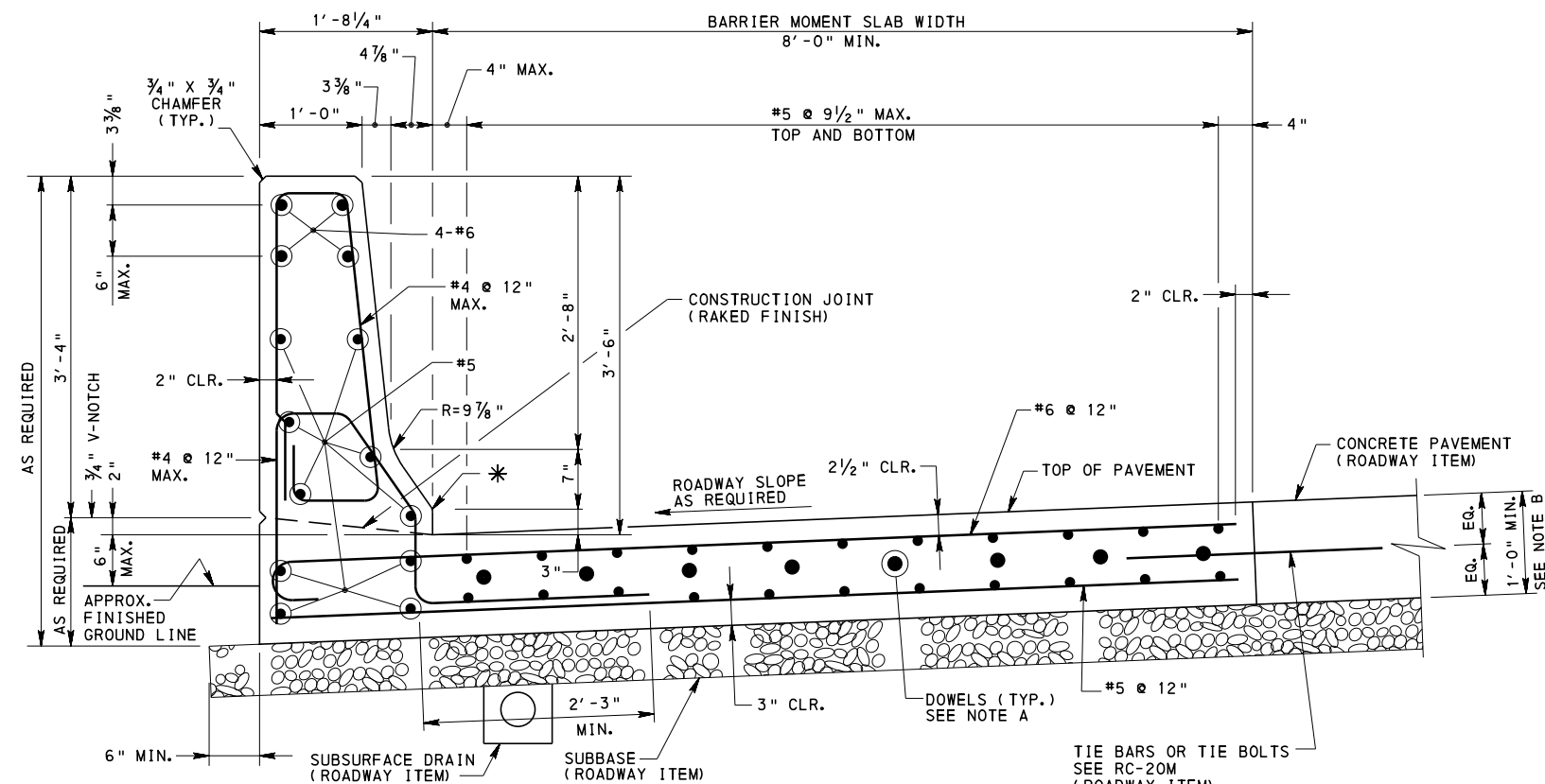
◆ ASPHALT RUBBER SEALING
COMPOUND [PUB. 408,
SECTION 705.4(g)]

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 TYPICAL C.I.P. BARRIER

SEE SHEET 6 FOR PLAN OF C.I.P. MOMENT SLAB

* R=1"

NOTES

1. FOR NOTES, SEE SHEET 1.

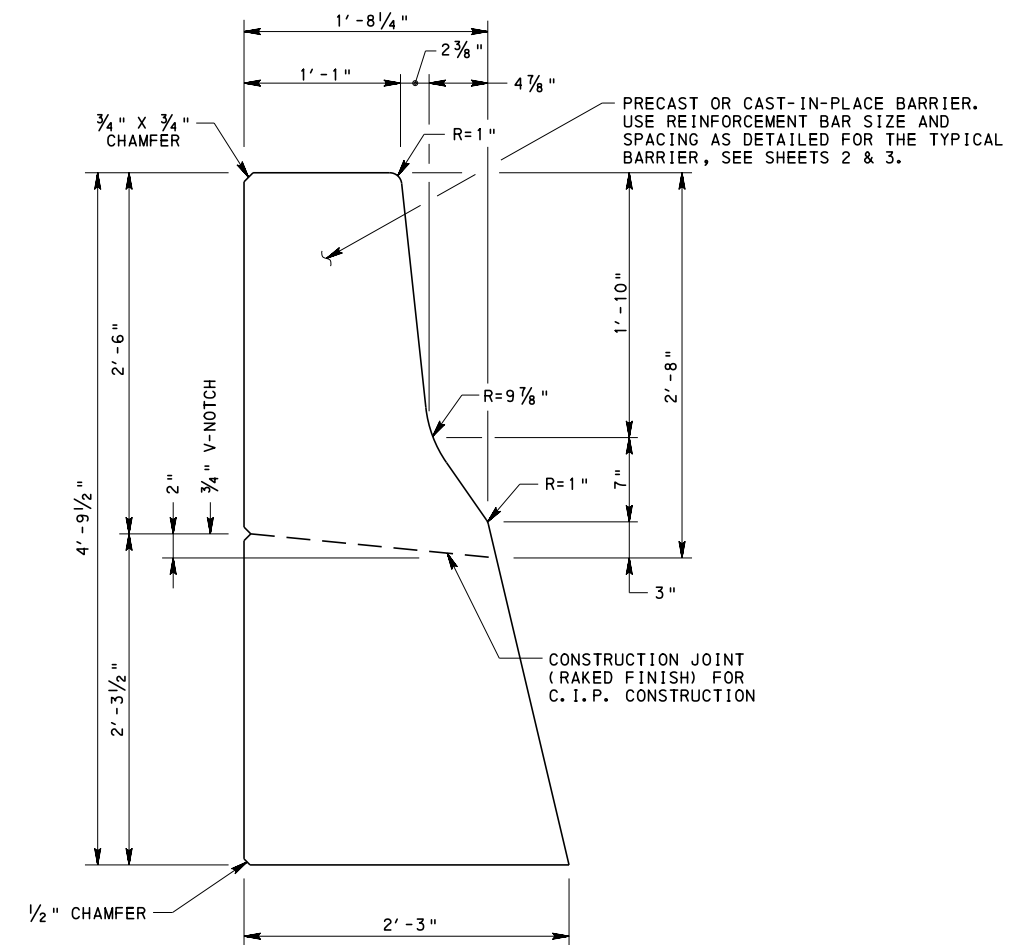
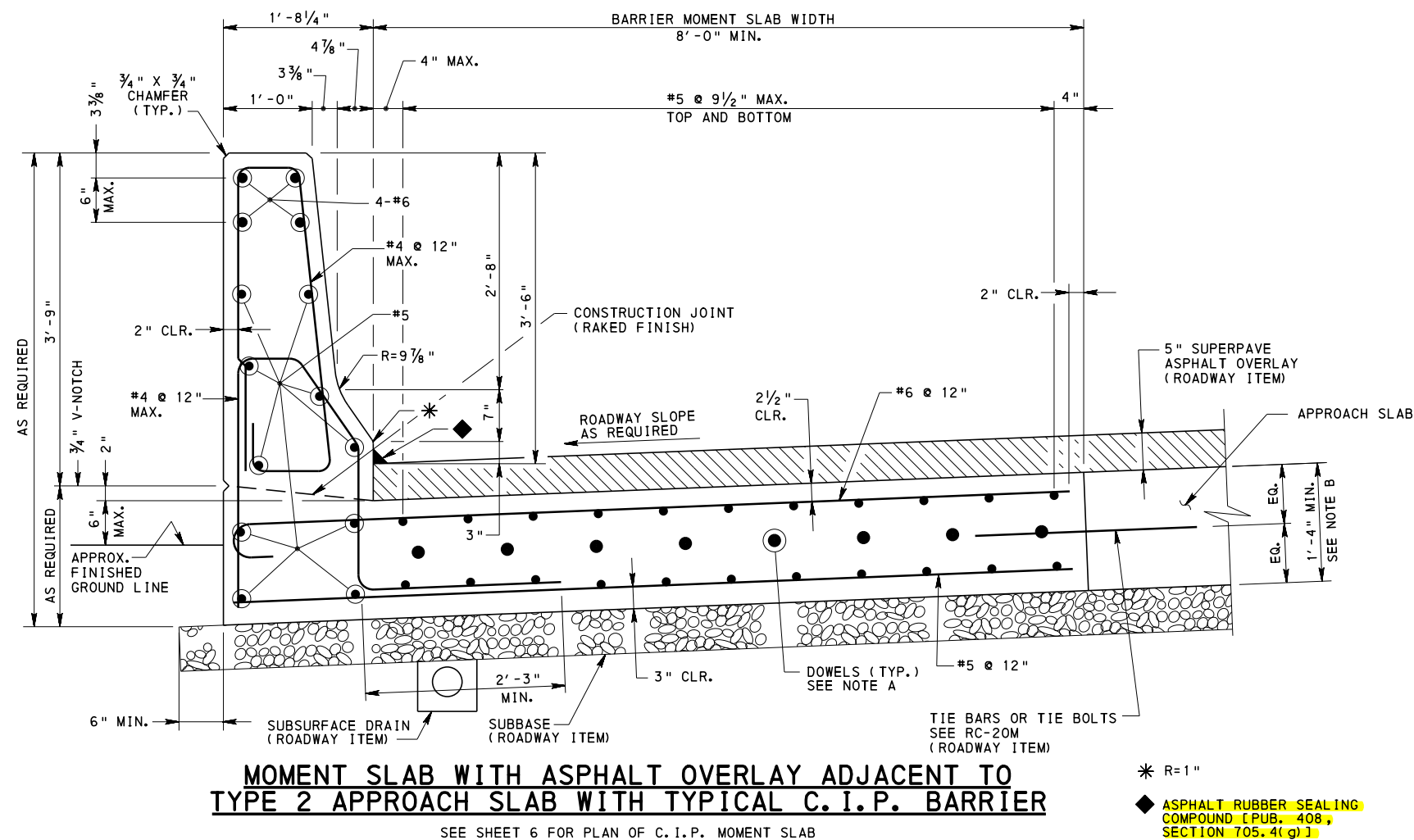
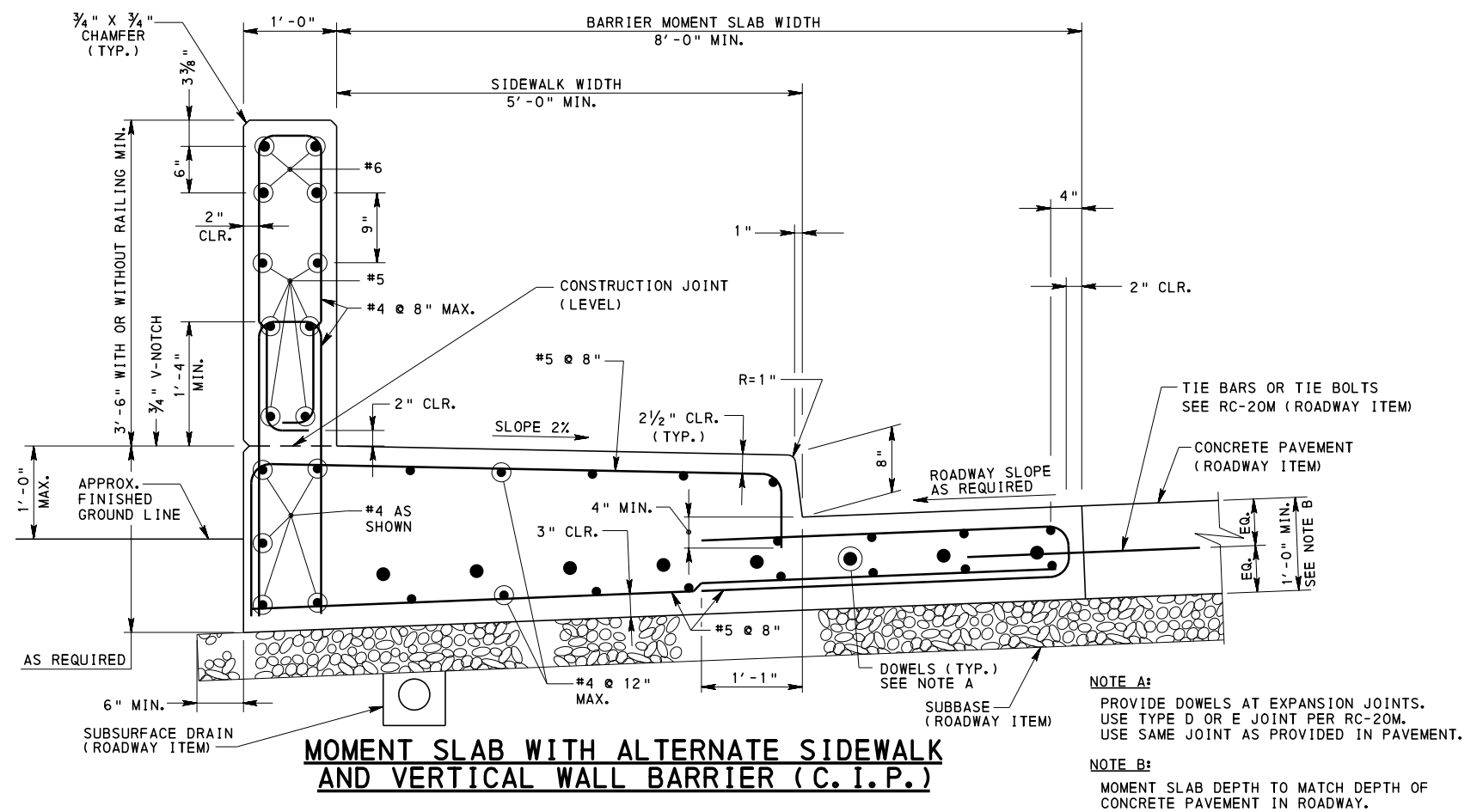
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
MOMENT SLABS
TYPICAL C.I.P. BARRIER DETAILS

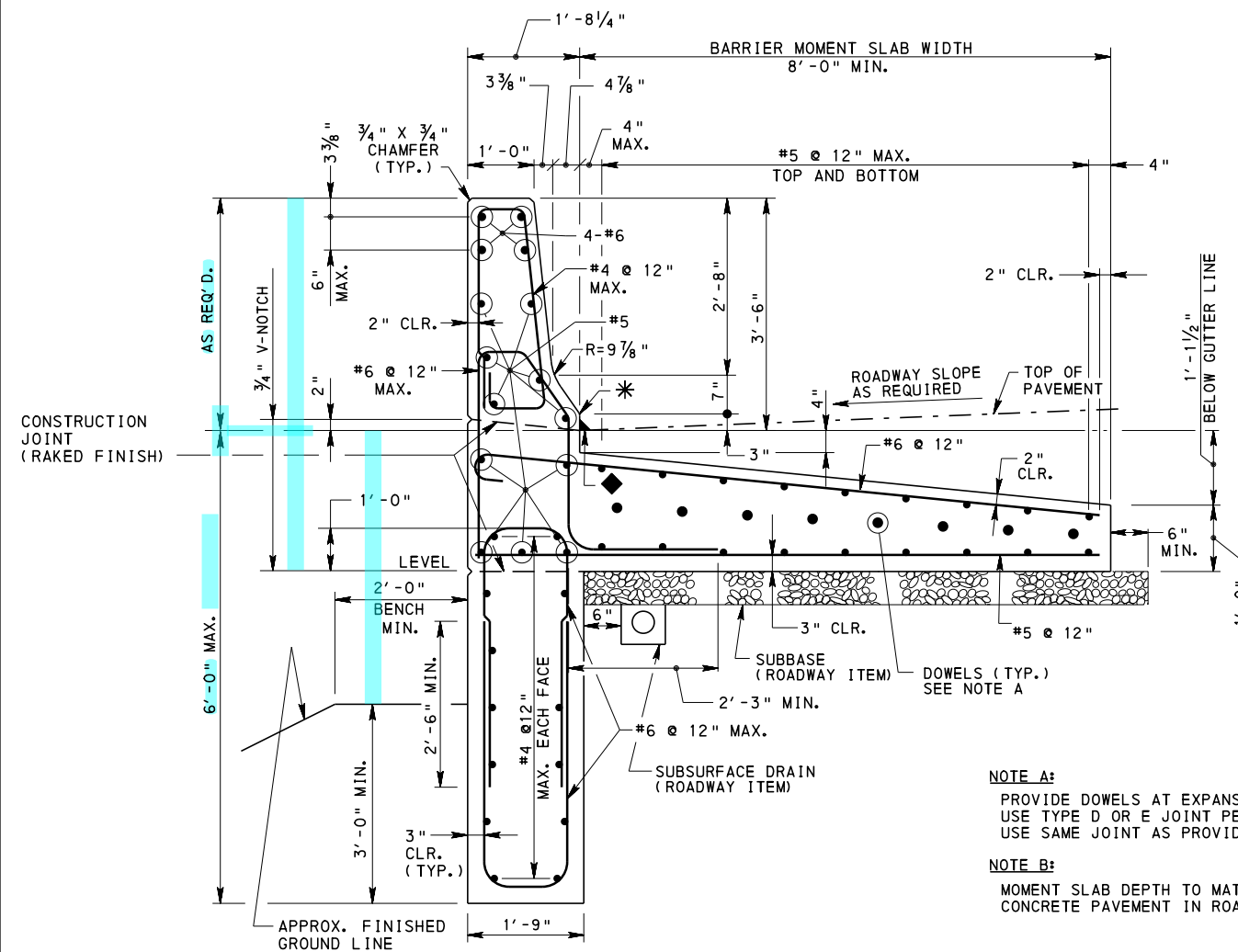
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 2 OF 8
BD-627M

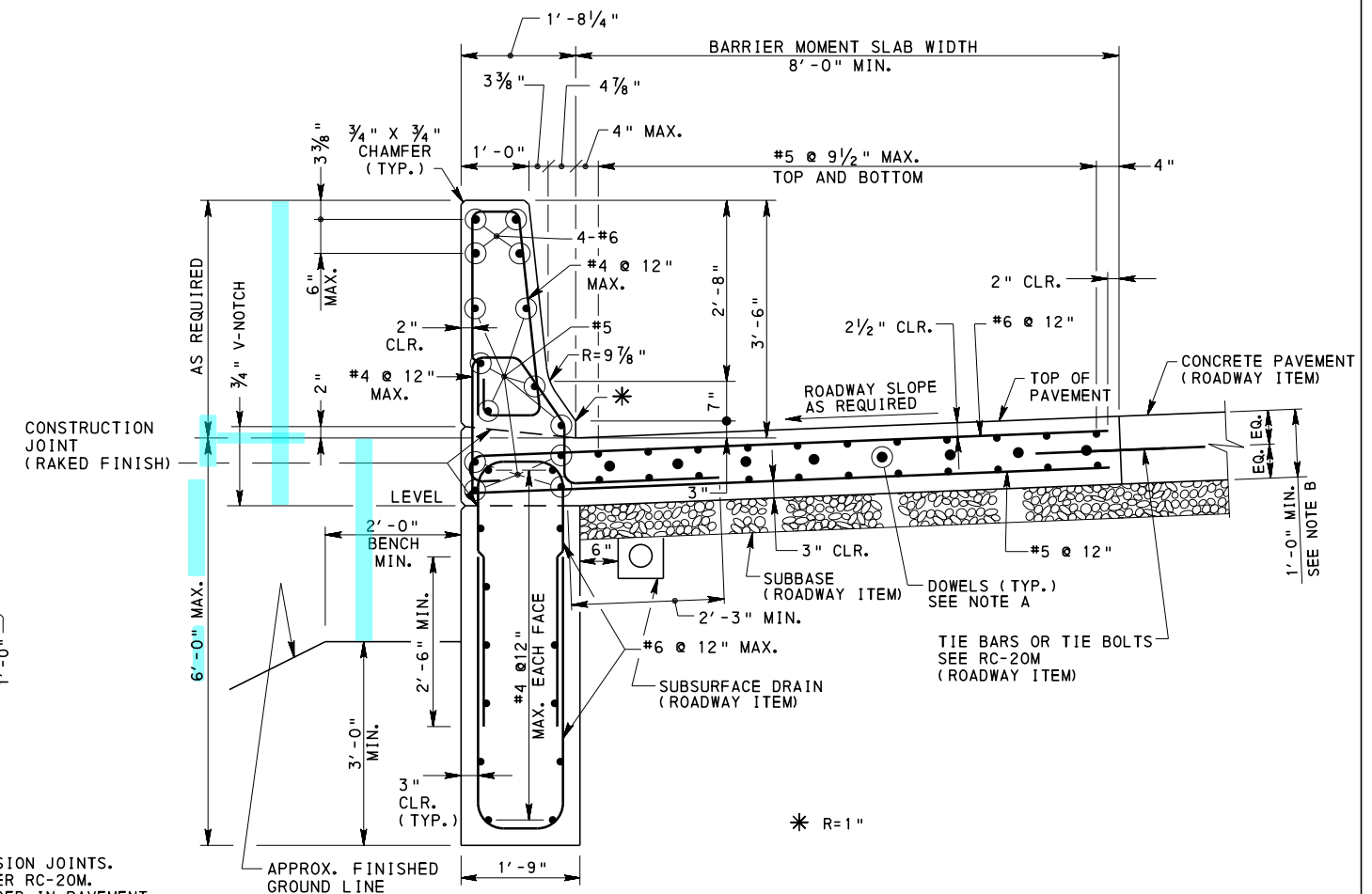


NOTES
1. FOR NOTES, SEE SHEET 1.



NOTE A:

PROVIDE DOWELS AT EXPANSION JOINTS.
USE TYPE D OR E JOINT PER RC-20M.
USE SAME JOINT AS PROVIDED IN PAVEMENT.

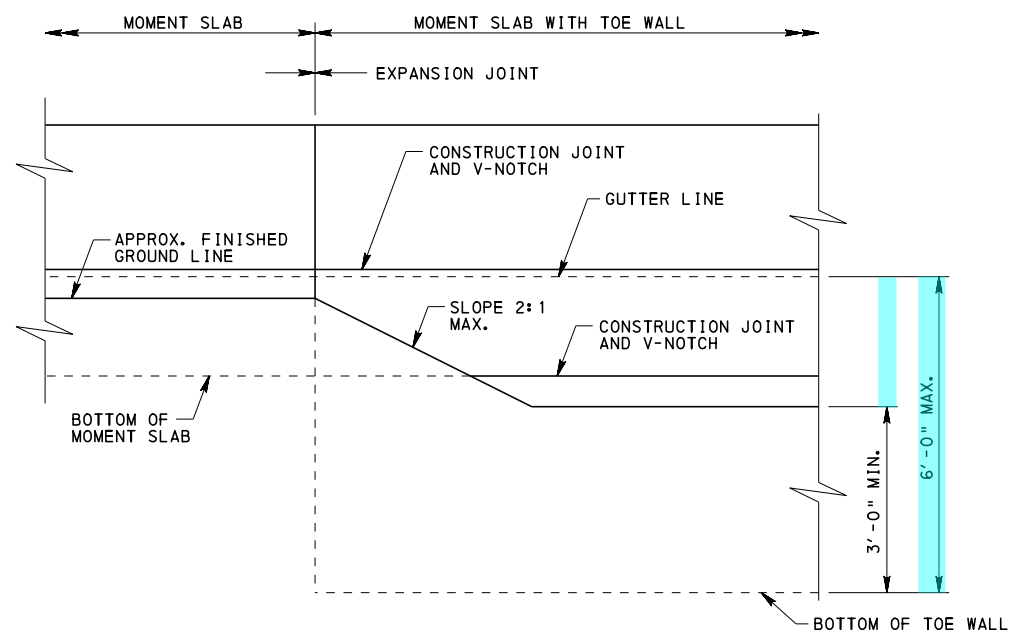


MOMENT SLAB (AT-GRADE) WITH TOE WALL
AND TYPICAL C.I.P. BARRIER

SEE SHEET 6 FOR PLAN OF C. I. P. MOMENT SLAB

* R=1 "

◆ ASPHALT RUBBER SEALING
COMPOUND [PUB. 408,
SECTION 705.4 (g)]



TOE WALL ELEVATION TRANSITION

NOTES

1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

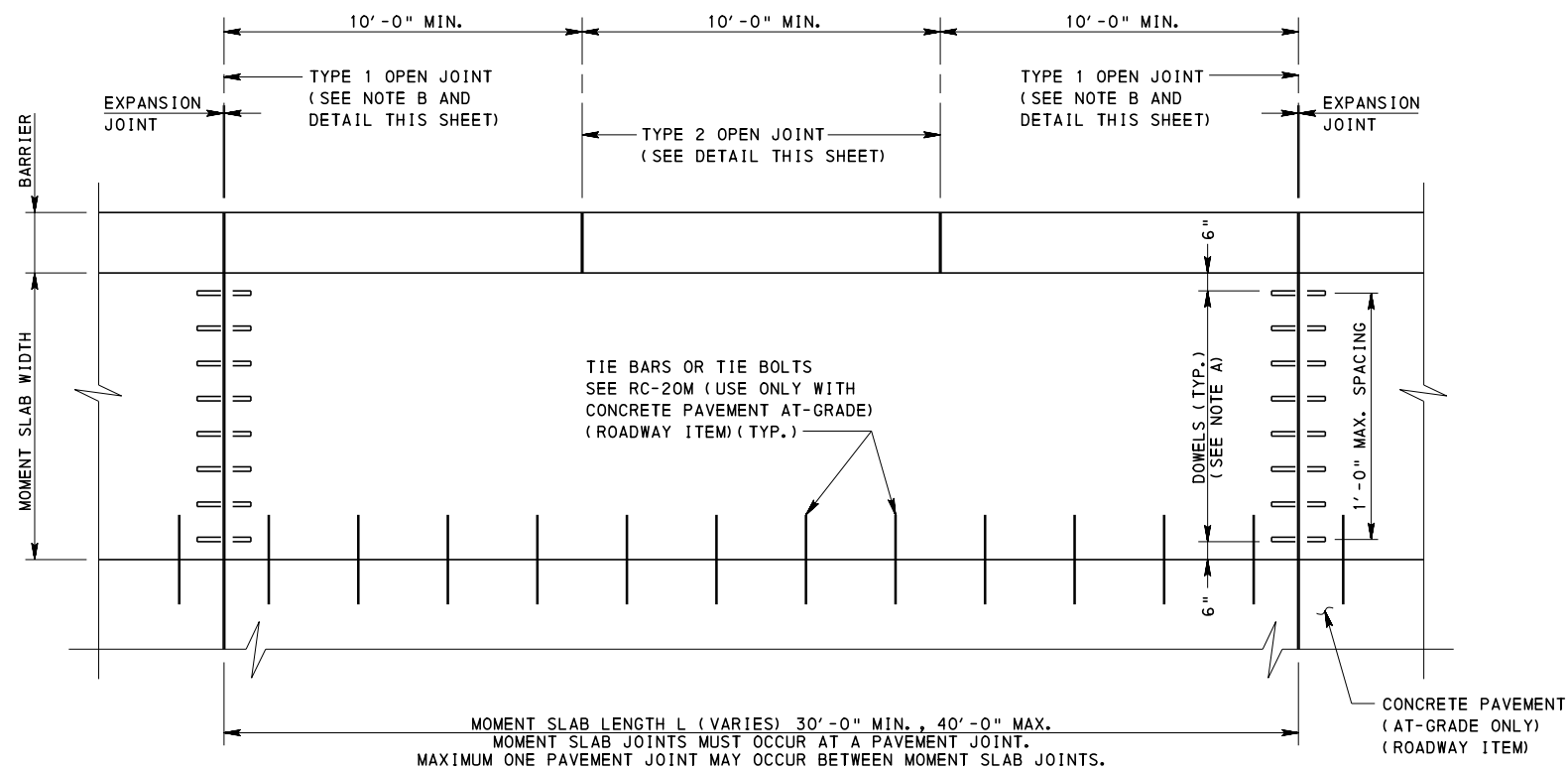
STANDARD
MOMENT SLABS
TOE-WALL DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciara
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
 ACTING DIR, BUR. OF PROJECT DELIVERY

SHEET 5 OF 8

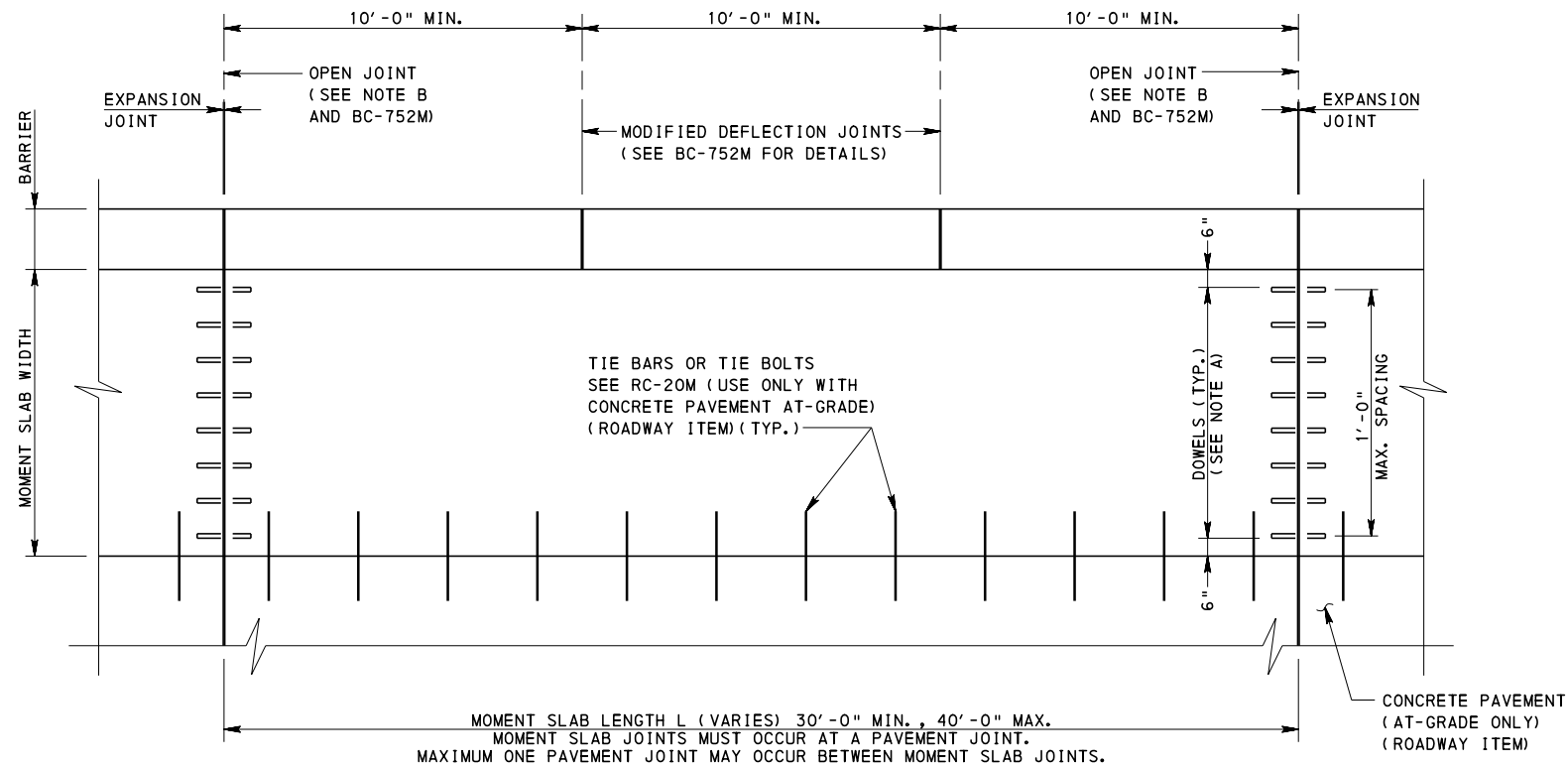
BD-627M



NOTE A: USE TYPE D OR E JOINT PER RC-20M. USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B: PROVIDE TYPE 1 OPEN JOINTS AT SAME LOCATIONS AS THOSE PROVIDED FOR THE MOMENT SLAB.

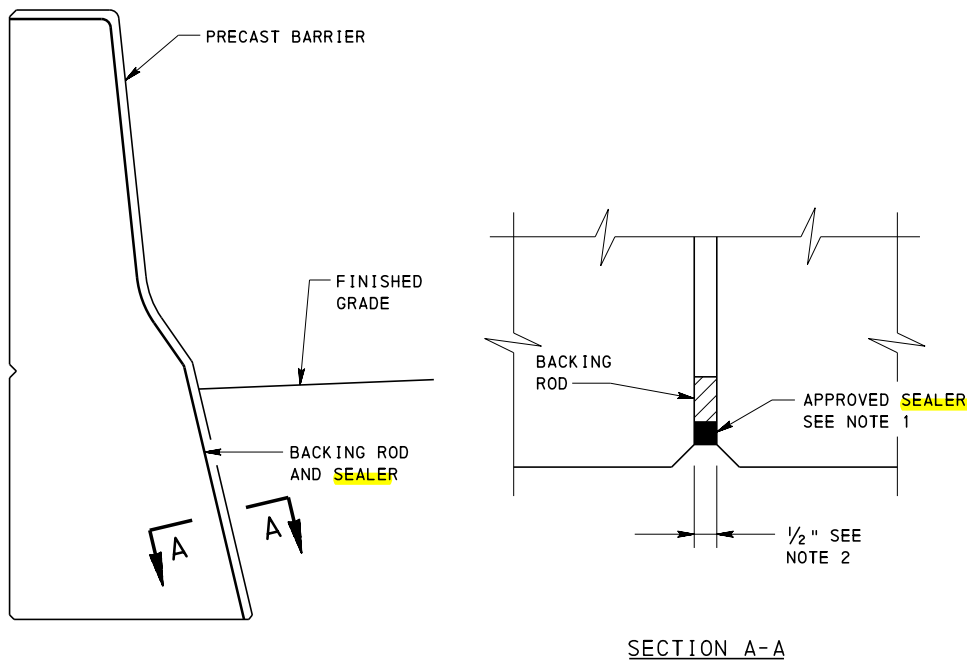
PLAN - BARRIER MOMENT SLAB
(PRECAST BARRIER)



NOTE A: USE TYPE D OR E JOINT PER RC-20M. USE SAME JOINT AS PROVIDED IN PAVEMENT.

NOTE B: PROVIDE OPEN JOINTS IN BARRIER AT SAME LOCATIONS AS THOSE PROVIDED FOR THE MOMENT SLAB.

PLAN - BARRIER MOMENT SLAB
(C. I. P. BARRIER)



**TYPE 1 AND TYPE 2 OPEN JOINT
IN PRECAST BARRIER**

- JOINT NOTES:**
- ALL OPEN JOINTS IN THE BARRIER MUST BE FILLED WITH BACKING ROD AND SEALED WITH SILICONE JOINT SEALING MATERIAL PER PUBLICATION 408, SECTION 705.4(c).
 - 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.

MOMENT SLAB AND BARRIER NOTE:
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.

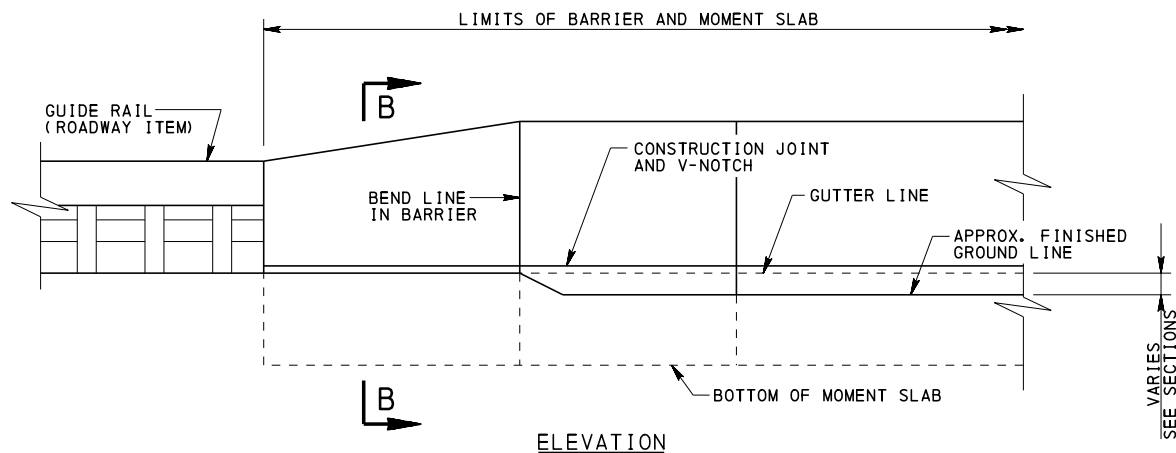
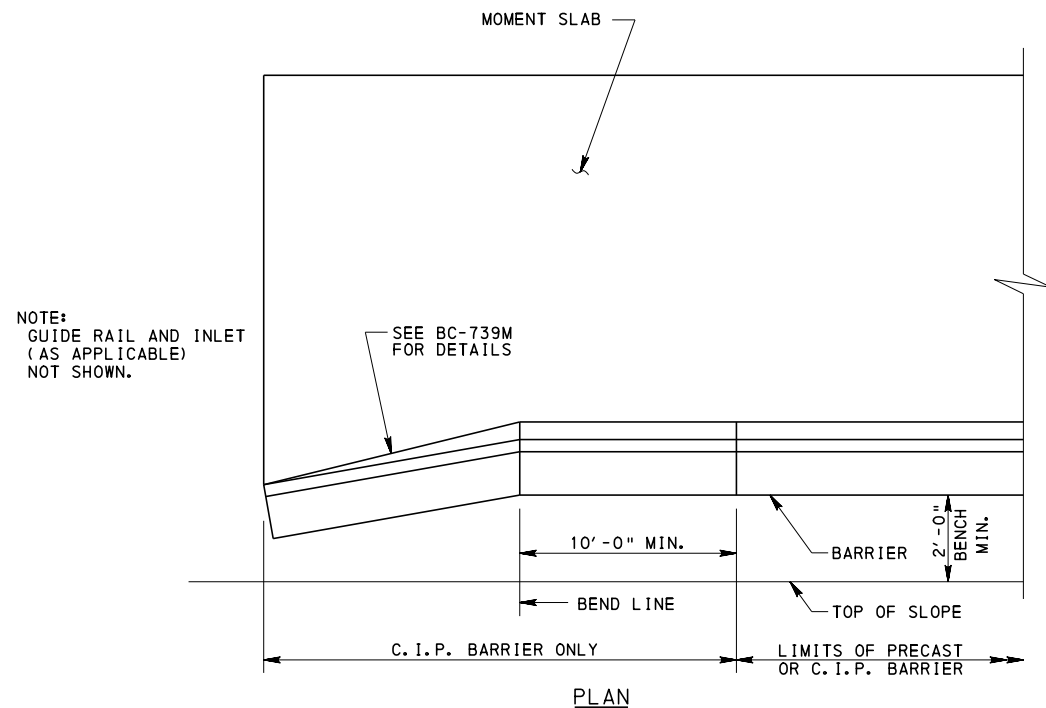
NOTES
1. FOR NOTES, SEE SHEET 1.

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

**STANDARD
MOMENT SLABS
PLANS**

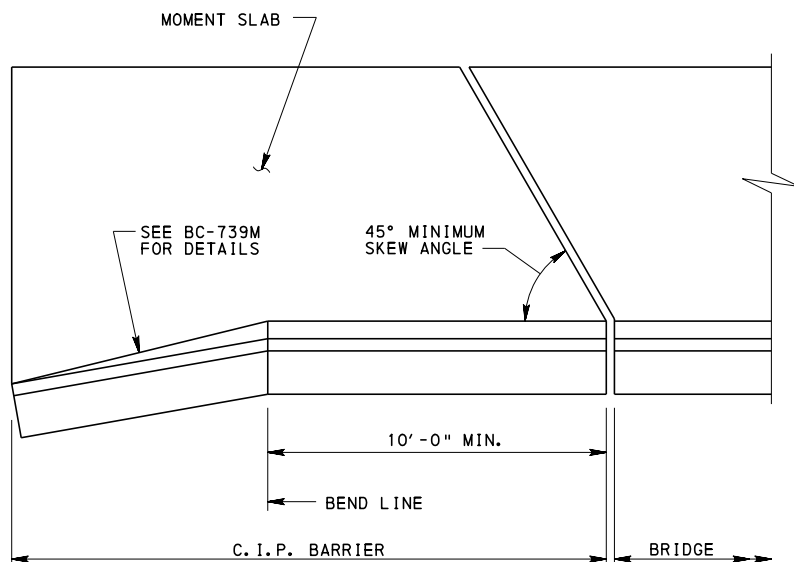
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR., BUR. OF PROJECT DELIVERY	SHEET 6 OF 8 BD-627M
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NOTE:
GUIDE RAIL AND INLET
(AS APPLICABLE)
NOT SHOWN.

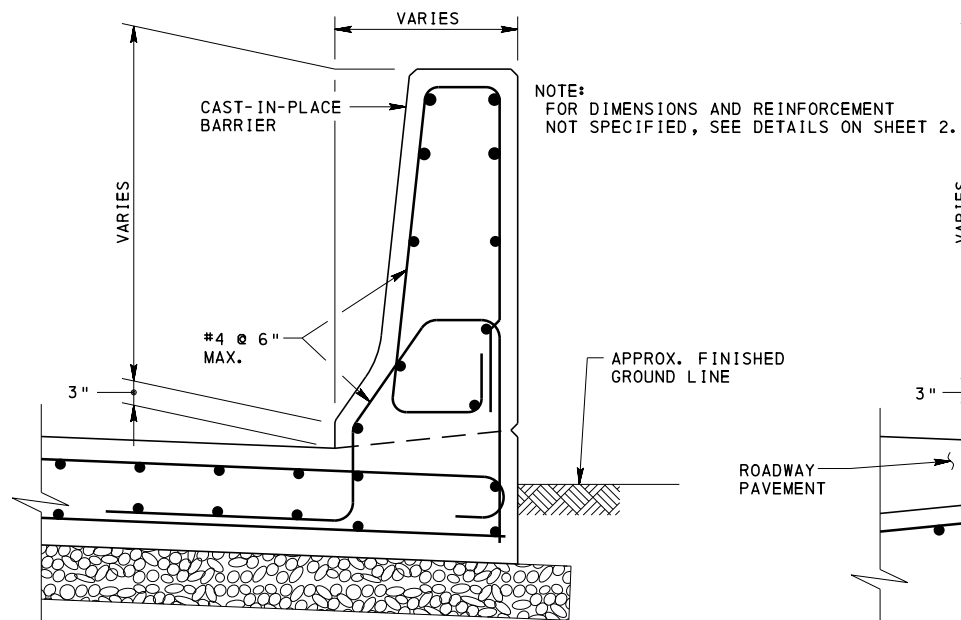


BARRIER TO GUIDE RAIL TRANSITION

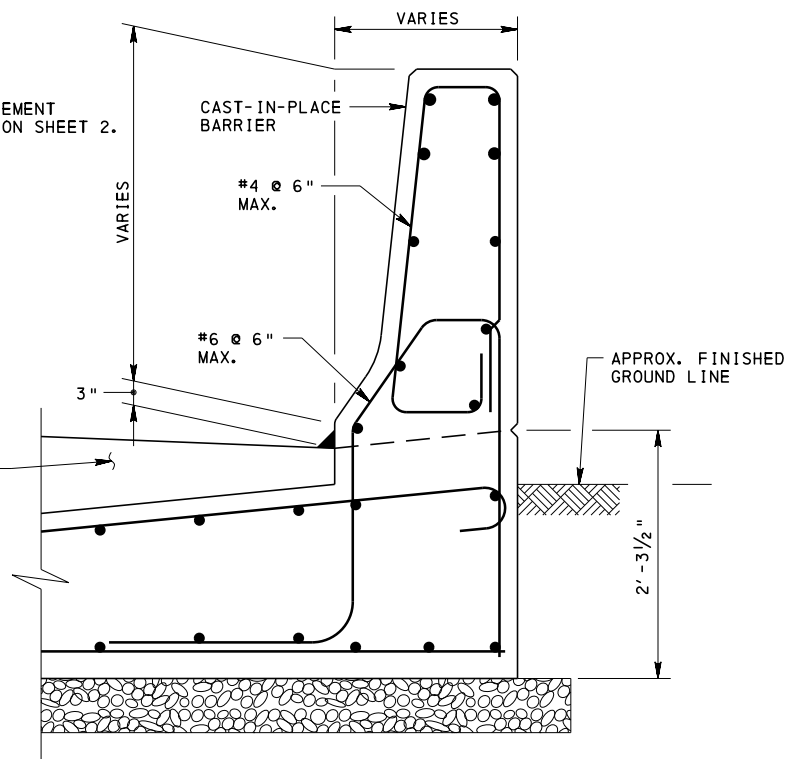
NOTE:
GUIDE RAIL AND INLET
(AS APPLICABLE)
NOT SHOWN.



MOMENT SLAB ADJACENT TO BRIDGE



BARRIER WITH MOMENT SLAB (AT-GRADE)
(C.I.P.)



BARRIER WITH MOMENT SLAB (BURIED)
(C.I.P.)

SECTION B-B

(REFER TO BC-739M FOR ADDITIONAL INFORMATION)

NOTES

1. FOR NOTES, SEE SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

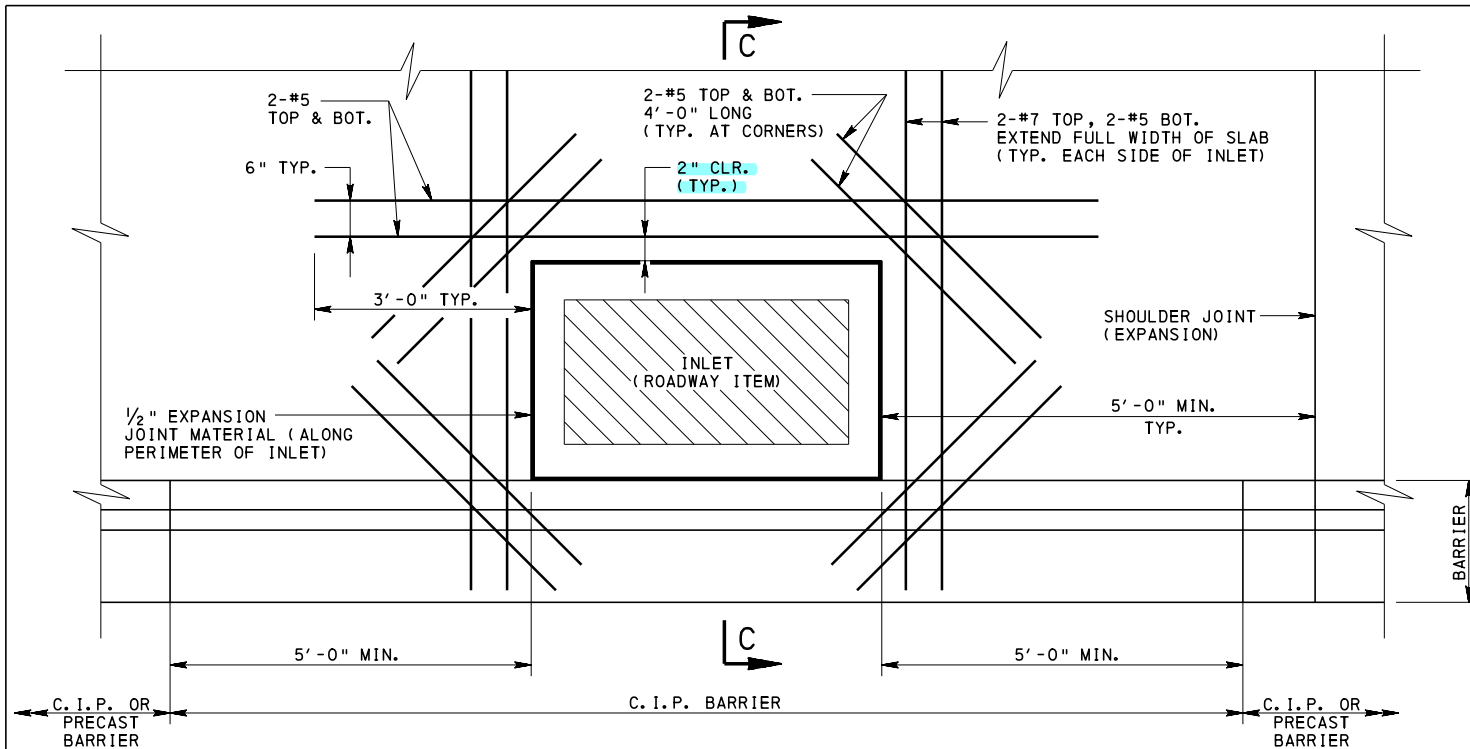
STANDARD
MOMENT SLABS
FLARED END TRANSITION

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

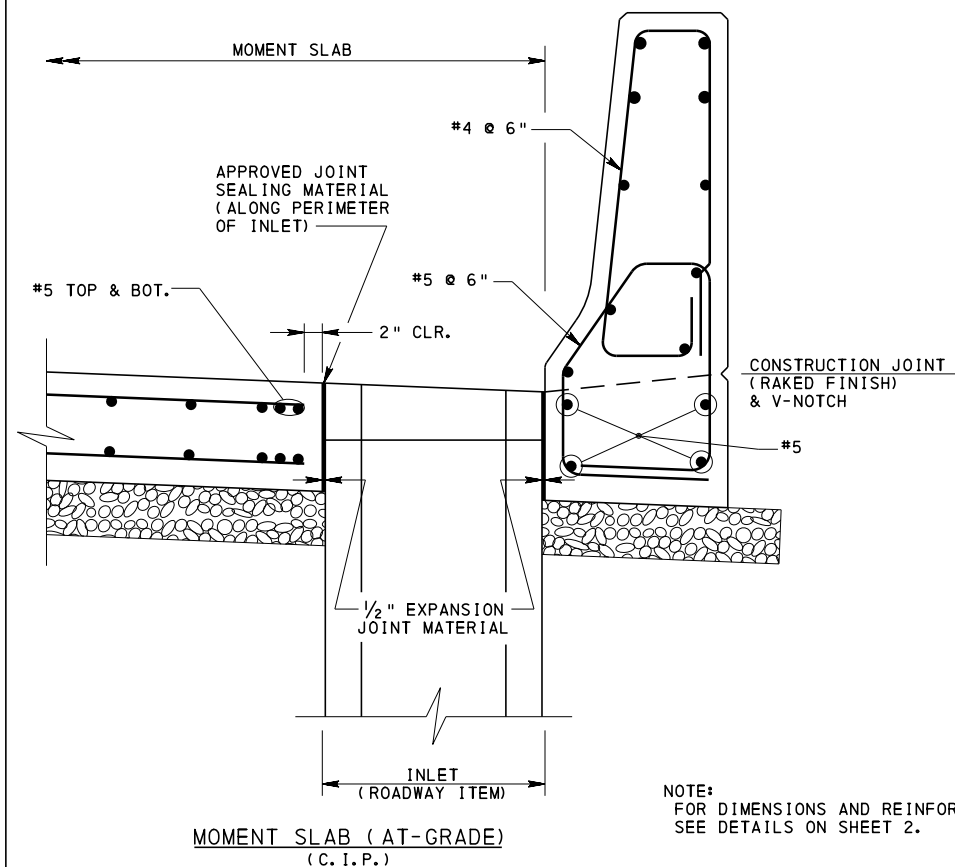
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 7 OF 8

BD-627M

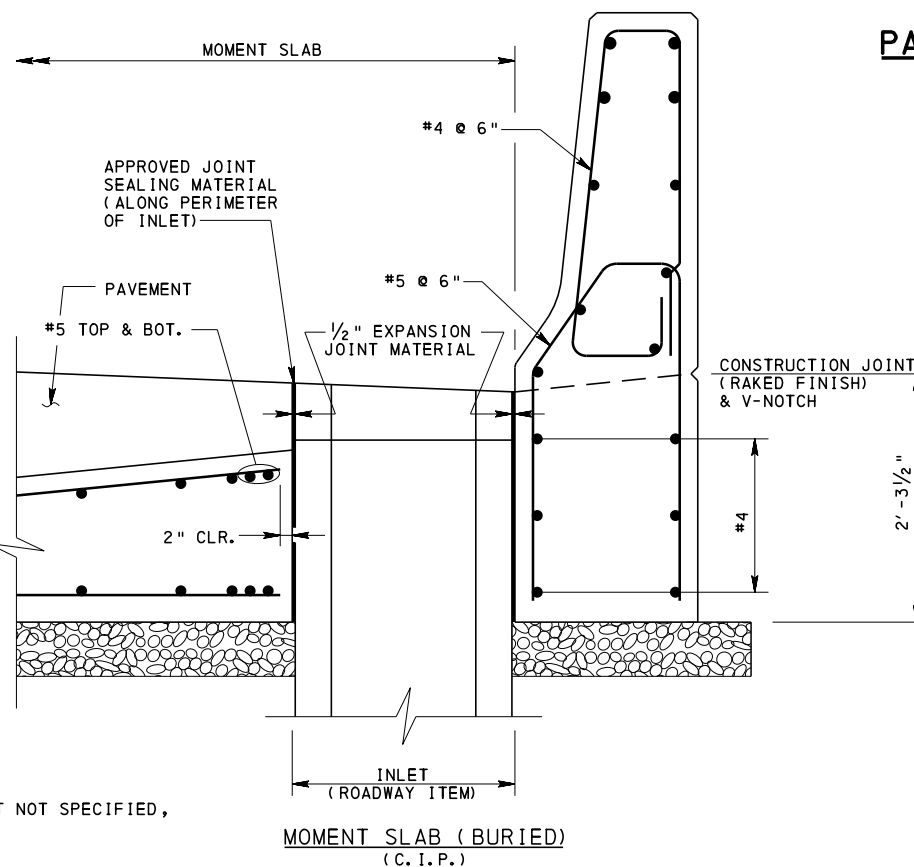


PLAN - SHOULDER DETAILS AT INLET
(ADDITIONAL REINFORCEMENT AT INLETS)

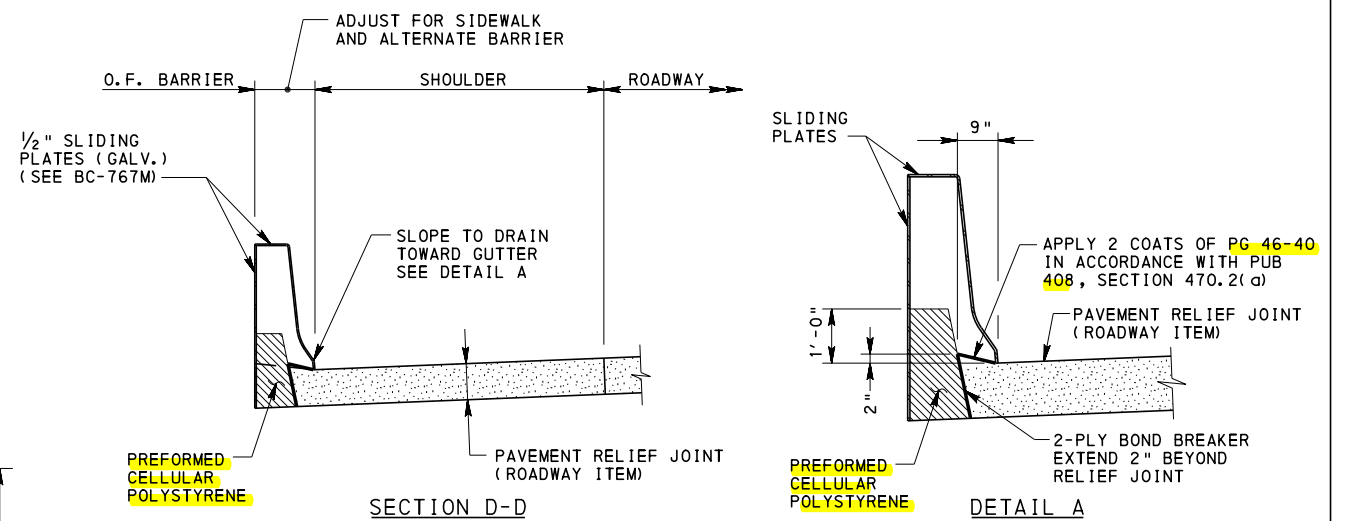


NOTE:
FOR DIMENSIONS AND REINFORCEMENT NOT SPECIFIED,
SEE DETAILS ON SHEET 2.

SECTION C-C

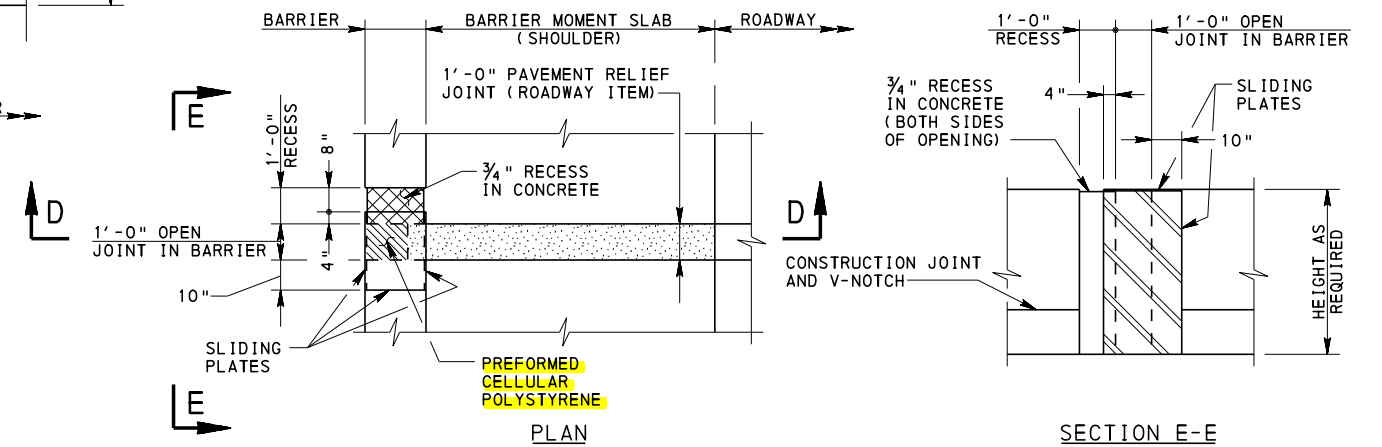


**MOMENT SLAB (BURIED)
(C.I.P.)**



SECTION D-D

DETAIL A



PLAN

SECTION E-E

PAVEMENT RELIEF JOINT DETAILS

NOTES

1. FOR NOTES, SEE SHEET 1.

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

**STANDARD
MOMENT SLABS
PAVEMENT RELIEF JOINT AND
INLET INSTALLATION**

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian D. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 8 OF 8
BD-627M

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 WORKMANSHIP:
- 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 2002 - 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 2002.)
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.

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

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 AAP 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 [ASTM A709, GRADE 36] 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.

RC-12M	BACKFILL AT STRUCTURES		
RC-20M	CONCRETE PAVEMENT JOINTS	BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-24M	PAVEMENT RELIEF JOINT	BC-799M	MECHANICALLY STABILIZED EARTH RETAINING WALLS
RC-30M	SUBSURFACE DRAINS	BD-601M	CONCRETE DECK SLAB
RC-50M	GUIDE RAIL TO BRIDGE BARRIER TRANSITIONS	BD-610M	PA BRIDGE BARRIER
BC-703M	THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION	BD-611M	CONCRETE DIAPHRAGM DETAILS
BC-708M	THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION	BD-615M	PA HT BRIDGE BARRIER
BC-709M	PA TYPE 10M BRIDGE BARRIER	BD-617M	PA TYPE 10M BRIDGE BARRIER
BC-712M	THRIE-BEAM TO PA BRIDGE BARRIER TRANSITION CONNECTION	BD-618M	PA VERTICAL WALL BRIDGE BARRIER
BC-713M	PA BRIDGE BARRIER	BD-621M	REINFORCED CONCRETE ABUTMENTS
BC-735M	WALL CONSTRUCTION AND EXPANSION JOINT DETAILS	BD-622M	R.C. ABUTMENTS WITH BACKWALL
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS	BD-624M	R.C. ABUTMENTS WITHOUT BACKWALL
BC-739M	TYPE F-BRIDGE BARRIER TO GUIDE RAIL TRANSITION	BD-627M	MOMENT SLABS
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES	BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL JOINT FOR APPROACH SLABS	BD-656M	TYPICAL LONGITUDINAL SECTIONS
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE AND STEEL BEAM BRIDGES	BD-661M	BOX BEAM REINFORCEMENT DETAILS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS	BD-662M	I-BEAM AND PA BULB-TEE BEAM REINFORCEMENT DETAILS
		BD-667M	INTEGRAL ABUTMENTS
		BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
GENERAL NOTES - 1

RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. Wayne Willey
ACTING DIR., BDR. OF PROJECT DELIVERY

SHEET 1 OF 35

BD-628M

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 QUALITY ASSURANCE DIVISION.

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, PROTECTIVE COATINGS AND ANY OTHER ITEM THAT MAY BE REQUIRED FOR THE CONSTRUCTION OF THE APPROACH SLAB.
 - **COMPRESSION SEALS OR INVERTED V JOINT SEALS, WATERSTOPS, POLYETHYLENE SHEETING, CLOSED CELL NEOPRENE SPONGE, EPOXY BONDING COMPOUND, SAWING AND SEALING JOINTS, BACKER ROD, AND BITUMINOUS 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 TYPICAL 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).**
- CONTRACT DRAWING 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.
- 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 CONNECTS 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.

4. **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.**

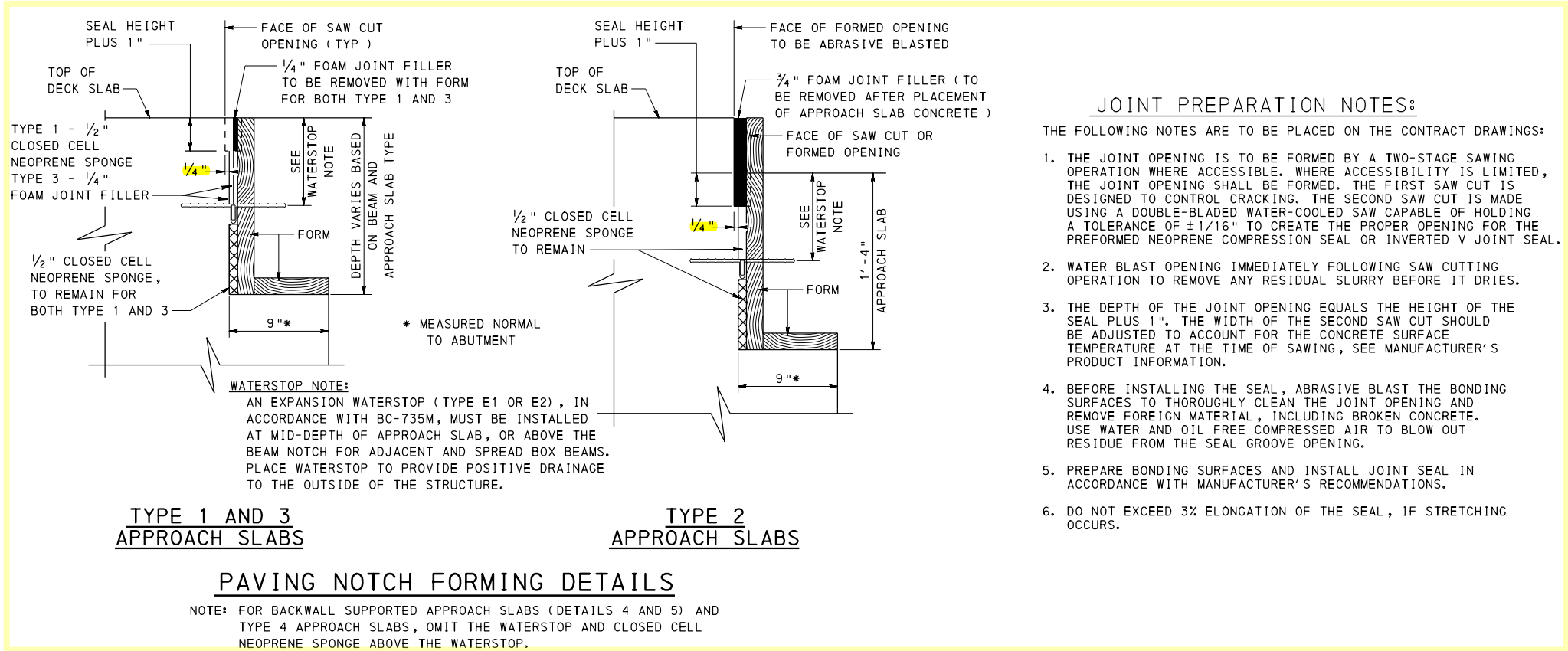
6. TYPE 5 APPROACH SLAB:
 - PROVIDE TYPE 5 APPROACH SLAB WHEN INTEGRAL ABUTMENTS ARE SPECIFIED.
 - DESIGNER TO DETERMINE THE REQUIRED JOINT OPENING AT TIME OF CONSTRUCTION AND THE MOVEMENT REQUIREMENTS OF THE EXPANSION JOINT AT THE END OF THE APPROACH SLAB IN ACCORDANCE WITH THE REQUIREMENTS OF DESIGN 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 | 45 | N/A | NO | NO | N/A |
| | FLEXIBLE | 45 | | | | |
| 2 | FLEXIBLE | 45 | N/A | NO | YES | N/A |
| | CONCRETE | 45 | | | | |
| 3 | FLEXIBLE | 45 | YES | YES | NO | NEOPRENE STRIP SEAL |
| | CONCRETE | 45 | | | | |
| 4 | FLEXIBLE | 45 | YES | YES | NO | TOOTH EXPANSION DAM |
| | CONCRETE | 45 | | | | |
| 5 (SEE NOTE 1) | CONCRETE | 45 | 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.

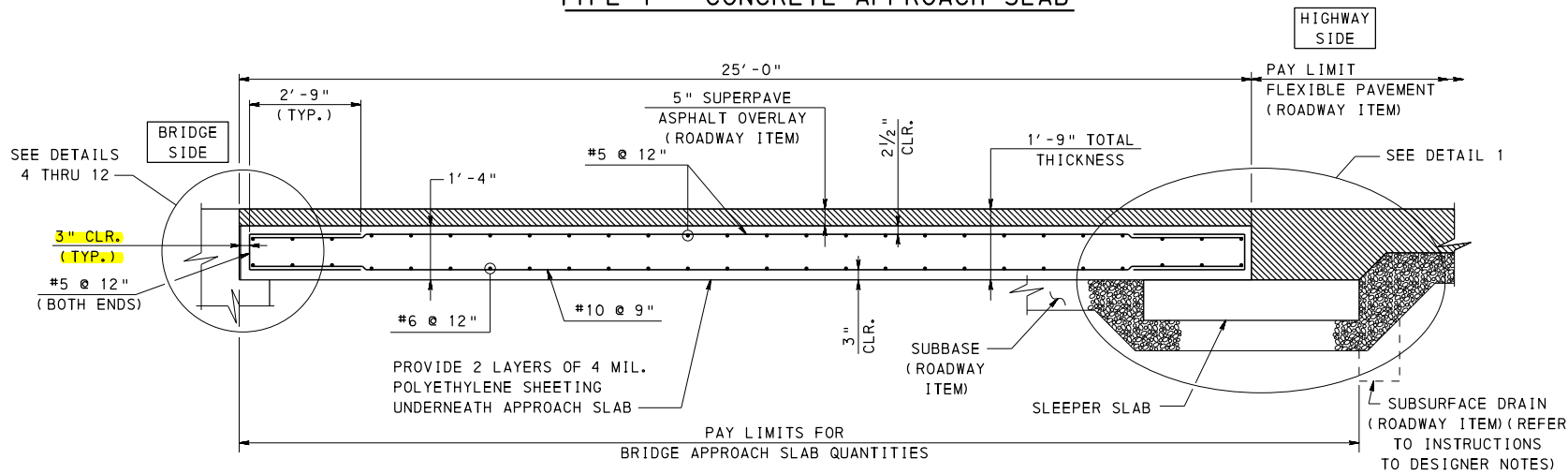
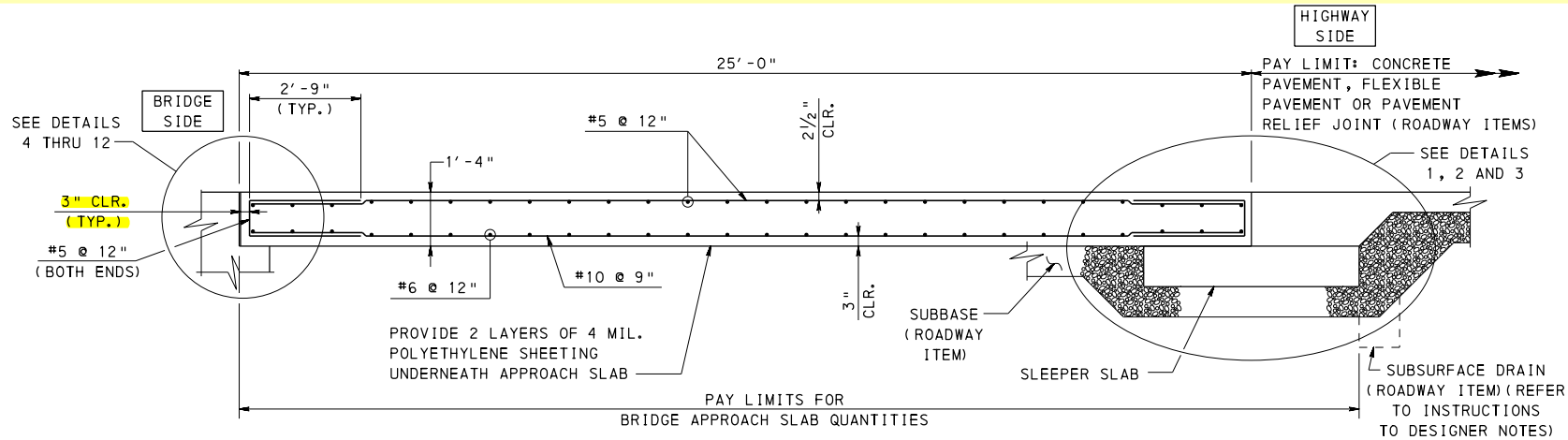
2. IF BRIDGE SKEW ANGLE IS LESS THAN 45 DEGREES THE DESIGNER MUST DISCUSS ALTERNATE DETAILS WITH THE BRIDGE QUALITY ASSURANCE DIVISION.
- COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY
- STANDARD
BRIDGE APPROACH SLABS
GENERAL NOTES - 2
- RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. Wayne Willey
ACTING DIR., BUREAU OF PROJECT DELIVERY
- SHEET 2 OF 35
- BD-628M

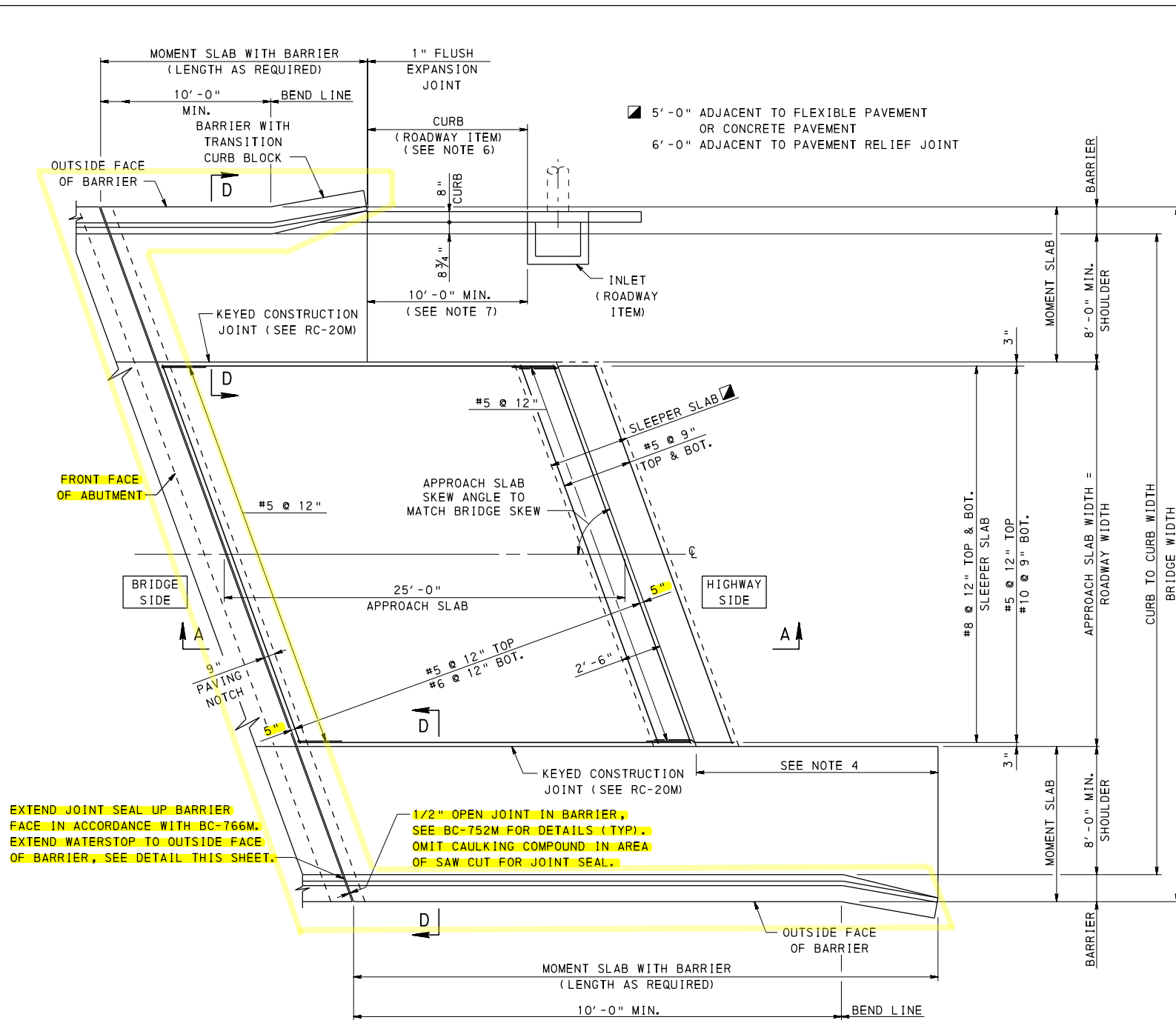


DESCRIPTION OF PLANS FOR TYPE 1 AND TYPE 2 APPROACH SLABS		
PLAN	DESCRIPTION	SHEET NO.
1	APPROACH SLAB SET TO ROADWAY WIDTH WITH FLARED WINGS AND MOMENT SLABS (IN SHOULDER)	4
2	FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH FLARED WINGS OR SHORT U-WINGS	5
3	FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH LONG U-WINGS	6
4	FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS	7

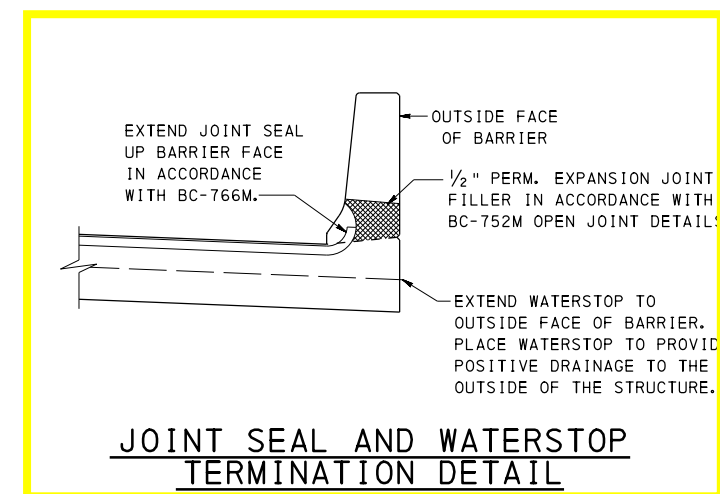
DESCRIPTION OF DETAILS FOR TYPE 1 AND TYPE 2 APPROACH SLABS		
DETAIL	DESCRIPTION	SHEET NO.
1	APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT	9
2	APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT	9
3	APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT	9
4	APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL WITH NEOPRENE STRIP SEAL DAM	10
5	APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL WITH TOOTH EXPANSION DAM	11
6	APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE ADJACENT BOX BEAMS	12
7	APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	13
8	APPROACH SLAB SUPPORTED ON PRESTRESSED CONCRETE I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	14
9	APPROACH SLAB SUPPORTED ON STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	15
10	APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE ADJACENT BOX BEAMS	16
11	APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO PRESTRESSED CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	17
12	APPROACH SLAB SUPPORTED ON ABUTMENT CORBEL ADJACENT TO STEEL I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS	18



NOTES
1. FOR NOTES, SEE SHEETS 1 AND 2.

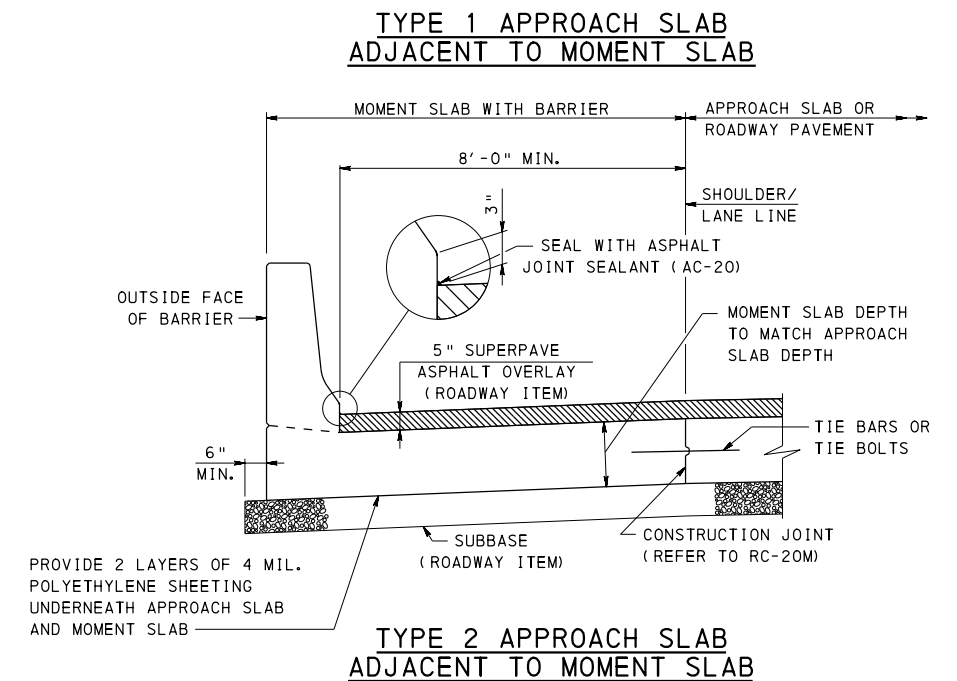
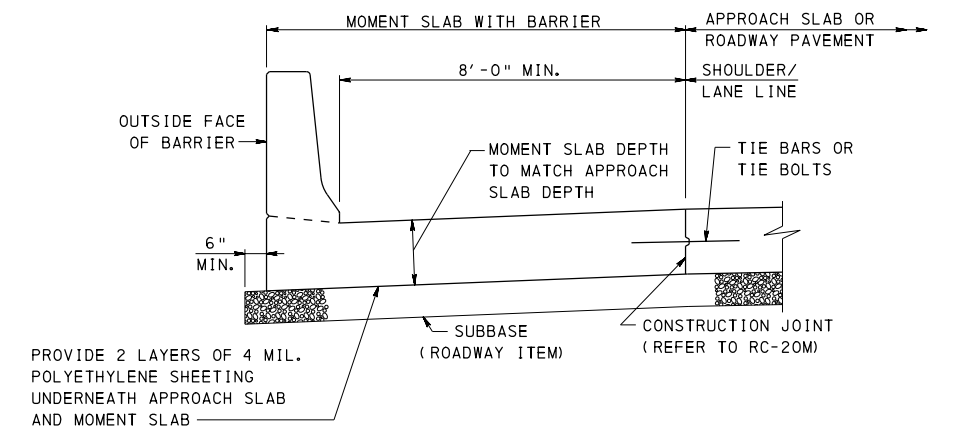


PLAN 1
TYPE 1 AND TYPE 2
 APPROACH SLAB SET TO ROADWAY WIDTH
 WITH FLARED WINGS AND
 MOMENT SLABS (IN SHOULDER)



NOTES

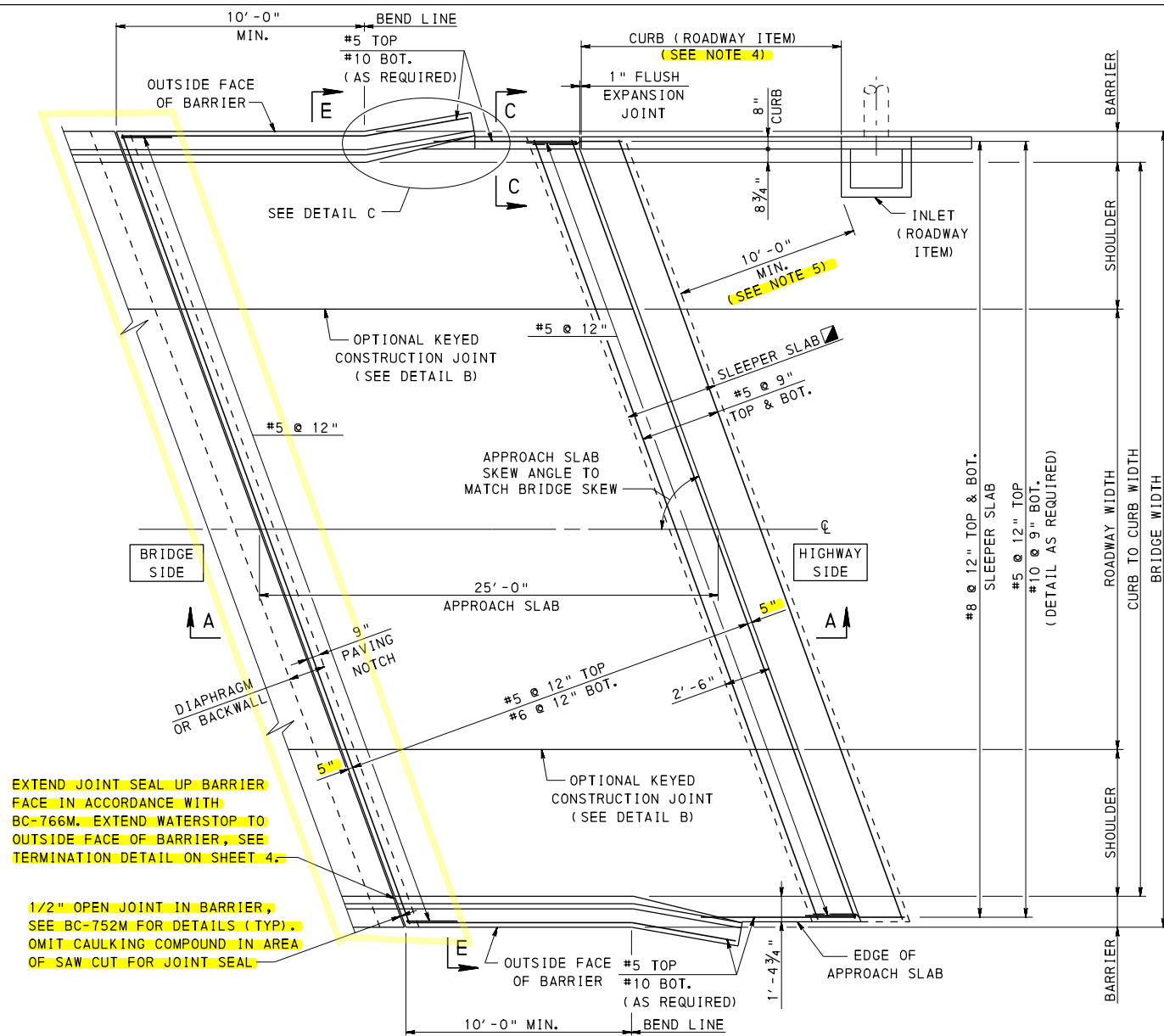
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION A-A, SEE SHEET 3.
3. FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
4. ELIMINATE THE TIE BARS OR TIE BOLTS ALONG LENGTH INDICATED.
5. PROVIDE PAVING NOTCH **OUT TO OUT**.
6. PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 3'-1 1/2" SPA. ALONG CURB AFTER **APPROACH END** TRANSITION.
7. INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.



SECTION D-D

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

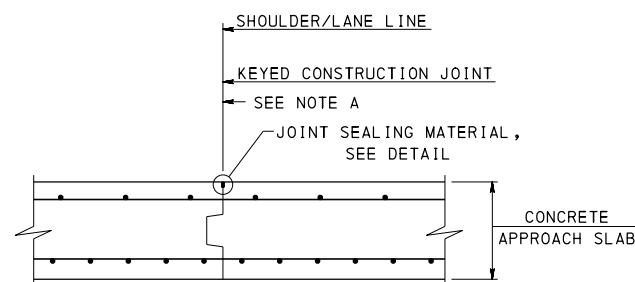
STANDARD
 BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 1



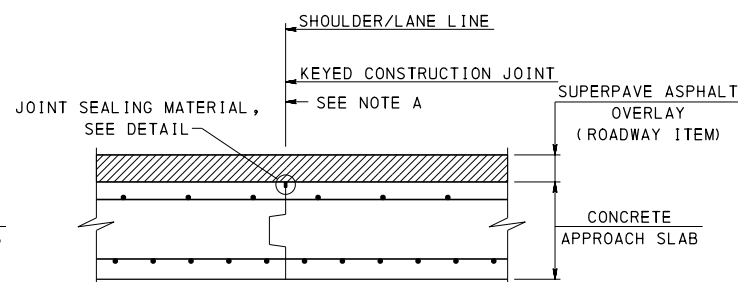
EXTEND JOINT SEAL UP BARRIER
FACE IN ACCORDANCE WITH
BC-766M. EXTEND WATERSTOP TO
OUTSIDE FACE OF BARRIER, SEE
TERMINATION DETAIL ON SHEET 4.

1/2" OPEN JOINT IN BARRIER,
SEE BC-752M FOR DETAILS (TYP.).
OMIT CAULKING COMPOUND IN AREA
OF SAW CUT FOR JOINT SEAL.

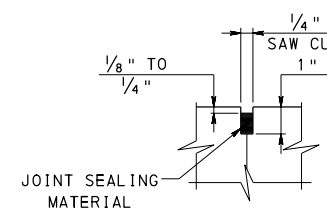
PLAN 2
TYPE 1 AND TYPE 2
FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS
WITH FLARED WINGS OR SHORT U-WINGS



WITHOUT ASPHALT OVERLAY



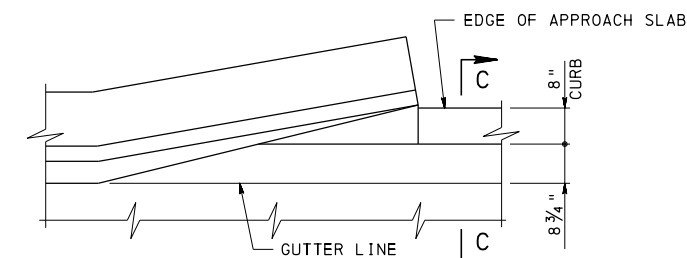
WITH ASPHALT OVERLAY



JOINT SEALING DETAIL

NOTE A:
PROVIDE CONTINUOUS REINFORCEMENT THRU JOINT.
MECHANICAL SPLICES ARE PERMITTED AS AN OPTION.

DETAIL B
OPTIONAL CONSTRUCTION JOINT AT SHOULDER/LANE LINE

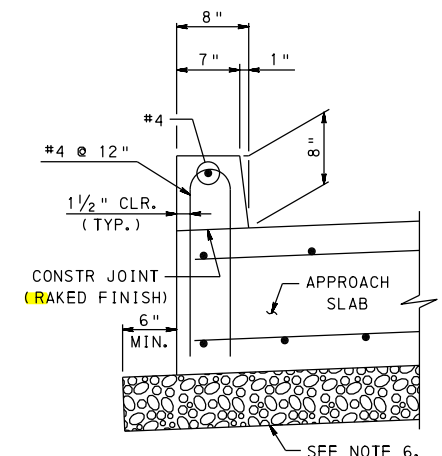


DETAIL C

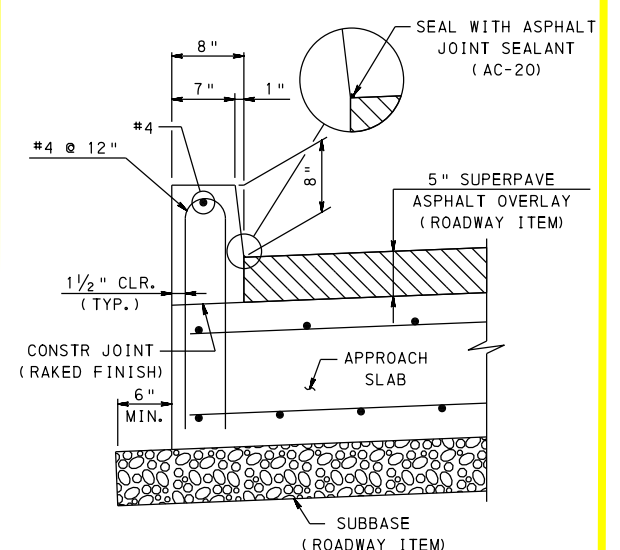
- 5'-0" ADJACENT TO FLEXIBLE PAVEMENT
OR CONCRETE PAVEMENT
- 6'-0" ADJACENT TO PAVEMENT RELIEF JOINT

NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- FOR SECTION A-A, SEE SHEET 3.
- FOR SECTION E-E, SEE SHEET 8.
- PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 3'-1/2" SPA. ALONG CURB AFTER **APPROACH END** TRANSITION.
- INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.
- TYPE 1 AND TYPE 3 APPROACH SLAB: SUBBASE (ROADWAY ITEM)
TYPE 5 APPROACH SLAB: STRUCTURAL BACKFILL, REFER TO RC-12M.



**TYPE 1, 3, OR 5 - CONCRETE
APPROACH SLAB**

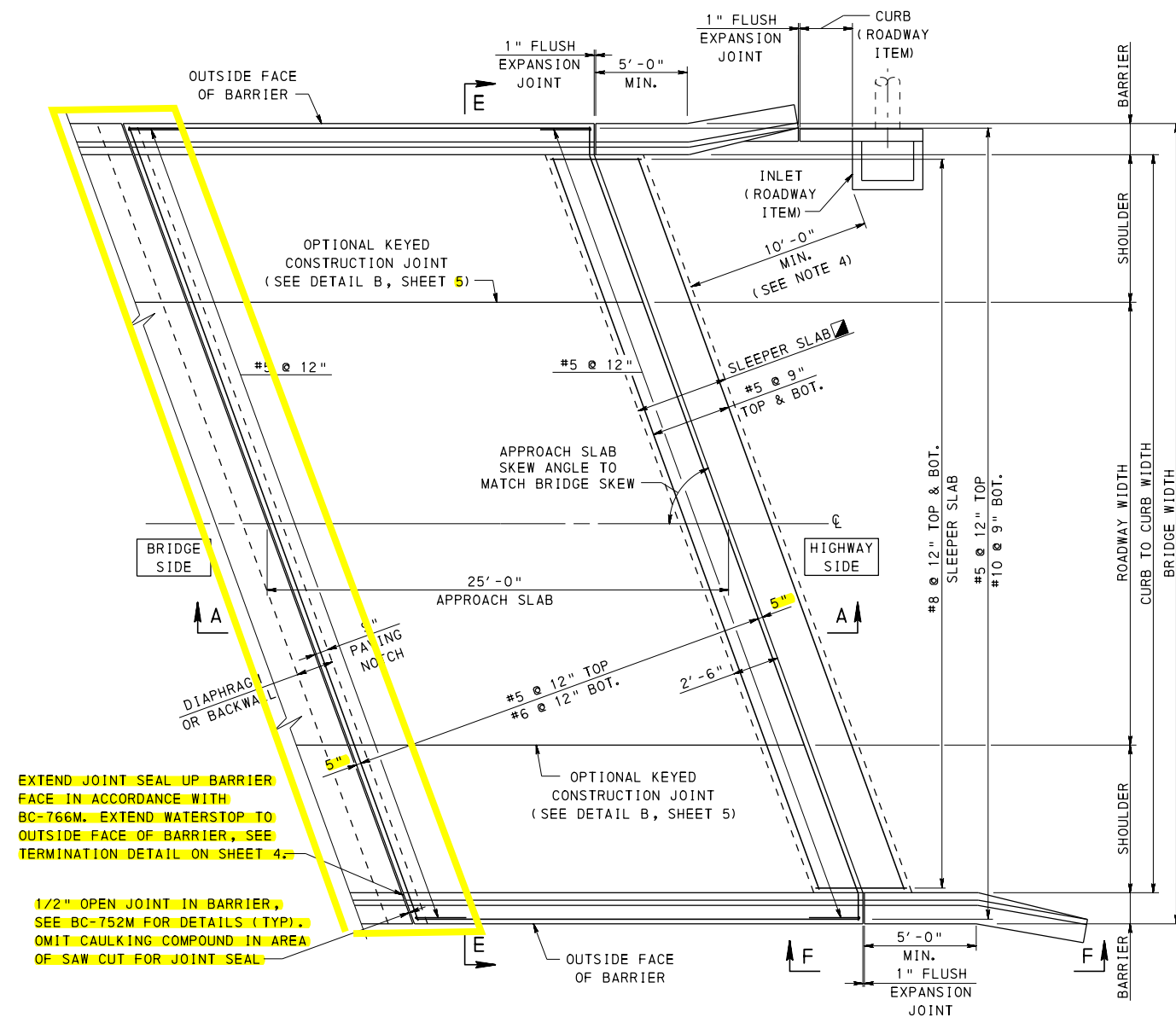


**TYPE 2 - CONCRETE APPROACH SLAB
WITH SUPERPAVE ASPHALT OVERLAY**

SECTION C-C

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 2

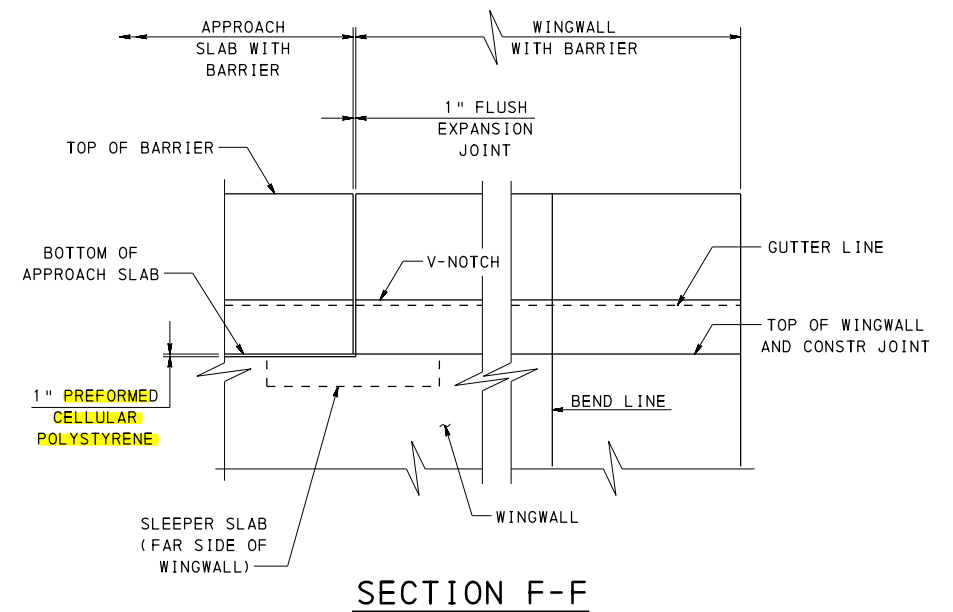


EXTEND JOINT SEAL UP BARRIER
FACE IN ACCORDANCE WITH
BC-766M. EXTEND WATERSTOP TO
OUTSIDE FACE OF BARRIER, SEE
TERMINATION DETAIL ON SHEET 4.

1/2" OPEN JOINT IN BARRIER,
SEE BC-752M FOR DETAILS (TYP).
OMIT CAULKING COMPOUND IN AREA
OF SAW CUT FOR JOINT SEAL

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
- 6'-0" ADJACENT TO PAVEMENT RELIEF JOINT

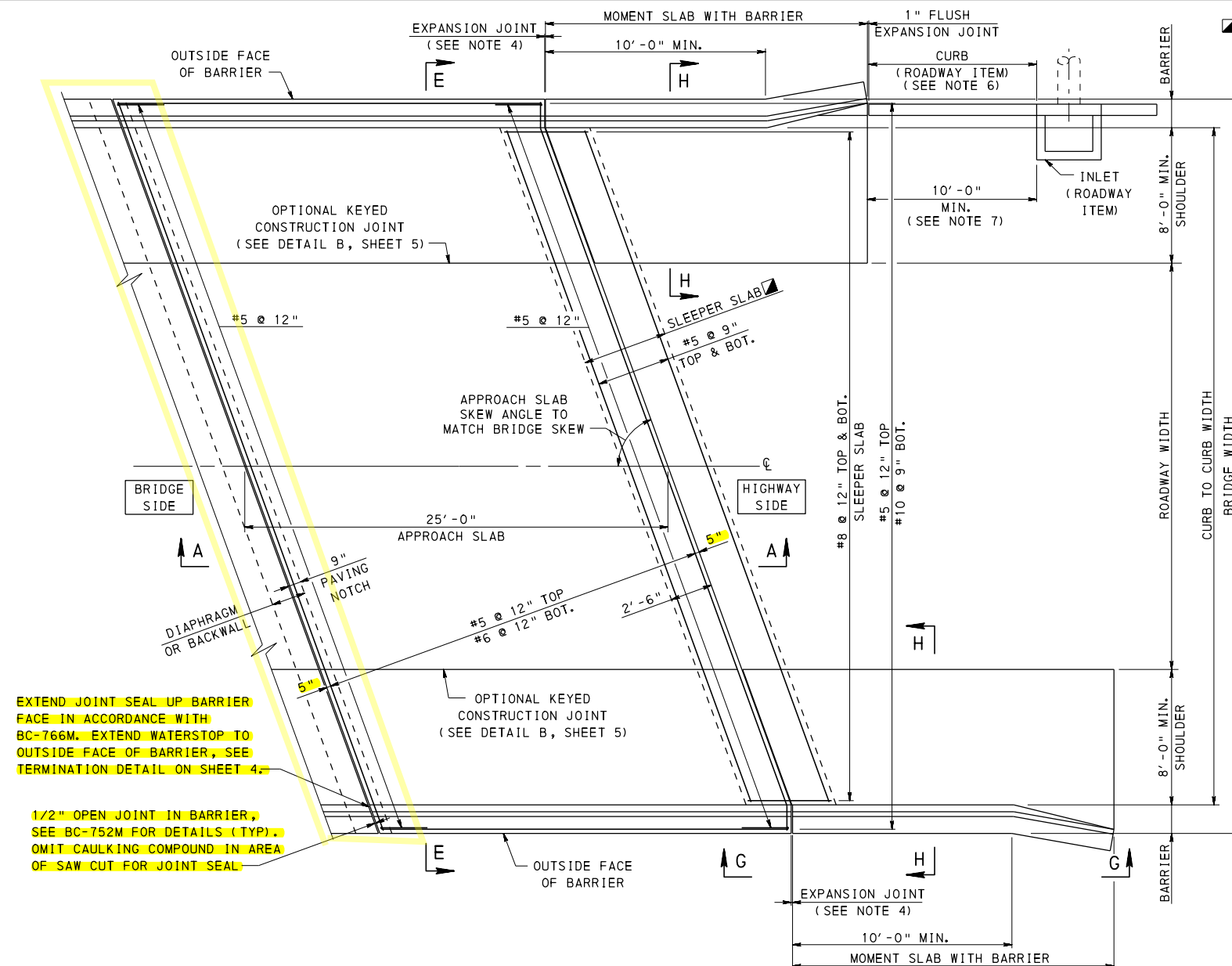


NOTES

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. INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES
TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

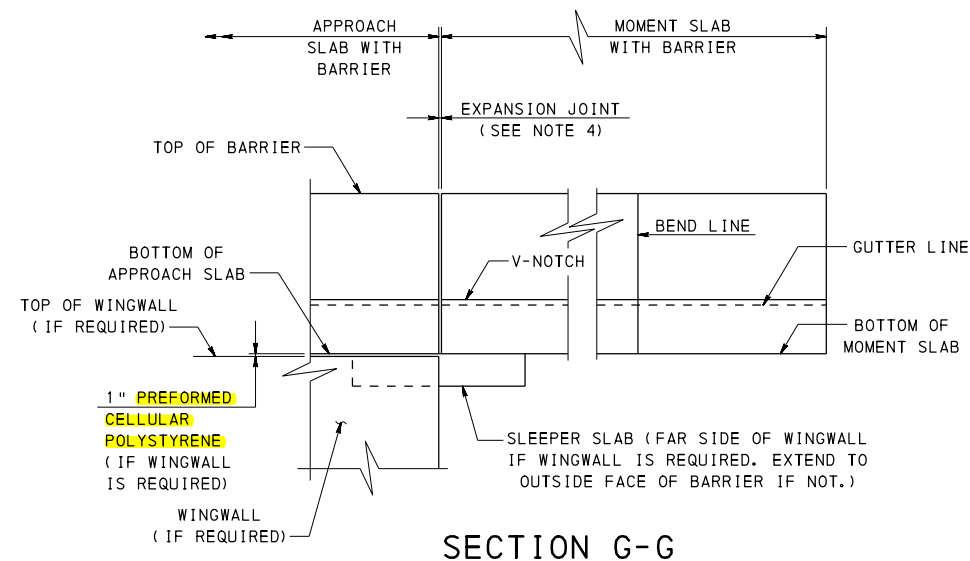
STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 3



EXTEND JOINT SEAL UP BARRIER FACE IN ACCORDANCE WITH BC-766M. EXTEND WATERSTOP TO OUTSIDE FACE OF BARRIER, SEE TERMINATION DETAIL ON SHEET 4.

1/2" OPEN JOINT IN BARRIER, SEE BC-752M FOR DETAILS (TYP). OMIT CAULKING COMPOUND IN AREA OF SAW CUT FOR JOINT SEAL

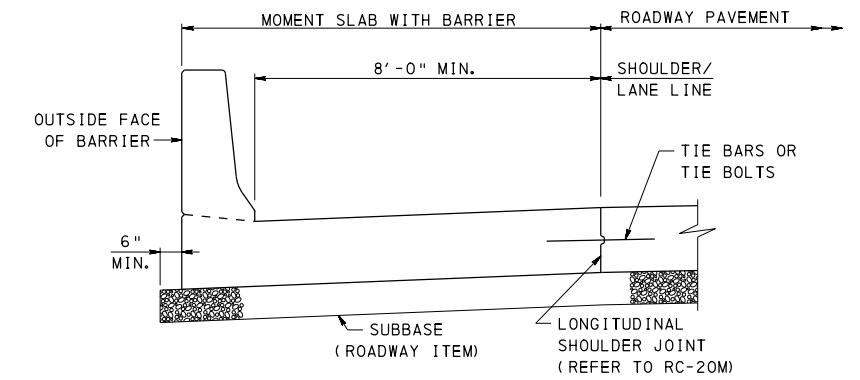
PLAN 4
TYPE 1 AND TYPE 2
FULL WIDTH APPROACH SLAB WITH ATTACHED BARRIERS
WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS



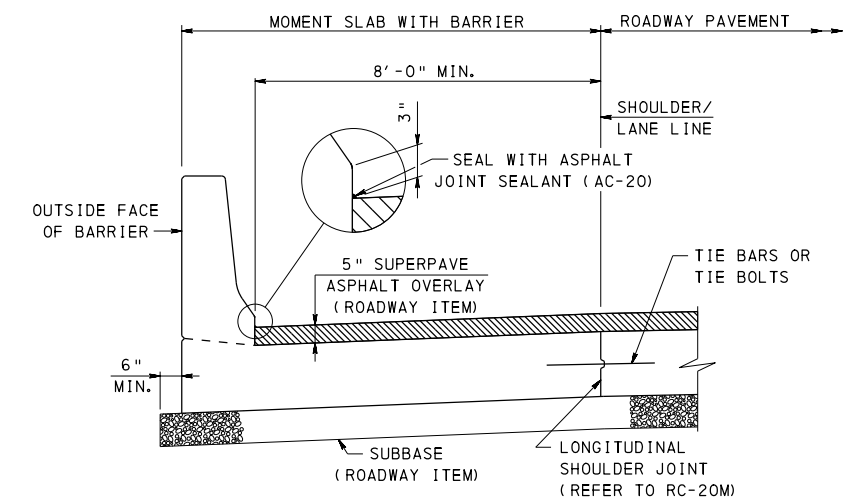
SECTION G-G

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: 1'-0" AND PROVIDE SLIDING PLATE IN ACCORDANCE WITH THE DETAILS SHOWN ON BD-627M.
- FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
- PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 3'-1 1/2" SPA. ALONG CURB AFTER **APPROACH END** TRANSITION.
- INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.



MOMENT SLAB ADJACENT TO TYPE 1 APPROACH SLAB

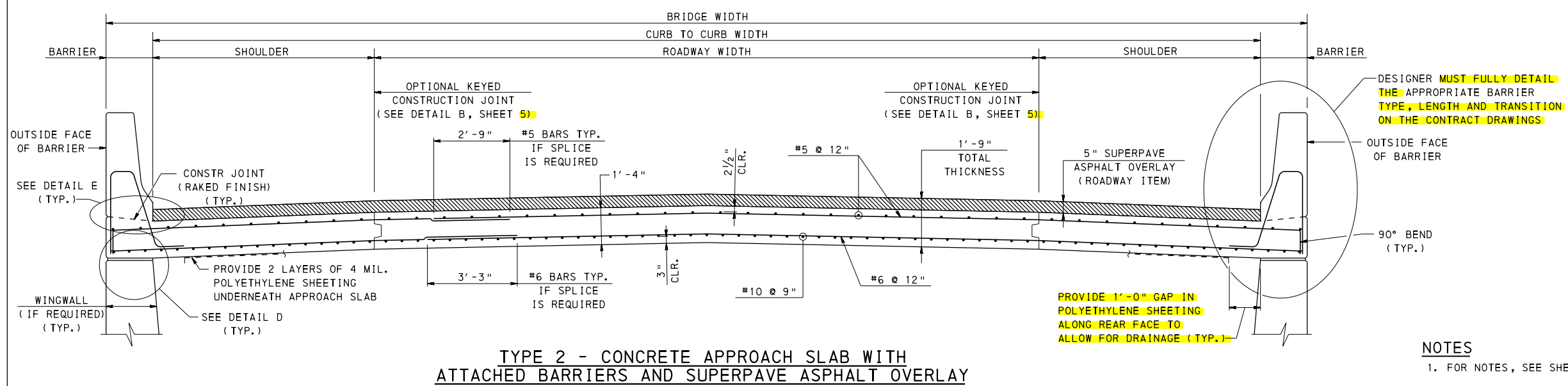
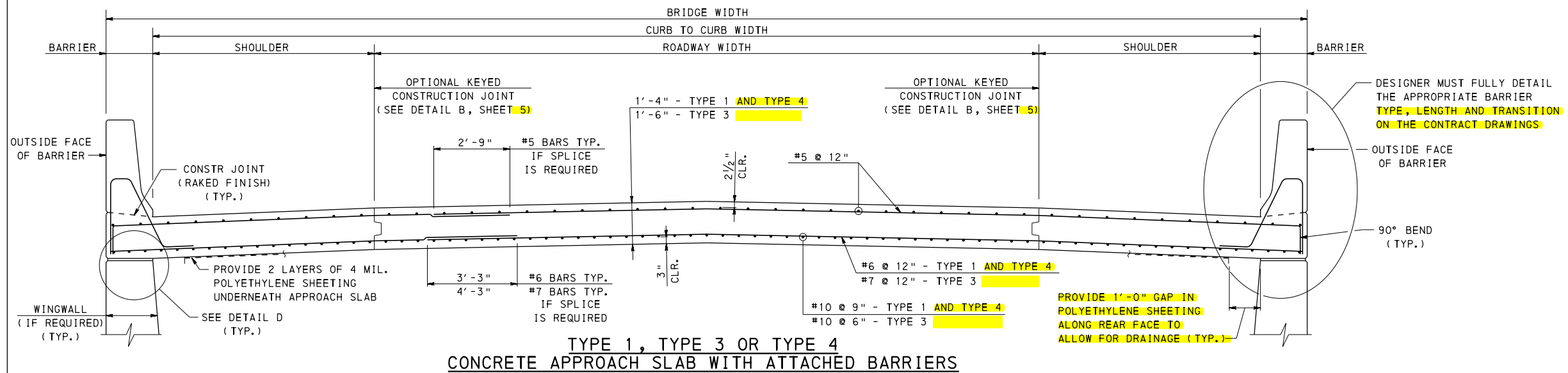


MOMENT SLAB ADJACENT TO TYPE 2 APPROACH SLAB

SECTION H-H

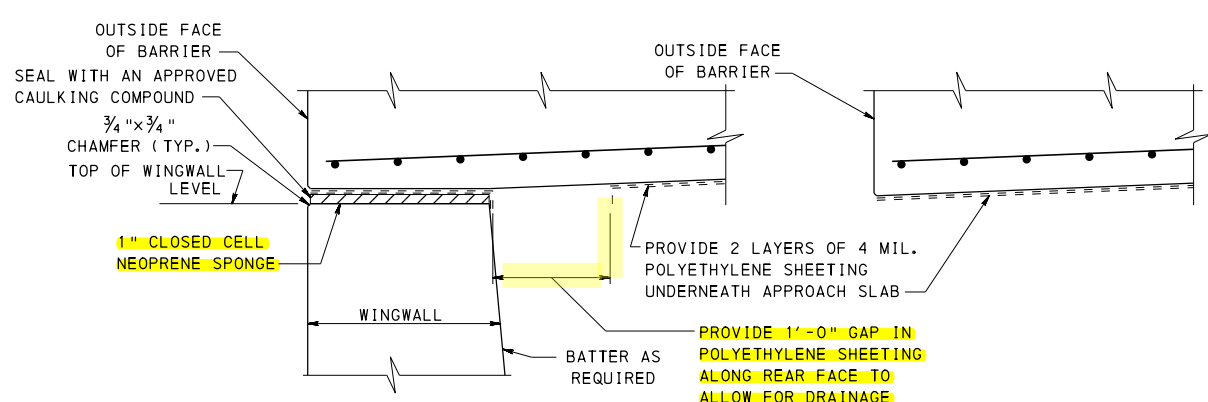
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - PLAN 4



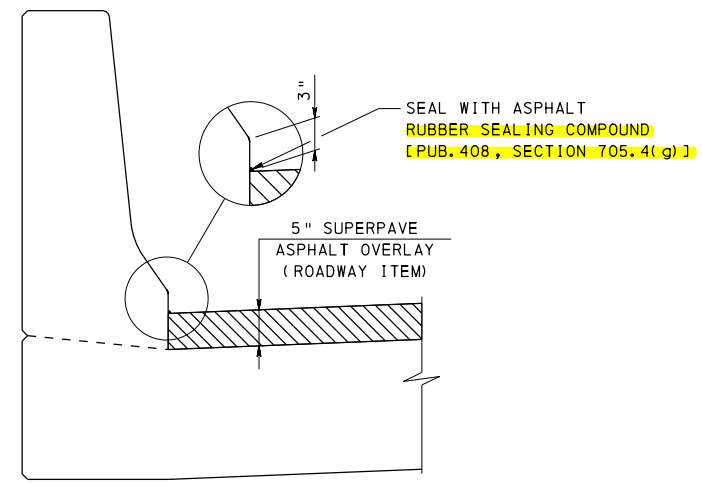
NOTES
1. FOR NOTES, SEE SHEETS 1 AND 2.

SECTION E-E



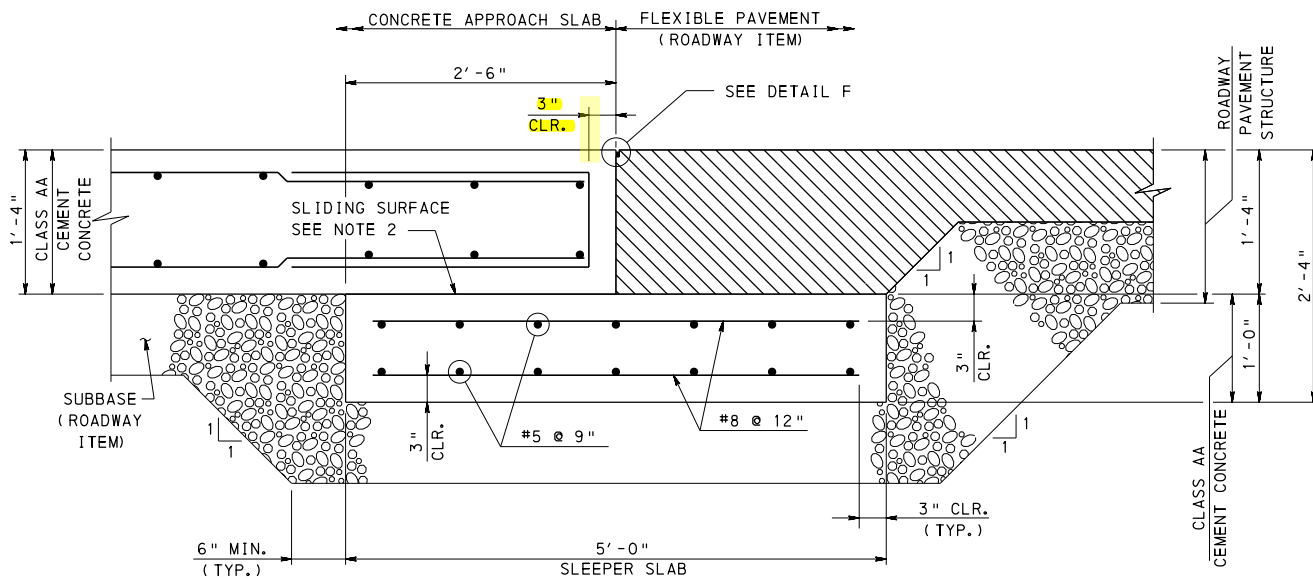
DETAIL D
WITH WINGWALL

DETAIL D
WITHOUT WINGWALL

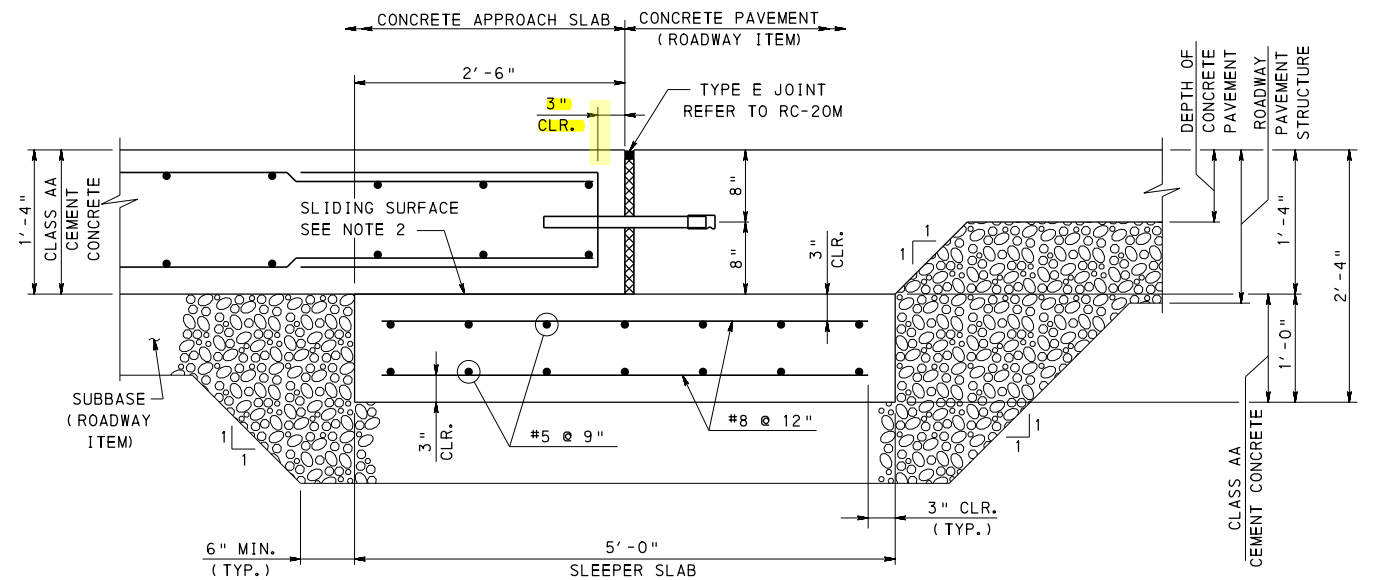


DETAIL E

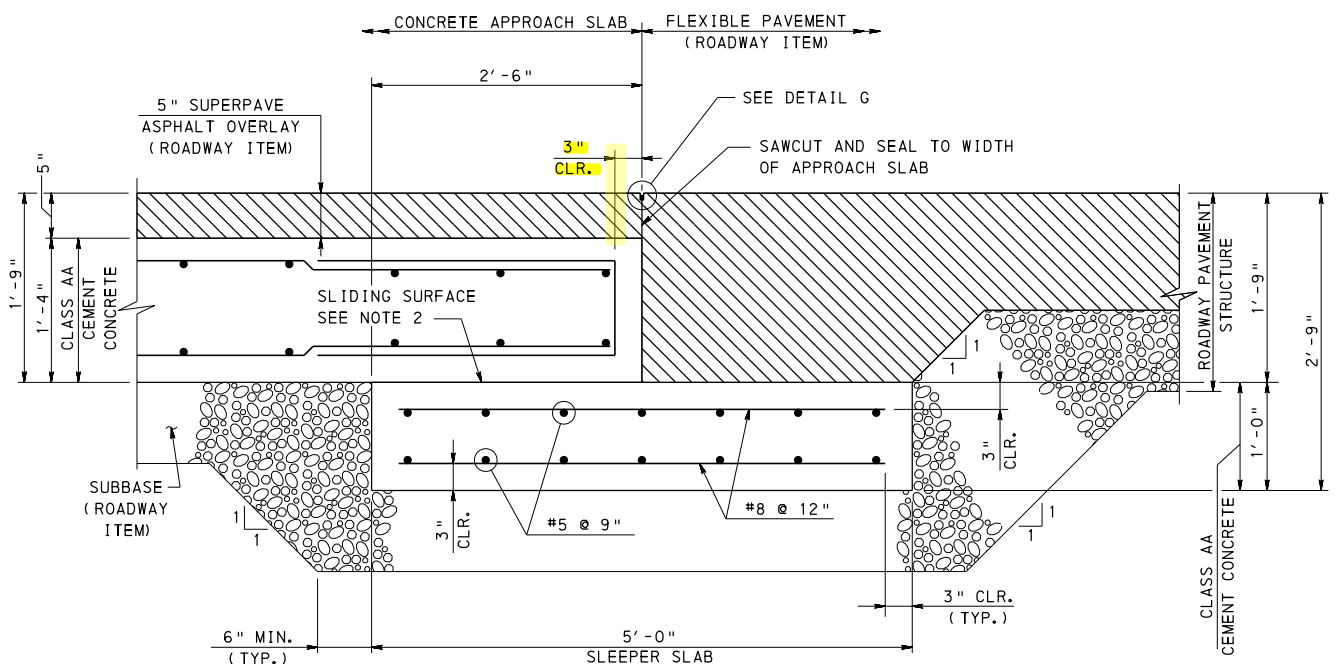
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<p align="center">STANDARD BRIDGE APPROACH SLABS TYPE 1 THRU TYPE 4 - TRANSVERSE SECTION WITH ATTACHED BARRIERS</p>		
<p>RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER</p>	<p>RECOMMENDED AUG. 31, 2012 <i>R. Wayne Willey</i> ACTING DIR., BDR. OF PROJECT DELIVERY</p>	<p>SHEET 8 OF 35 BD-628M</p>



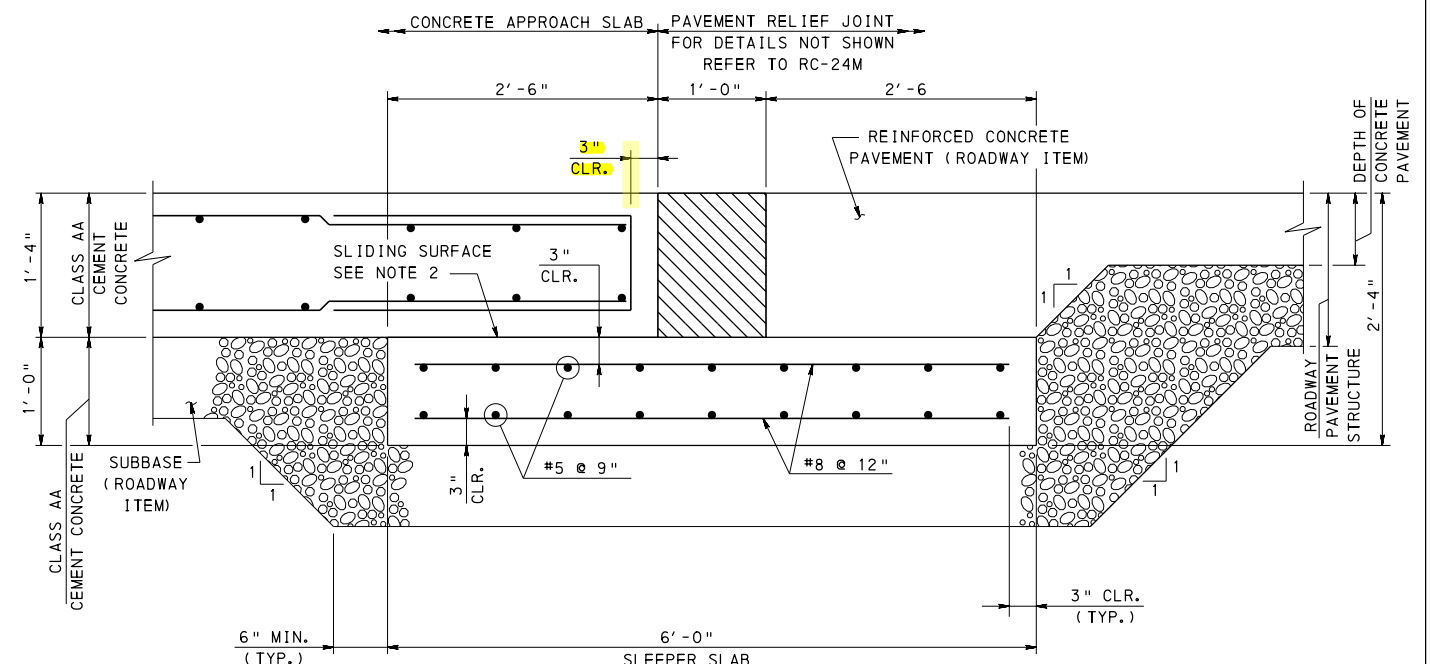
TYPE 1 AND TYPE 4 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 1
END OF APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT



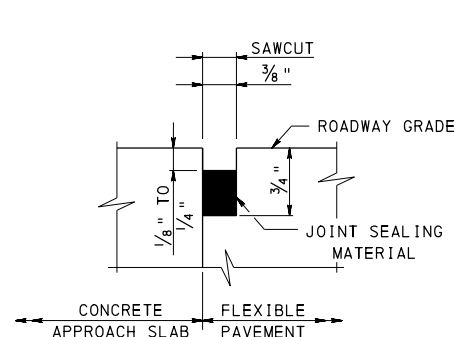
TYPE 1 AND TYPE 4 APPROACH SLAB - DETAIL 2
(SEE NOTE 3)
END OF APPROACH SLAB ADJACENT TO CONCRETE PAVEMENT



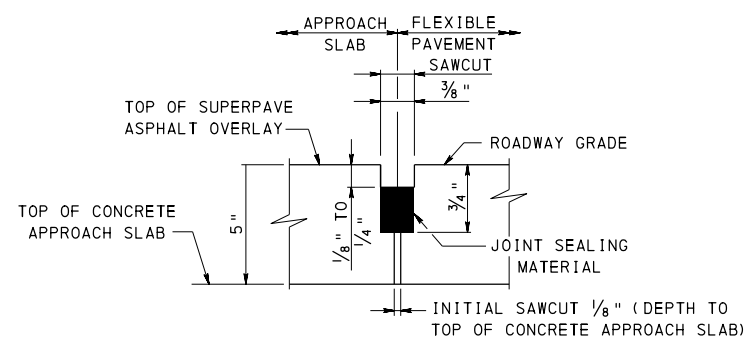
TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 1
END OF APPROACH SLAB ADJACENT TO FLEXIBLE PAVEMENT



TYPE 1 AND TYPE 4 APPROACH SLAB - DETAIL 3
END OF APPROACH SLAB ADJACENT TO PAVEMENT RELIEF JOINT



DETAIL F



DETAIL G

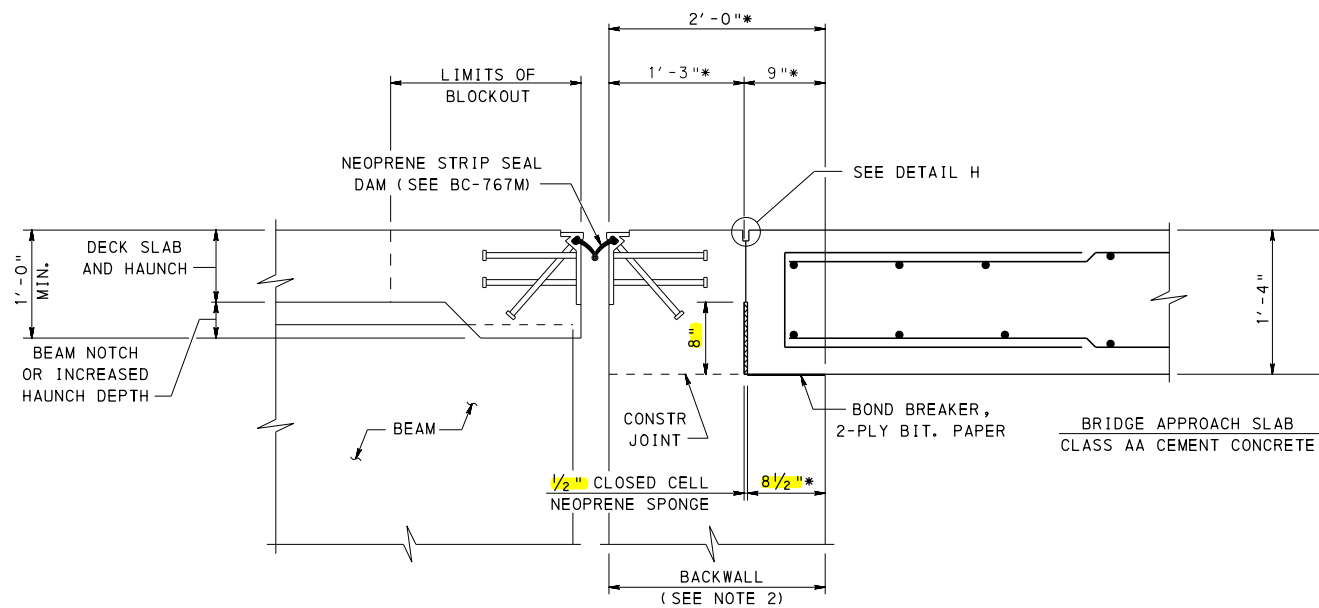
NOTES

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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BUREAU OF PROJECT DELIVERY**

**STANDARD
BRIDGE APPROACH SLABS
TYPE 1, 2 AND 4 - DETAILS 1, 2 AND 3
(ADJACENT TO ROADWAY)**

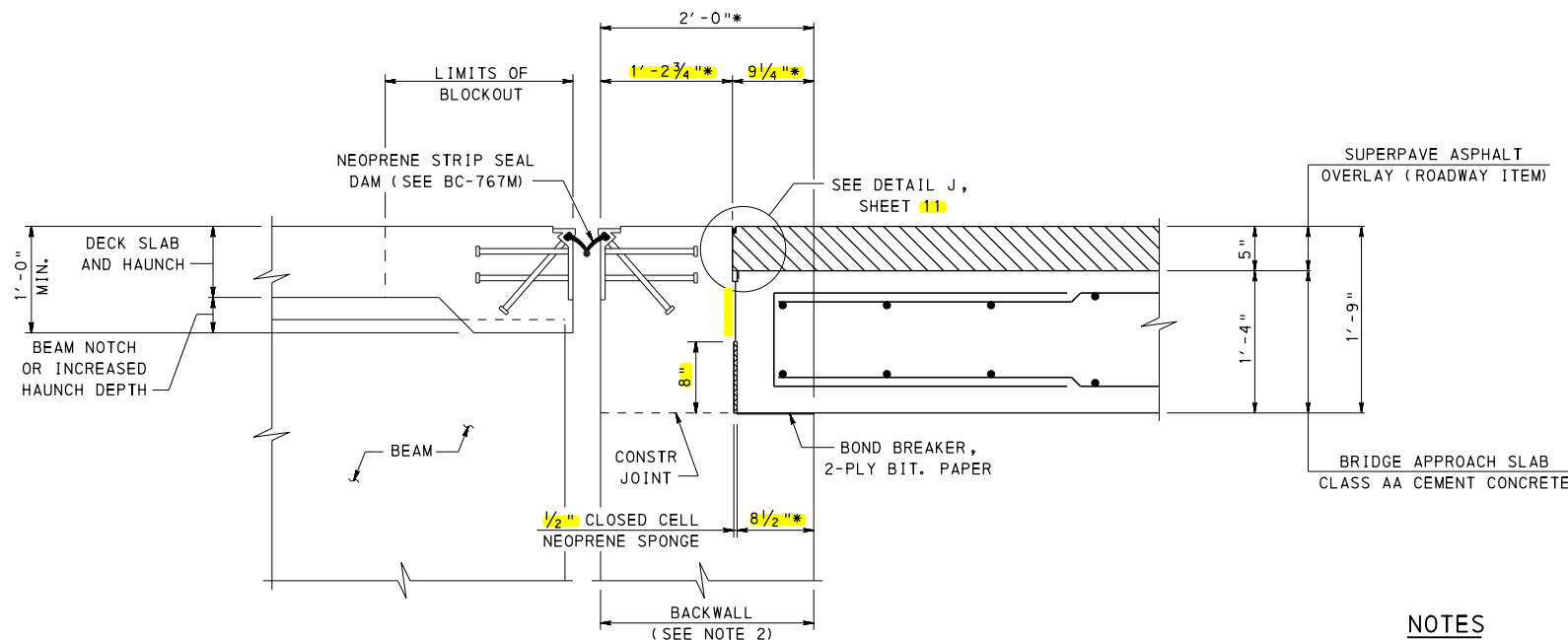
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 9 OF 35 BD-628M
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* MEASURED NORMAL TO ABUTMENT

TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 4

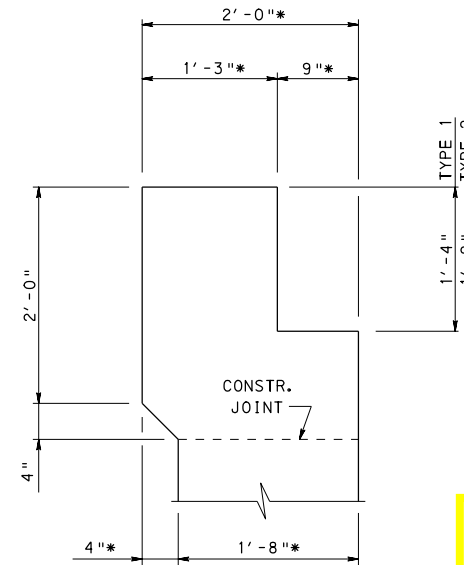
APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH NEOPRENE STRIP SEAL DAM



* MEASURED NORMAL TO ABUTMENT

TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 4

APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH NEOPRENE STRIP SEAL DAM

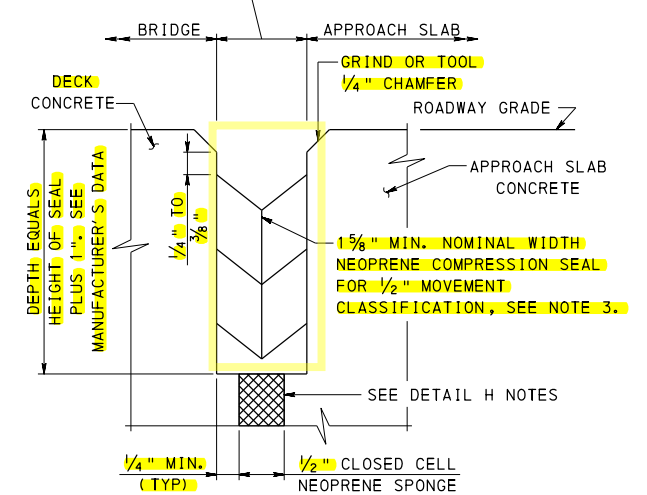


* MEASURED NORMAL TO ABUTMENT

OPTIONAL BACKWALL

(SEE NOTE 2)

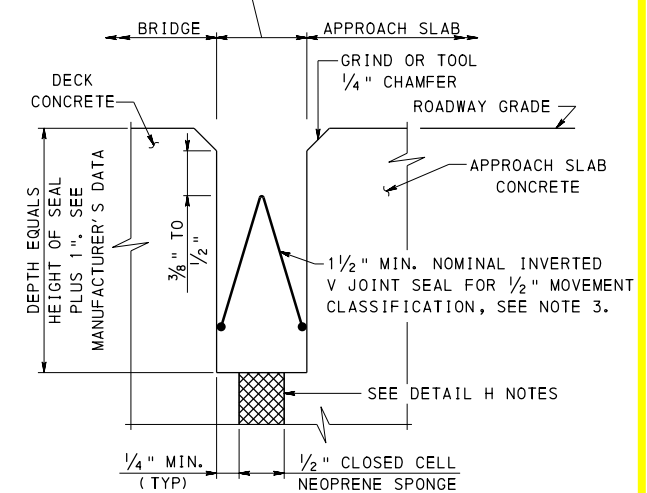
JOINT OPENING FOR JOINT SEAL, SEE JOINT PREPARATION NOTES ON SHEET 3. WIDTH OF OPENING SHOULD BE ADJUSTED TO ACCOUNT FOR THE CONCRETE SURFACE TEMPERATURE AT THE TIME OF SAWING. SEE MANUFACTURER'S DATA.



DETAIL H

(NEOPRENE COMPRESSION SEAL)

JOINT OPENING FOR JOINT SEAL, SEE JOINT PREPARATION NOTES ON SHEET 3. WIDTH OF OPENING SHOULD BE ADJUSTED TO ACCOUNT FOR THE CONCRETE SURFACE TEMPERATURE AT THE TIME OF SAWING. SEE MANUFACTURER'S DATA.



DETAIL H

(INVERTED V JOINT SEAL)

DETAIL H NOTES

1. DETAIL H SHOWN FOR TYPE 1-STRUCTURE SUPPORTED APPROACH SLABS.
2. FOR TYPE 1-BACKWALL SUPPORTED AND TYPE 4 APPROACH SLABS, OMIT WATERSTOP AND 1/2" CLOSED CELL NEOPRENE SPONGE ABOVE WATERSTOP.
3. FOR TYPE 3 APPROACH SLABS, OMIT 1/2" CLOSED CELL NEOPRENE SPONGE ABOVE WATERSTOP.

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STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 4
(NEOPRENE STRIP SEAL DAM WITH BACKWALL)

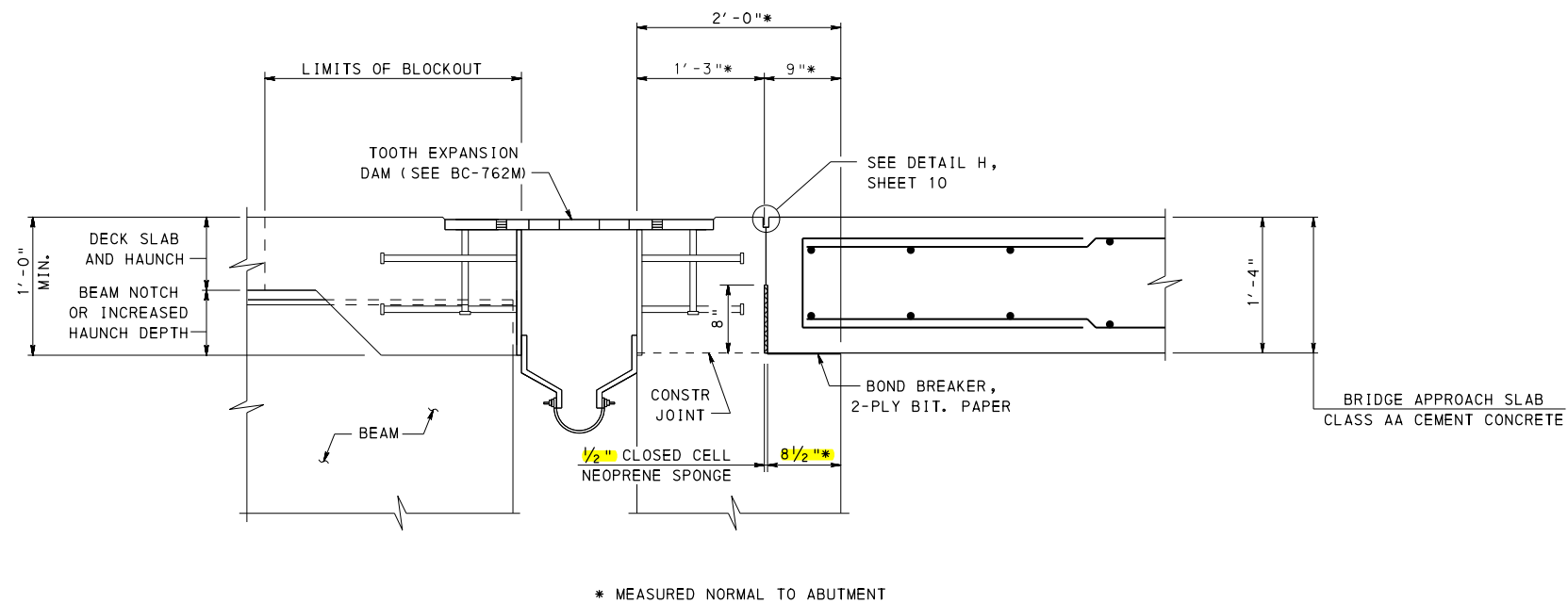
RECOMMENDED AUG. 31, 2012
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CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. WILLY
ACTING DIR. BDR. OF PROJECT DELIVERY

SHEET 10 OF 35
BD-628M

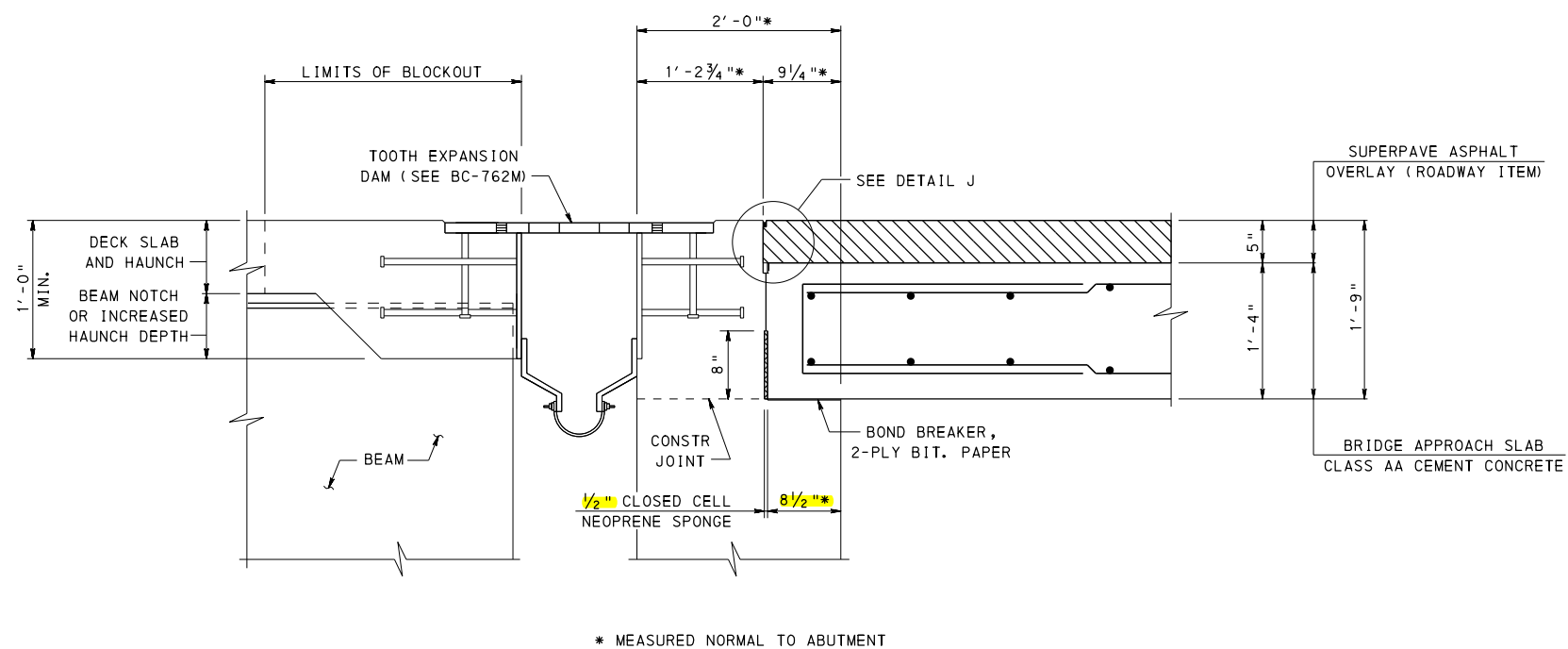
NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. DESIGNER TO DETERMINE BACKWALL SHAPE, REFER TO BD-621M, SHEET 2.
3. 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 CHAMFER. MAKE THE TOP EDGES OF THE CONTACT SURFACES ON BOTH SIDES OF THE SEAL AT THE SAME ELEVATION.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.



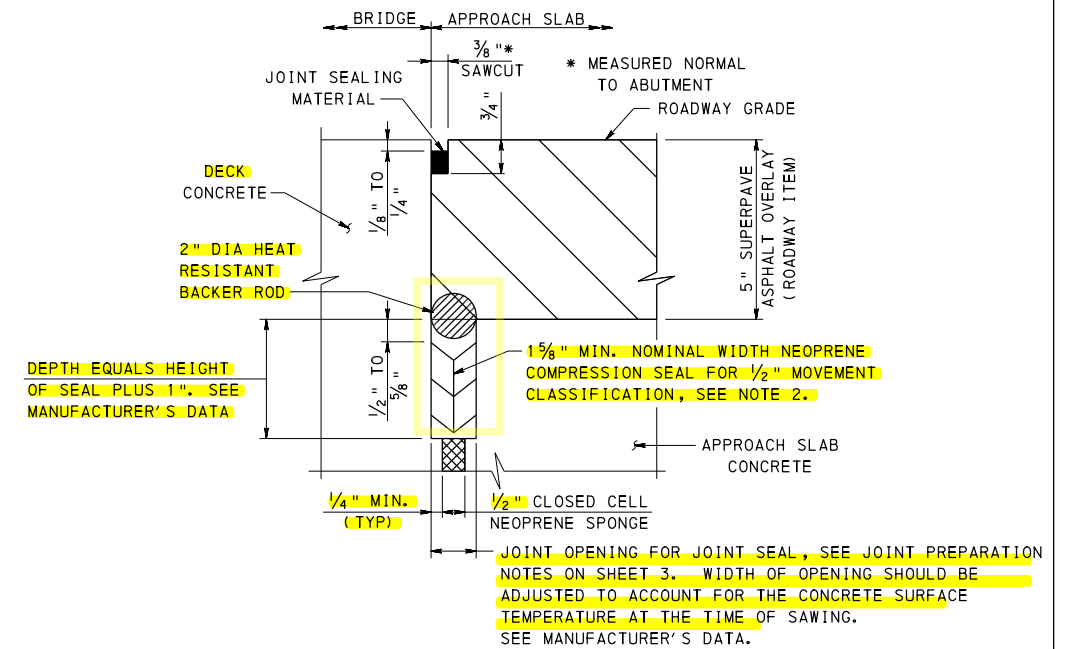
TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 5

APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH TOOTH EXPANSION DAM



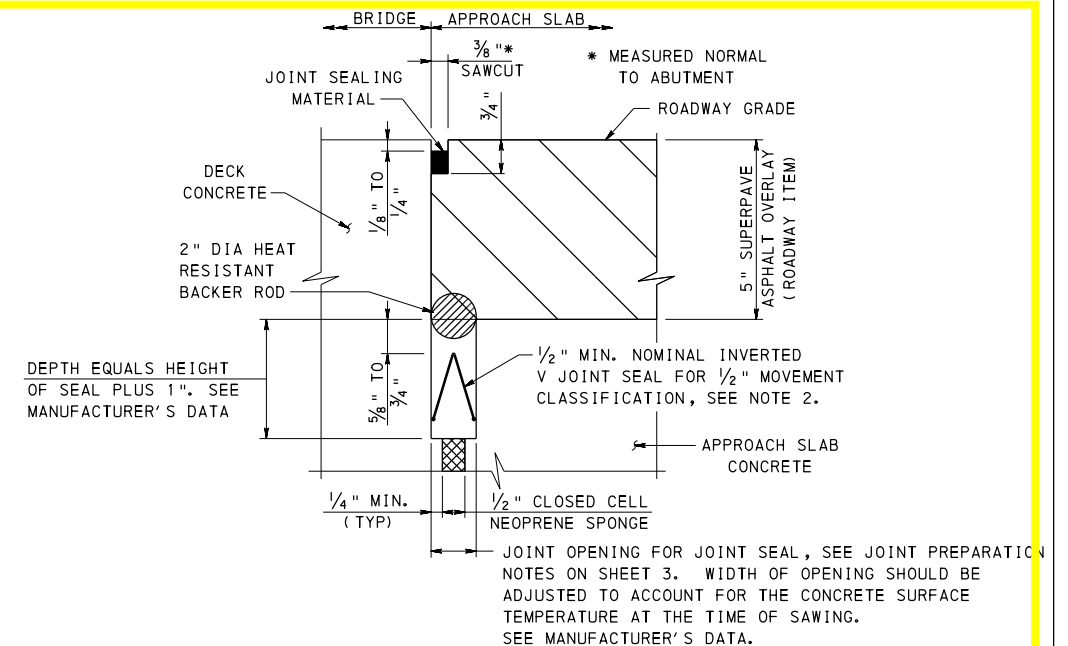
TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 5

APPROACH SLAB SUPPORTED ON ABUTMENT
BACKWALL WITH TOOTH EXPANSION DAM



DETAIL J

(NEOPRENE COMPRESSION SEAL)



DETAIL J

(INVERTED V JOINT SEAL)

DETAIL J NOTES

1. DETAIL J SHOWN FOR TYPE 2-STRUCTURE SUPPORTED APPROACH SLABS.
2. FOR TYPE 2-BACKWALL SUPPORTED APPROACH SLABS, OMIT WATERSTOP AND 1/2" CLOSED CELL NEOPRENE SPONGE ABOVE WATERSTOP.

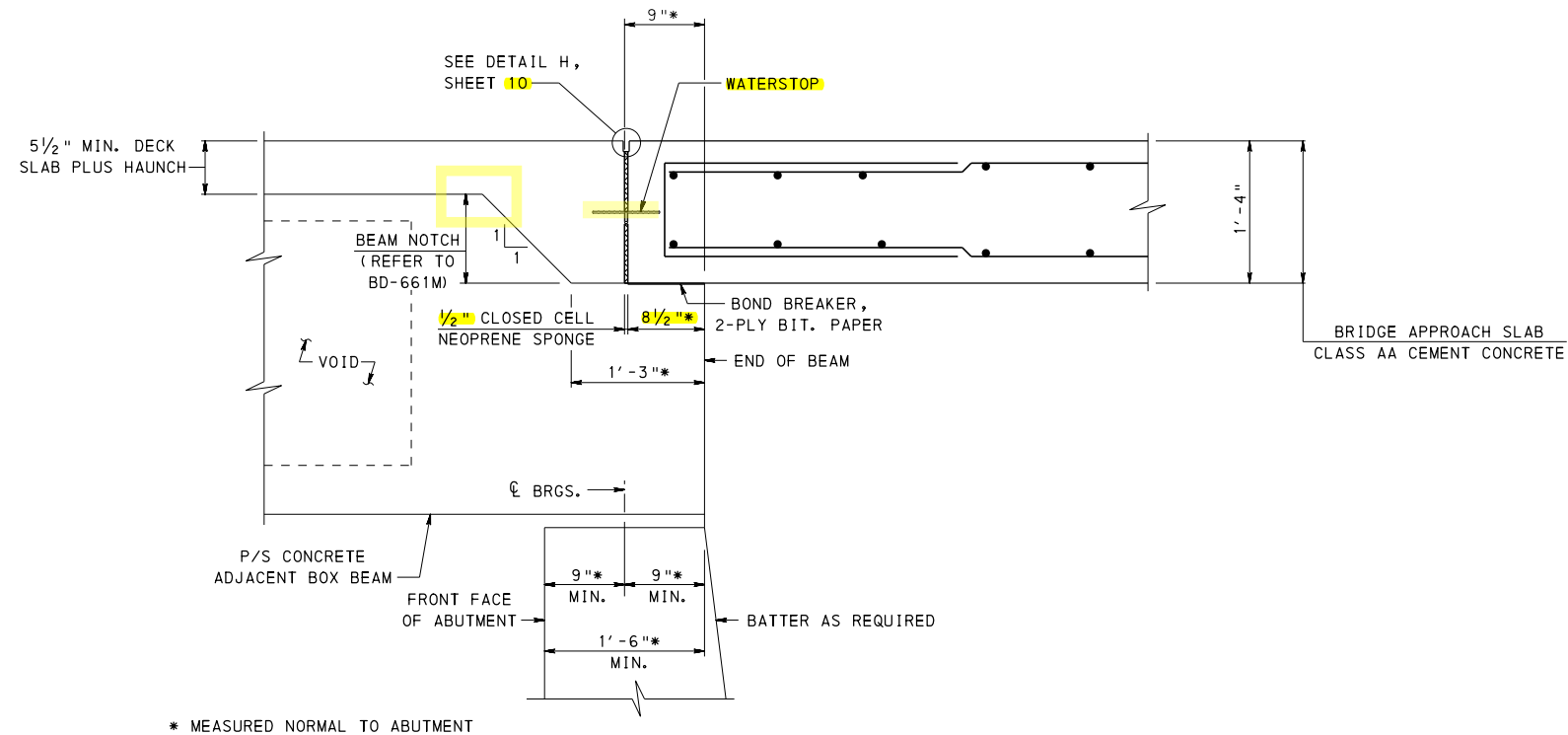
COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 5
(TOOTH EXPANSION DAM WITH BACKWALL)

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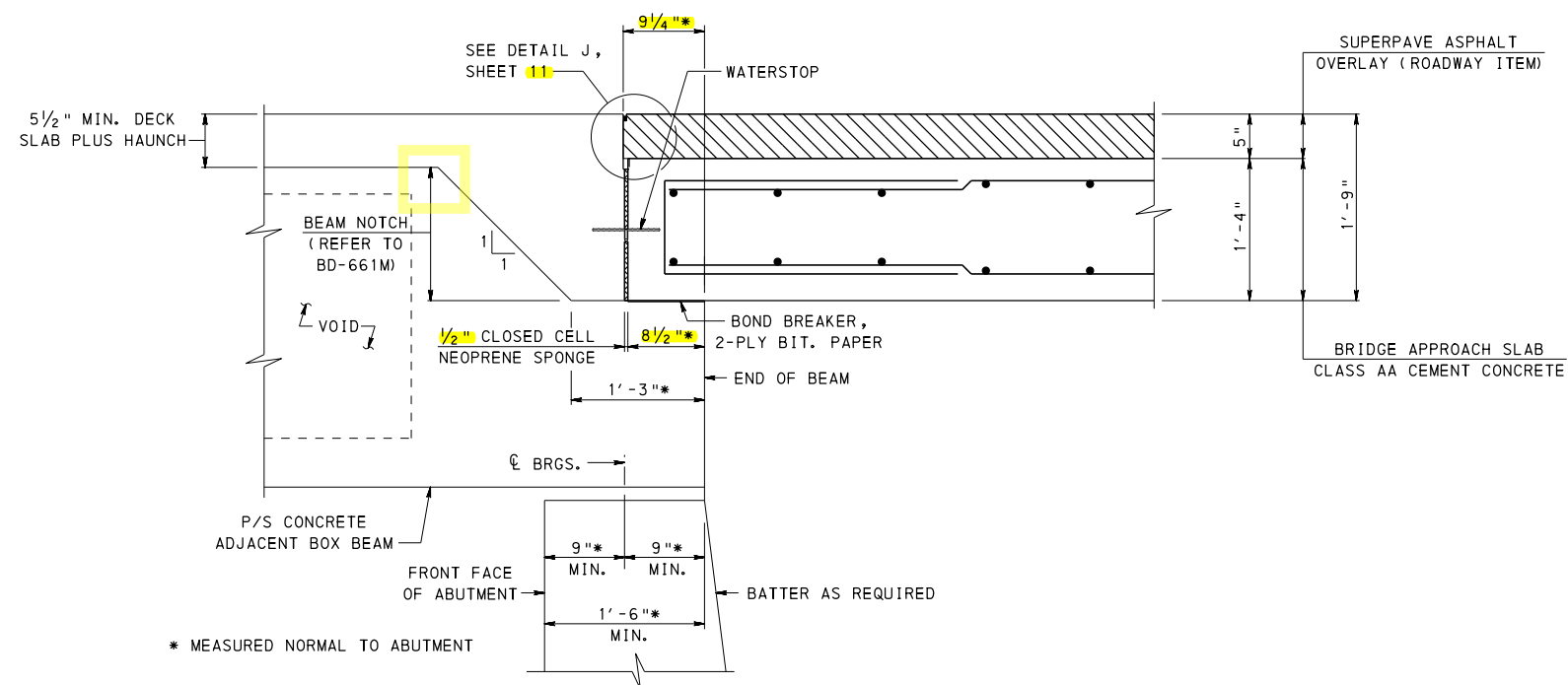
NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.
2. USE ONLY APPROVED SEALS, AS LISTED IN BULLETIN 15. INSTALL JOINT SEALS TO A UNIFORM DEPTH WITH THE TOP OF THE SEAL FROM 1/2" TO 3/4" 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.
3. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.



TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 6

APPROACH SLAB SUPPORTED ON P/S CONCRETE ADJACENT BOX BEAMS FOR BEAM DEPTHS 27" AND GREATER



TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 6

APPROACH SLAB SUPPORTED ON P/S CONCRETE ADJACENT BOX BEAMS FOR BEAM DEPTHS 30" AND GREATER

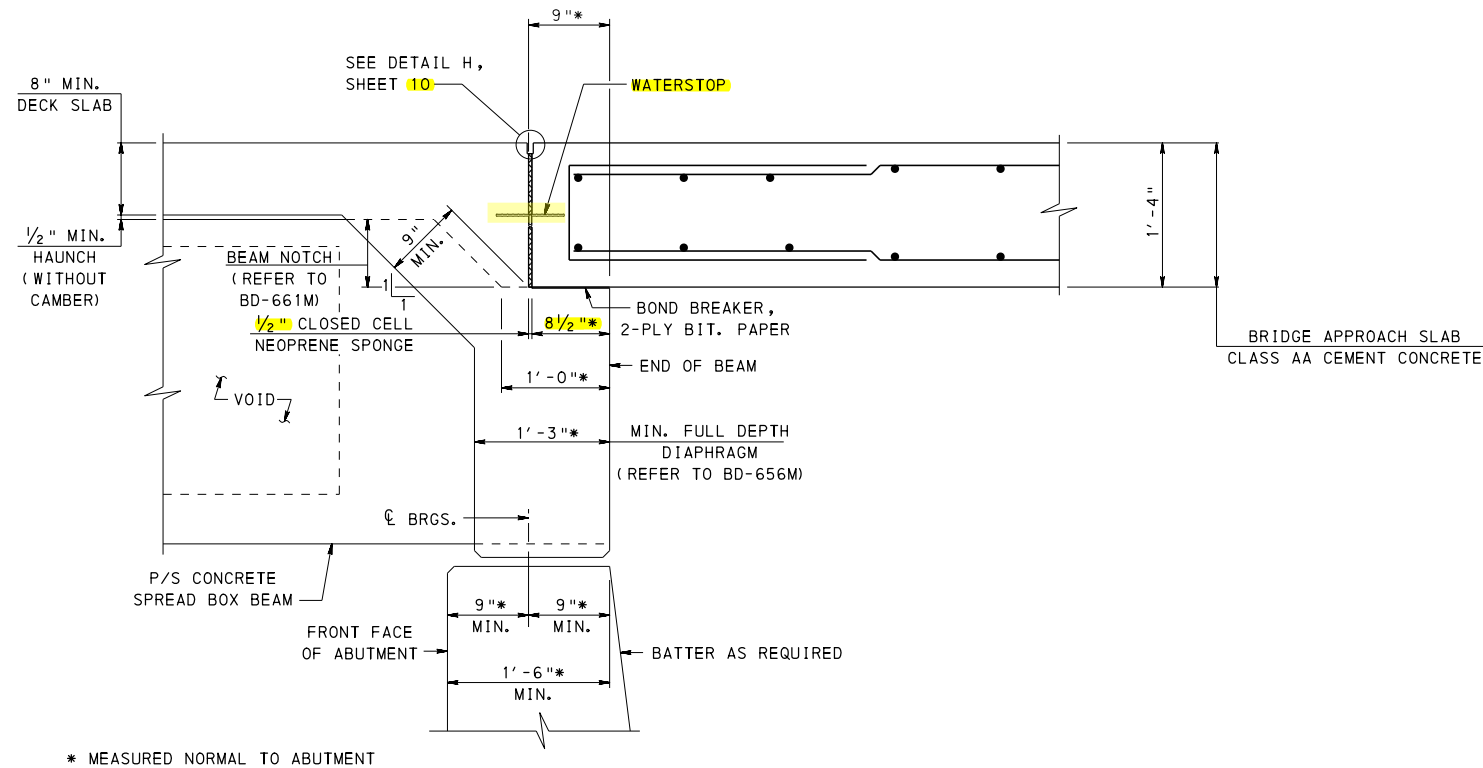
NOTES

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 FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

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BUREAU OF PROJECT DELIVERY

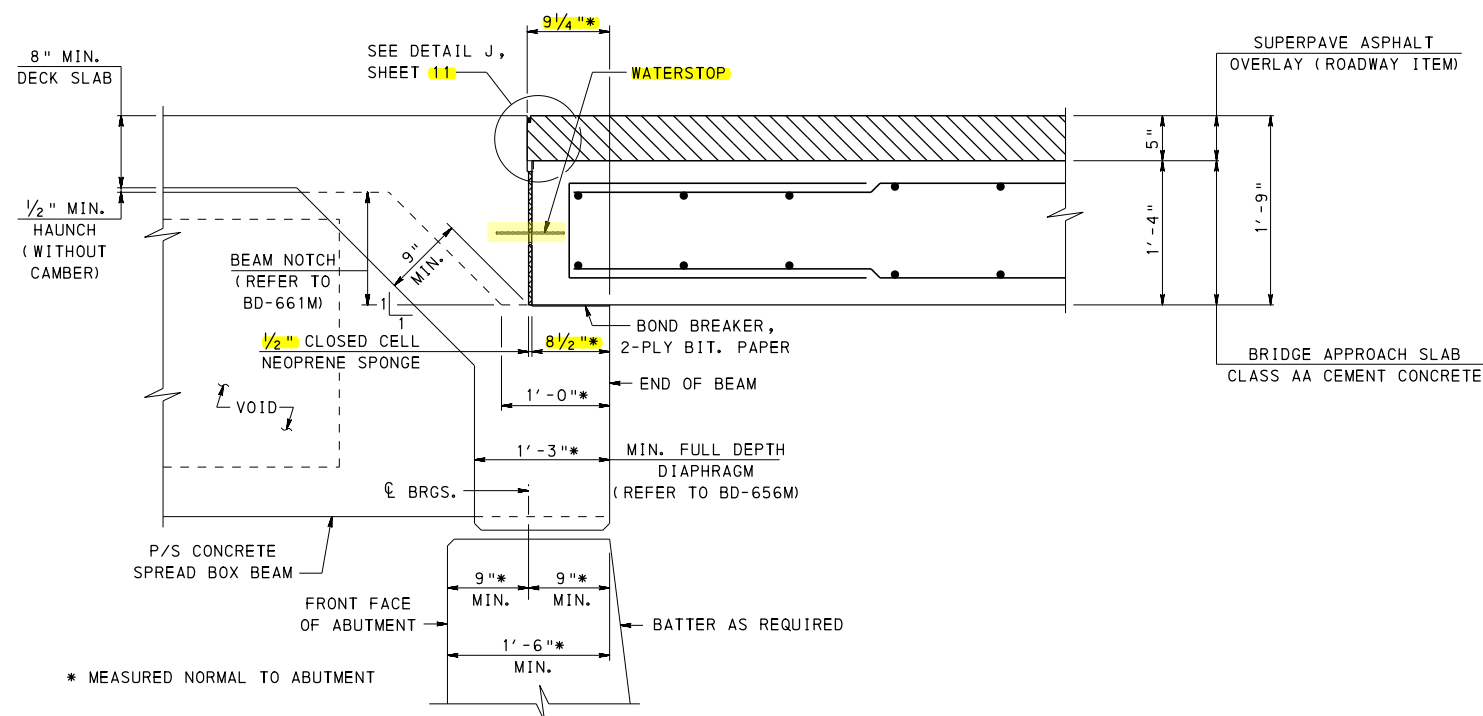
STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 6
(P/S CONCRETE ADJACENT BOX BEAMS
WITHOUT BACKWALL)

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TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 7

APPROACH SLAB SUPPORTED ON P/S CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS FOR BEAM DEPTHS 24" AND GREATER



TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 7

APPROACH SLAB SUPPORTED ON P/S CONCRETE SPREAD BOX BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS 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 11.
4. FOR FORMING AND WATERSTOP DETAILS, SEE SHEET 3.

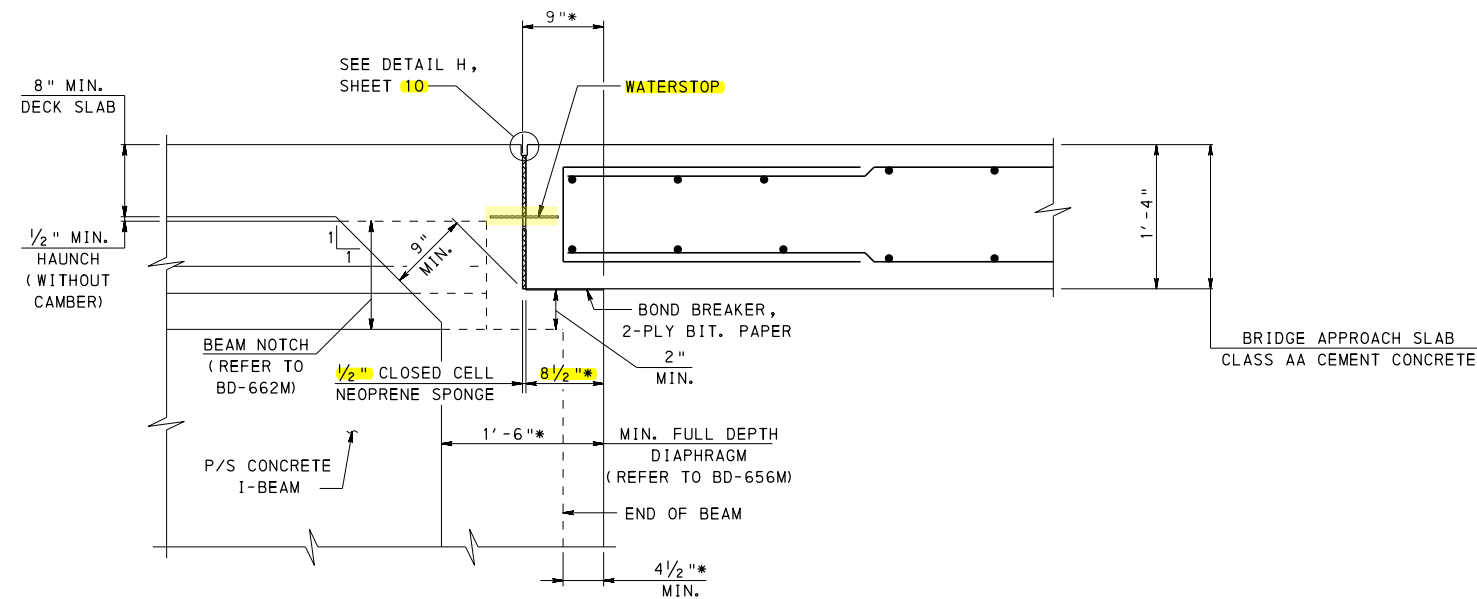
COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 7
(P/S CONCRETE SPREAD BOX BEAMS
WITHOUT BACKWALL)

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THOMAS P. MACIORA
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. WILLY
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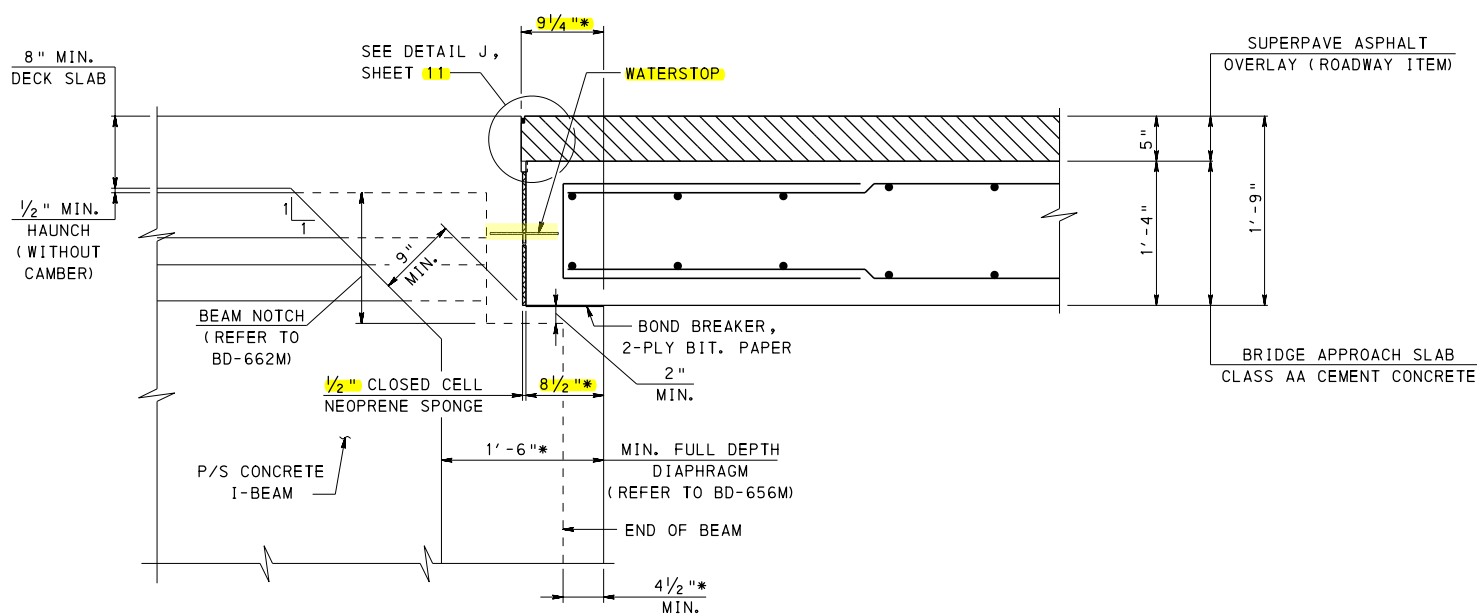
SHEET 13 OF 35
BD-628M



* MEASURED NORMAL TO ABUTMENT

TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 8

APPROACH SLAB SUPPORTED ON P/S CONCRETE
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS



* MEASURED NORMAL TO ABUTMENT

TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 8

APPROACH SLAB SUPPORTED ON P/S CONCRETE
I-BEAMS AND FULL DEPTH CONCRETE END DIAPHRAGMS

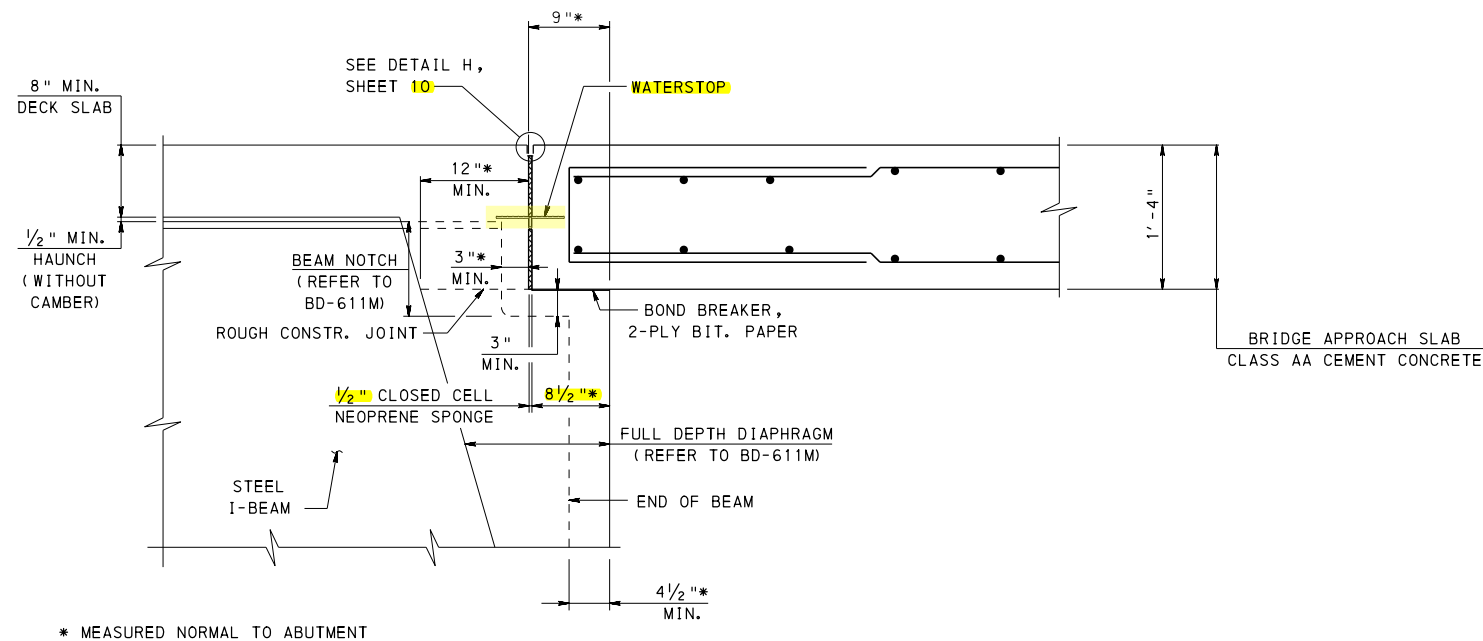
NOTES

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.

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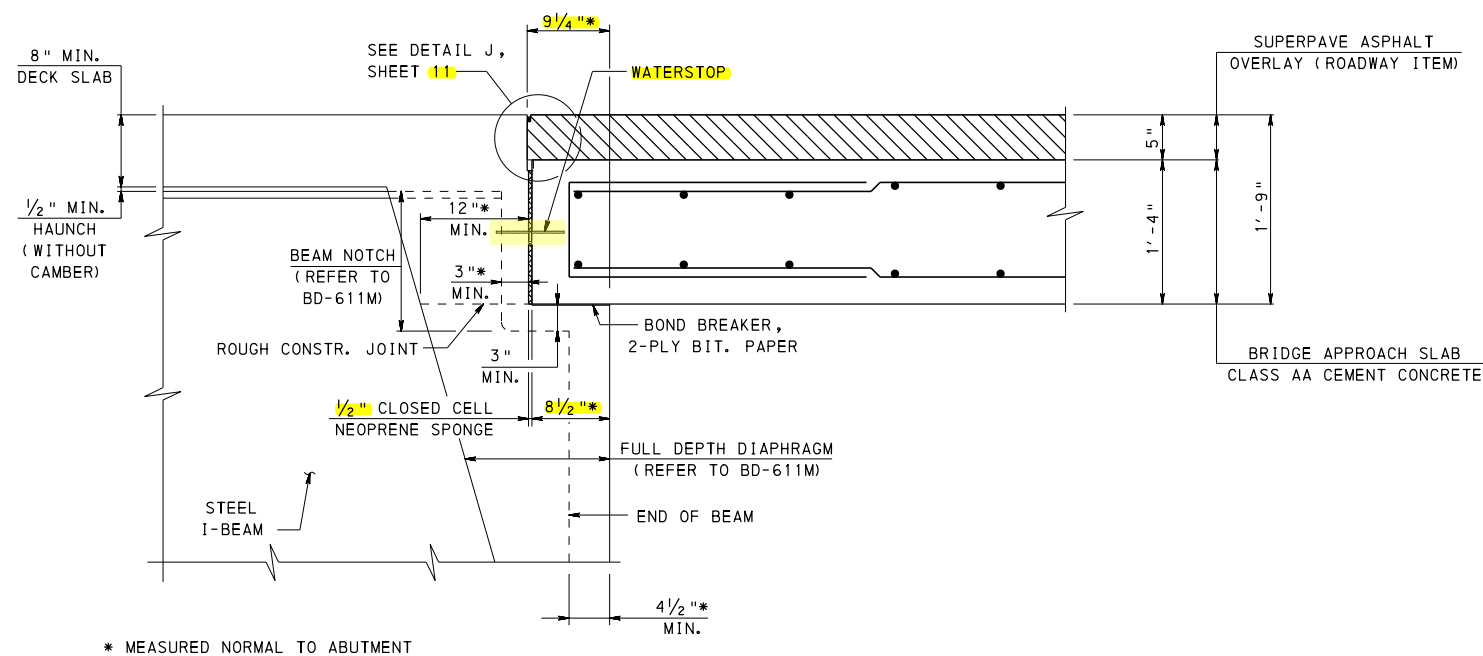
STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 8
(P/S CONCRETE I-BEAMS WITHOUT BACKWALL)

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 14 OF 35 BD-628M
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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



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

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.

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DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 9
(STEEL BEAMS WITHOUT BACKWALL)

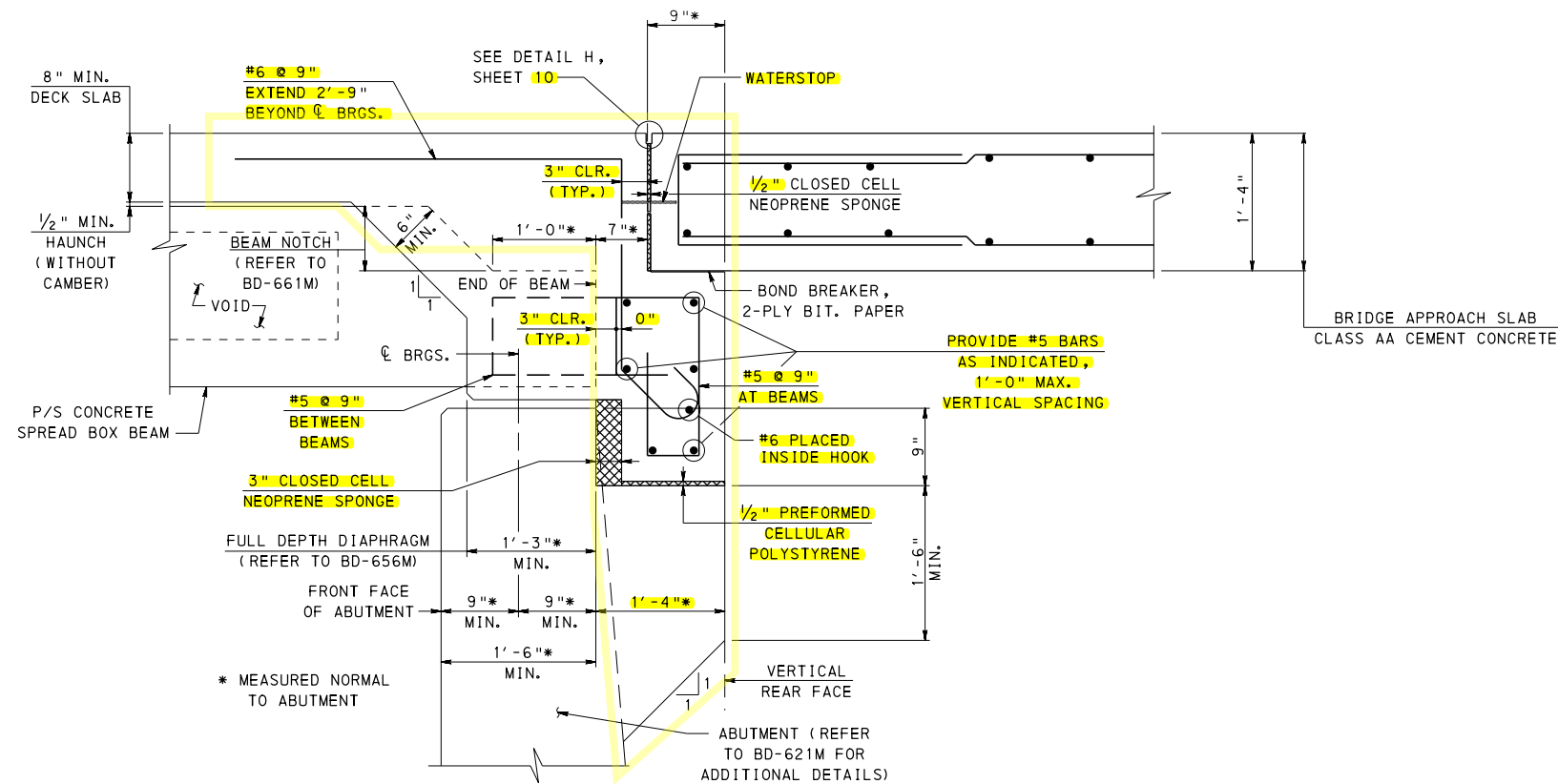
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. Wayne Willey</i> ACTING DIR., BUR. OF PROJECT DELIVERY	SHEET 15 OF 35 BD-628M
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TYPE 2 APPROACH SLAB (WITH OVERLAY) - DETAIL 10

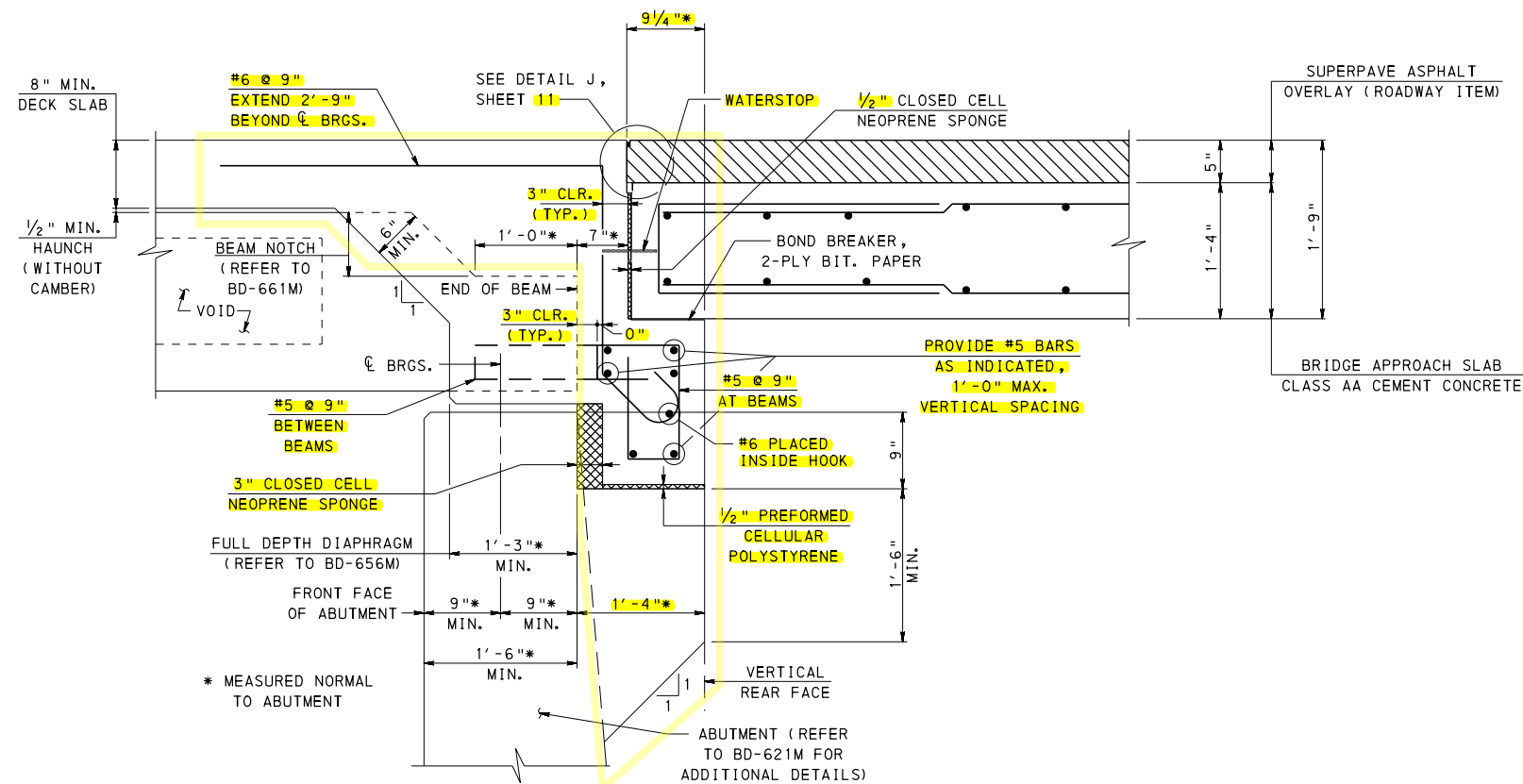
STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 10
(P/S CONCRETE ADJACENT BOX BEAMS
WITH ABUTMENT CORBEL)

RECOMMENDED <u>AUG. 31, 2012</u> <u>Thomas P. Maciara</u> CHIEF BRIDGE ENGINEER	RECOMMENDED <u>AUG. 31, 2012</u> <u>R. W. Wiley</u> ACTING DIR. OF PROJECT DELIVERY	SHEET <u>16</u> OF 35 BD-628M
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TYPE 1 APPROACH SLAB (WITHOUT OVERLAY) - DETAIL 11

APPROACH SLAB SUPPORTED ON ABUTMENT ADJACENT TO P/S 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 ADJACENT TO P/S 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.

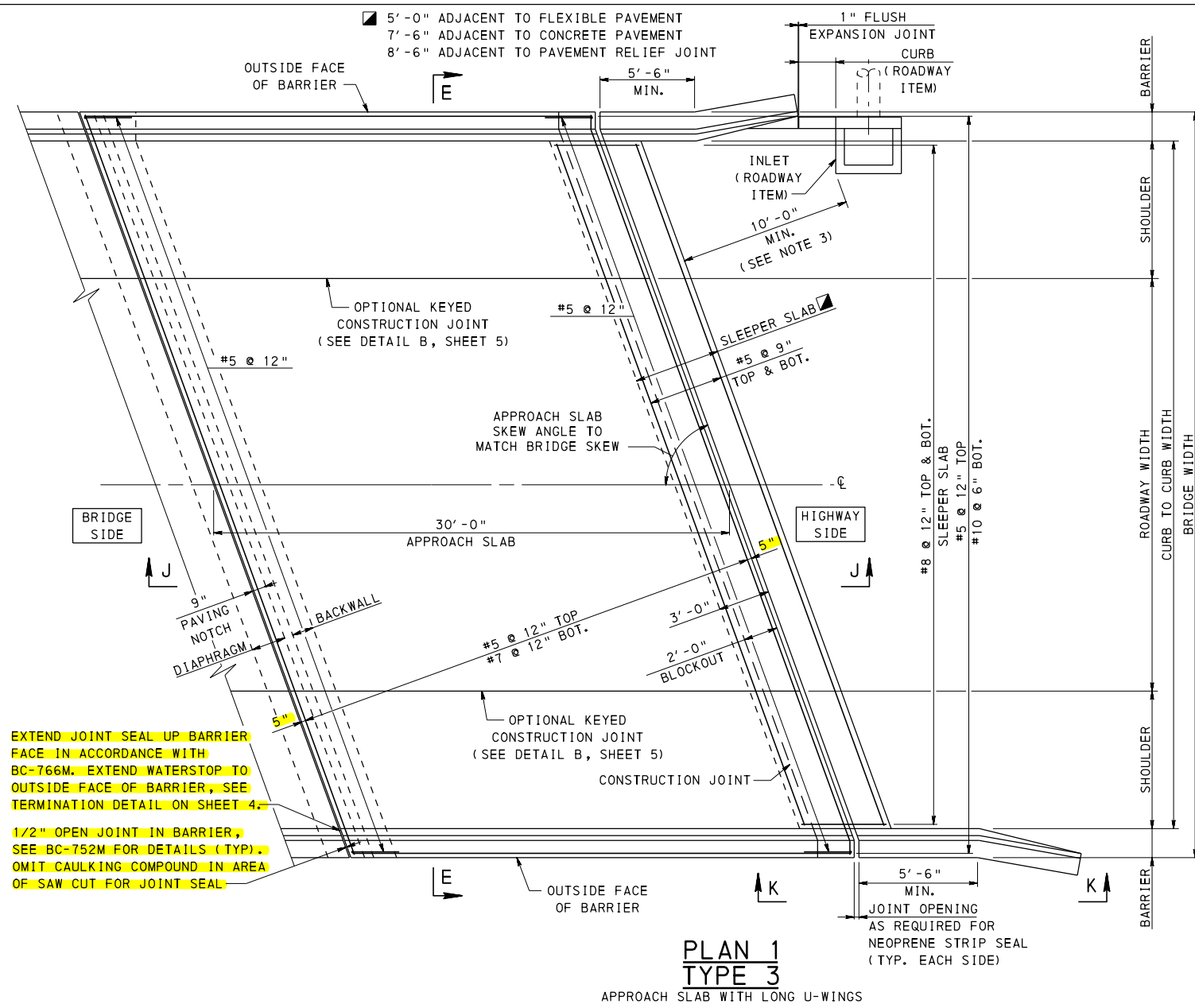
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STANDARD
BRIDGE APPROACH SLABS
TYPE 1 AND TYPE 2 - DETAIL 11
(P/S CONCRETE SPREAD BOX BEAMS
WITH ABUTMENT CORBEL)

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CHIEF BRIDGE ENGINEER

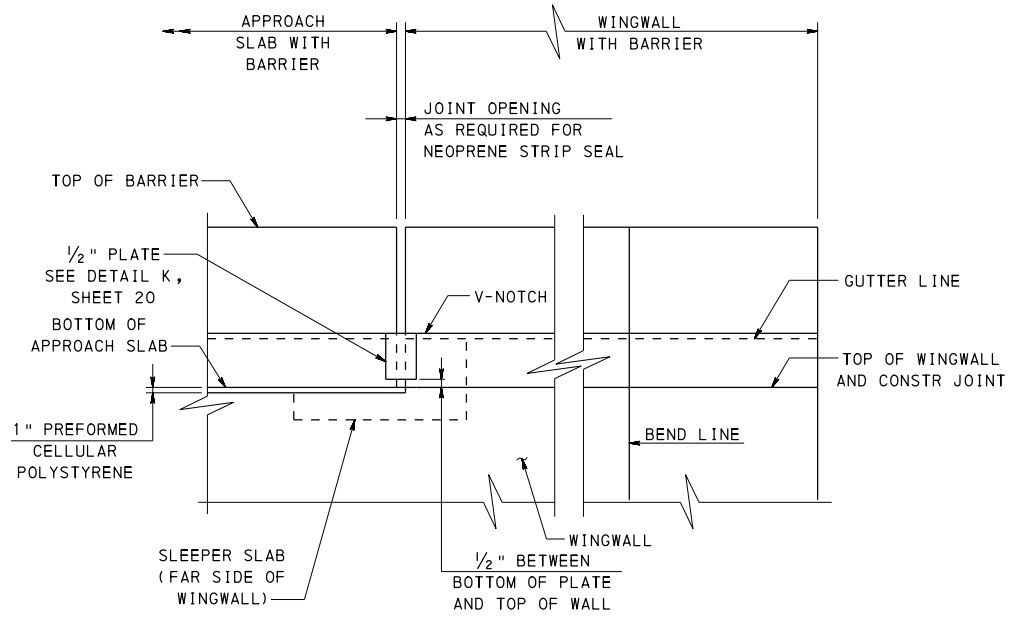
RECOMMENDED AUG. 31, 2012
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SHEET 17 OF 35
BD-628M



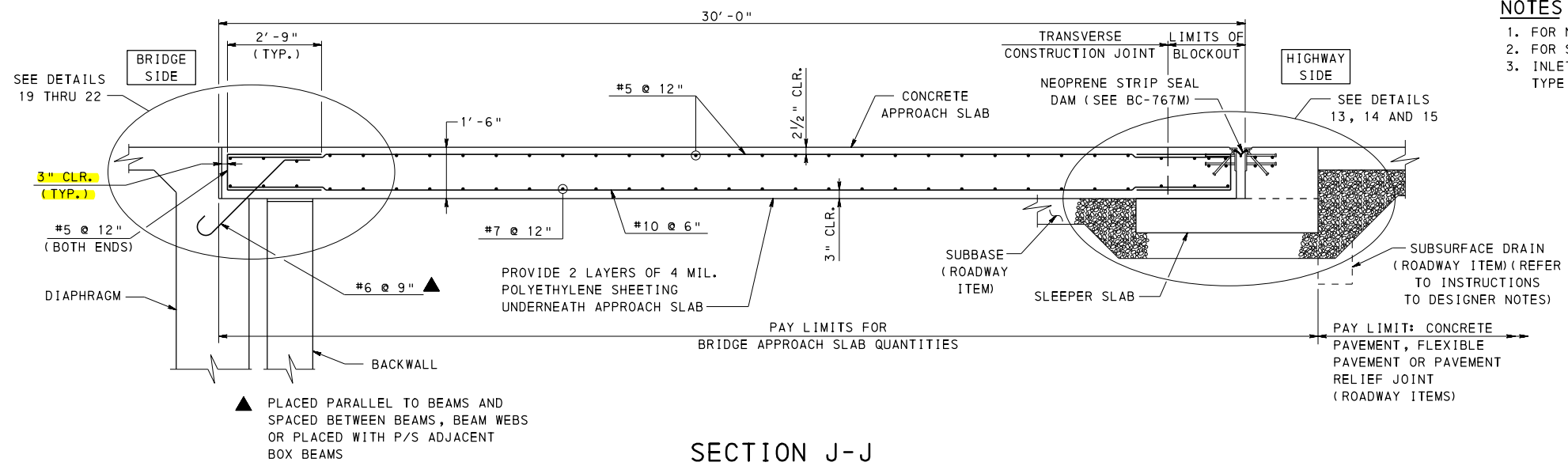
PLAN	DESCRIPTION	SHEET NO.
1	APPROACH SLAB WITH LONG U-WINGS	19
2	APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS WITH MOMENT SLABS	20
3	APPROACH SLAB WITH FLARED WINGS OR SHORT U-WINGS	21

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 P/S CONCRETE ADJACENT BOX BEAMS WITH BACKWALL	24
20	APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (P/S CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL	24
21	APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (P/S 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



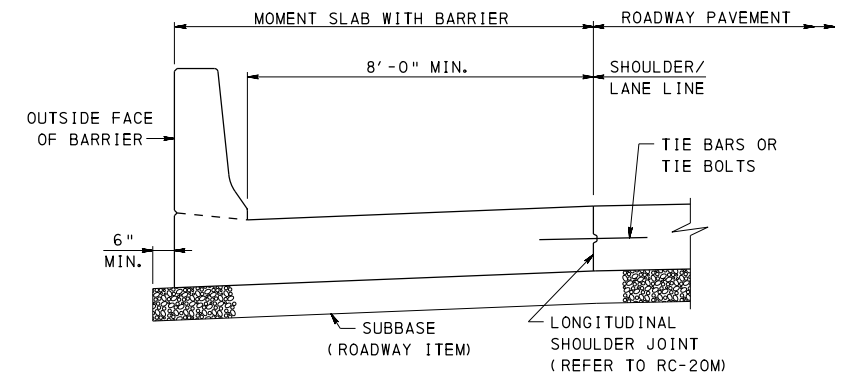
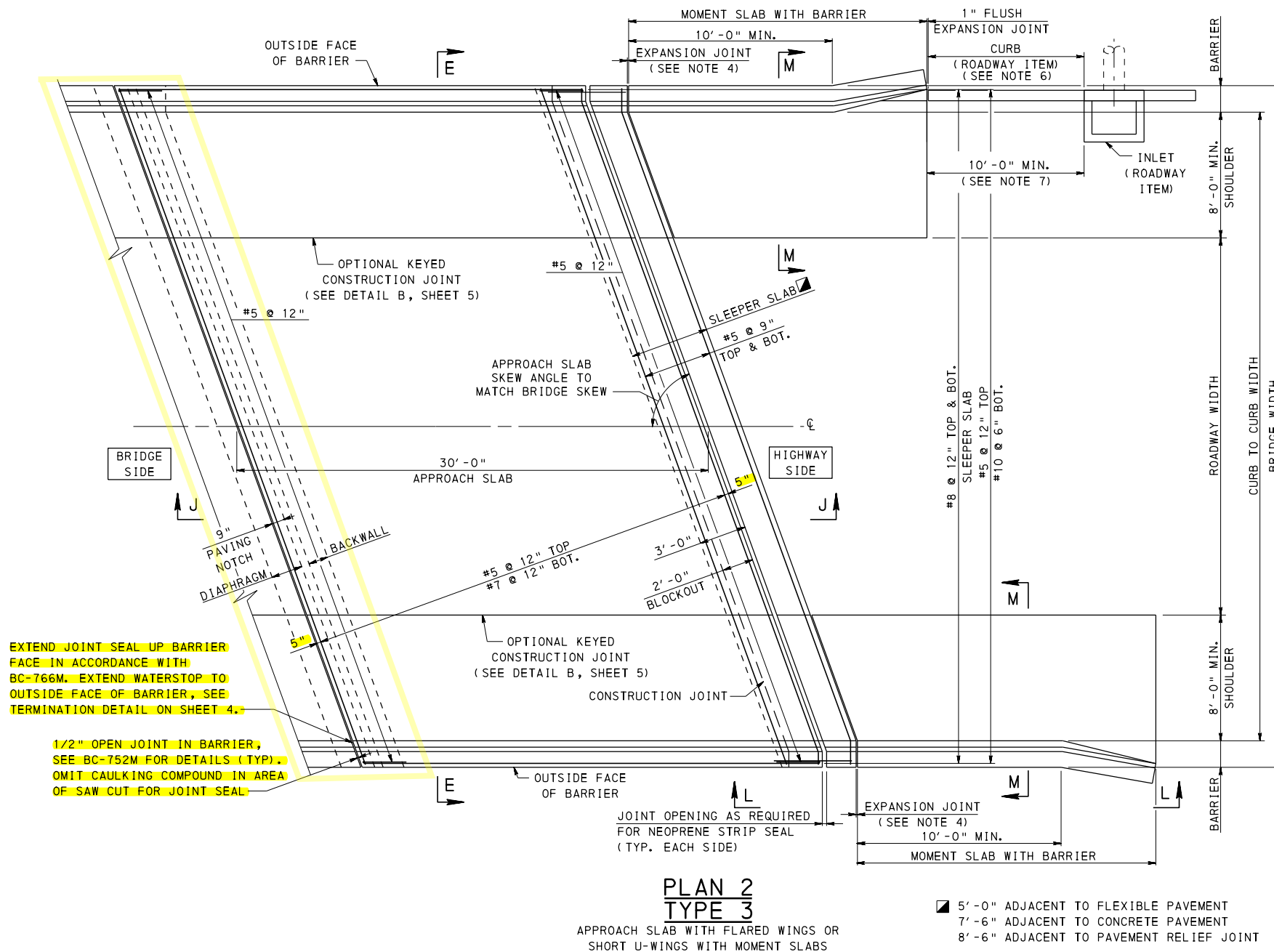
NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- FOR SECTION E-E, SEE SHEET 8.
- INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.



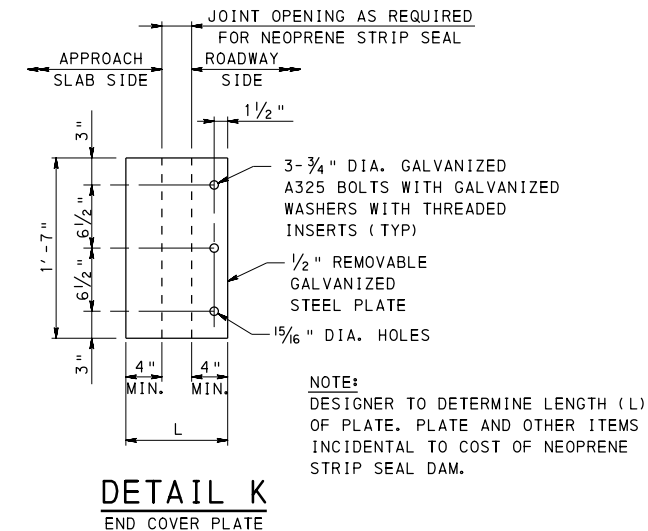
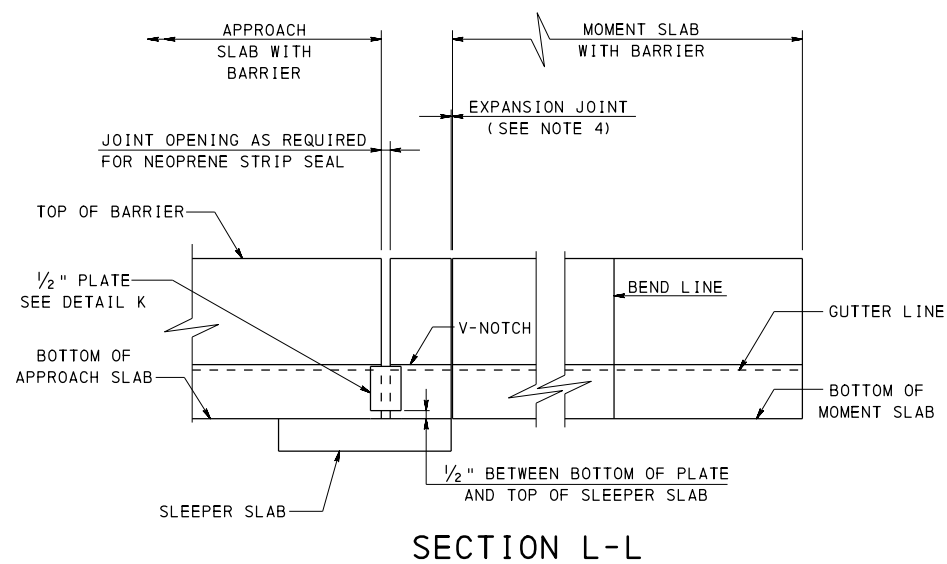
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STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - PLAN 1 AND SECTION



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: 1'-0" AND PROVIDE SLIDING PLATE IN ACCORDANCE WITH THE DETAILS SHOWN ON BD-627M.
- FOR ADDITIONAL MOMENT SLAB DETAILS REFER TO BD-627M.
- PROVIDE TYPE 2-SC GUIDE RAIL WITH POSTS AT 3'-1 1/2" SPA. ALONG CURB AFTER APPROACH END TRANSITION.
- INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.



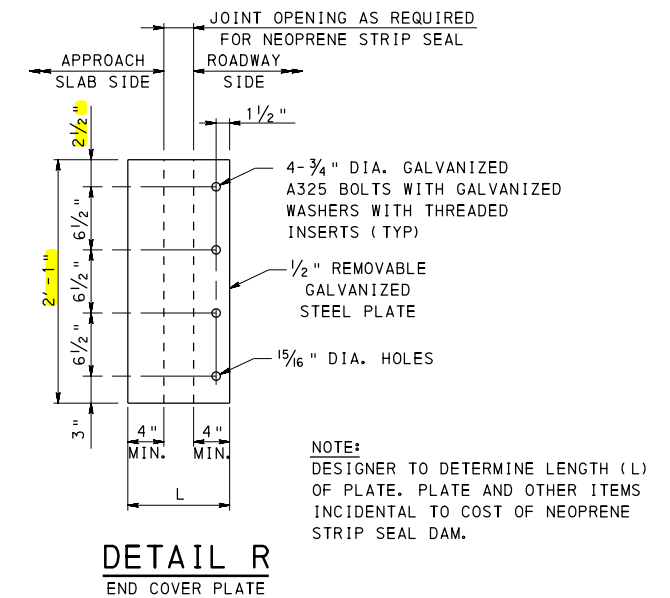
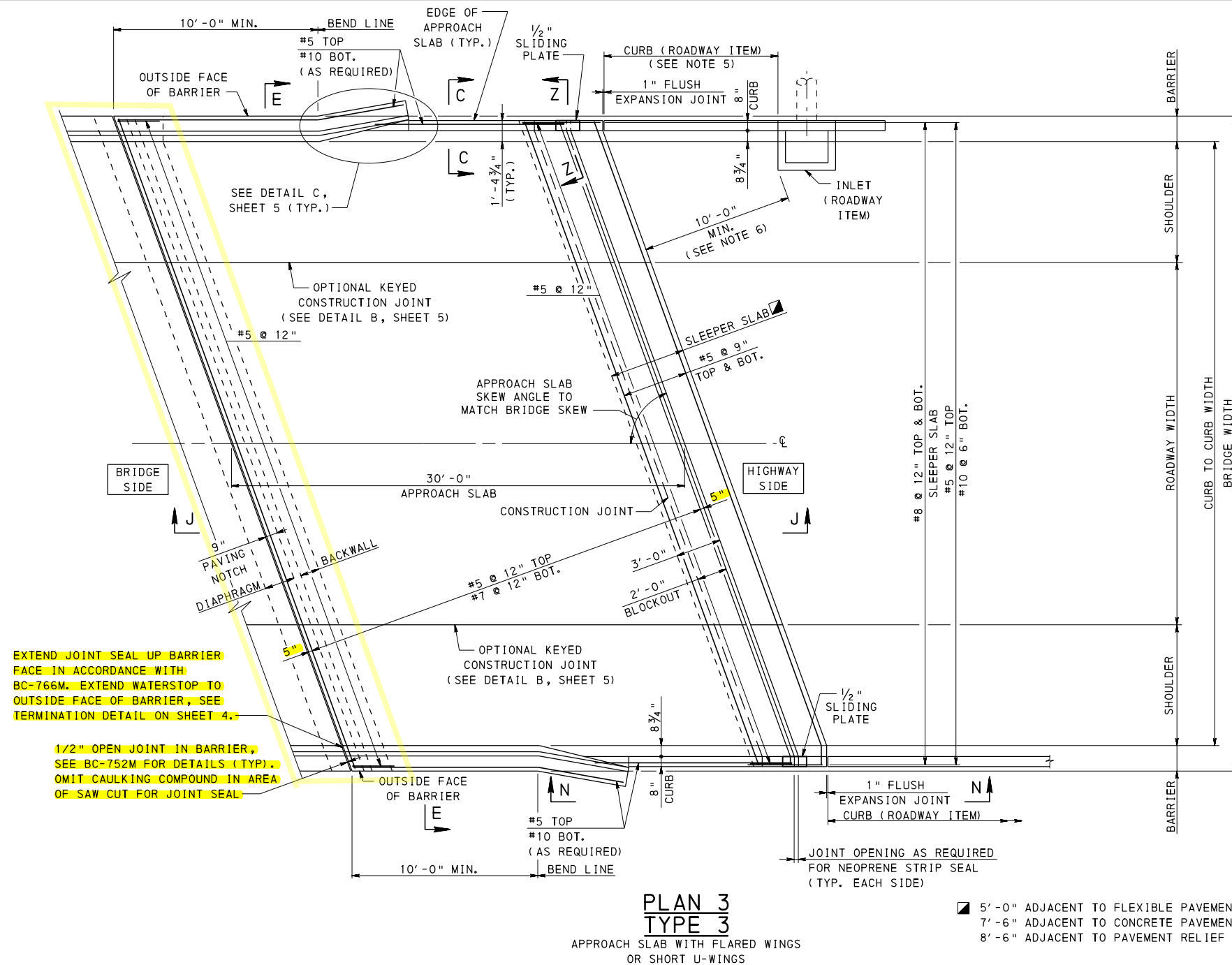
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BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - PLAN 2

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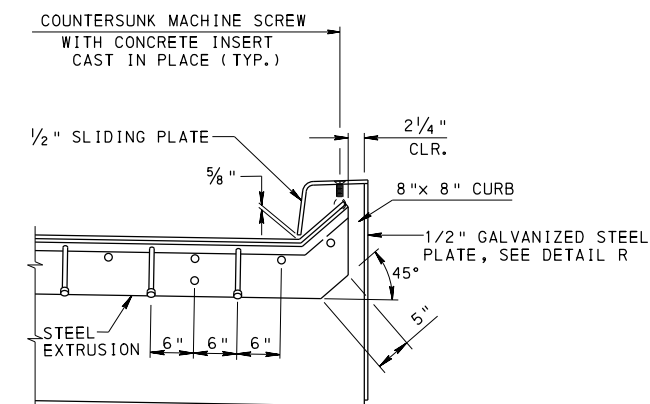
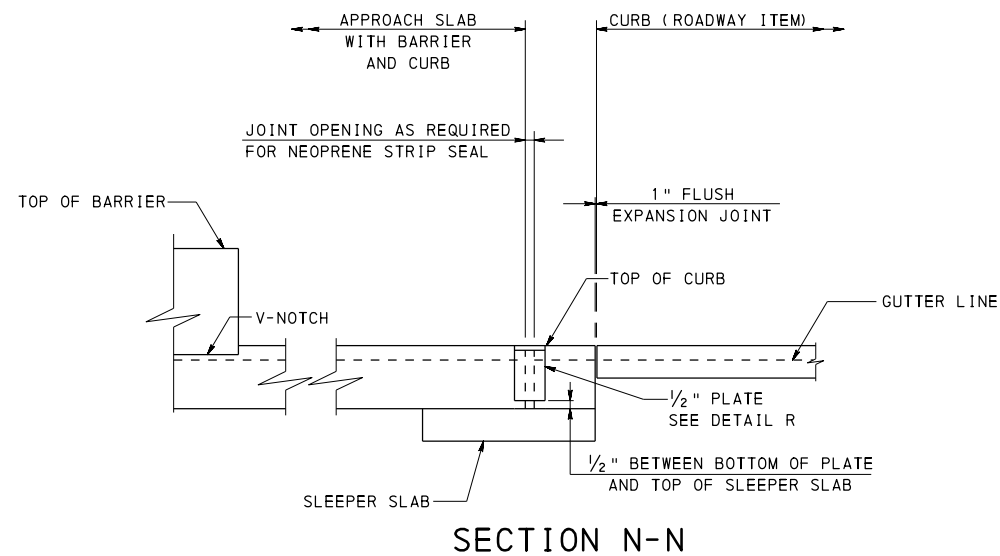
SHEET 20 OF 35
BD-628M



NOTES

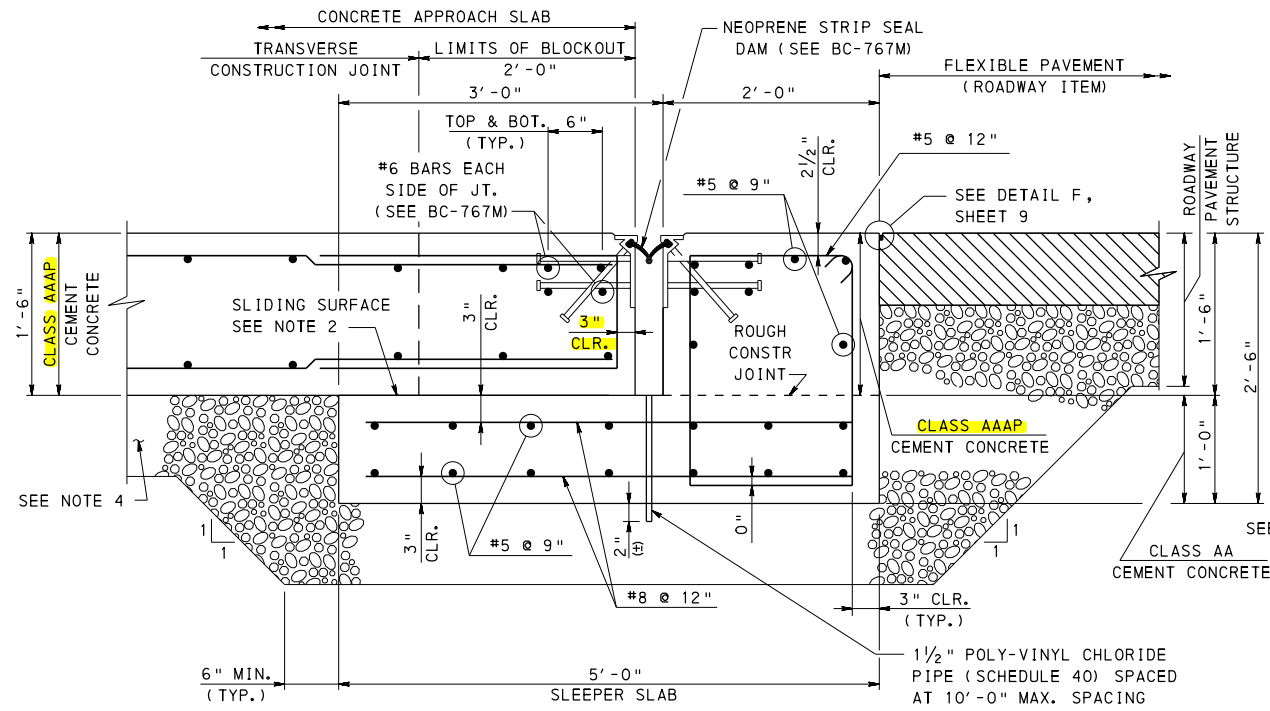
1. FOR NOTES, SEE SHEETS 1 AND 2.
2. FOR SECTION C-C, SEE SHEET 5.
3. FOR SECTION E-E, SEE SHEET 8.
4. FOR SECTION J-J, SEE SHEET 19.
5. USE GUIDE RAIL TRANSITION SIMILAR TO DETAIL ON BC-739M. ONCE BEYOND INLET, PROVIDE GUIDE RAIL AND POSTS AS PER RC-50M AND/OR RC-52M.
6. INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.

- 5'-0" ADJACENT TO FLEXIBLE PAVEMENT
- 7'-6" ADJACENT TO CONCRETE PAVEMENT
- 8'-6" ADJACENT TO PAVEMENT RELIEF JOINT



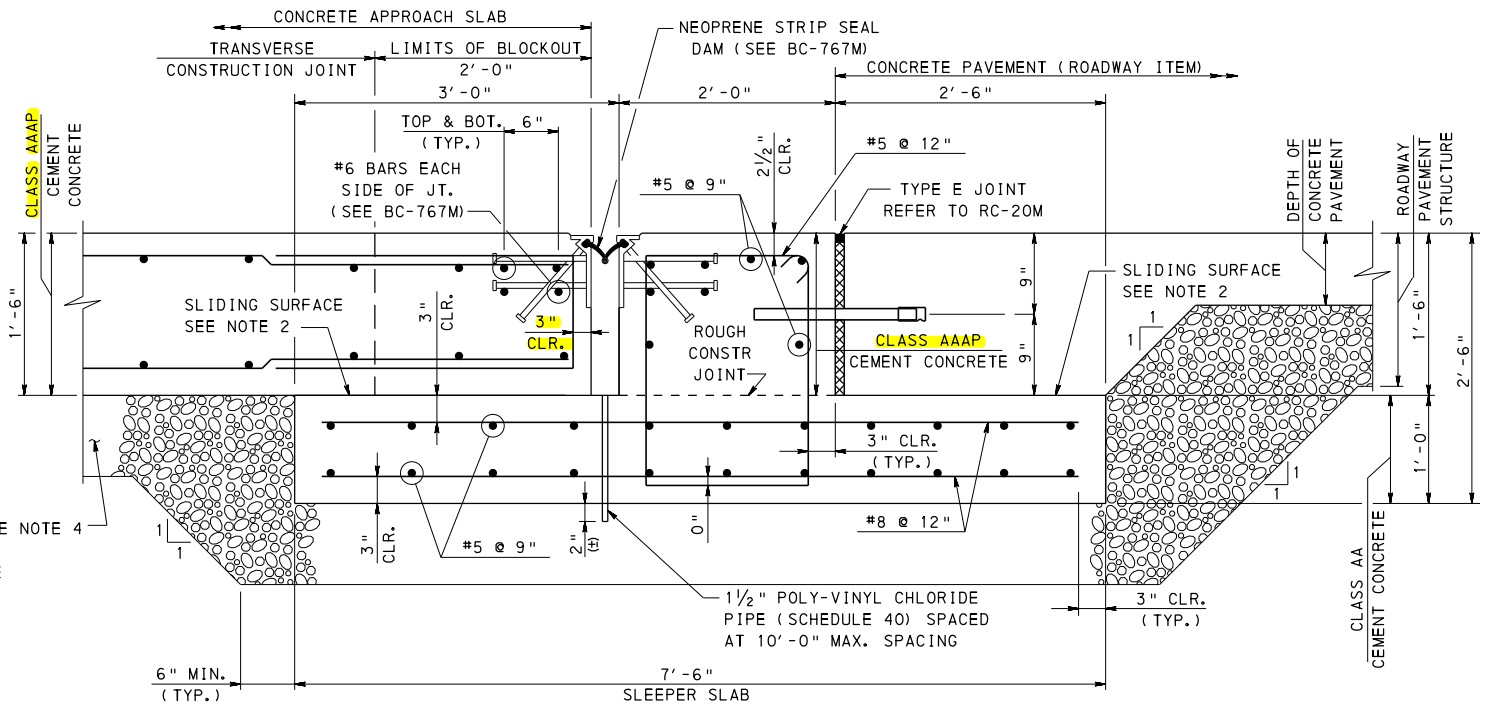
**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY**

**STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - PLAN 3**



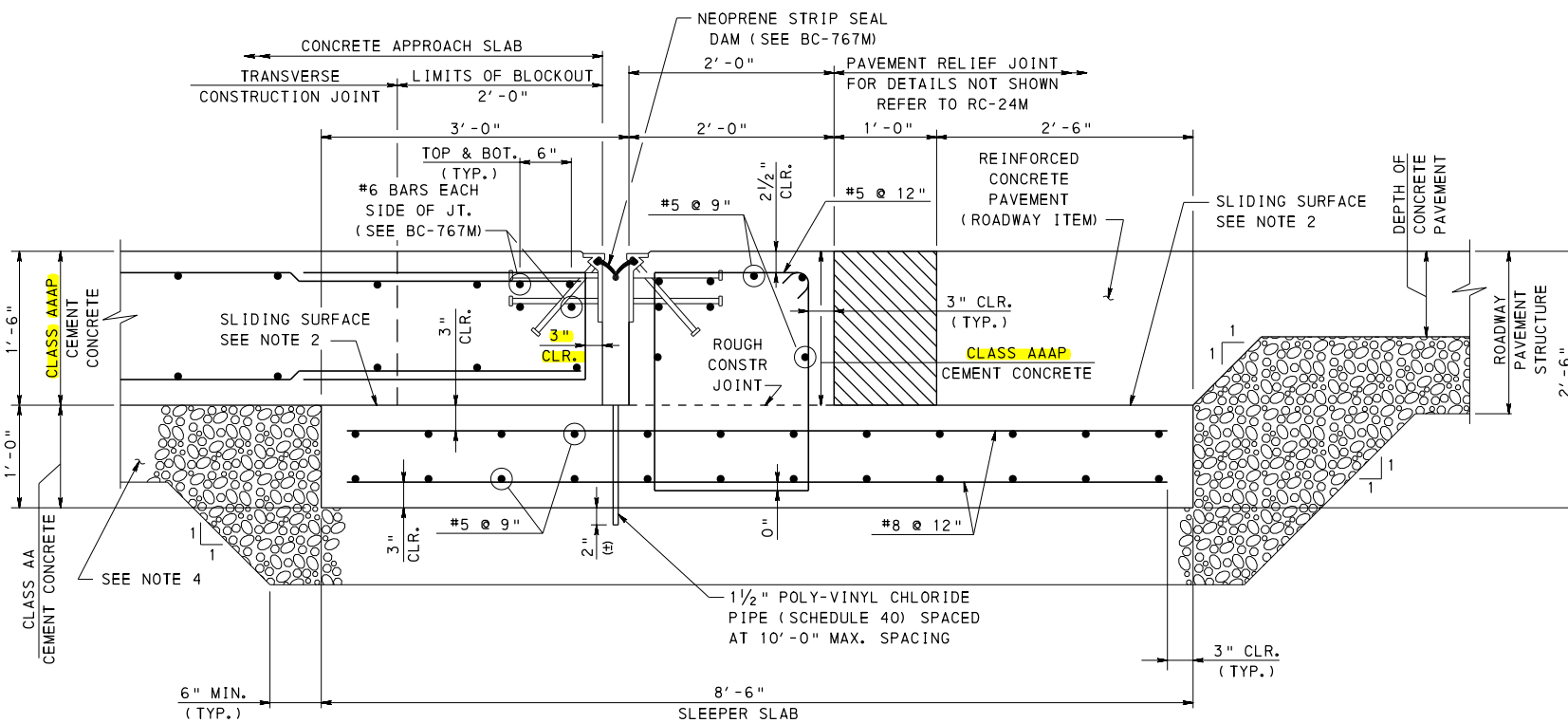
TYPE 3 AND TYPE 5 APPROACH SLAB - DETAIL 13

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

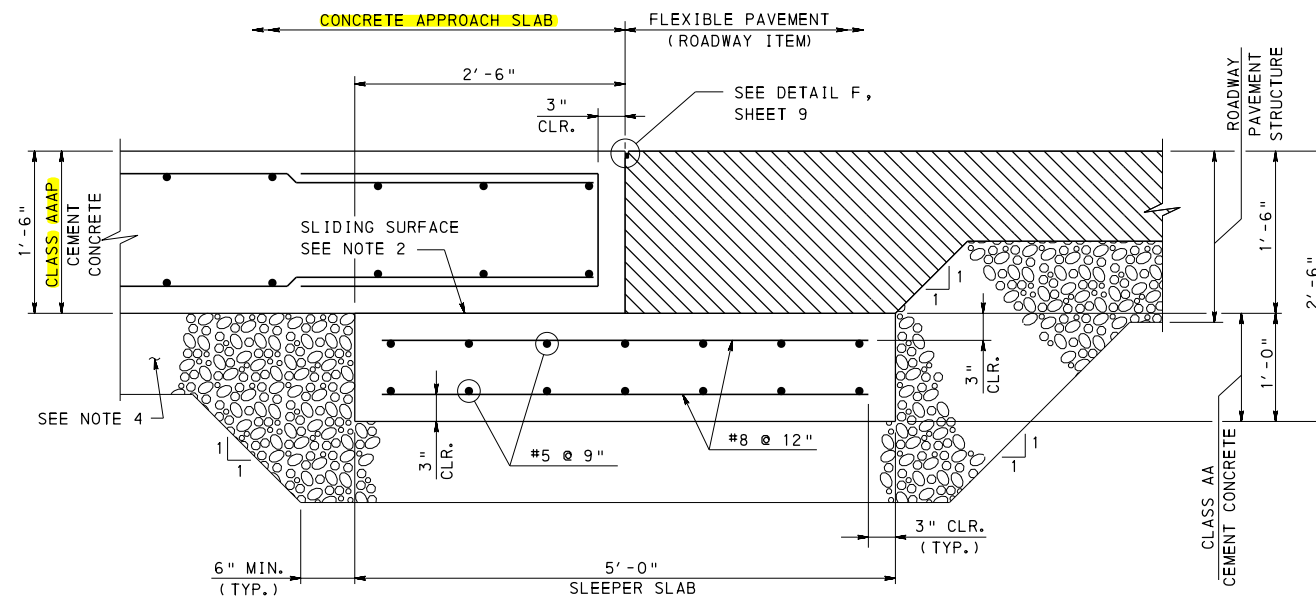
NOTES

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 14 ONLY WHEN LIMITED MOVEMENT IS ANTICIPATED IN THE ROADWAY OTHERWISE USE DETAIL 15. REFER TO RC-24M FOR ADDITIONAL INFORMATION.
4. TYPE 3 APPROACH SLAB; SUBBASE (ROADWAY ITEM)
TYPE 5 APPROACH SLAB; STRUCTURAL BACKFILL, REFER TO RC-12M.

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DEPARTMENT OF TRANSPORTATION
BUREAU OF **PROJECT DELIVERY**

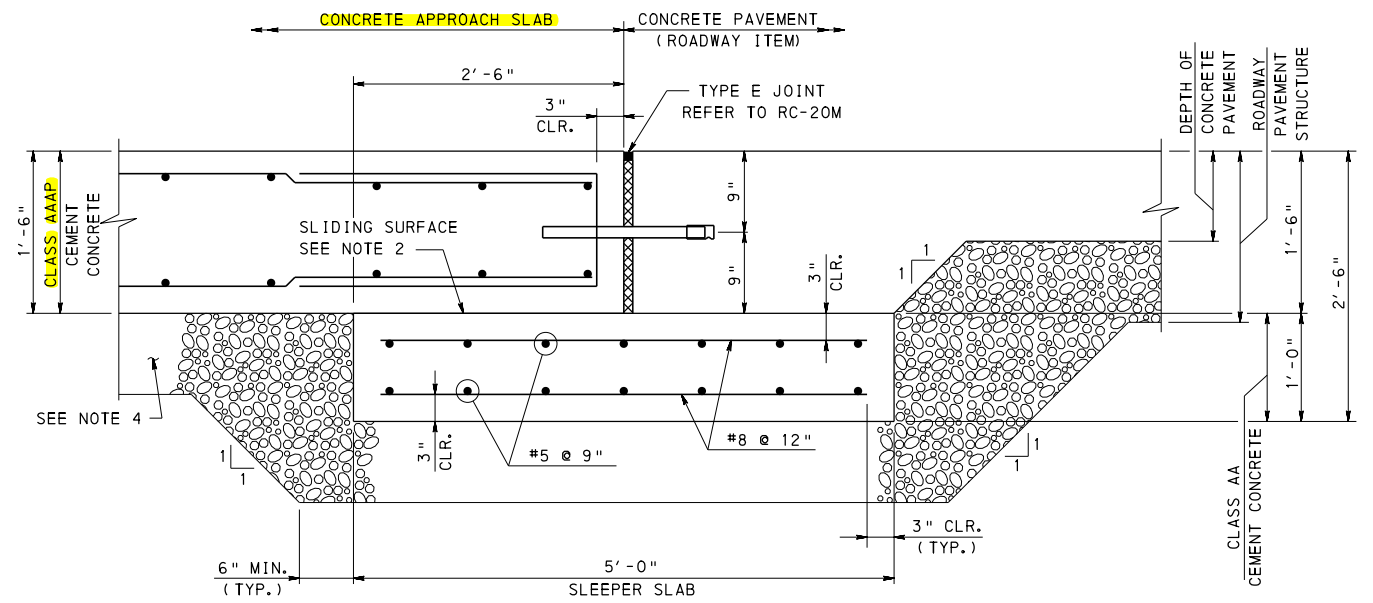
STANDARD
BRIDGE APPROACH SLABS
TYPE 3 & TYPE 5 - DETAILS 13, 14 AND 15
(ADJACENT TO ROADWAY)

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 22 OF 35 BD-628M
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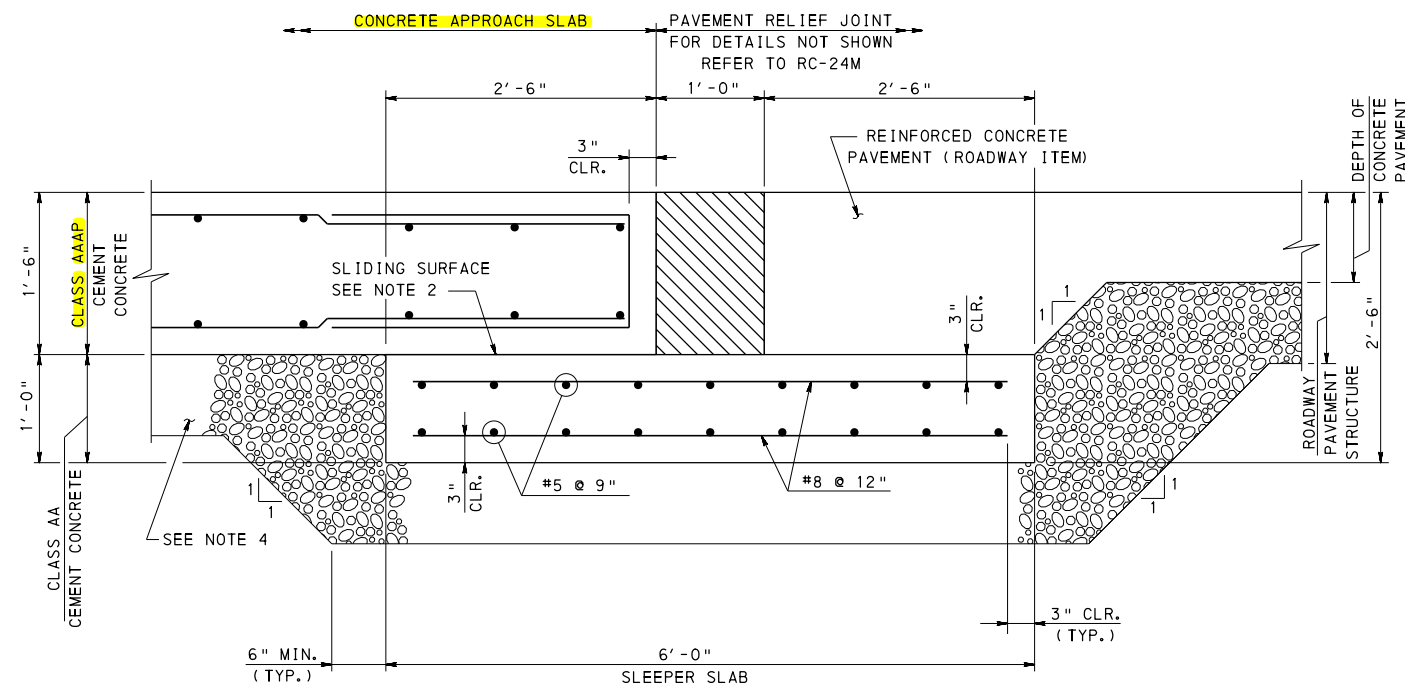
TYPE 5 APPROACH SLAB - DETAIL 16

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

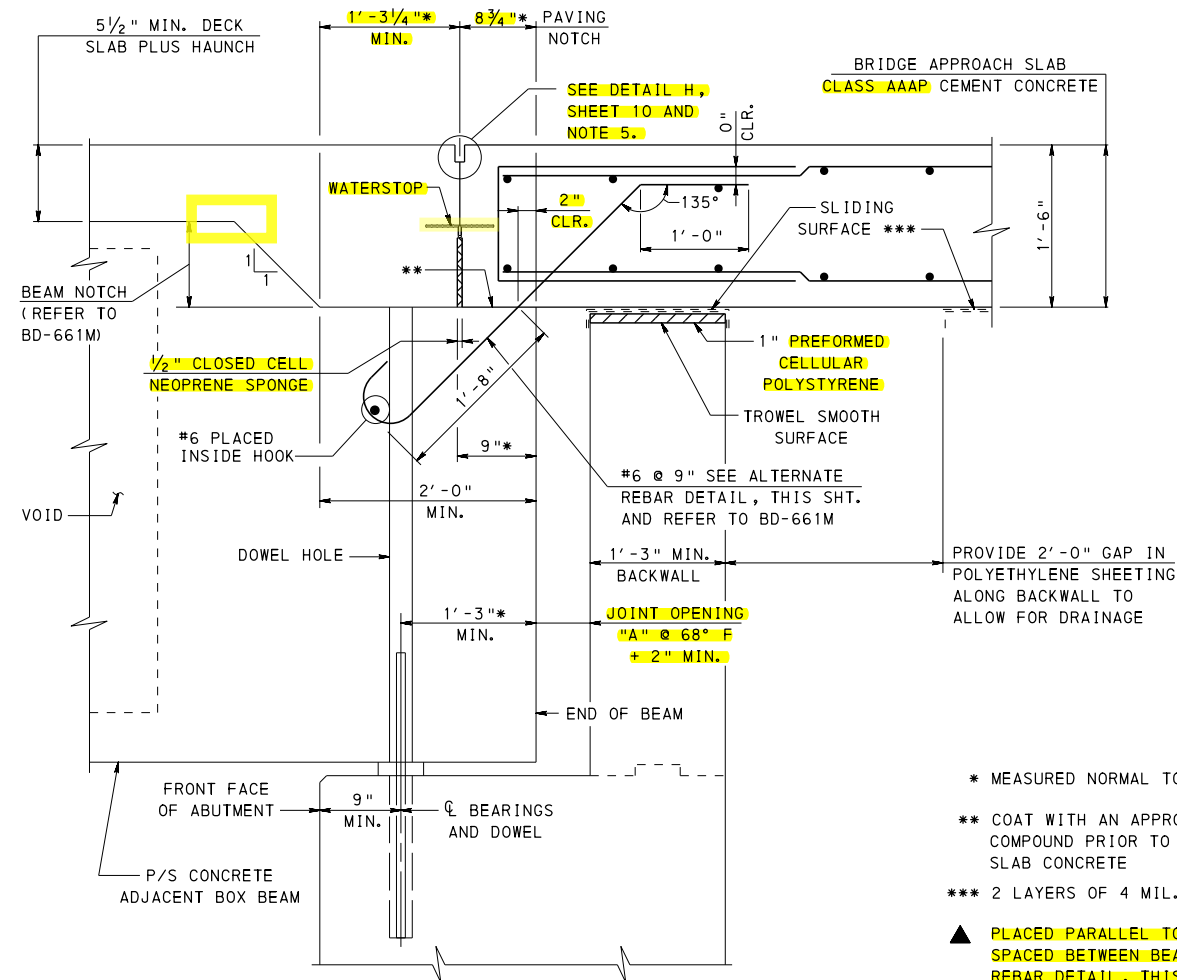
END OF APPROACH SLAB
ADJACENT TO PAVEMENT RELIEF JOINT

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.**

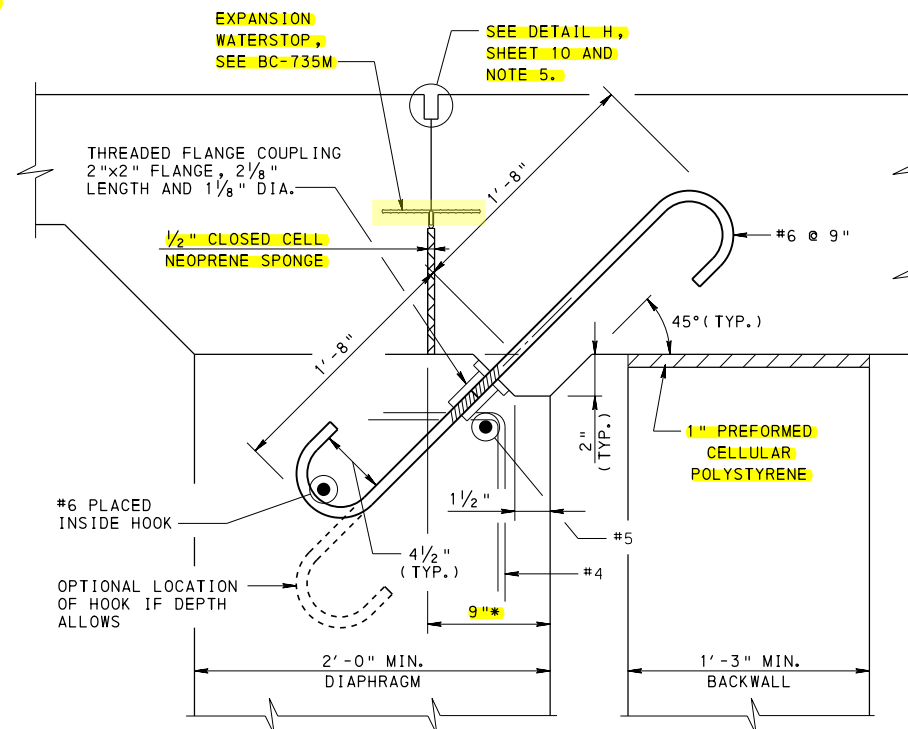
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF **PROJECT DELIVERY**

STANDARD
BRIDGE APPROACH SLABS
TYPE 5 - DETAILS 16, 17 AND 18
(ADJACENT TO ROADWAY)



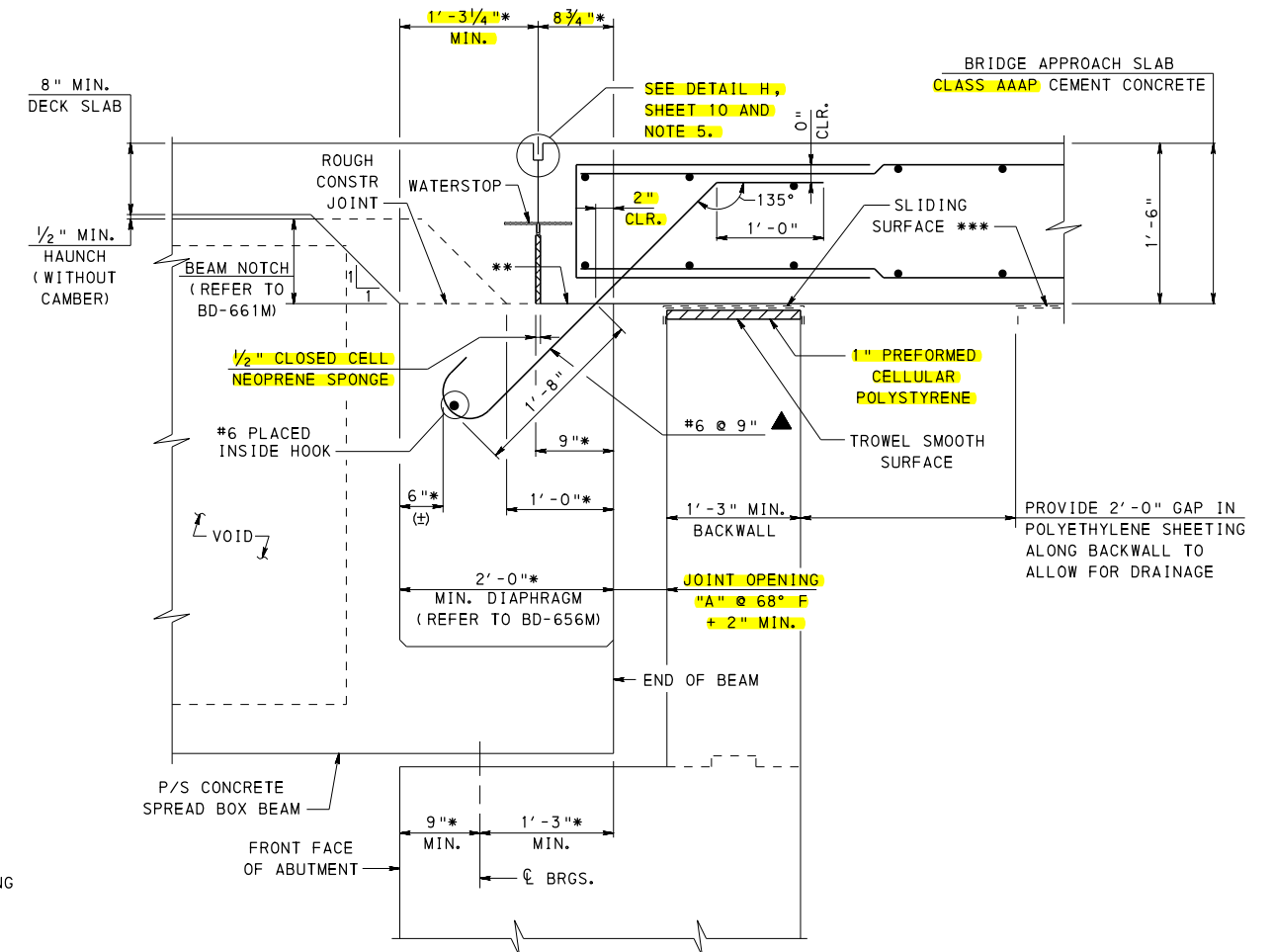
TYPE 3 APPROACH SLAB - DETAIL 19

APPROACH SLAB CONNECTED TO P/S CONCRETE ADJACENT BOX BEAMS WITH BACKWALL, FOR BEAM DEPTHS 33" AND GREATER



ALTERNATE REBAR DETAIL

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



TYPE 3 APPROACH SLAB - DETAIL 20

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE (P/S CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS) WITH BACKWALL, FOR BEAM DEPTHS 39" AND GREATER

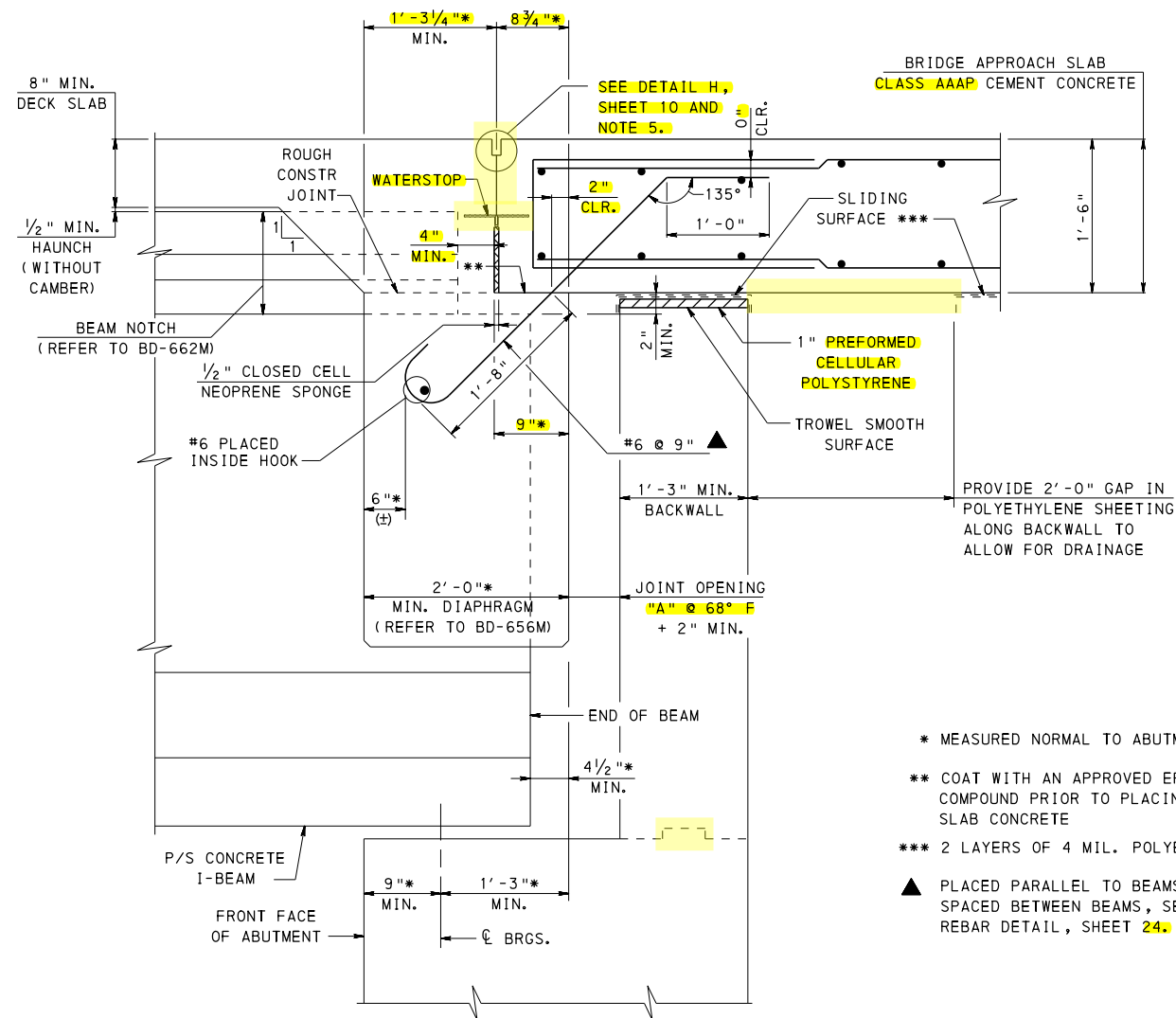
NOTES

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. DETAIL O ON SHEET 35 MAY BE SPECIFIED AS AN ALTERNATE JOINT SEAL TYPE, AS DIRECTED BY THE DISTRICT BRIDGE ENGINEER.
6. SEE STANDARD DRAWING BC-767M FOR JOINT OPENING "A".

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STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - DETAILS 19 AND 20
(P/S CONCRETE BOX BEAMS WITH BACKWALL)

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 24 OF 35 BD-628M
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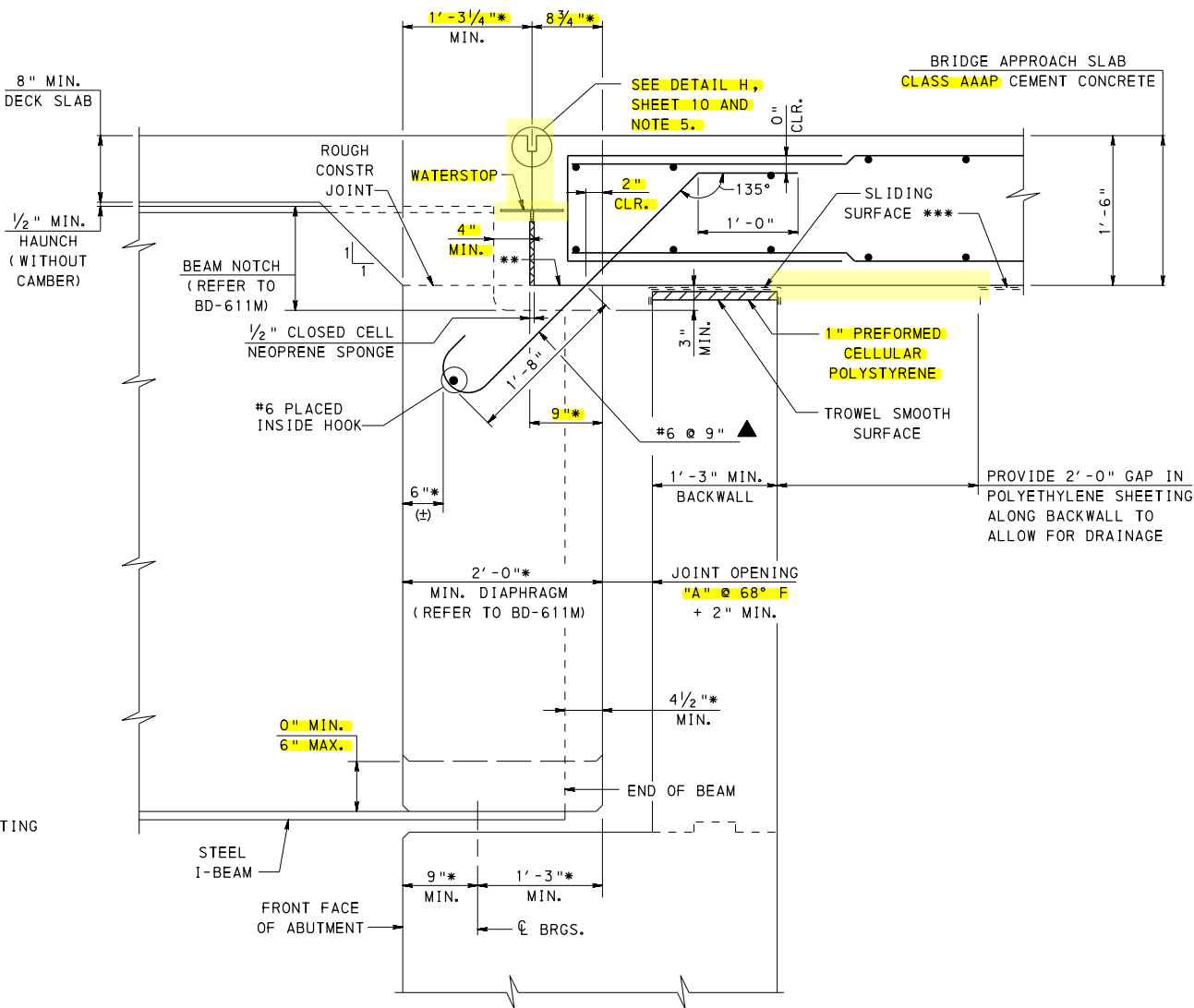


TYPE 3 **3** APPROACH SLAB - DETAIL 21

APPROACH SLAB CONNECTED TO THE SUPERSTRUCTURE
(P/S 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 **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

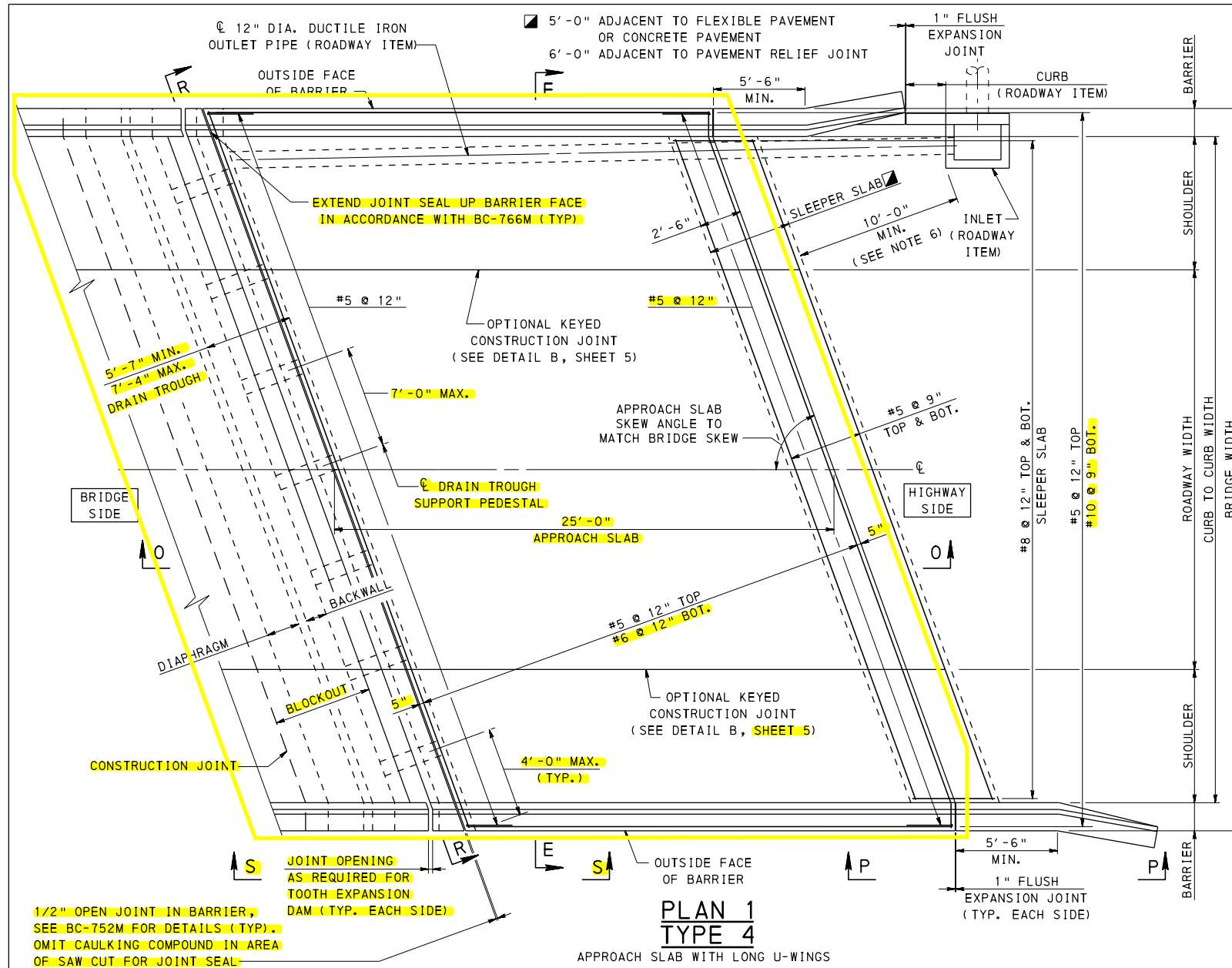
NOTES

- 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.
- DETAIL O ON SHEET 35 MAY BE SPECIFIED AS AN ALTERNATE JOINT SEAL TYPE, AS DIRECTED BY THE DISTRICT BRIDGE ENGINEER.
- SEE STANDARD DRAWING BC-767M FOR JOINT OPENING "A".

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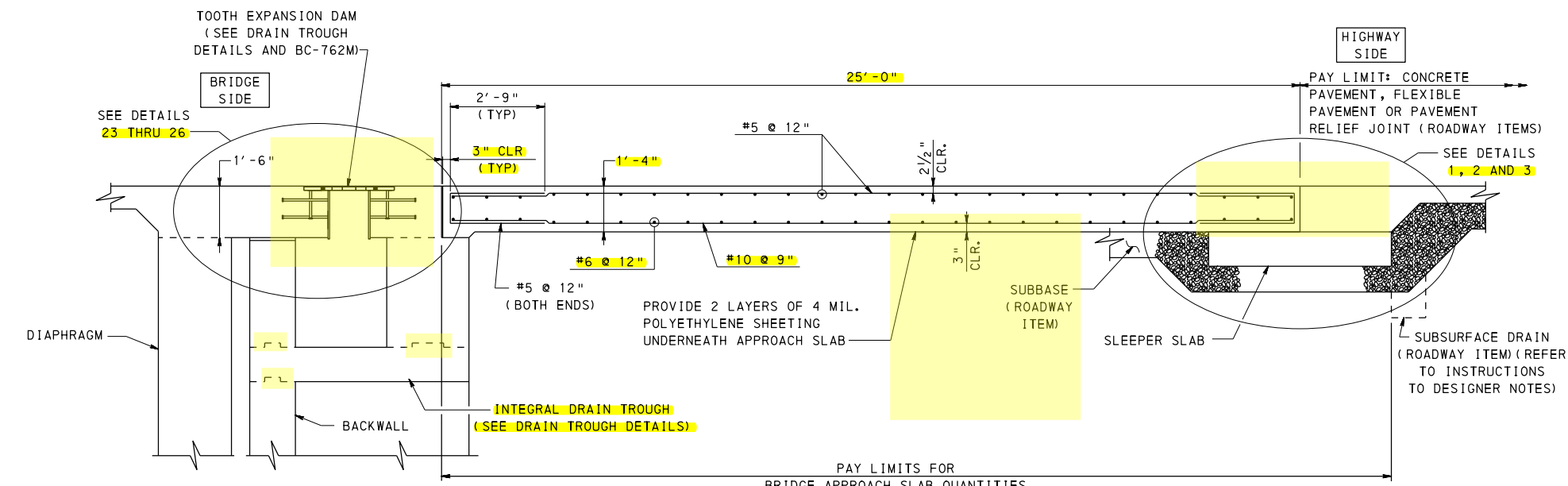
STANDARD
BRIDGE APPROACH SLABS
TYPE 3 - DETAILS 21 AND 22
(I-BEAMS WITH BACKWALL)

RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 25 OF 35 BD-628M
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PLAN 1
TYPE 4

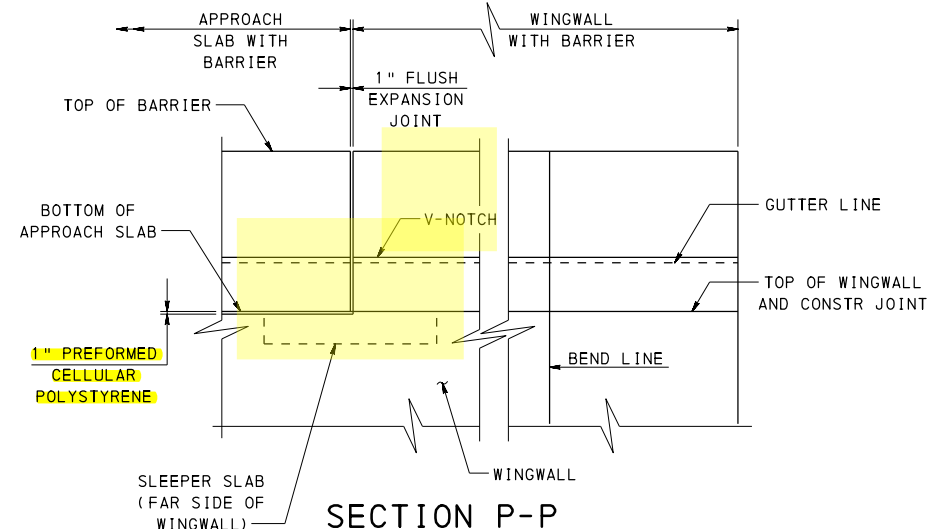
APPROACH SLAB WITH LONG U-WINGS



SECTION 0-0

DESCRIPTION OF PLANS FOR TYPE 4 APPROACH SLABS		
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

DESCRIPTION OF DETAILS FOR TYPE 4 APPROACH SLAB		
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	P/S CONCRETE ADJACENT BOX BEAMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND NO APPROACH SLAB	29
24	P/S CONCRETE SPREAD BOX BEAMS AND CONCRETE END DIAPHRAGMS WITH BACKWALL AND INTEGRAL DRAIN TROUGH FOR TOOTH DAM AND APPROACH SLAB SUPPORT	30
25	P/S 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

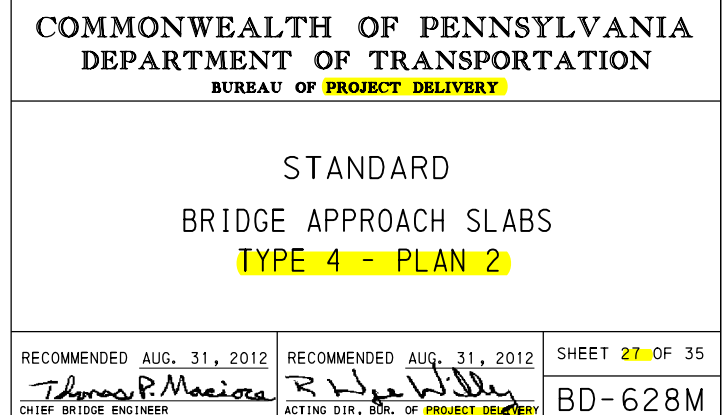
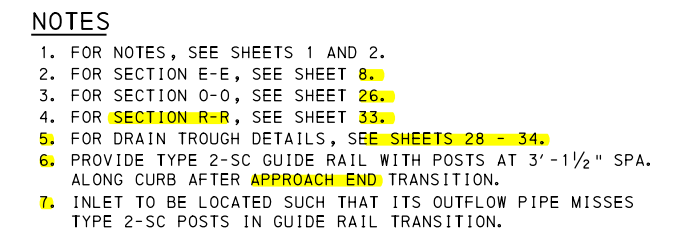


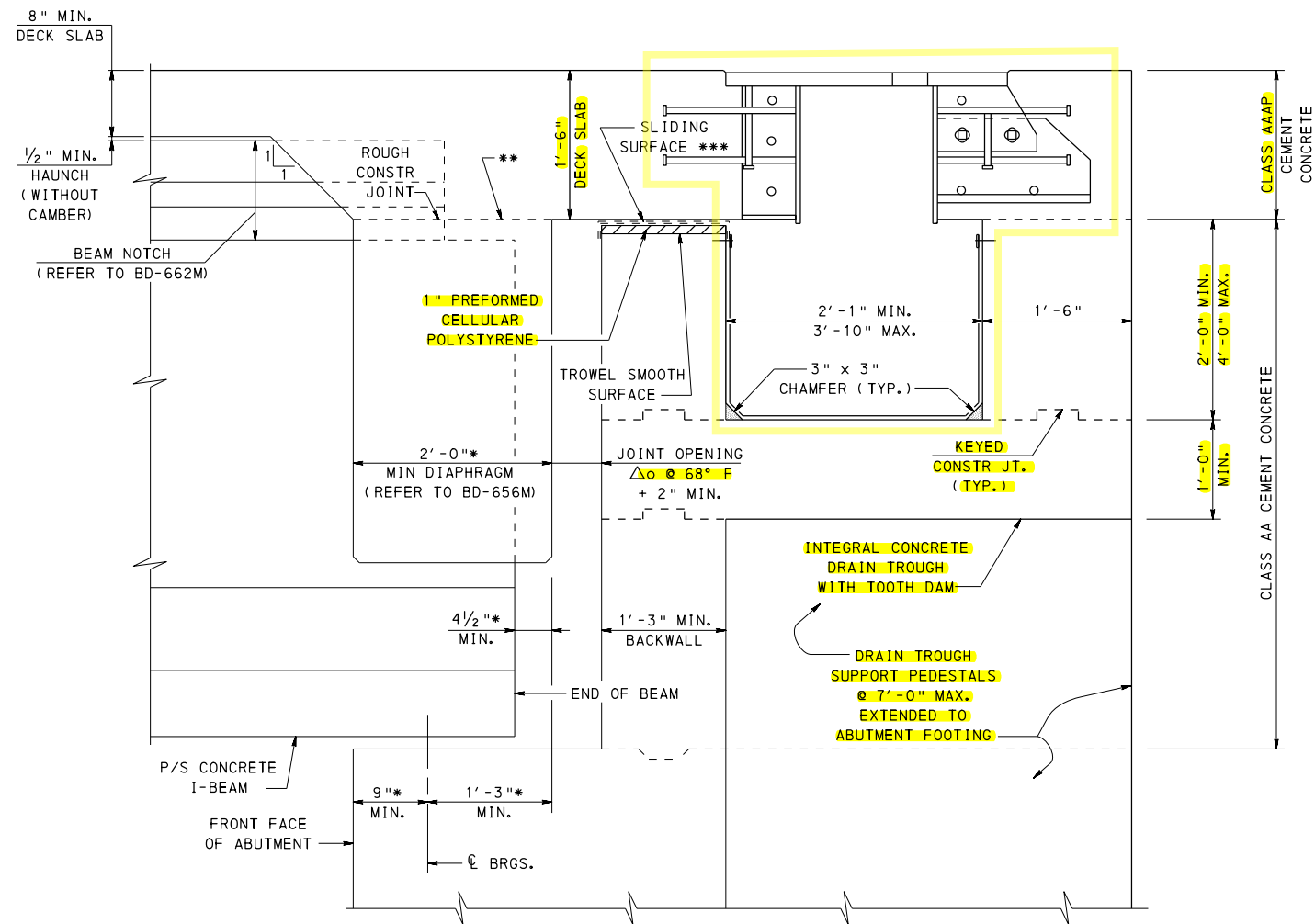
SECTION P-P

- NOTES
1. FOR NOTES, SEE SHEETS 1 AND 2.
 2. FOR SECTION E-E, SEE SHEET 8.
 3. FOR SECTION S-S, SEE SHEET 27.
 4. FOR SECTION R-R, SEE SHEET 33.
 5. FOR DRAIN TROUGH DETAILS, SEE SHEETS 28 - 34.
 6. INLET TO BE LOCATED SUCH THAT ITS OUTFLOW PIPE MISSES TYPE 2-SC POSTS IN GUIDE RAIL TRANSITION.

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STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - PLAN 1 AND SECTION





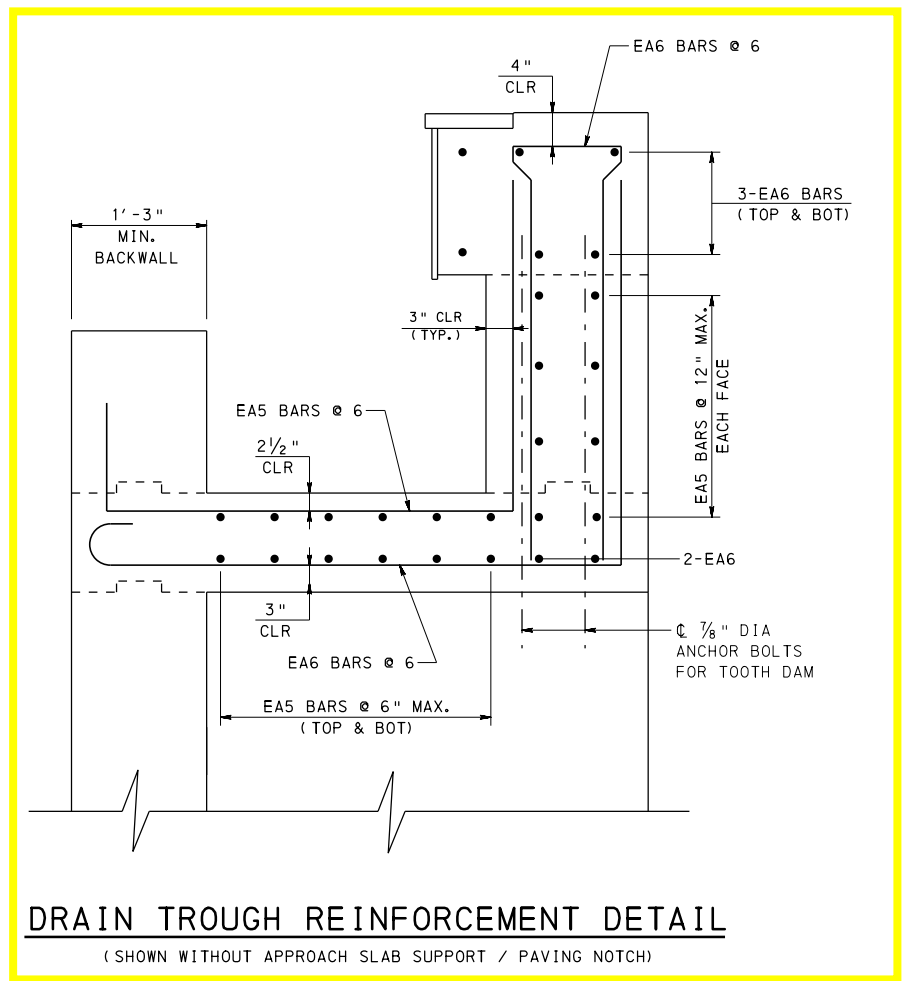
TYPE 4 APPROACH SLAB - DETAIL 25

P/S 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 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



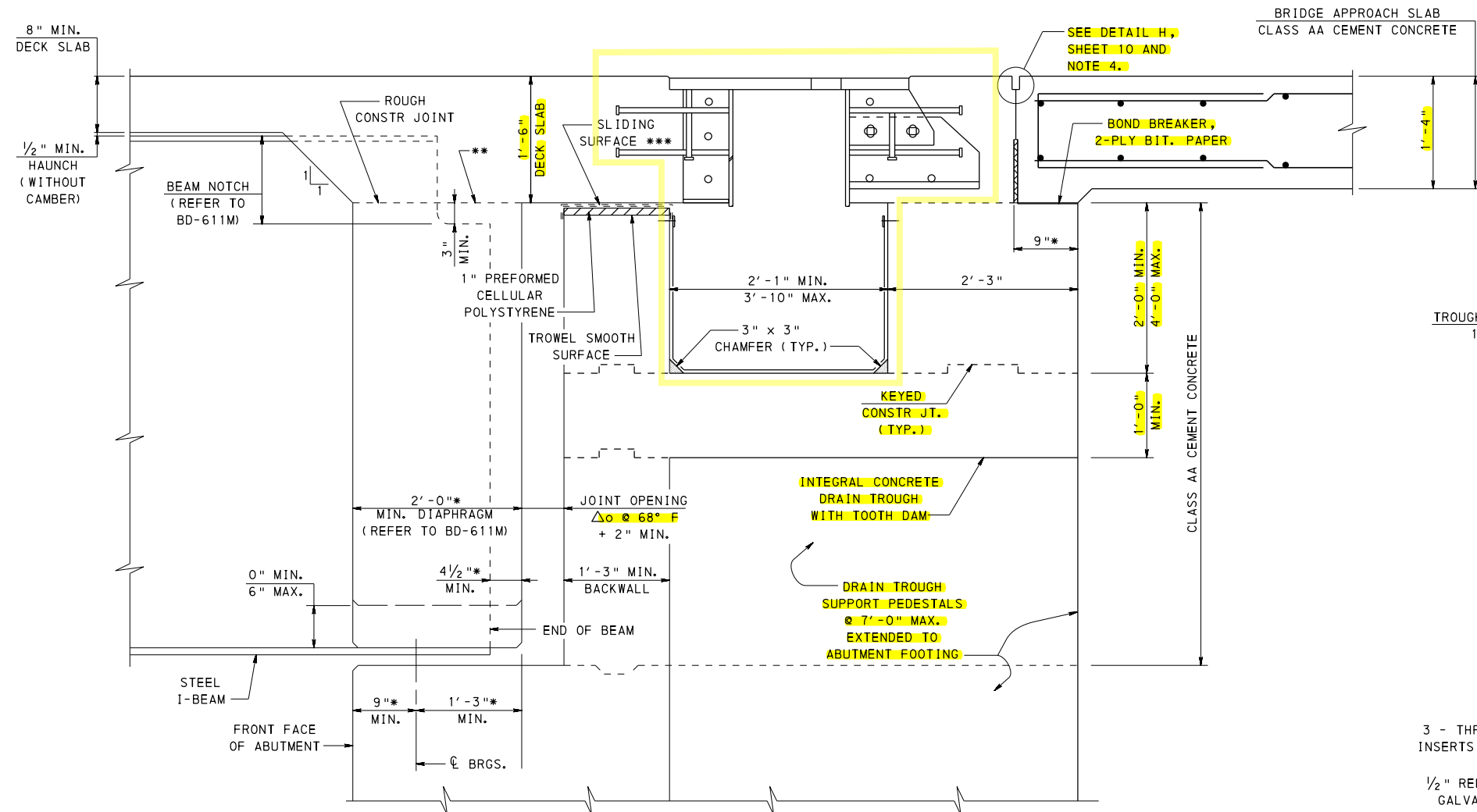
NOTES

- 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 STANDARD DRAWING BC-762M FOR JOINT OPENING Δo .

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
 BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - DETAIL 25
(P/S CONCRETE I-BEAMS WITH BACKWALL)

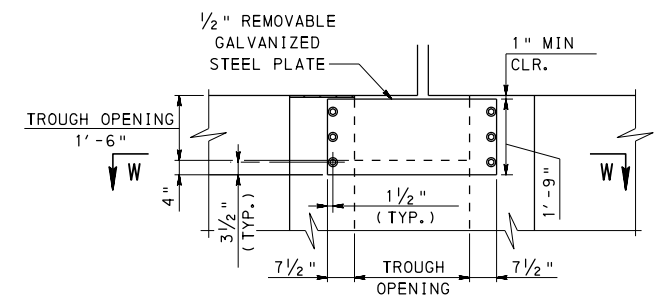
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. Wayne Willey</i> ACTING DIR. BDR. OF PROJECT DELIVERY	SHEET 31 OF 35 BD-628M
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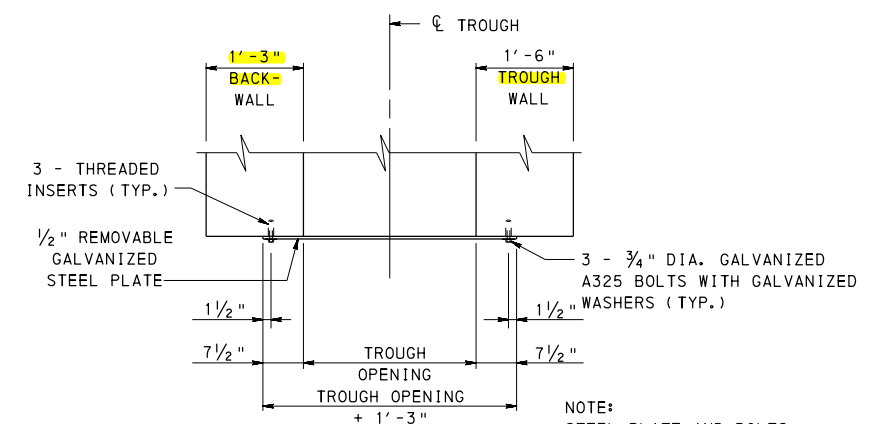
TYPE 4 APPROACH SLAB - DETAIL 26

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



**DETAIL N -
DRAIN TROUGH
END VIEW**
(BURIED ENDS)

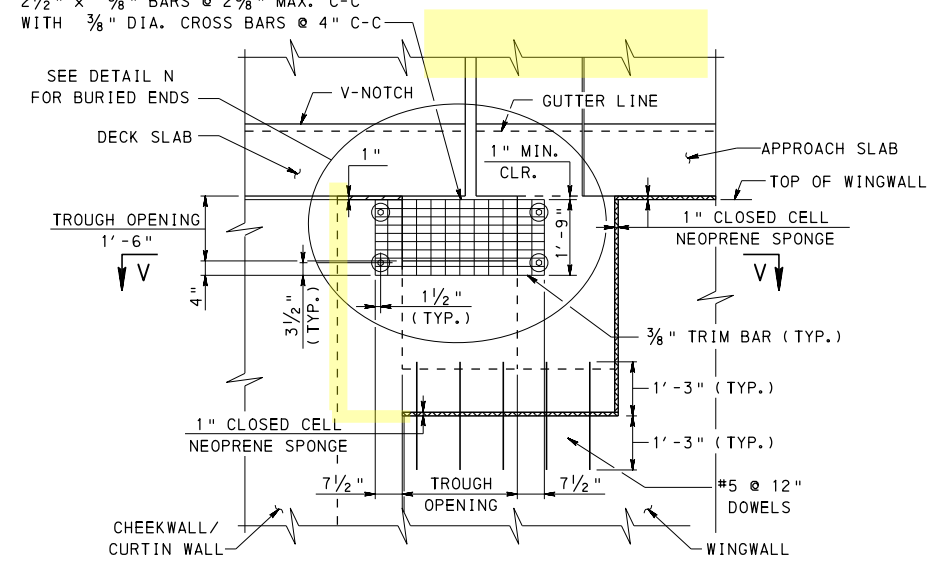


SECTION W-W

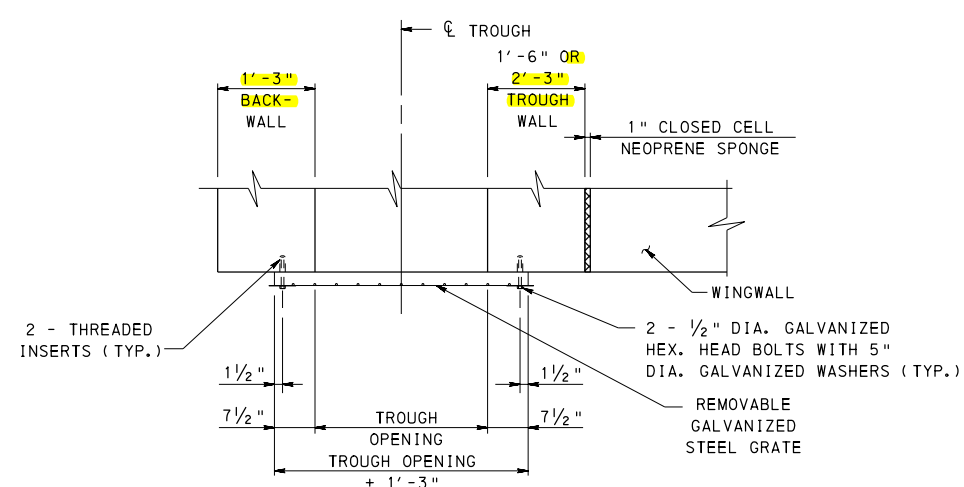
NOTES

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 PROVIDE TYPE 1 OR TYPE 2 APPROACH SLAB.
3. SEE STANDARD DRAWING BC-762M FOR JOINT OPENING Δo .
4. DETAIL O ON SHEET 35 MAY BE SPECIFIED AS AN ALTERNATE JOINT SEAL TYPE, AS DIRECTED BY THE DISTRICT BRIDGE ENGINEER.

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

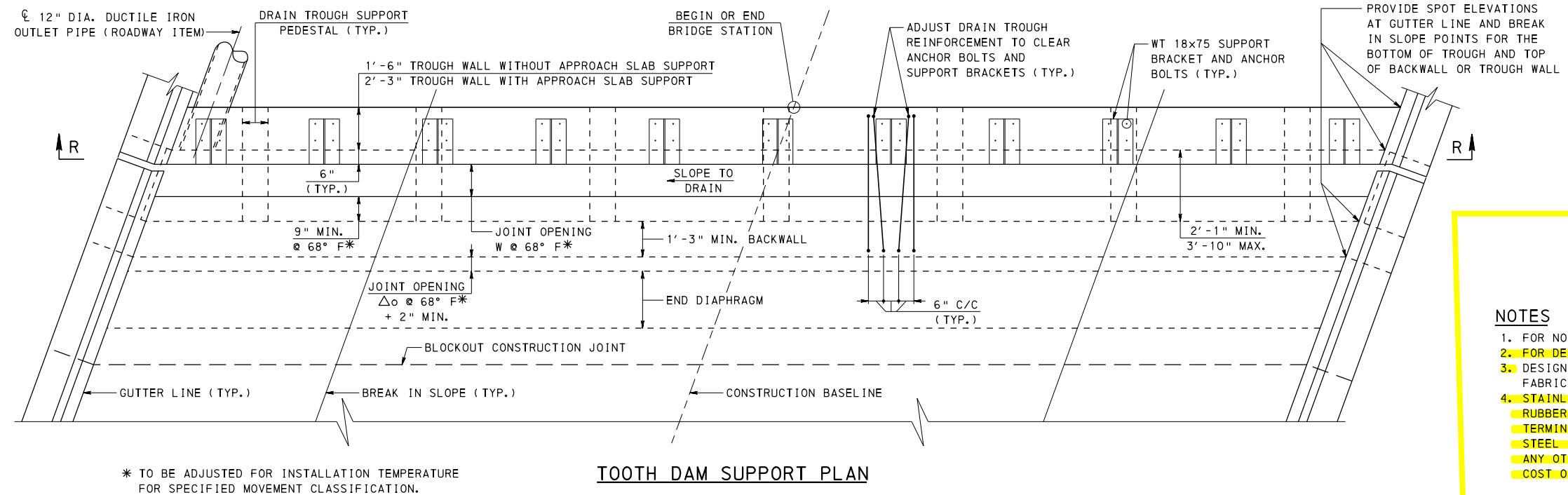
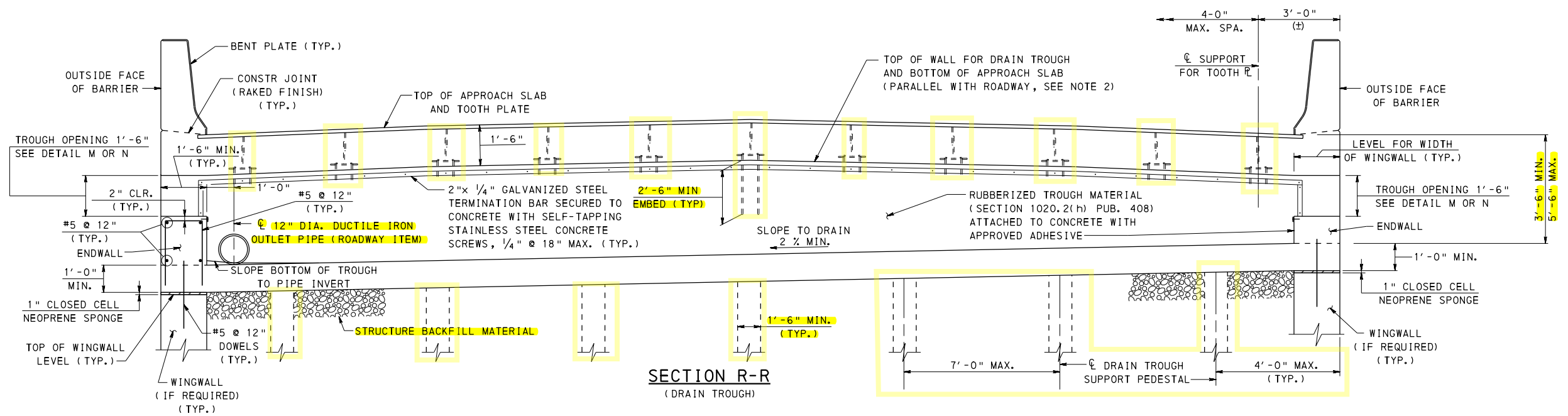


**DETAIL M - DRAIN
TROUGH END VIEW**
(EXPOSED ENDS)



SECTION V-V

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD BRIDGE APPROACH SLABS TYPE 4 - DETAIL 26 (STEEL BEAMS WITH BACKWALL)		
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR., BUREAU OF PROJECT DELIVERY	SHEET 32 OF 35 BD-628M



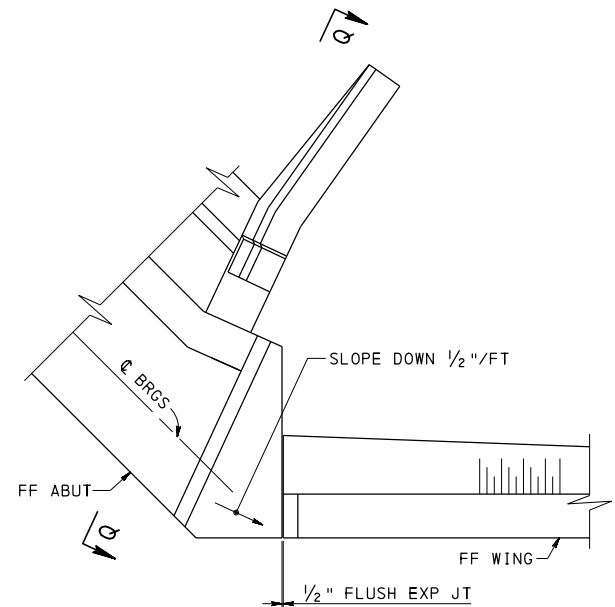
NOTES

- FOR NOTES, SEE SHEETS 1 AND 2.
- FOR DETAILS M AND N, SEE SHEET 32.
- DESIGNER MAY ADJUST AS REQUIRED TO SIMPLIFY FABRICATION AND CONSTRUCTION.
- 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.

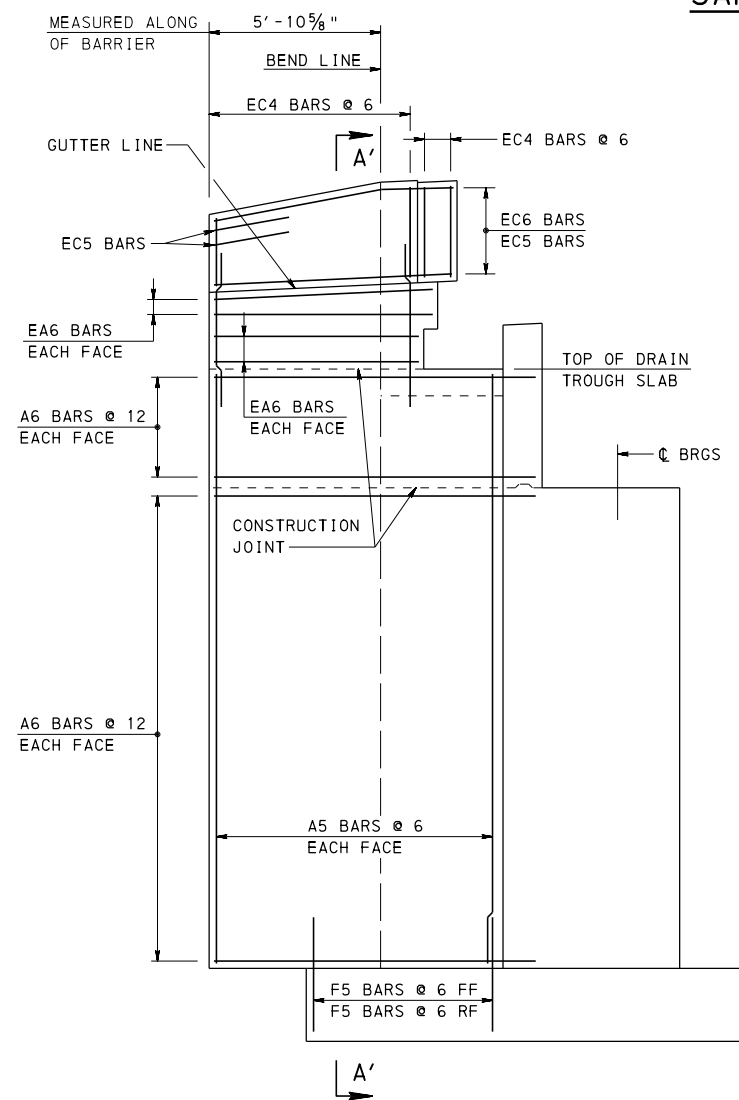
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - DRAIN TROUGH DETAILS 1

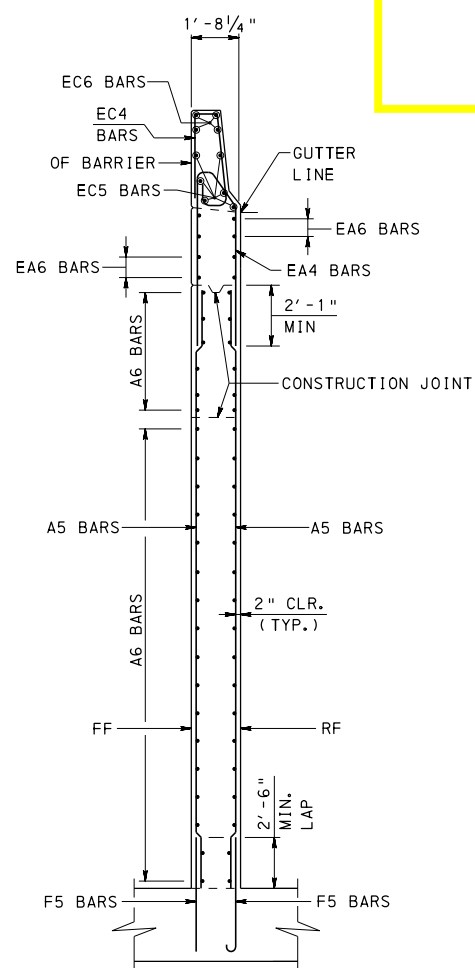
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 33 OF 35 BD-628M
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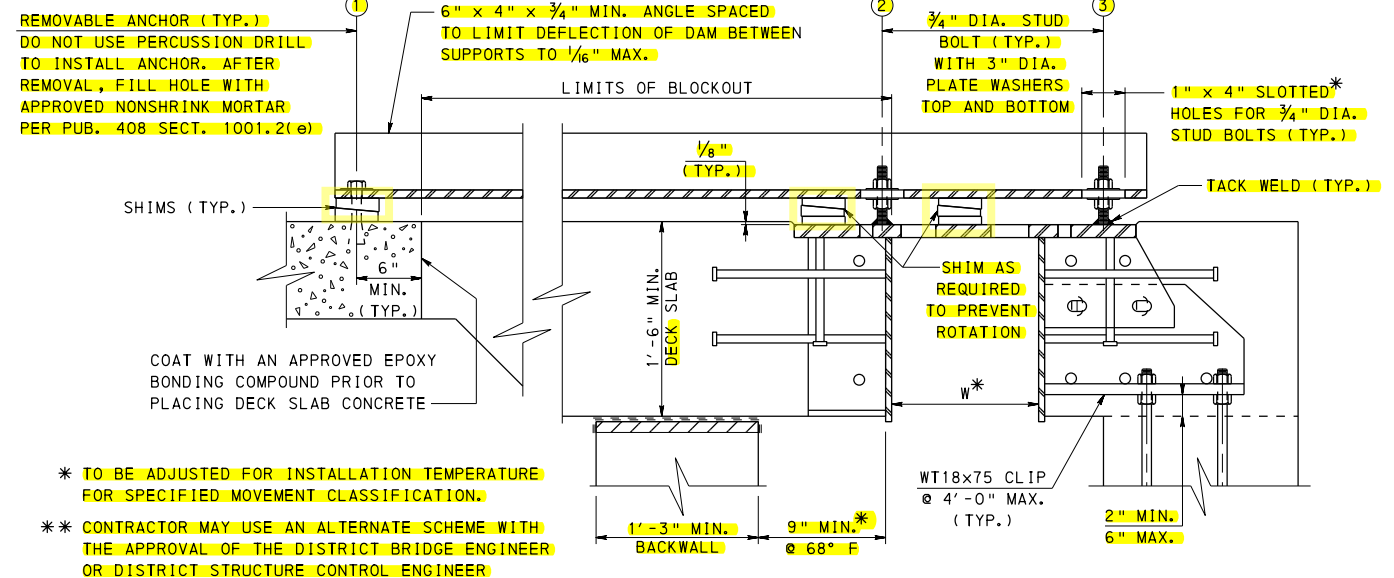
SAFETY WING PLAN



SECTION Q-Q



SECTION A'-A'



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 PRESCRIBED STRENGTH IN ACCORDANCE WITH PUB. 408 SECTION 1001.3(q)1, REMOVE THE TEMPORARY SUPPORT ASSEMBLY AND GRIND OFF TACK WELDS UNTIL SMOOTH.
10. APPLY TOUCH-UP PAINT.

NOTES

1. FOR NOTES, SEE SHEETS 1 AND 2.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BRIDGE APPROACH SLABS
TYPE 4 - DRAIN TROUGH DETAILS 2

- CHANGE 1
- CHANGE 2
- CHANGE 3

GENERAL NOTES

1. ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615, A 706, OR A 996.
2. MATERIALS AND WORKMANSHIP ARE TO BE IN ACCORDANCE WITH PUBLICATION 408.
3. PIER DIMENSIONS ARE DETERMINED BY DESIGN.
4. 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
5. USE CLASS A CEMENT CONCRETE IN PIERS, FOOTINGS AND DRILLED SHAFTS.
6. USE CLASS C CEMENT CONCRETE BELOW BOTTOM OF FOOTINGS, IF SPECIFIED.
7. EPOXY COAT MAIN REINFORCEMENT BARS (J-BARS) PROTRUDING FROM PIER FOOTINGS INTO COLUMNS OR STEM AND CAP STEEL BELOW OPEN JOINTS.
8. FOR ADDITIONAL EPOXY COATED REINFORCEMENT BAR REQUIREMENTS, SEE DESIGN MANUAL, PART 4, CONCRETE STRUCTURES, SECTION D.5.4.3.6P.
9. KEY FOR CONSTRUCTION JOINT MAY BE FORMED INTO THE COLUMN OR INTO THE FOOTING.
10. SEE BC-736M FOR STANDARD SPLICE AND DEVELOPMENT LENGTHS.
11. PROVIDE ¾" V-NOTCH IN COLUMNS OF PIERS AT FINISH GROUND LINE FOR PIERS NEAR WATER.
12. 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.
13. FOR CHECKING CRACK CONTROL, THE SIDE CLEARANCE SHALL BE 2". A 3" COVER IS INDICATED TO PROVIDE CONSTRUCTION TOLERANCE AND LONG TERM SERVICEABILITY.
14. 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	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIERS

GENERAL NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 15
BD-629M



Diagram illustrating the cross-section of a girder with reinforcement details. Key components and labels include:

- STIRRUP SPACING** (1) $\phi 24"$ MAX. OVER COLUMN
- TOP SPLICE (BETWEEN COLUMNS)** (4) (IF REQUIRED)
- TOP FLEXURAL REINF.** (8)
- CL GIRDER** (9)
- LEVEL (SEE TYP. CAP DETAILS ON SHEET 14 FOR SLOPED OR STEPPED CAP)**
- SEE DETAIL A ON SHEET 14**
- #5 $\phi 12"$ MAX. SPA.** (6)
- BOT. SPLICE**
- BOT. FLEXURAL REINF.** (10)
- FOR COLUMN TIES EXTENDING INTO CAP SEE COLUMN DETAILS ON SHEET 3**

CAP ELEVATION

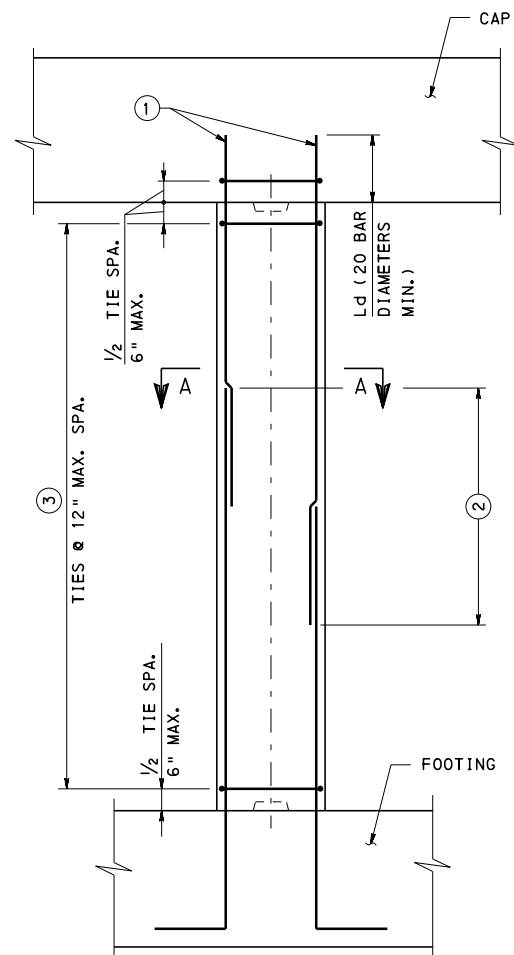


▲ - DENOTES RECOMMENDED VALUE

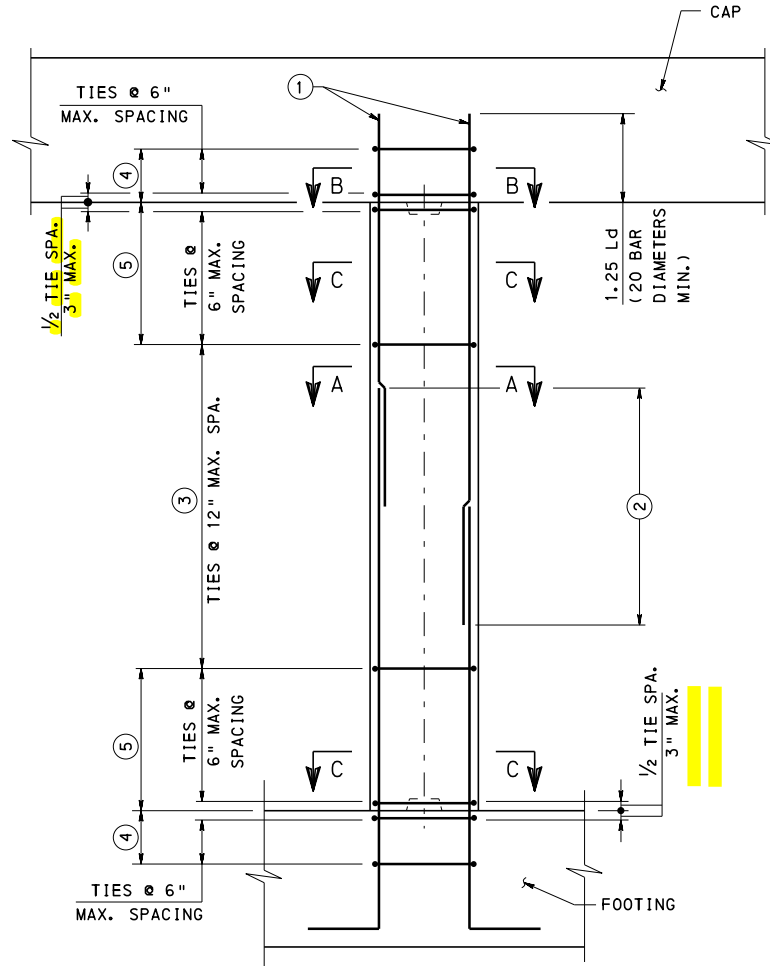
NOTES:

- 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_e" EXCEEDS 3'-0", PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4.
- ④ ALTERNATE SPLICE LOCATIONS OF ADJACENT BARS.
- ⑤ TYPICAL RANGE OF COLUMN SPACING, S IS 12' TO 20'. ▲
- ⑥ WHEN POSSIBLE, ENDS OF PIER CAPS SHALL EXTEND S/3 TO S/2 TO BALANCE POSITIVE AND NEGATIVE MOMENTS IN THE CAP.
- ⑦ FOR CONSTRUCTABILITY, PROVIDE STIRRUP SPLICE OVER COLUMNS AND CANTILEVER PORTIONS OF CAP.
- ⑧ MULTI-LAYERS
 - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
 - CLEAR SPACING MUST BE 1½" MINIMUM
- ⑨ DIMENSION BASED ON THE FOLLOWING PARAMETERS: BEAM SIZE, BEARING SIZE, ANCHOR BOLT LOCATION/EDGE DISTANCES AND SKEW.
- ⑩ COORDINATE BOTTOM FLEXURAL CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
- ⑪ BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

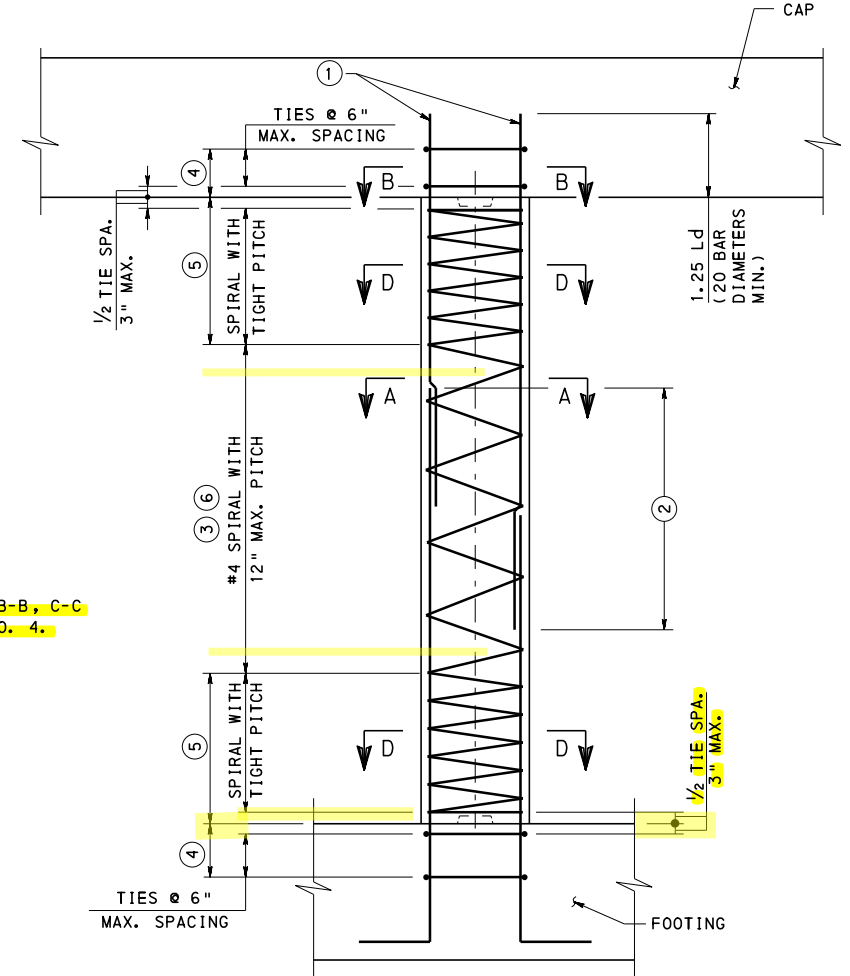
STANDARD
REINFORCED CONCRETE PIERS
MULTI-COLUMN BENT
DETAILS



ROUND, SQUARE OR
RECTANGULAR COLUMN
(RESPONSE ACCELERATION
COEFFICIENT, S_{D1} ,
LESS THAN 0.10)



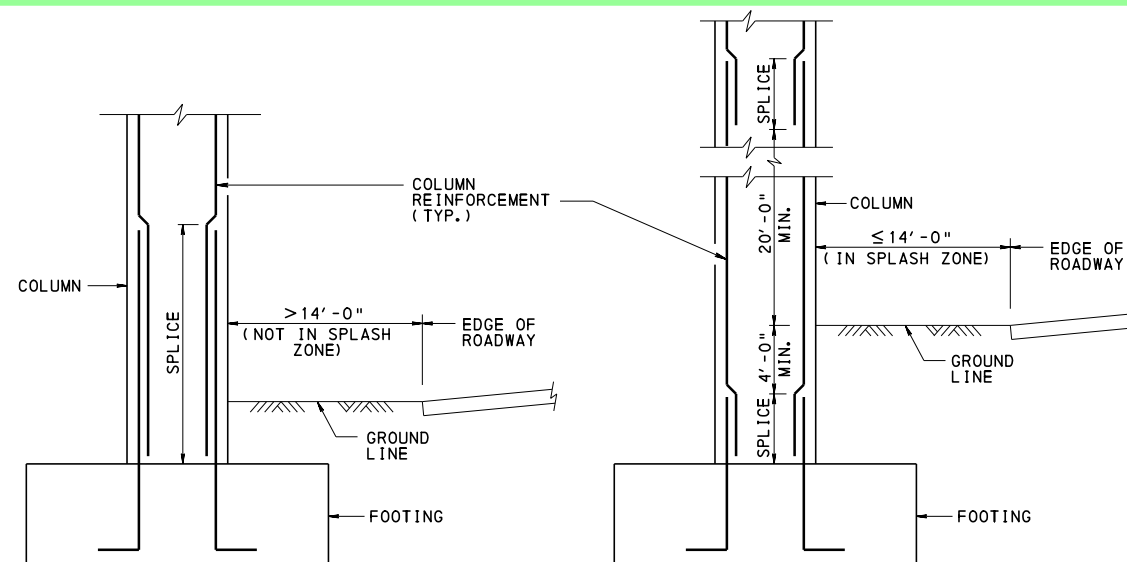
ROUND, SQUARE OR
RECTANGULAR COLUMN
(SITE CLASS E, F OR RESPONSE
ACCELERATION COEFFICIENT, S_{D1} ,
GREATER THAN OR EQUAL TO 0.10)



ROUND COLUMN (ALTERNATE)
(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 FLEXURAL CAP REINFORCEMENT TO AVOID INTERFERENCE.
- ② SPLICE CRITERIA: (SEE PERMITTED SPLICE LOCATION DETAILS)
 - THE SPLICE LENGTH MUST NOT BE LESS THAN CLASS B SPLICE PER BC-736M.
 - STAGGER CLASS B SPLICES SUCH THAT NO MORE THAN 50% OF THE REINFORCING BARS ARE SPLICED AT ONE LOCATION.
 - USE A 6" MAXIMUM TIE SPACING ALONG THE LENGTH OF THE SPLICE.
 - IF THE ABOVE SPLICE CRITERIA CANNOT BE MET, FULL-MECHANICAL CONNECTION SPLICES CAN BE USED PROVIDED NOT MORE THAN ALTERNATE REINFORCING BARS IN EACH LAYER ARE SPLICED AT A SECTION, AND THE DISTANCE BETWEEN SPLICES OF ADJACENT REINFORCING BARS IS GREATER THAN 24" MEASURED ALONG THE LONGITUDINAL AXIS OF THE COLUMN.
- ③ FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING OR PITCH OF SPIRAL MUST NOT EXCEED 6".
- ④ COLUMN CONNECTION GREATER OF: $\frac{1}{2}$ MAX. COL. DIMENSION OR 15"
- ⑤ PLASTIC HINGE ZONE GREATER OF: MAX. COLUMN DIMENSION, $\frac{1}{6}$ CLR. HEIGHT OF COLUMN OR 18"
- ⑥ SPIRAL REINFORCEMENT #4 @ 12" MAXIMUM PITCH, BUT NOT LESS THAN THE SIZE AND SPACING SHOWN ON THE DRAWINGS, MAY BE SUBSTITUTED AT NO ADDITIONAL COST TO THE DEPARTMENT.



PERMITTED SPLICE LOCATION
IN NON-SPLASH ZONE

PERMITTED SPLICE LOCATION
IN SPLASH ZONE

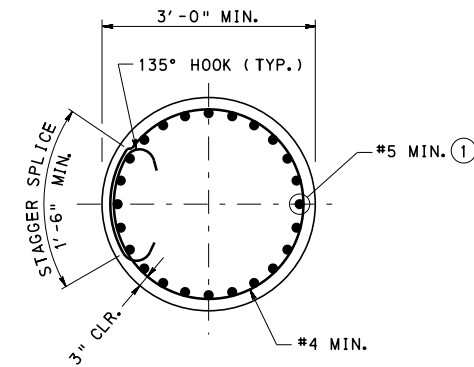
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
REINFORCED CONCRETE PIERS
MULTI-COLUMN BENT
COLUMN DETAILS

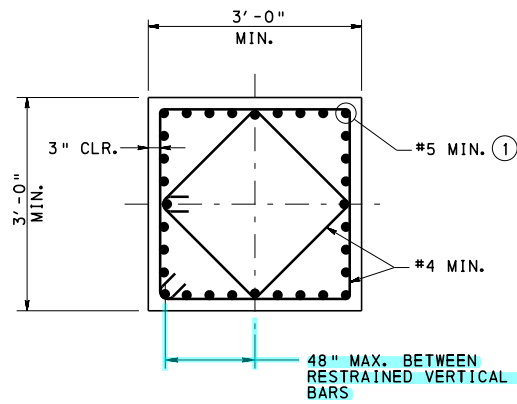
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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Brenda Thompson
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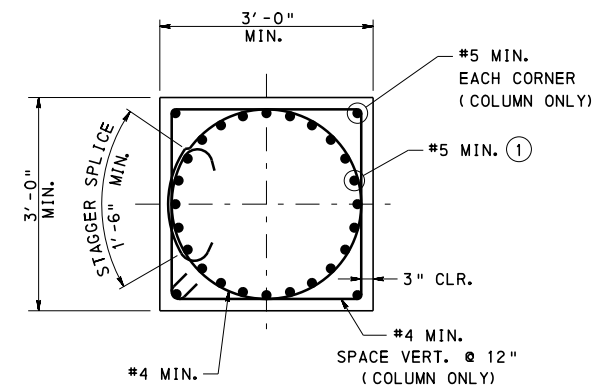
SHEET 3 OF 15
BD-629M



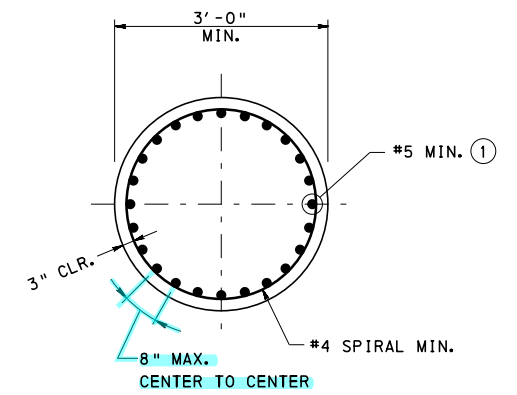
ROUND COLUMN



SQUARE COLUMN

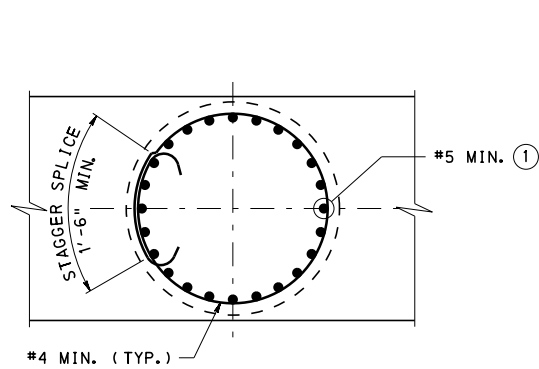


SQUARE COLUMN
(DESIGNED AS ROUND)

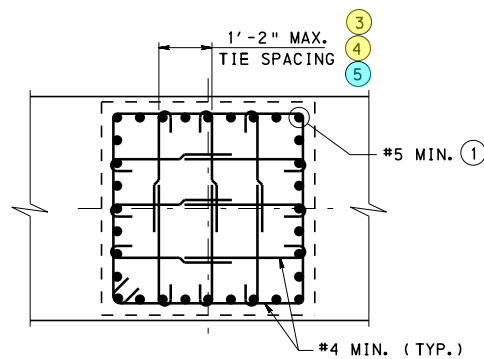


SECTION D-D (2)
(PLASTIC HINGE ZONE)

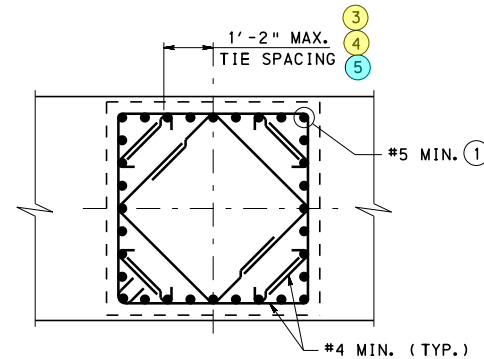
SECTION A-A (2)



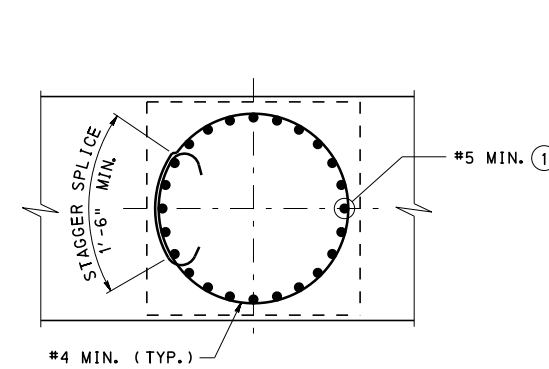
ROUND COLUMN



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.

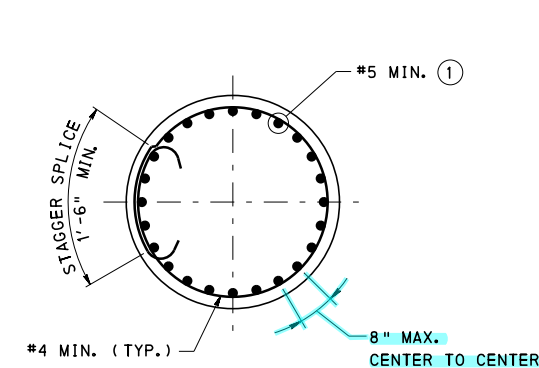
PITCH
 1½ EXTRA TURNS
 SPACING = PITCH MAXIMUM
 #4 SPIRAL MIN.

OR APPROVED MECHANICAL CONNECTORS.

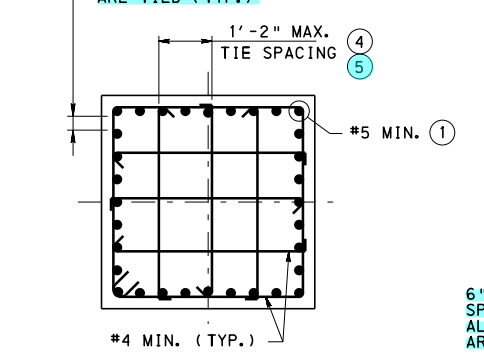
SPIRAL ANCHORAGE:

- 1½ EXTRA TURNS

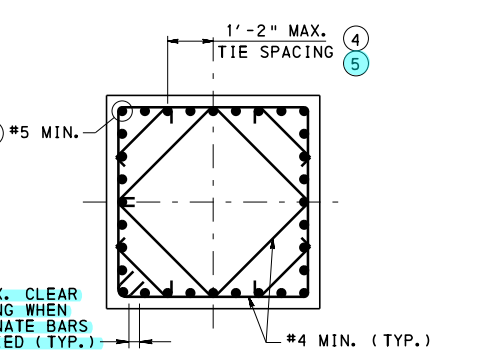
SECTION B-B (2)



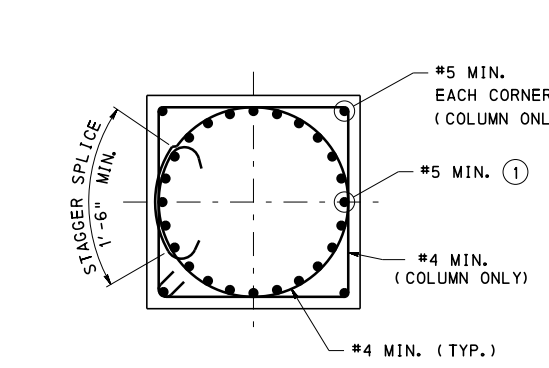
ROUND COLUMN



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.

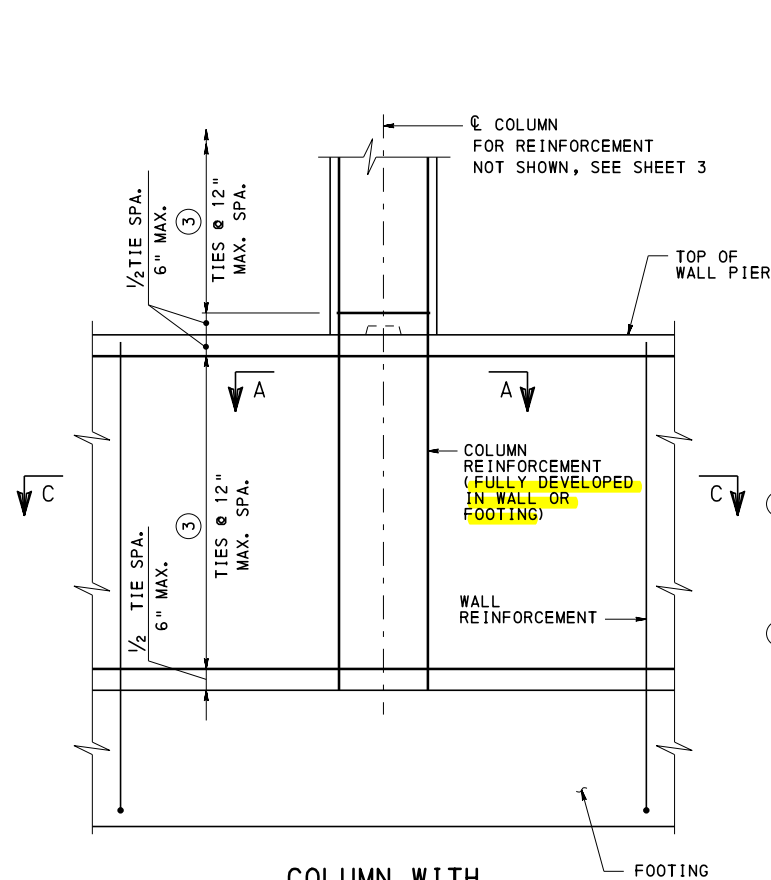
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
 BUREAU OF PROJECT DELIVERY

STANDARD
 REINFORCED CONCRETE PIERS
 MULTI-COLUMN BENT
 COLUMN SECTIONS

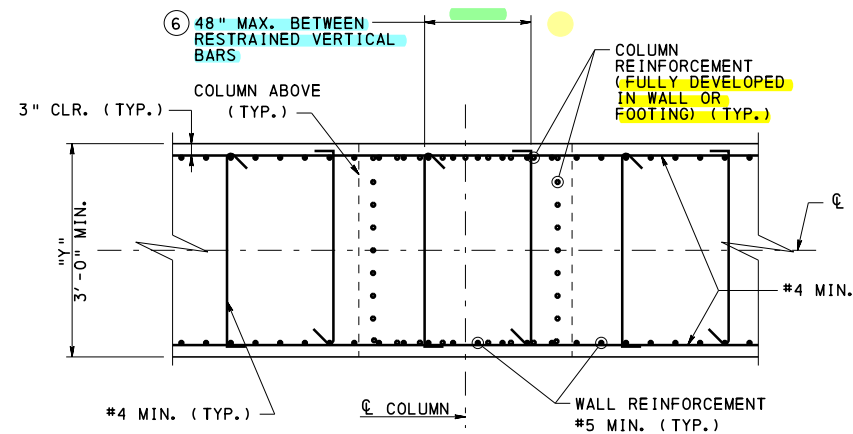
RECOMMENDED NOV. 21, 2014
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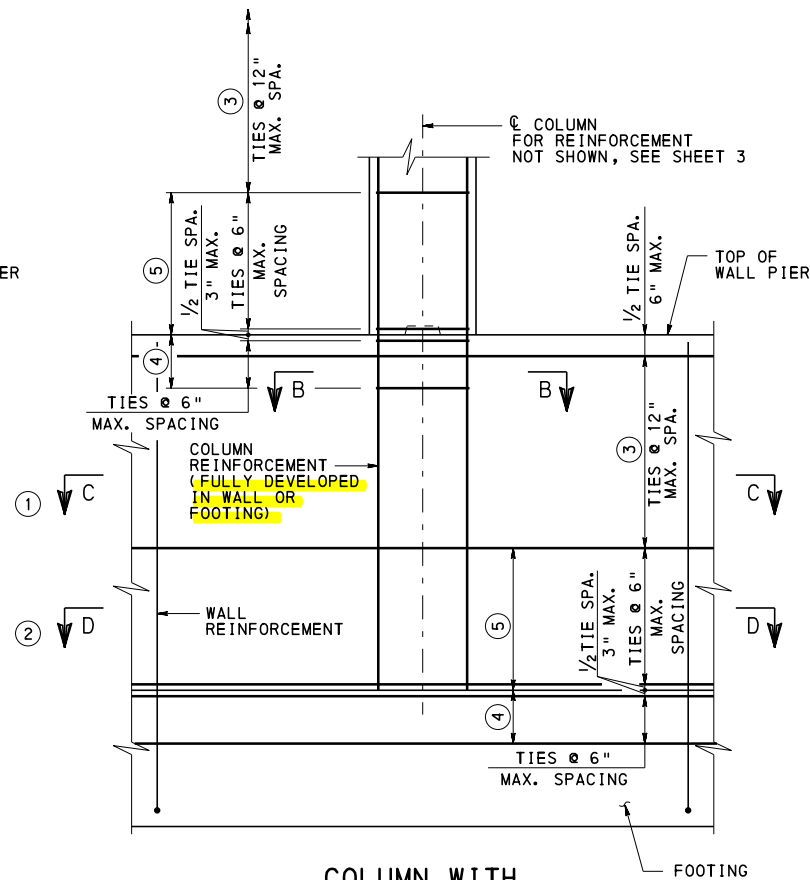
SHEET 4 OF 15
 BD-629M



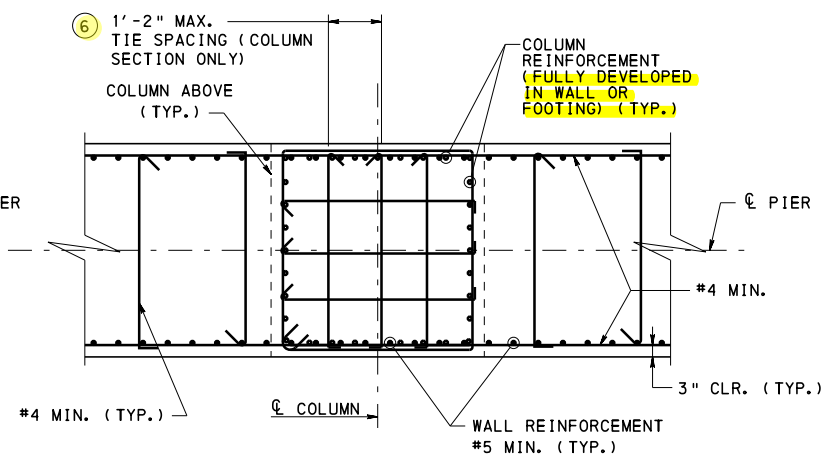
**COLUMN WITH
INTEGRAL WALL PIER
(RESPONSE ACCELERATION
COEFFICIENT, S_{D1} ,
LESS THAN 0.10)**



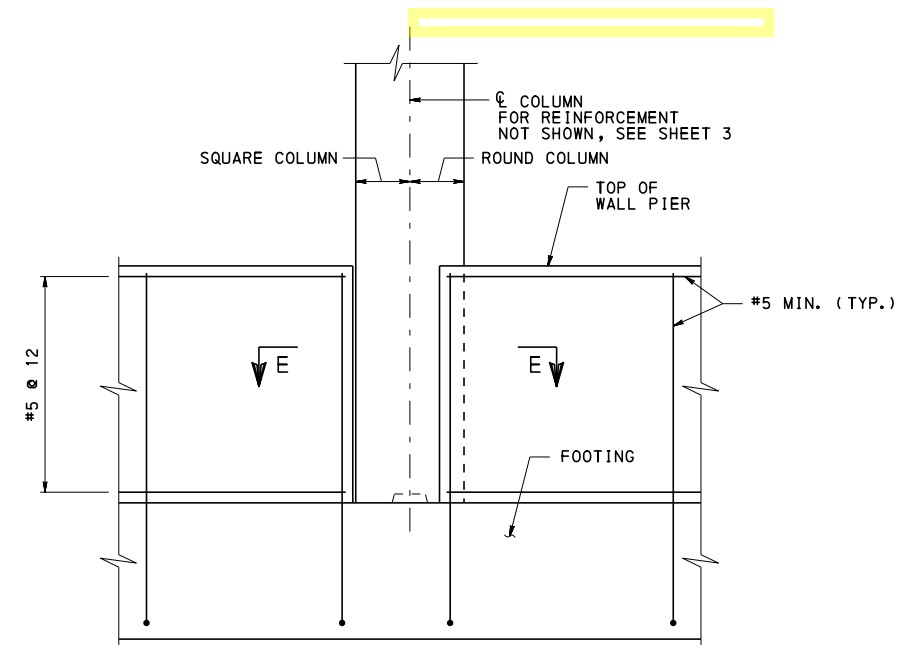
SECTION A-A



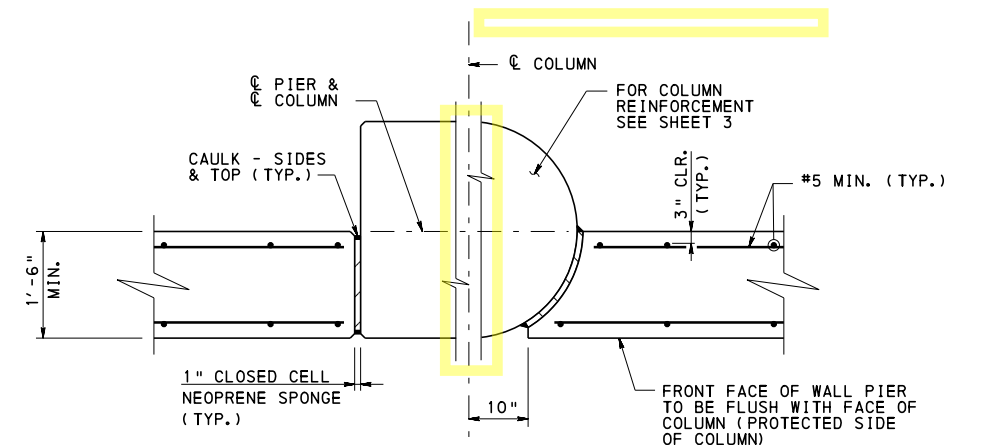
**COLUMN WITH
INTEGRAL WALL PIER
(SITE CLASS E, F OR RESPONSE
ACCELERATION COEFFICIENT, S_{D1} ,
GREATER THAN OR EQUAL TO 0.10)**



SECTION B-B



**COLUMN WITH
INDEPENDANT WALL PIER
(SEISMIC DETAILING REQUIRED
FOR COLUMN SECTION ONLY)**



SQUARE COLUMN

SECTION E-E

ROUND COLUMN

NOTES:

- ① SECTION C-C IS SIMILAR TO SECTION A-A ON SOLID SHAFT DETAILS, SHEET 8.
- ② SECTION D-D IS SIMILAR TO SECTION C-C ON SOLID SHAFT DETAILS, SHEET 8.
- ③ FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6\".
- ④ COLUMN CONNECTION GREATER OF: 1/2 MAX. COL. DIMENSION (1/2 MAX. \"Y\" DIMENSION FOR WALL SECTION) OR 15\".
- ⑤ PLASTIC HINGE ZONE GREATER OF: MAX. COLUMN DIMENSION (MAX. \"Y\" DIMENSION FOR WALL SECTION), 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 HORIZONTALLY AND VERTICALLY.

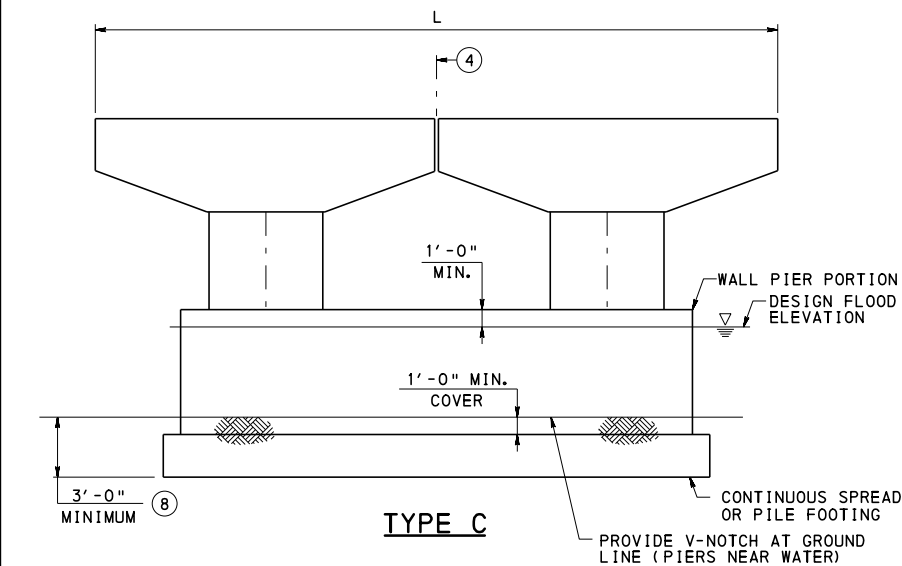
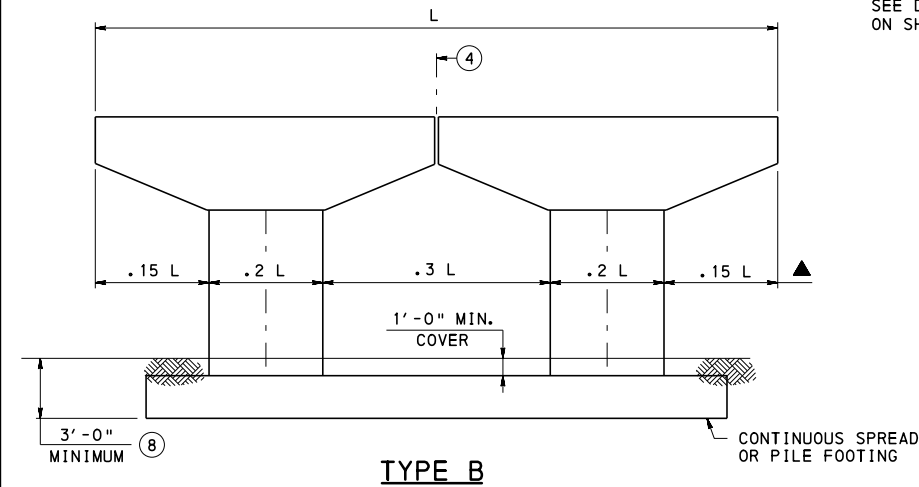
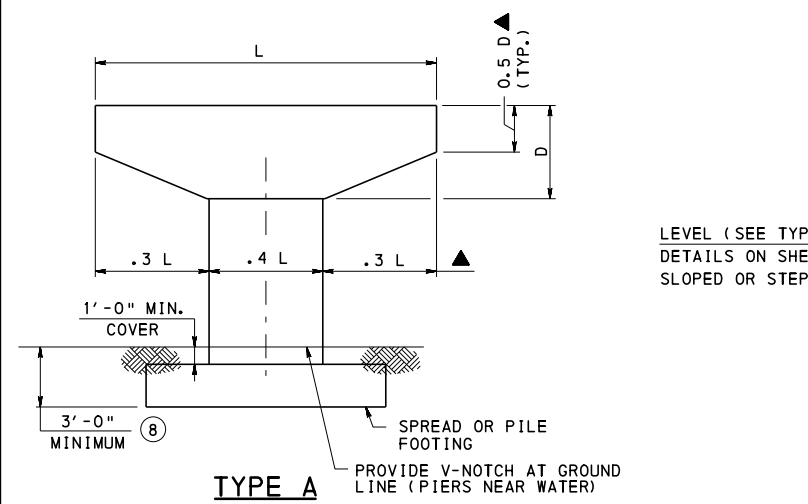
**COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY**

**STANDARD
REINFORCED CONCRETE PIERS
MULTI-COLUMN BENT
WALL PIER DETAILS**

RECOMMENDED NOV. 21, 2014
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Brian D. Thompson
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SHEET 5 OF 15
BD-629M

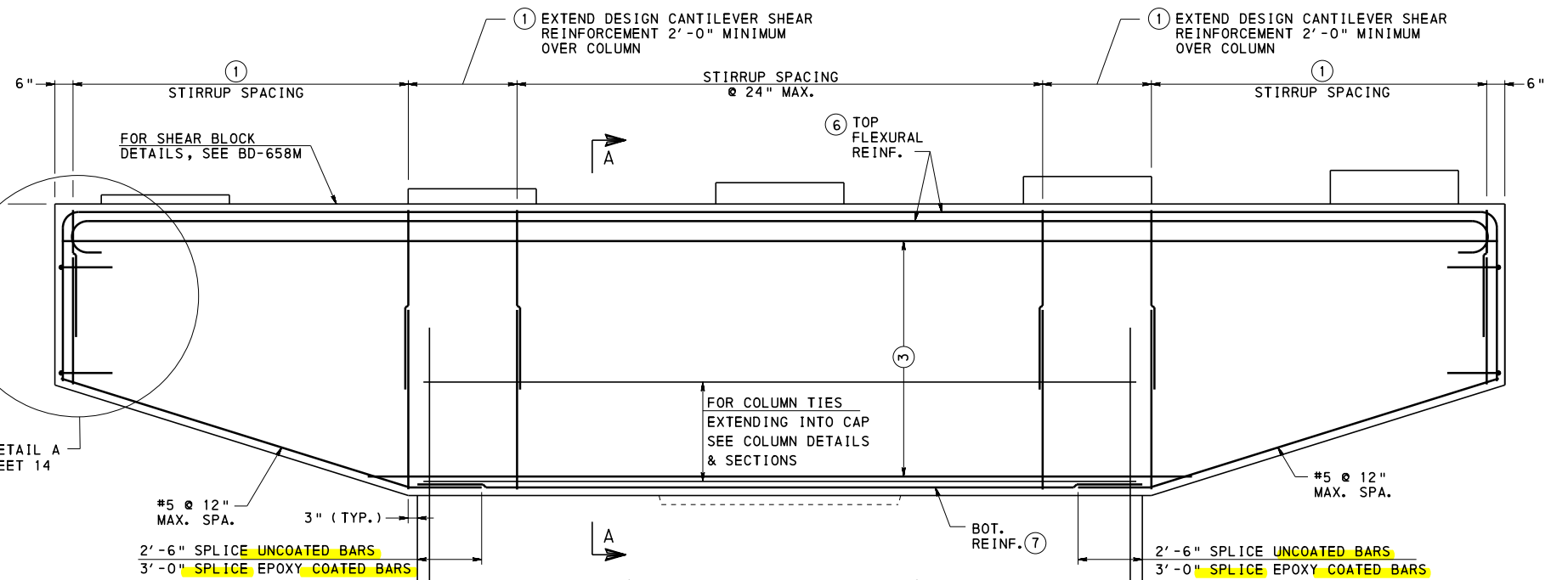


RECOMMENDED HAMMERHEAD PIER CONFIGURATIONS			
PIER TYPE	GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
A	X	X	X
B	X		
C	X	X	X

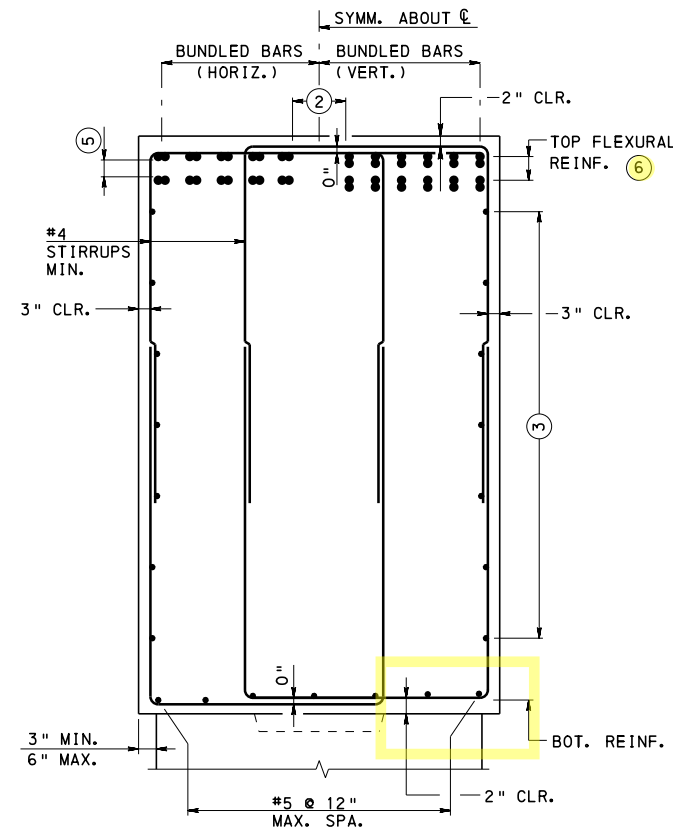
LEVEL (SEE TYP. CAP DETAILS ON SHEET 14 FOR SLOPED OR STEPPED CAP)

SEE DETAIL A ON SHEET 14

▲ - DENOTES RECOMMENDED VALUE



CAP ELEVATION



SECTION A-A

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_e" 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.

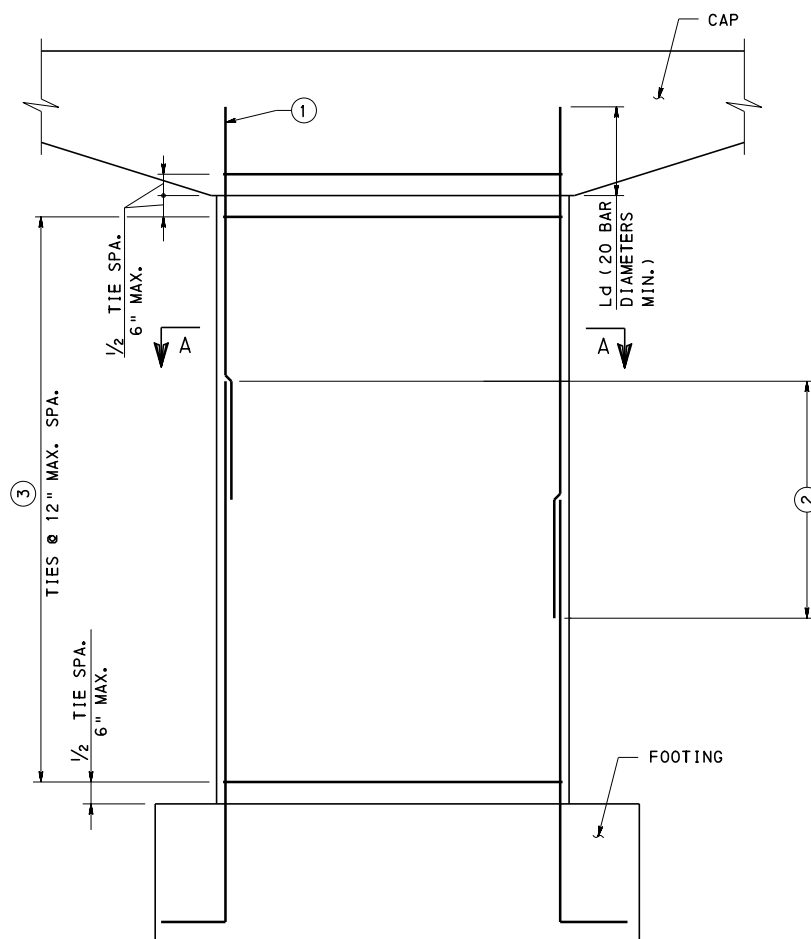
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIERS
HAMMERHEAD
DETAILS

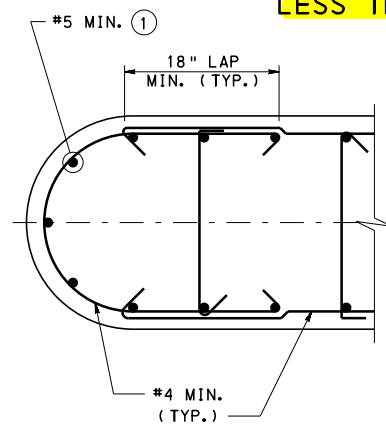
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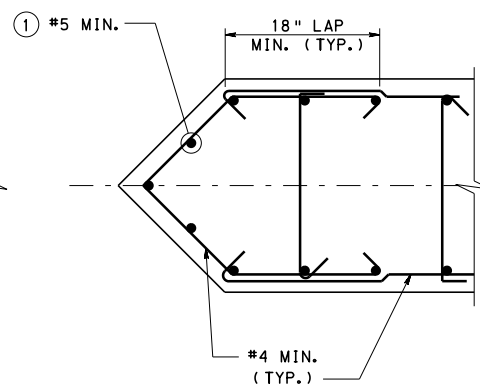
SHEET 6 OF 15
BD-629M



ELEVATION
(RESPONSE ACCELERATION
COEFFICIENT, S_{D1} ,
LESS THAN 0.10)

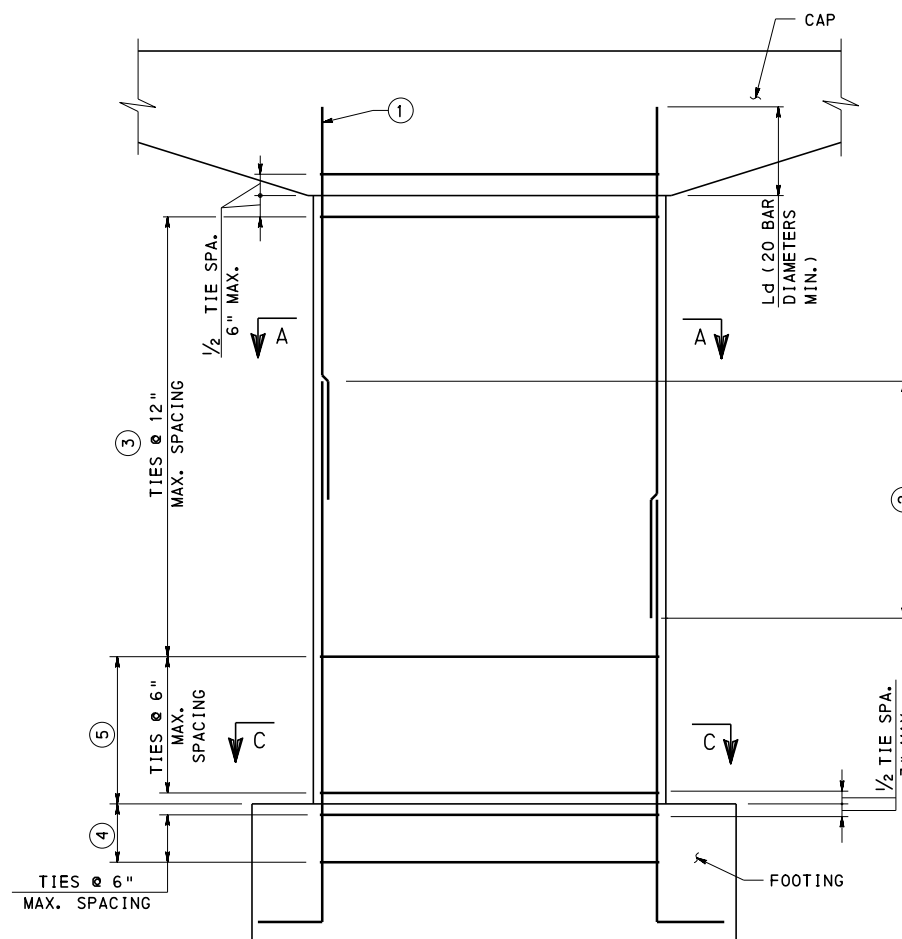


**ROADWAY, STREAMS
OR RIVERS**



**STREAMS
OR RIVERS**

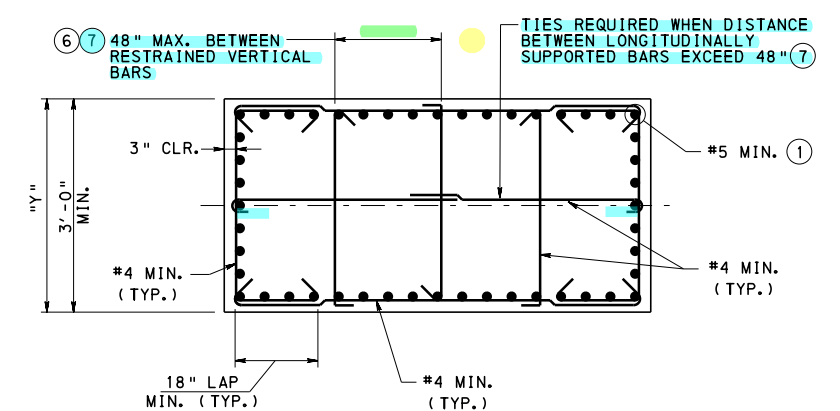
OPTIONAL END TREATMENTS



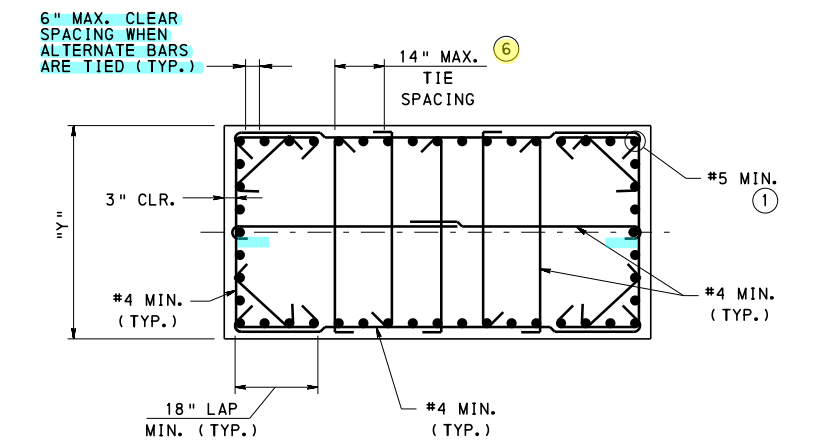
ELEVATION
(SITE CLASS E, F OR RESPONSE
ACCELERATION COEFFICIENT, S_{D1} ,
GREATER THAN OR EQUAL TO 0.10)

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)

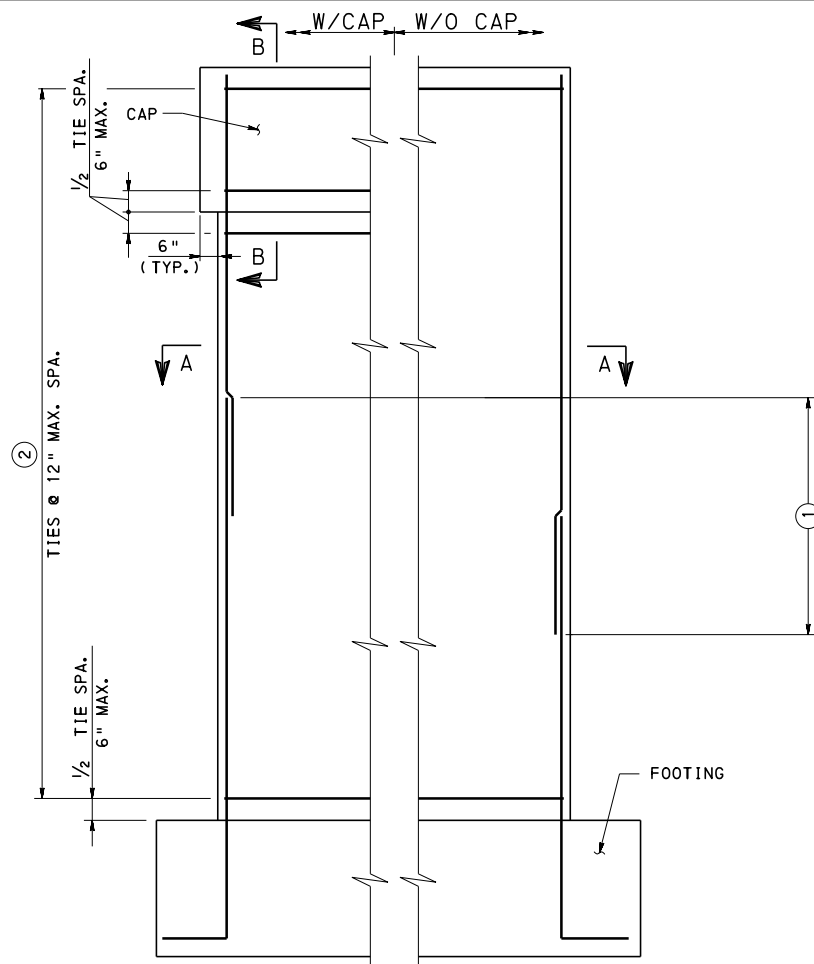
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DEPARTMENT OF TRANSPORTATION
BUREAU OF **PROJECT DELIVERY**

STANDARD
REINFORCED CONCRETE PIERS
HAMMERHEAD
COLUMN DETAILS AND SECTIONS

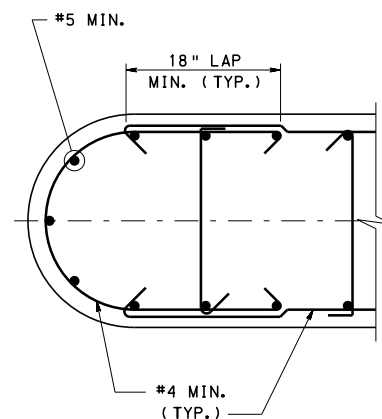
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
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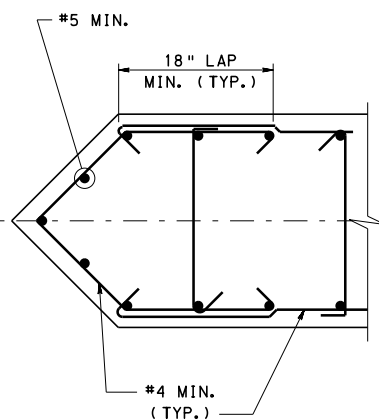
SHEET 7 OF 15
BD-629M



ELEVATION
(RESPONSE ACCELERATION
COEFFICIENT, S_{D1} ,
LESS THAN 0.10)



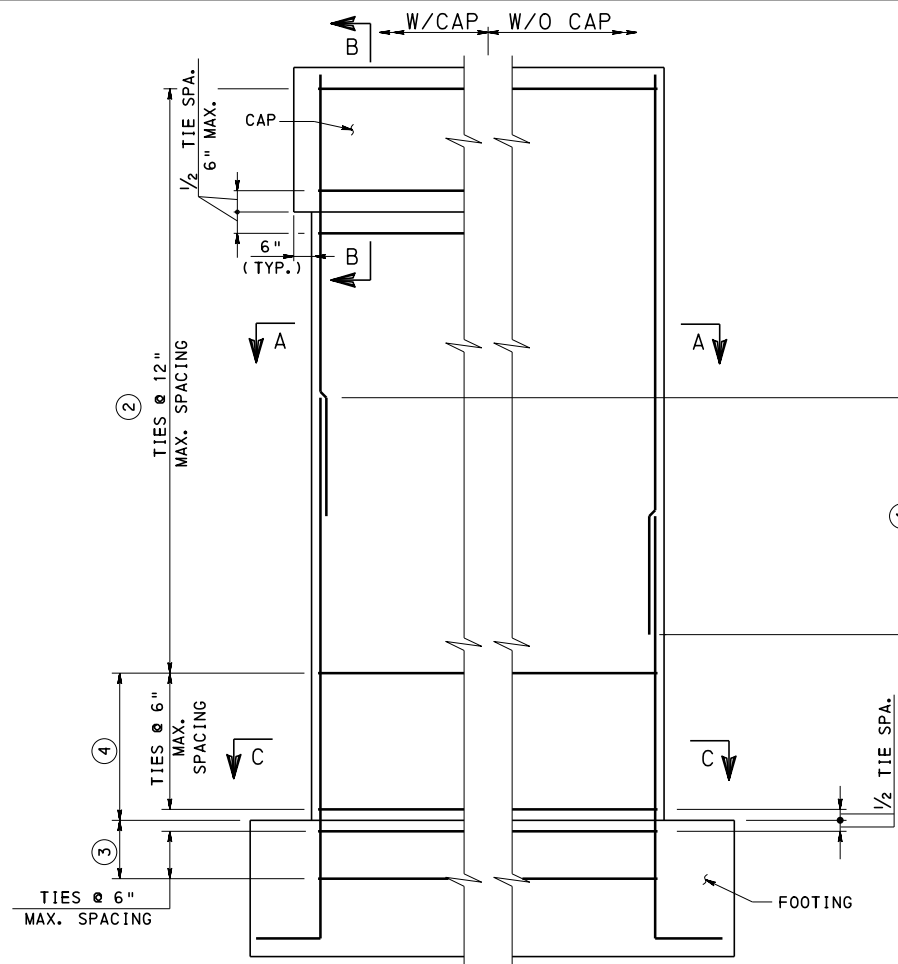
ROADWAY, STREAMS
OR RIVERS



STREAMS
OR RIVERS

OPTIONAL END TREATMENTS

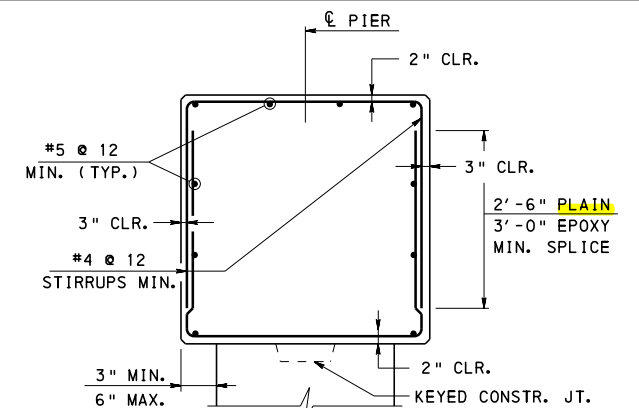
RECOMMENDED SOLID SHAFT CONFIGURATION		
GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
X	X	X



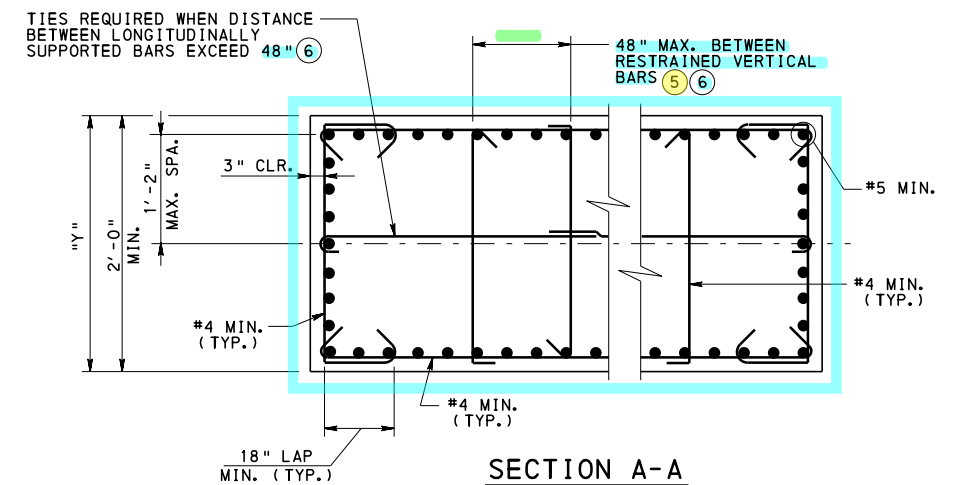
ELEVATION
(SITE CLASS E, F OR RESPONSE
ACCELERATION COEFFICIENT, S_{D1} ,
GREATER THAN OR EQUAL TO 0.10)

NOTES:

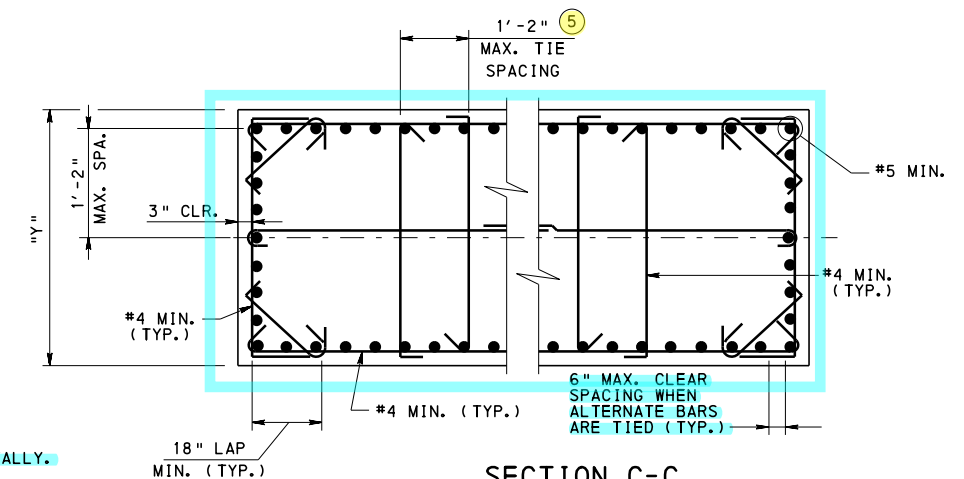
- FOR SPLICE CRITERIA, SEE SHEET 3, NOTE 2.
- FOR BUNDLED #10 BARS OR LARGER, VERTICAL TIE SPACING MUST NOT EXCEED 6".
- COLUMN CONNECTION GREATER OF: $\frac{1}{2}$ MAX. "Y" DIMENSION OR 15"
- PLASTIC HINGE ZONE GREATER OF: MAX. "Y" DIMENSION, $\frac{1}{6}$ CLR. HEIGHT OF COLUMN OR 18"
- ALL HOOKS ON 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 SPICED WITH A CLASS A SPLICE AND HAVE A 180 DEGREE HOOK WITH AN EXTENSION OF SIX BAR DIAMETERS.



SECTION B-B



SECTION A-A



SECTION C-C
(PLASTIC HINGE ZONE)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

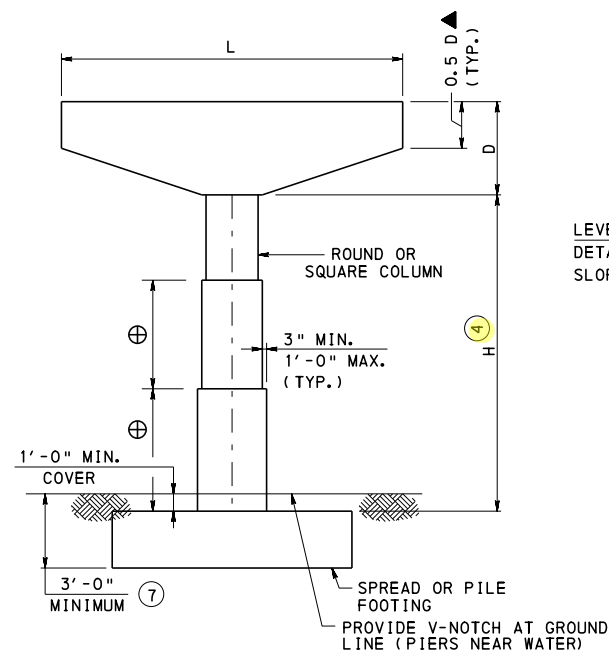
STANDARD
REINFORCED CONCRETE PIERS
SOLID SHAFT (WALL)
DETAILS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 8 OF 15

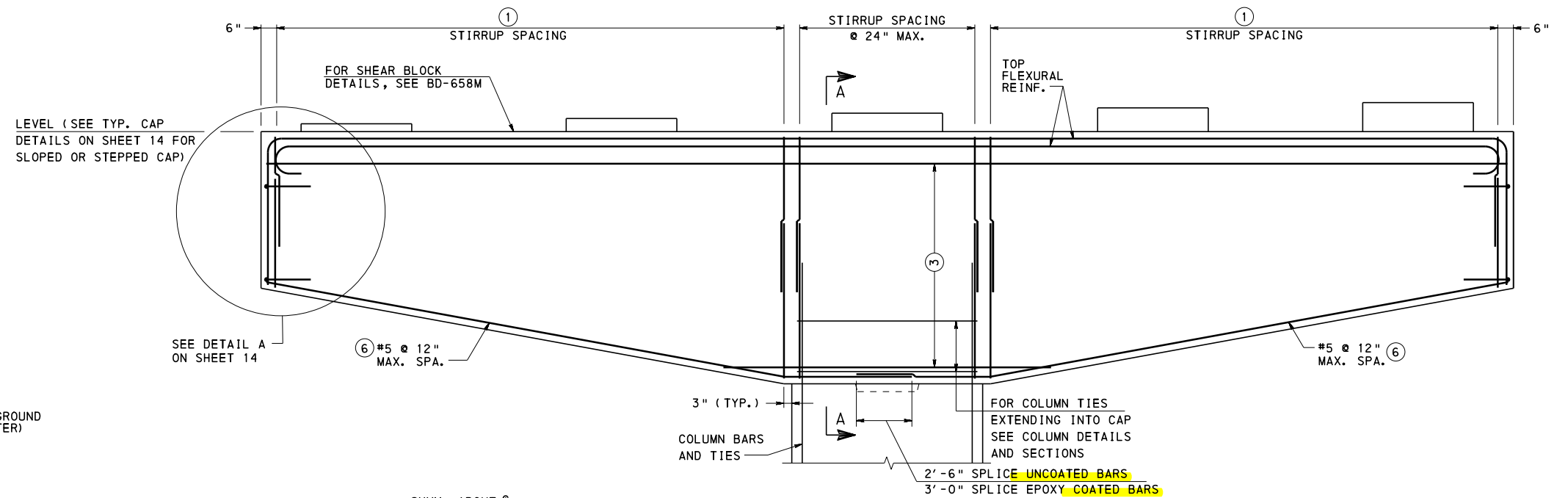
BD-629M



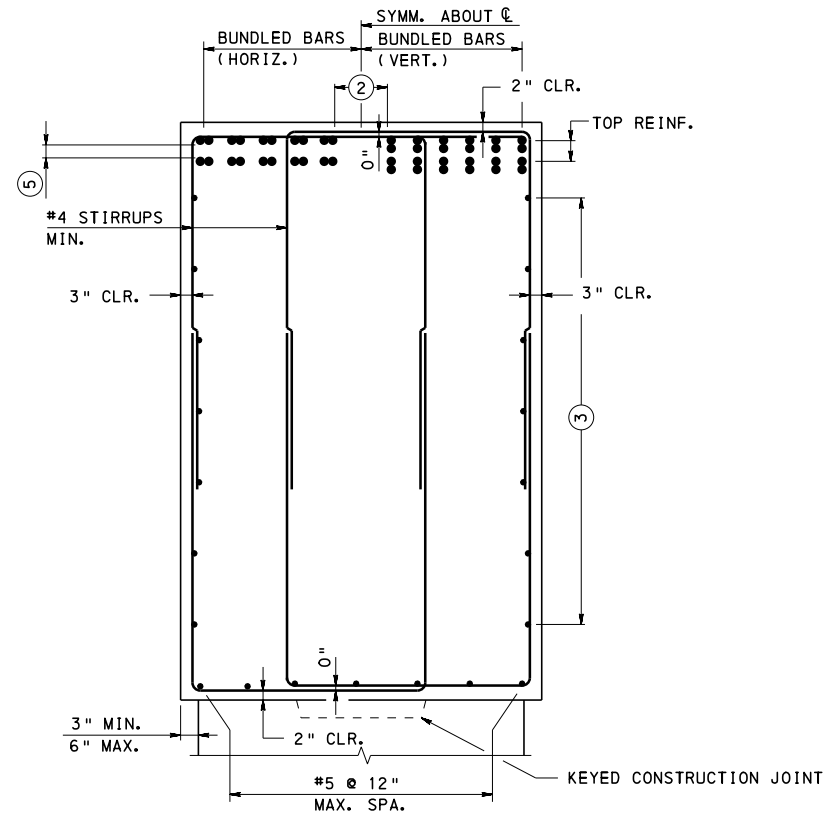
ELEVATION

⊕ CONSIDER USING 1'-0" INCREMENTS.

RECOMMENDED SINGLE COLUMN CONFIGURATION		
GRADE SEPARATION	RIVER	RAILROAD WITHIN 25 FT. OF CL TRACK
X	X	X



CAP ELEVATION



SECTION A-A

▲ - 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_e" EXCEEDS 3'-0" PROVIDE LONGITUDINAL SKIN REINFORCEMENT PER AASHTO 5.7.3.4..
- 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
- MULTI-LAYERS
 - PLACE REINFORCING BARS DIRECTLY BELOW REINFORCING BARS IN UPPER LAYER(S)
 - CLEAR SPACING MUST BE 1/2" MINIMUM.
- COORDINATE BOTTOM FLEXURAL CAP REINFORCEMENT WITH VERTICAL COLUMN REINFORCEMENT TO AVOID INTERFERENCE.
- BOTTOM OF FOOTING ELEVATION DETERMINED BY SOIL CONDITIONS, FROST, SCOUR, ROADWAY PAVEMENT DEPTH, ROADWAY DRAINAGE OR ANY OTHER REQUIREMENTS AS DETERMINED BY THE ENGINEER.

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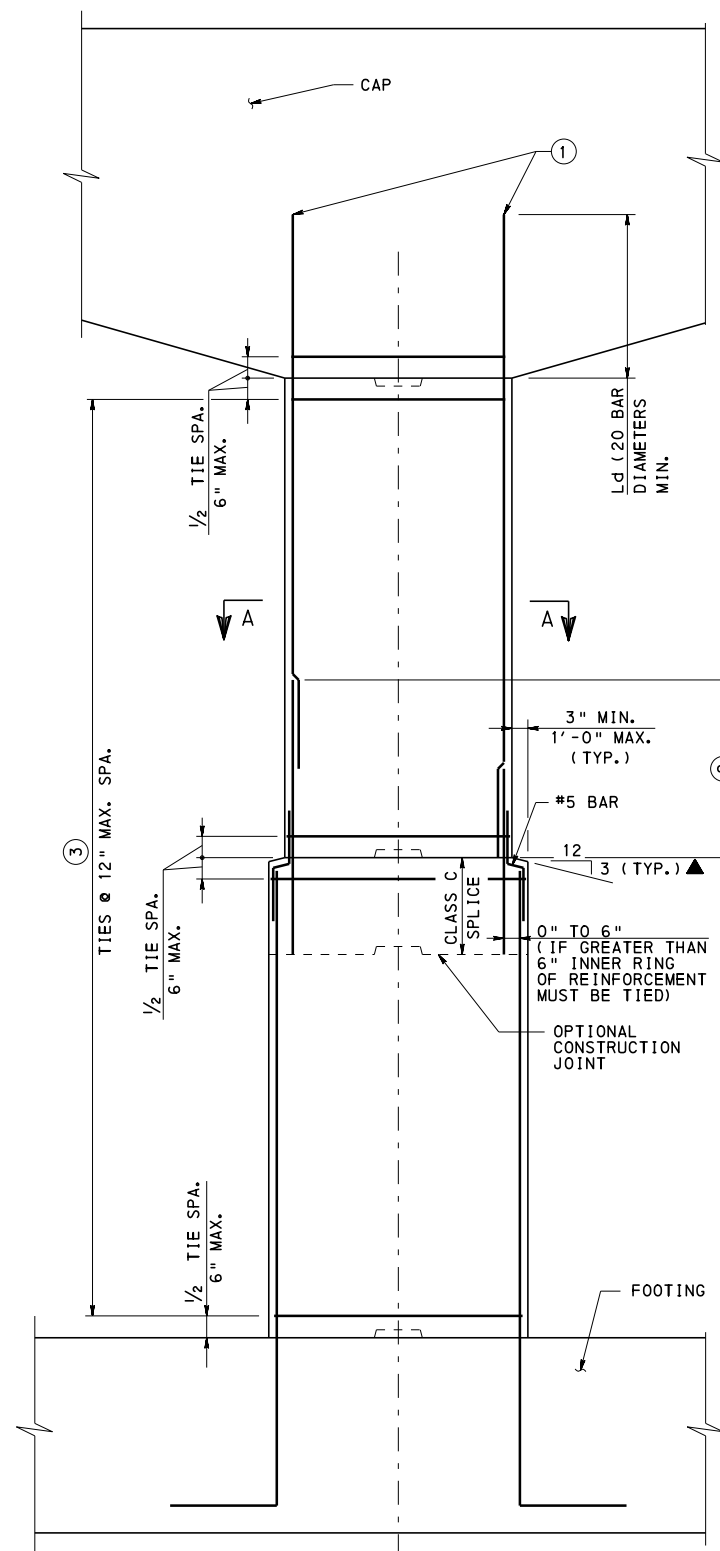
STANDARD
REINFORCED CONCRETE PIERS
SINGLE COLUMN
DETAILS

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 CHIEF BRIDGE ENGINEER

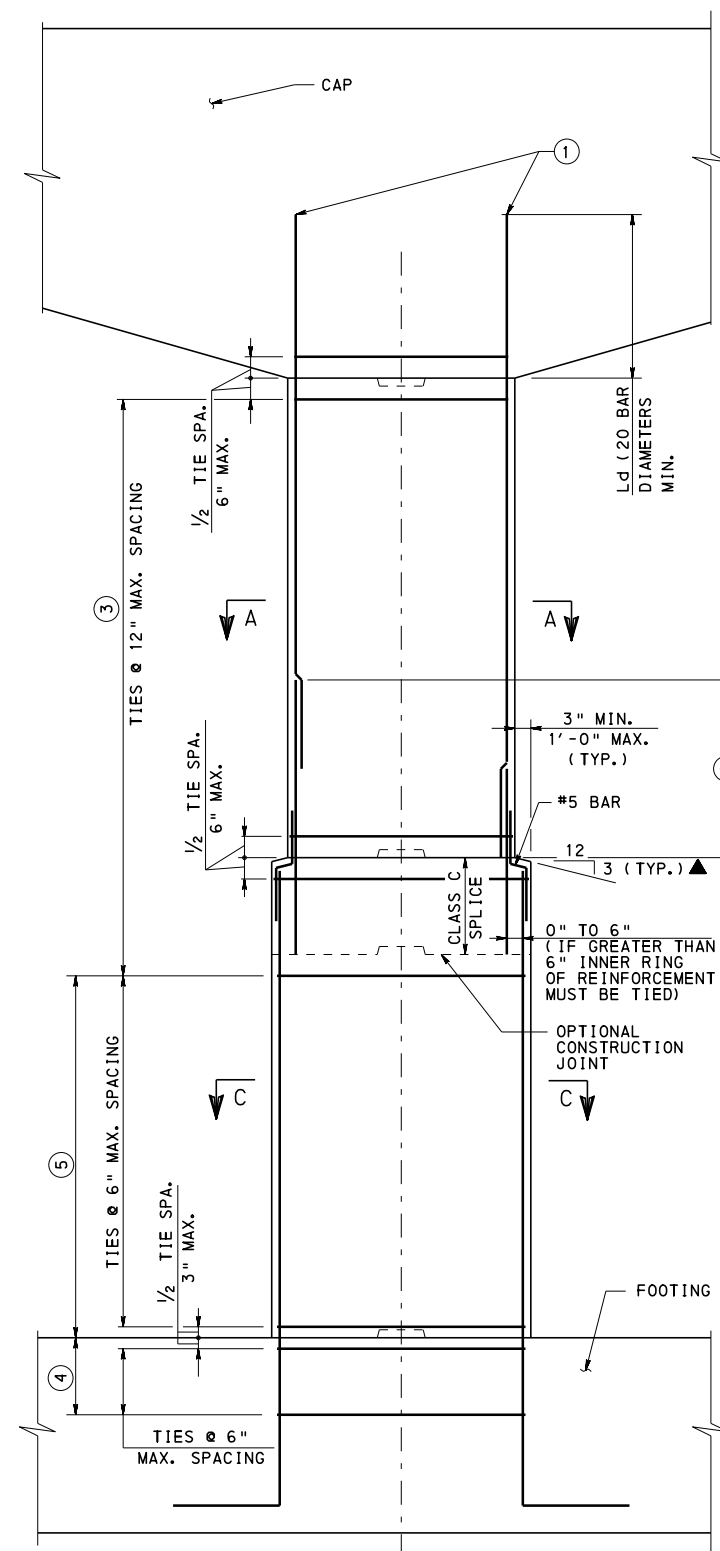
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SHEET 9 OF 15

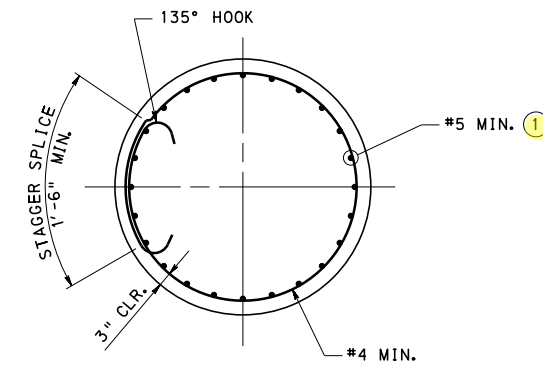
BD-629M



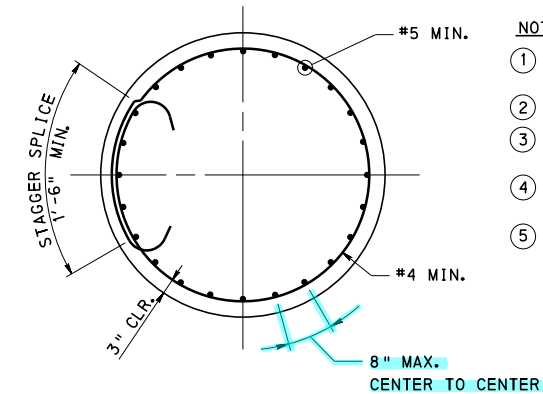
COLUMN
(RESPONSE ACCELERATION
COEFFICIENT, S_{D1} ,
LESS THAN 0.10)



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"

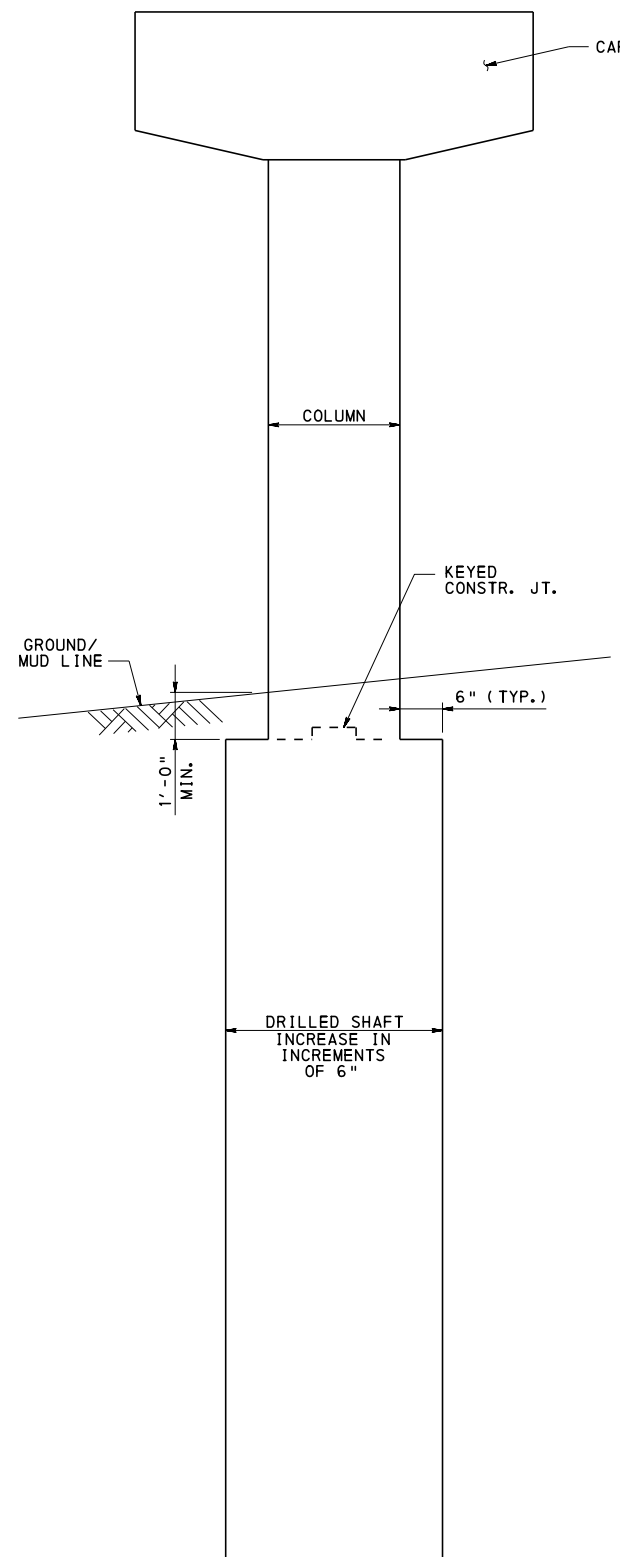
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF **PROJECT DELIVERY**

STANDARD
REINFORCED CONCRETE PIERS
SINGLE COLUMN
COLUMN DETAILS AND SECTIONS

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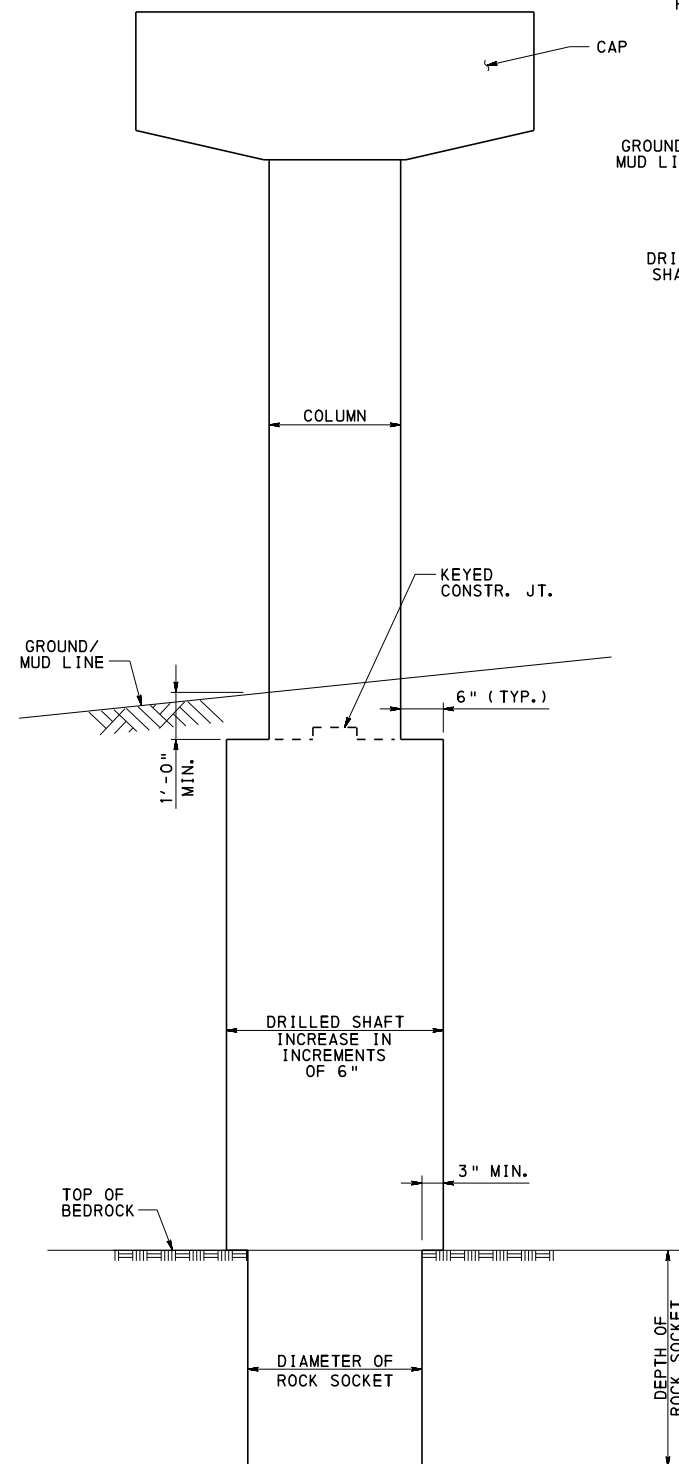
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SHEET 10 OF 15
BD-629M

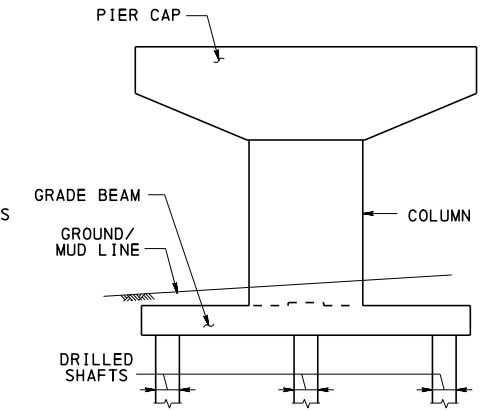
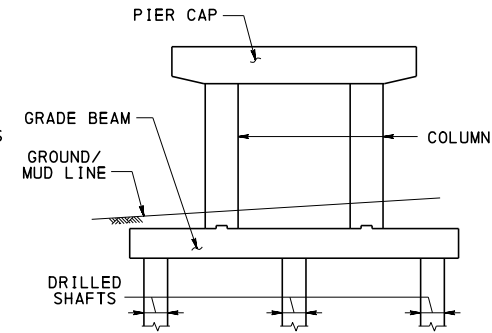
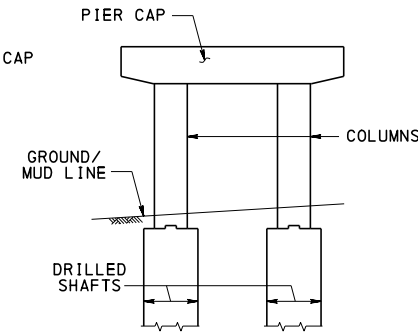


DRILLED SHAFT

①



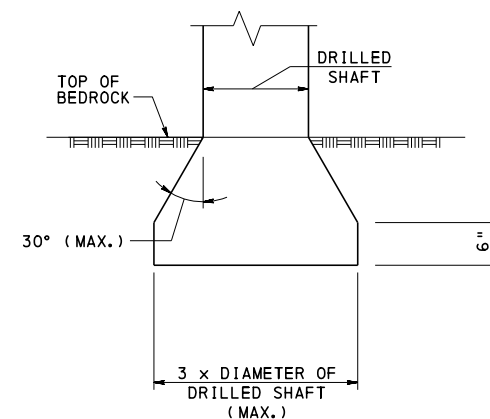
**DRILLED SHAFT
(WITH ROCK SOCKET)**



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 CHIEF BRIDGE ENGINEER.
- ② USE OF BELLED TIP REQUIRES THE PRIOR APPROVAL OF THE CHIEF BRIDGE ENGINEER.



BELLED TIP

②

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

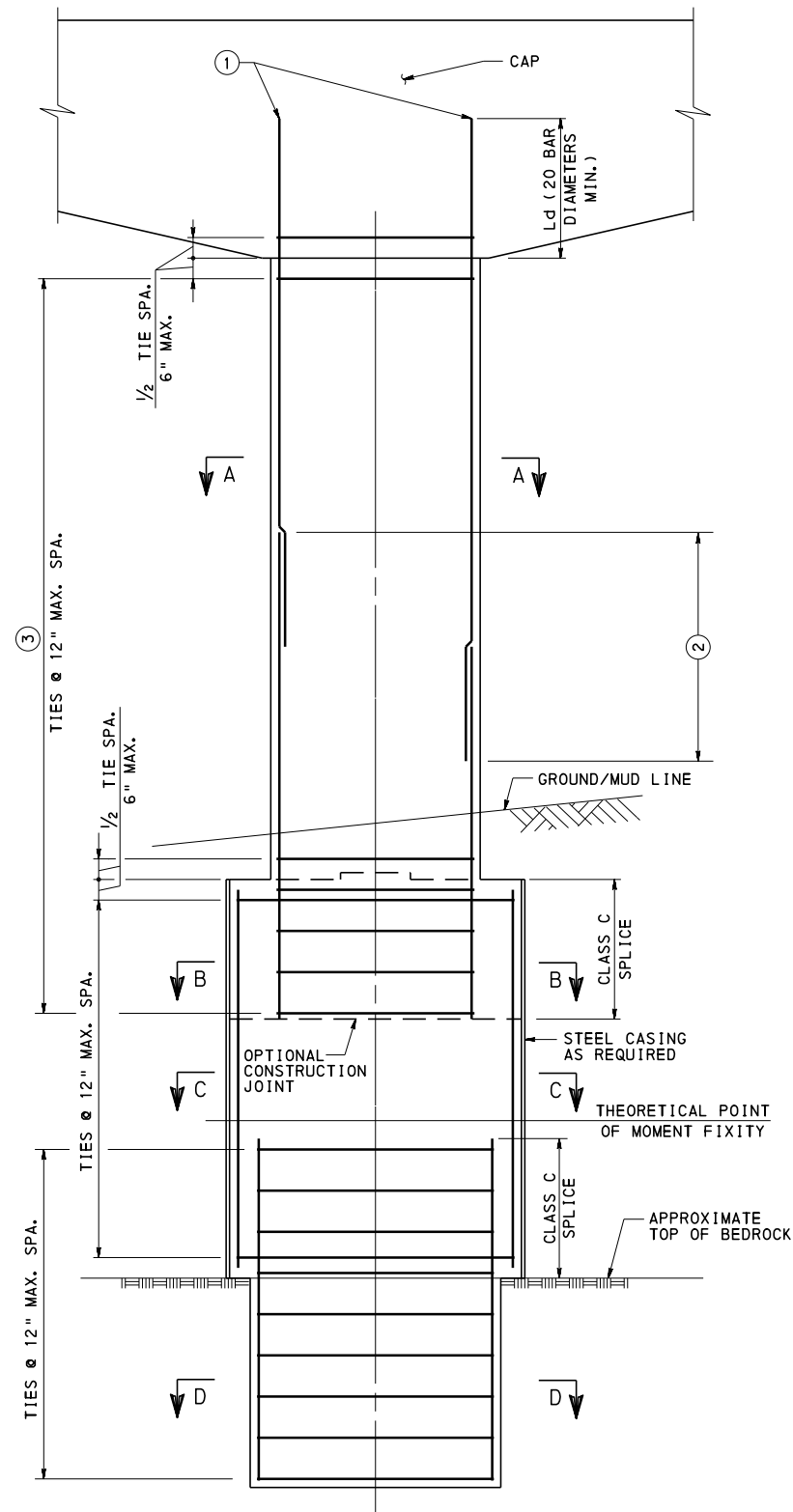
**STANDARD
REINFORCED CONCRETE PIERS
SINGLE DRILLED SHAFT
DETAILS**

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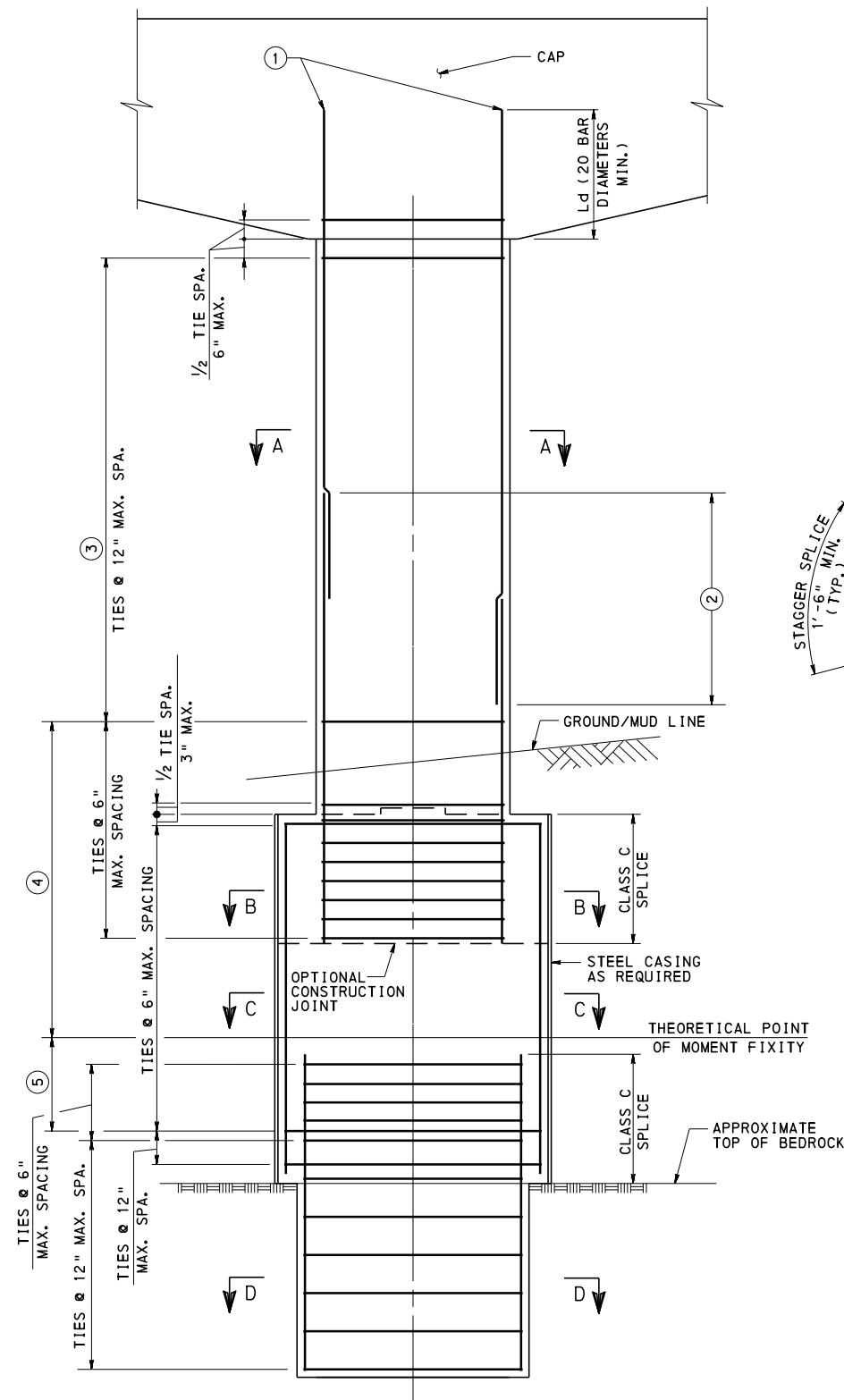
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SHEET 11 OF 15

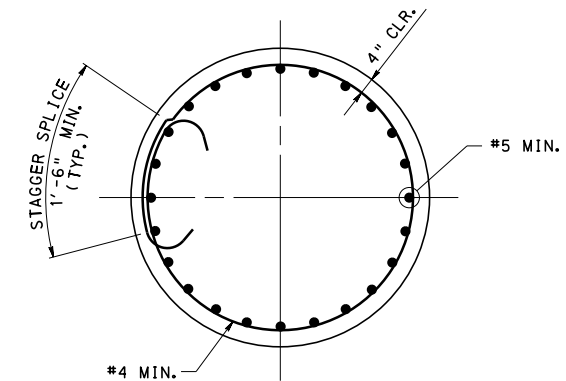
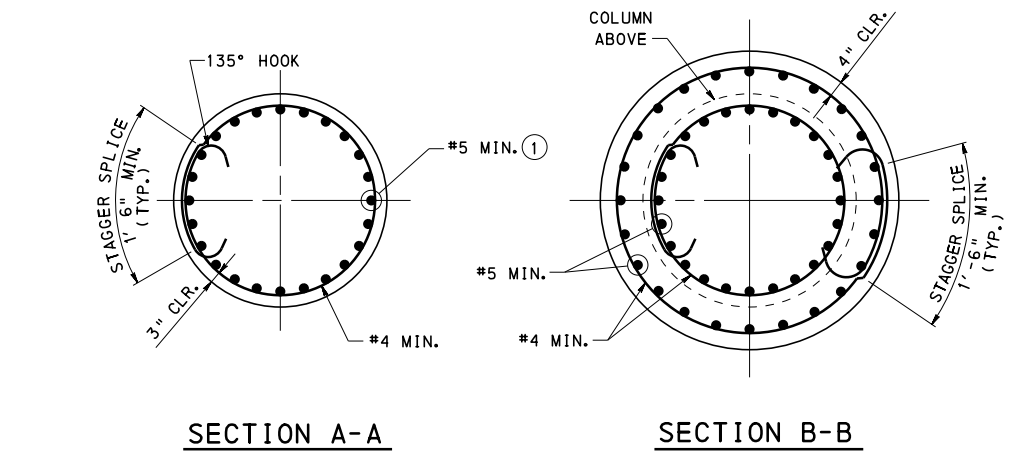
BD-629M



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)



SECTION C-C
(SECTION D-D SIMILAR)

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

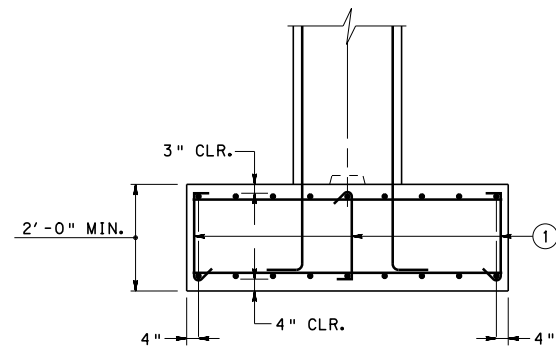
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF **PROJECT DELIVERY**

STANDARD
REINFORCED CONCRETE PIERS
SINGLE DRILLED SHAFT
SHAFT/COLUMN DETAILS AND SECTIONS

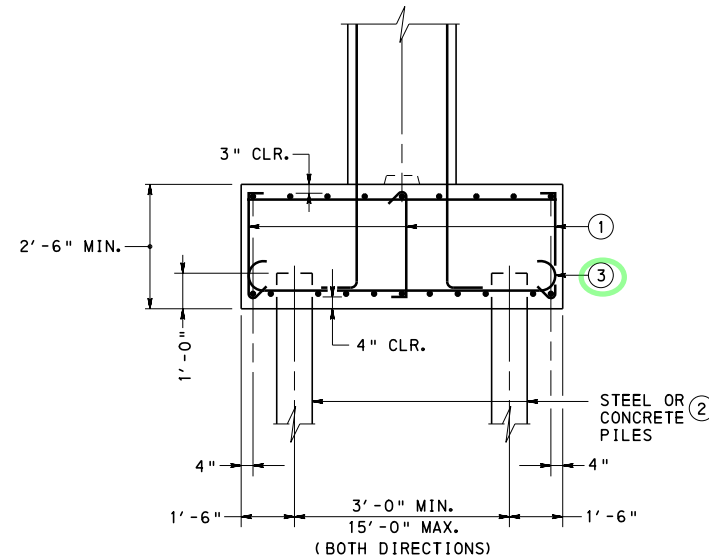
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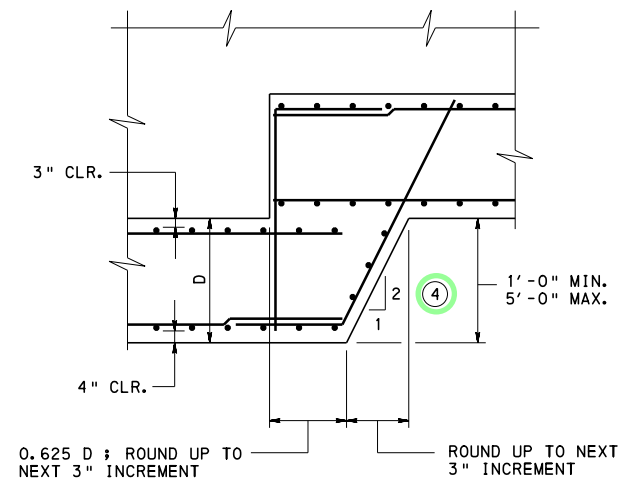
SHEET 12 OF 15
BD-629M



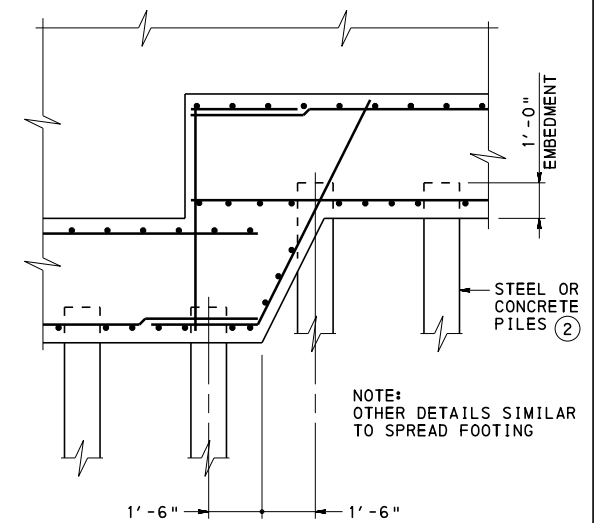
**SINGLE COLUMN
SPREAD FOOTING**



**SINGLE COLUMN
PILE FOOTING**

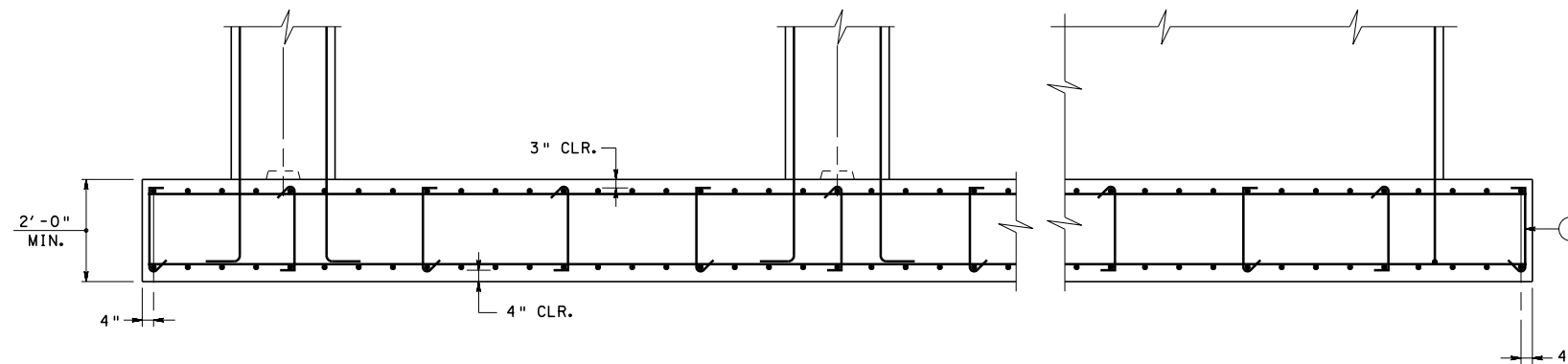


SPREAD FOOTING



PILE FOOTING

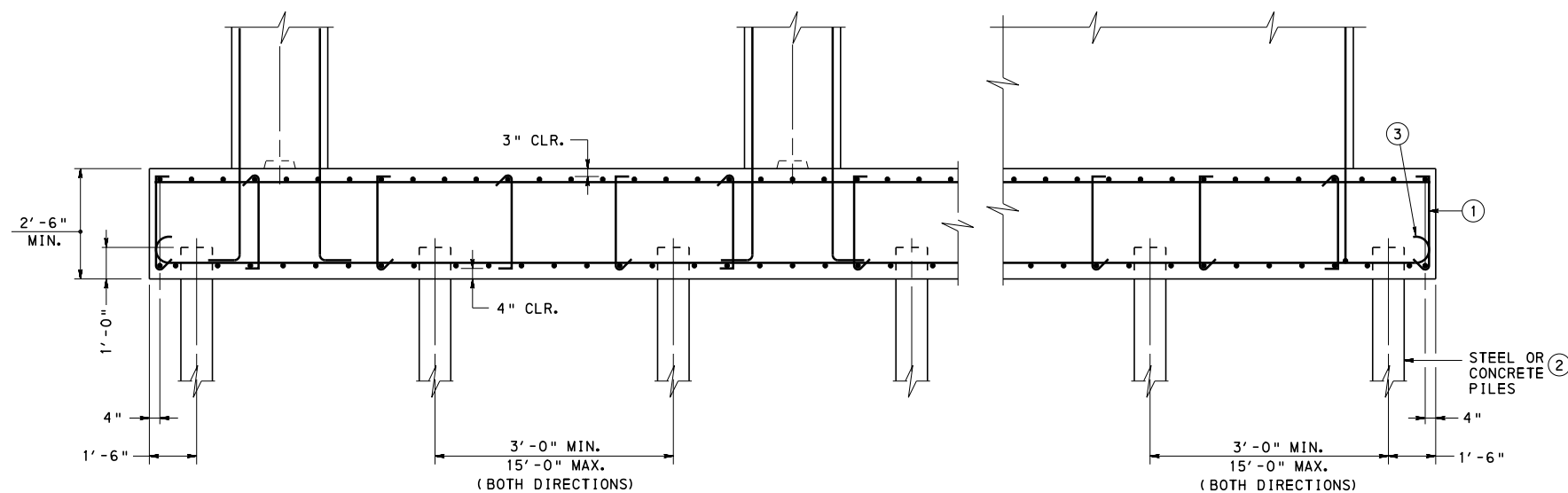
STEP DETAILS



MULTI-COLUMN BENT

CONTINUOUS SPREAD FOOTING

HAMMERHEAD & WALL



MULTI-COLUMN BENT

CONTINUOUS PILE 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.

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

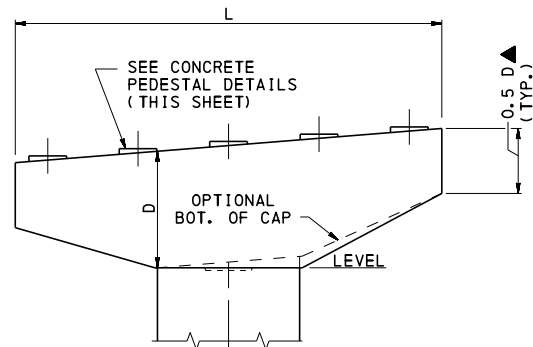
**STANDARD
REINFORCED CONCRETE PIERS
TYPICAL FOOTING
DETAILS**

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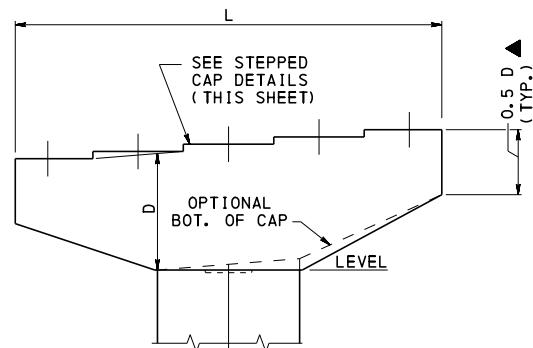
SHEET 13 OF 15

BD-629M

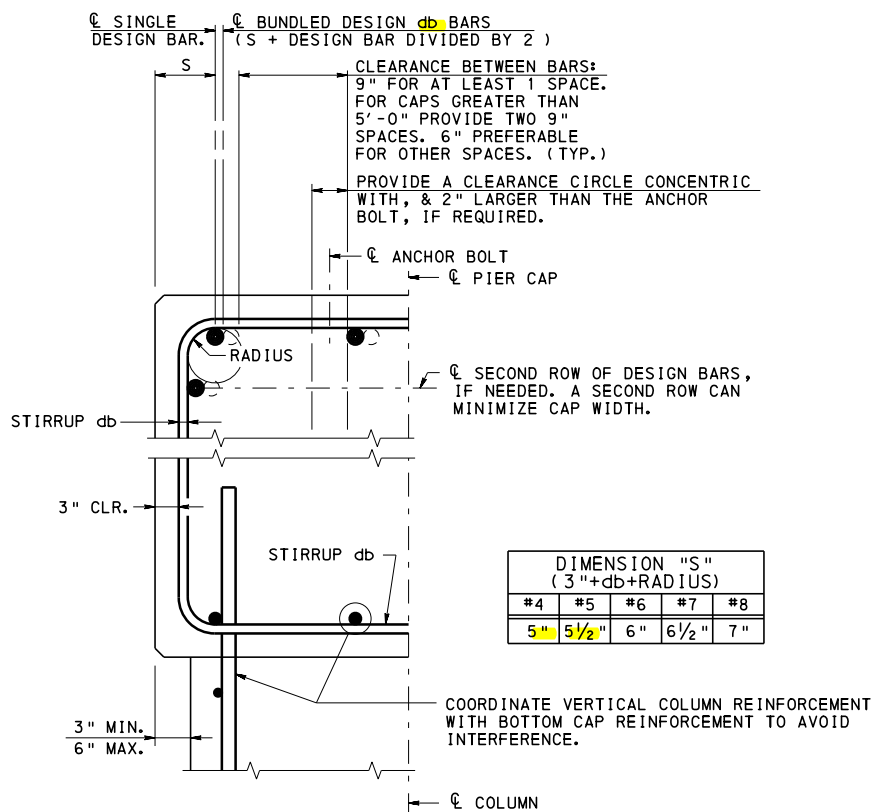


ELEVATION
SLOPED CAP WITH PEDESTALS

▲ - DENOTES RECOMMENDED VALUE

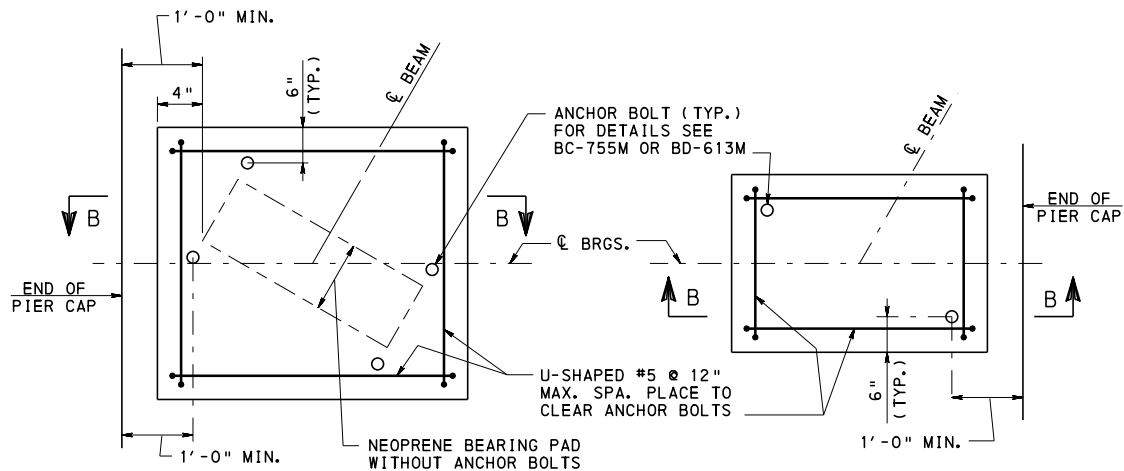


ELEVATION
STEPPED CAP



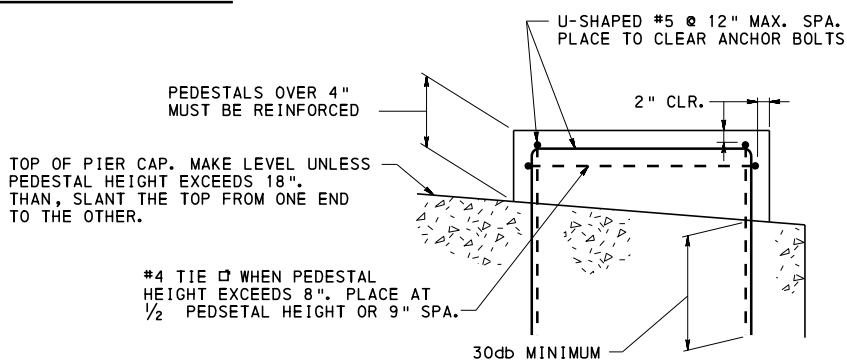
PIER CAP SECTION

DIMENSION "S" (3" + db + RADIUS)				
#4	#5	#6	#7	#8
5"	5 1/2"	6"	6 1/2"	7"



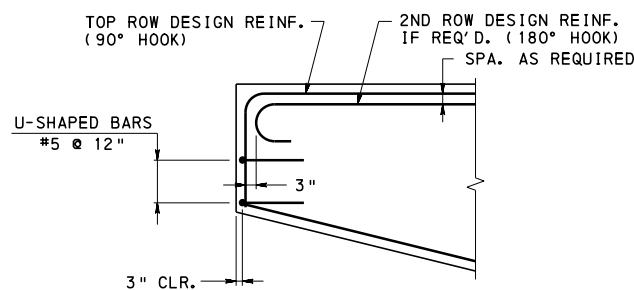
PLAN - 4 ANCHOR BOLTS OR NEOPRENE PAD

PLAN - 2 ANCHOR BOLTS

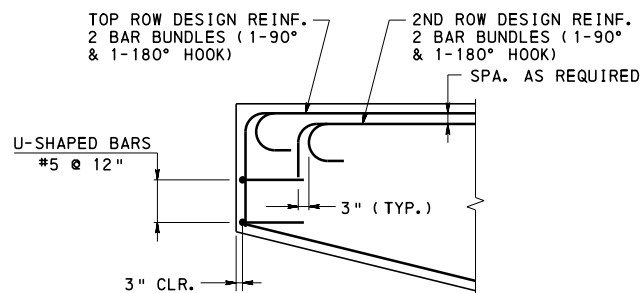


SECTION B-B

CONCRETE PEDESTAL DETAILS



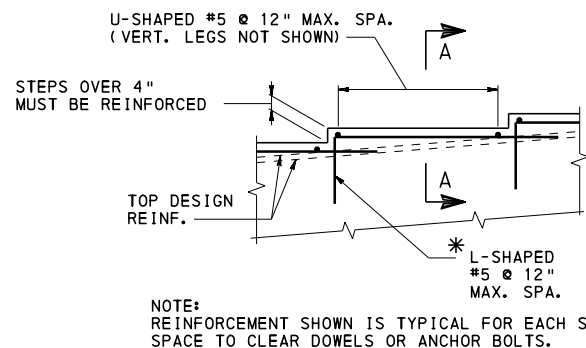
ELEVATION - SINGLE AND HORIZONTALLY BUNDLED BARS



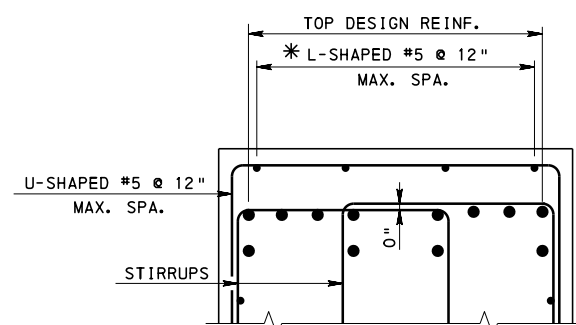
ELEVATION - VERTICALLY BUNDLED BARS

DETAIL A

NOTE: STIRRUPS AND SIDE REINF. NOT SHOWN.

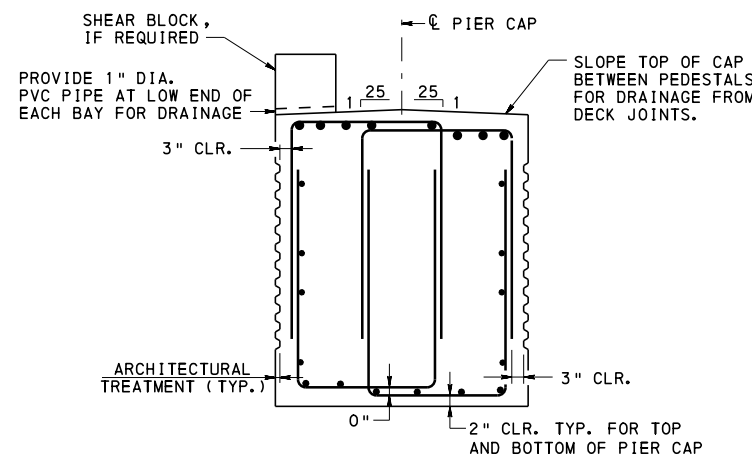


ELEVATION



SECTION A-A
STEPPED CAP DETAILS

* REINFORCING BARS MAY BE CONSIDERED FOR SERVICEABILITY REQUIREMENTS.



ARCHITECTURAL TREATMENT AND TOP OF CAP AT DECK JOINT

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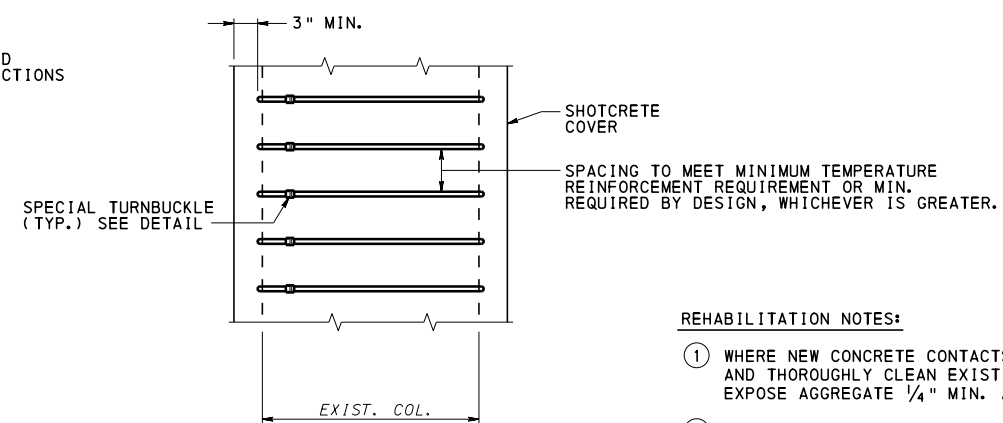
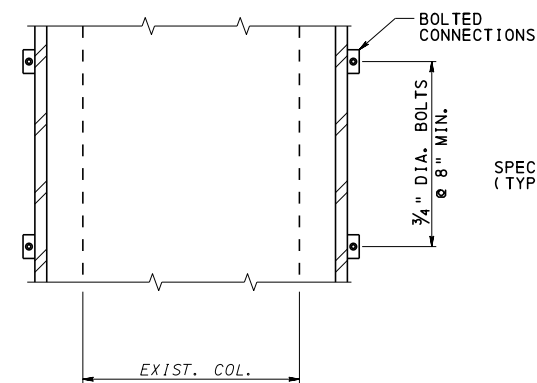
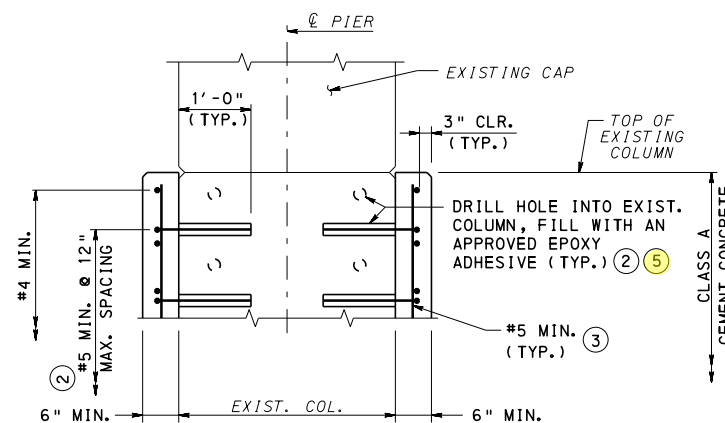
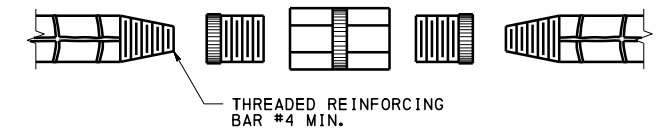
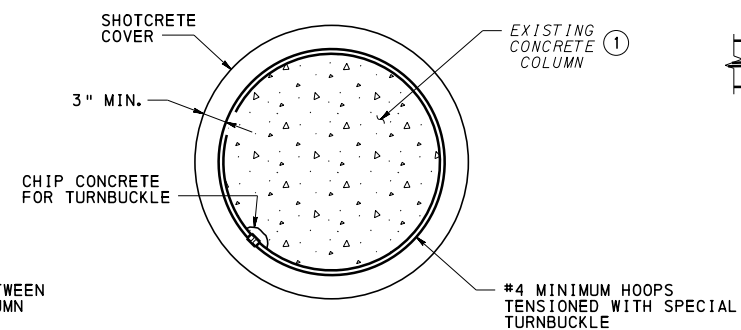
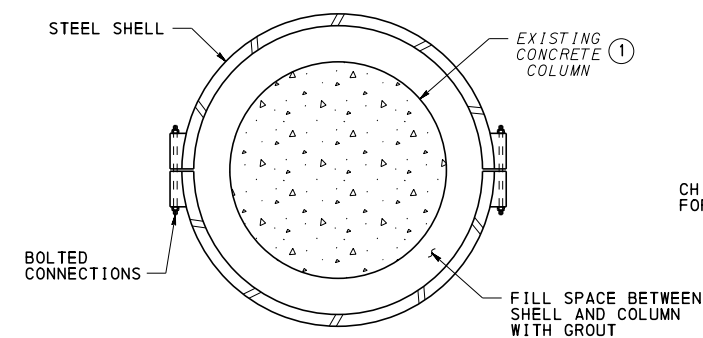
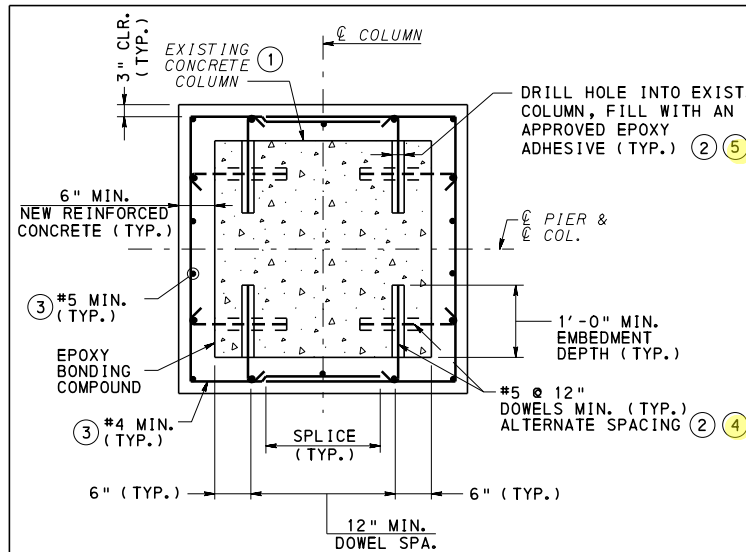
STANDARD
REINFORCED CONCRETE PIERS
TYPICAL CAP
DETAILS

RECOMMENDED NOV. 21, 2014
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CHIEF BRIDGE ENGINEER

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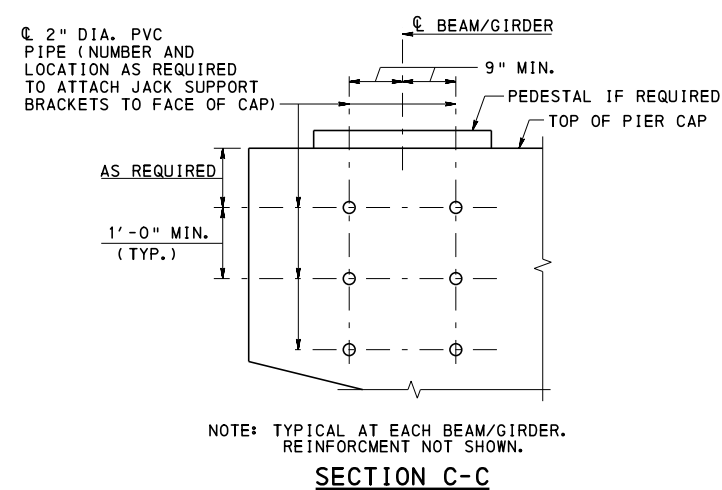
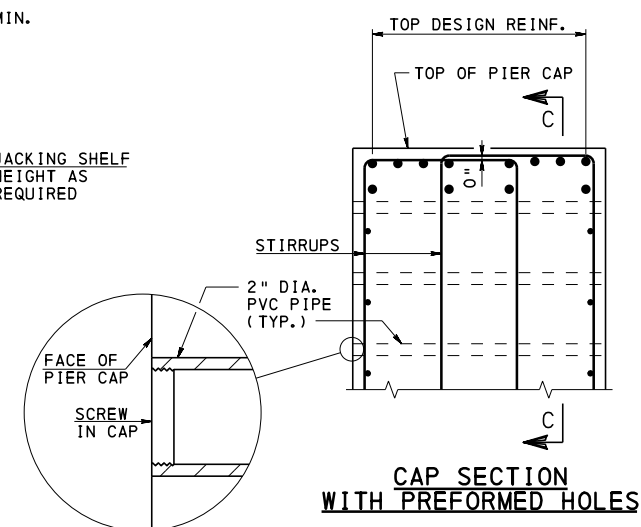
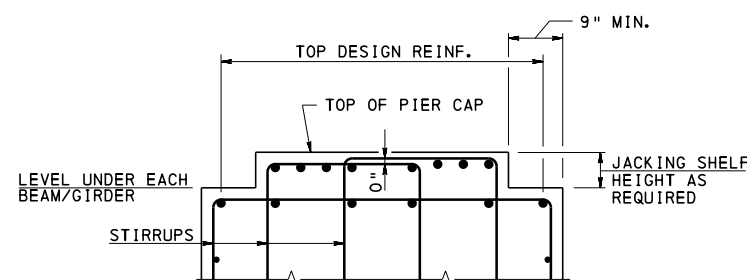
SHEET 14 OF 15

BD-629M



- REHABILITATION NOTES:

- ① 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.
- ② THE CONTRACTOR IS RESPONSIBLE FOR LOCATING THE EXISTING BARS PRIOR TO DRILLING DOWEL HOLES. ADJUST SPACING AS REQUIRED.
- ③ CONTRACTOR IS RESPONSIBLE FOR FINAL REINFORCEMENT BAR LENGTHS.
- ④ DOWEL BAR TO ENGAGE NEW VERTICAL COLUMN REINFORCEMENT.
- ⑤ DRILL HOLES OF PROPER DIAMETER AND DEPTH IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.



- JACKING NOTES:

- ① JACKING LOAD TO CONSIST OF SUPERSTRUCTURE DEAD LOAD ONLY
- ② SPACE 2" PVC PIPE TO CLEAR ANCHOR BOLTS AND PIER CAP REINFORCEMENT.

COMMONWEALTH OF PENNSYLVANIA
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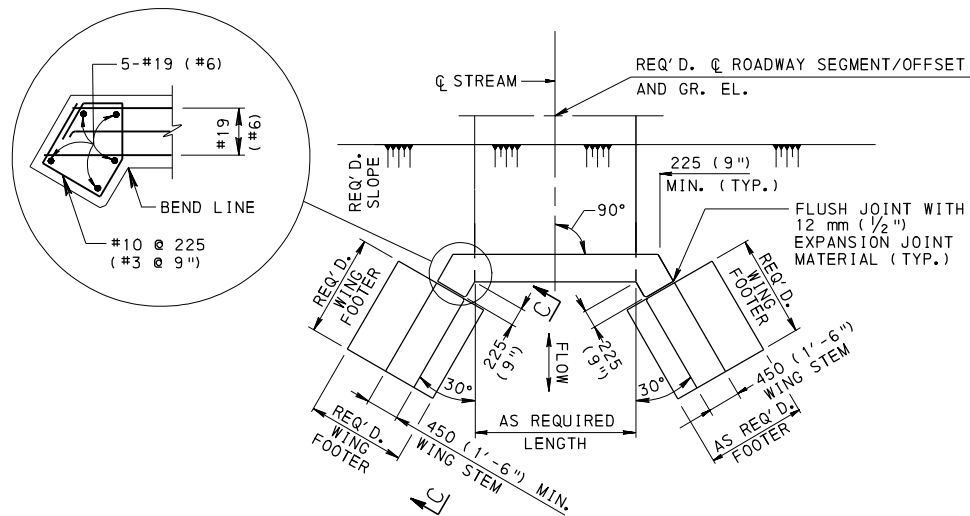
STANDARD REINFORCED CONCRETE PIERS REHABILITATION AND JACKING DETAILS

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 CHIEF BRIDGE ENGINEER

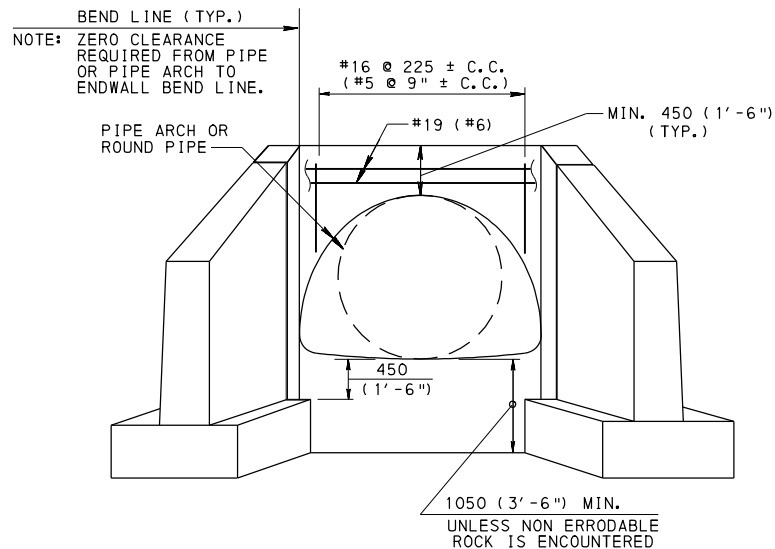
RECOMMENDED NOV. 21, 2014
Brenda Thompson
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SHEET 15 OF 15

3D-629M

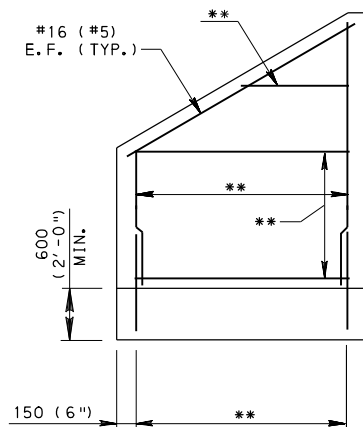


ENDWALL PLAN



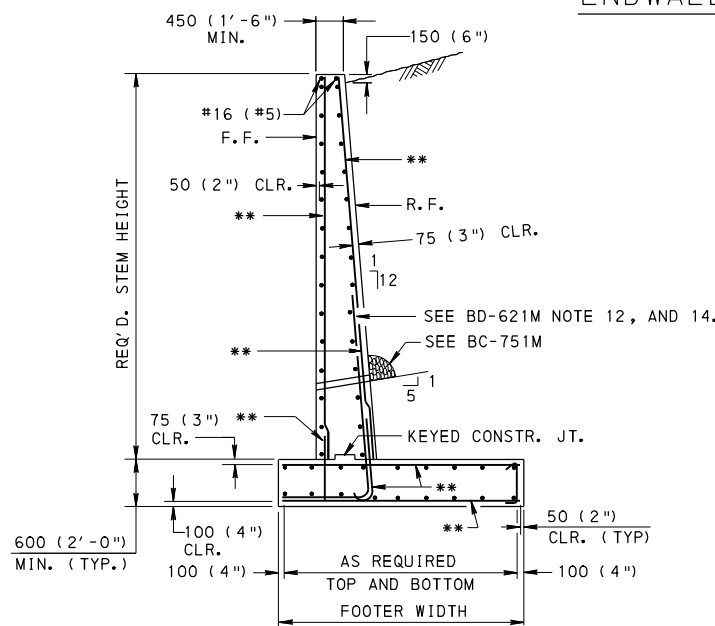
ENDWALL ELEVATION

NOTE: FOR OPTIONAL APRON DETAIL SEE BD-632M SHEET 1.



SECTION C-C

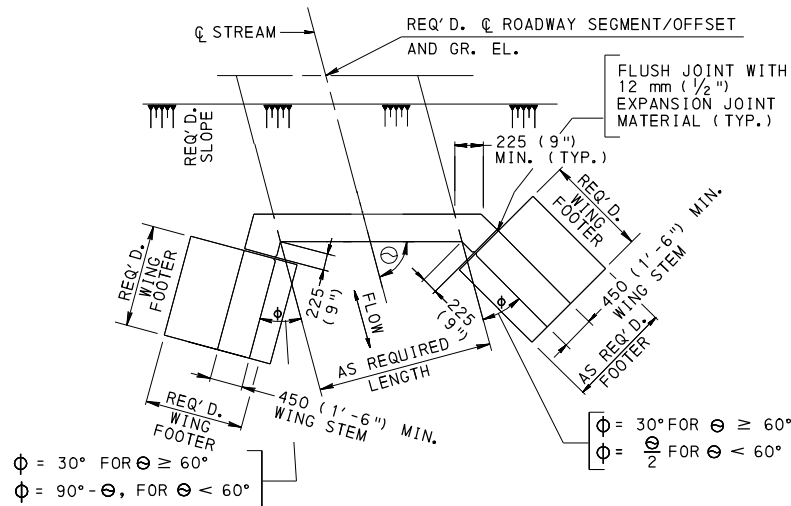
** SEE NOTE 13



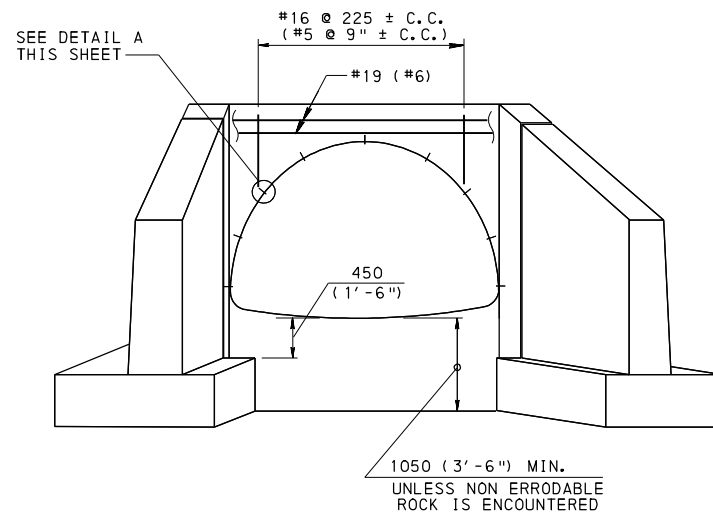
TYPICAL WING SECTION

** SEE NOTE 13

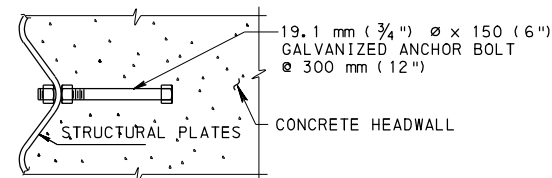
BATTER NOT REQUIRED IF STEM HEIGHT IS LESS THAN 12'-0"



ENDWALL PLAN-SKEWED CULVERT AND PLATE PIPE ARCH



ENDWALL ELEVATION-SKEWED CULVERT AND PLATE PIPE ARCH



DETAIL A
METAL STRUCTURAL PLATE ANCHORAGE

RC-52M	TYPE 2 STRONG POST GUIDERAIL
BD-621M	REINFORCED CONCRETE ABUTMENTS
BD-625M	REINF. CONC. ABUTMENTS MISC. DETAILS
BD-632M	STANDARD 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 DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES.
- ALL REINFORCEMENT AND GALVANIZED ANCHOR BOLT STEEL BAR DETAILS ARE SOFT CONVERTED METRIC SIZES THAT MEET THE REQUIREMENTS OF ASTM A 615M, A 996M, OR A 706M.
- 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.
- 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 150 mm (6'') REINFORCED CONCRETE APRON IS USED.
- IF THE LENGTH OF THE WINGWALL IS LESS THAN OR EQUAL TO 3000 mm (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 STRUCTURE MOUNTED GUIDE RAIL ATTACHMENT & CORRESPONDING HEADWALL REINFORCEMENT DETAILS FOR FILLS 600 mm (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 #16 @ 450 (#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

- $f'_c = 21 \text{ MPa}$ (3000 P.S.I.) FOR CONCRETE (USE CLASS A CEMENT CONCRETE)
- $f_y = 420 \text{ MPa}$ (60,000 P.S.I.) FOR REINFORCEMENT BARS
- DENSITY OF BACKFILL MATERIAL = 1900 kg/m^3 (120 lb/ft³)
- DENSITY OF CONCRETE = 2400 kg/m^3 (150 lb/ft³)
- EQUIVALENT FLUID EARTH PRESSURE = 5.5 Pa/mm (35 lb/ft²/ft) OF DEPTH.
- LIVE LOAD SURCHARGE : REFER TO DESIGN MANUAL PART 4.

LEGEND

- EQ. SP. : DENOTES EQUAL SPACING
 CLR. : DENOTES CLEAR
 SP. : DENOTES CENTER TO CENTER SPACING
 ⊙ : 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

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN

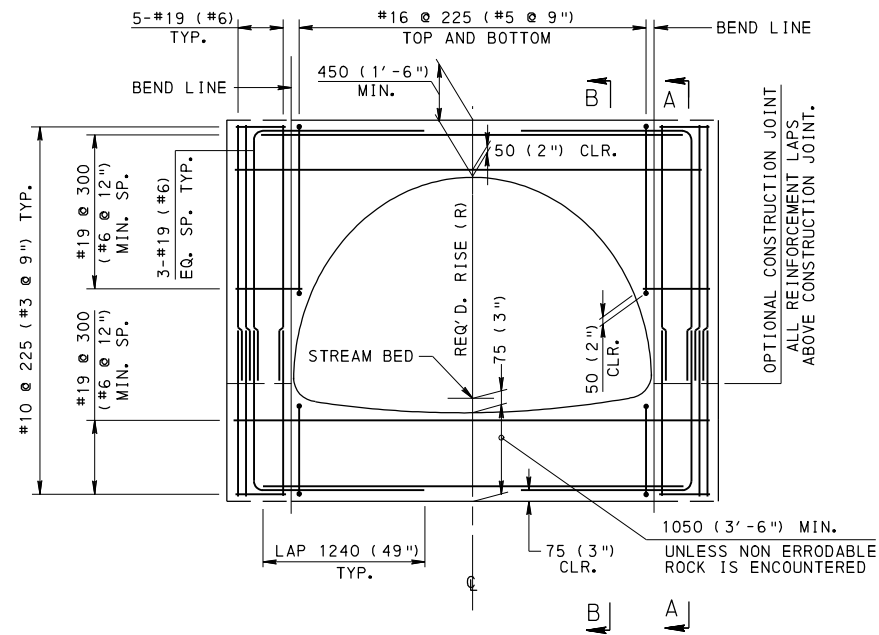
STANDARD END WALL DETAILS FOR CULVERTS

RECOMMENDED SEPT. 20, 2010
 Thomas P. Maciore
 CHIEF BRIDGE ENGINEER

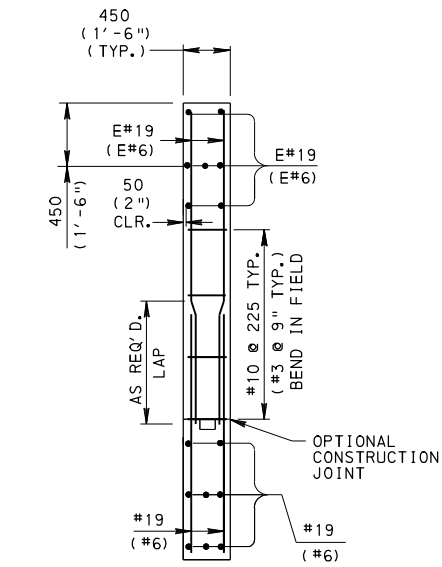
RECOMMENDED SEPT. 20, 2010
 Bruce S. Thompson
 DIRECTOR, BUREAU OF DESIGN

SHEET 1 OF 2

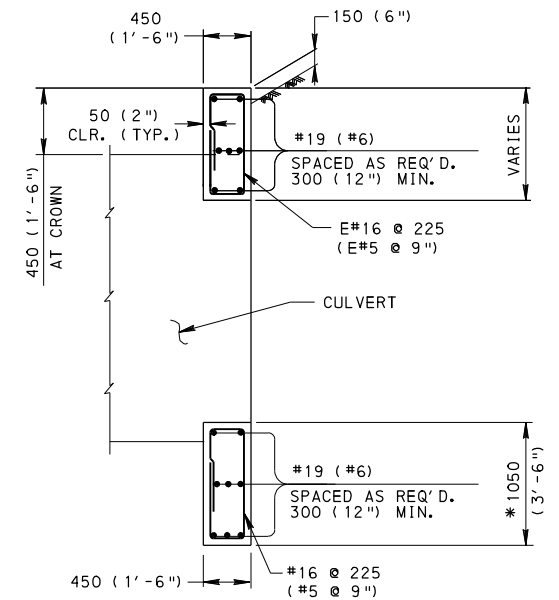
BD-631M



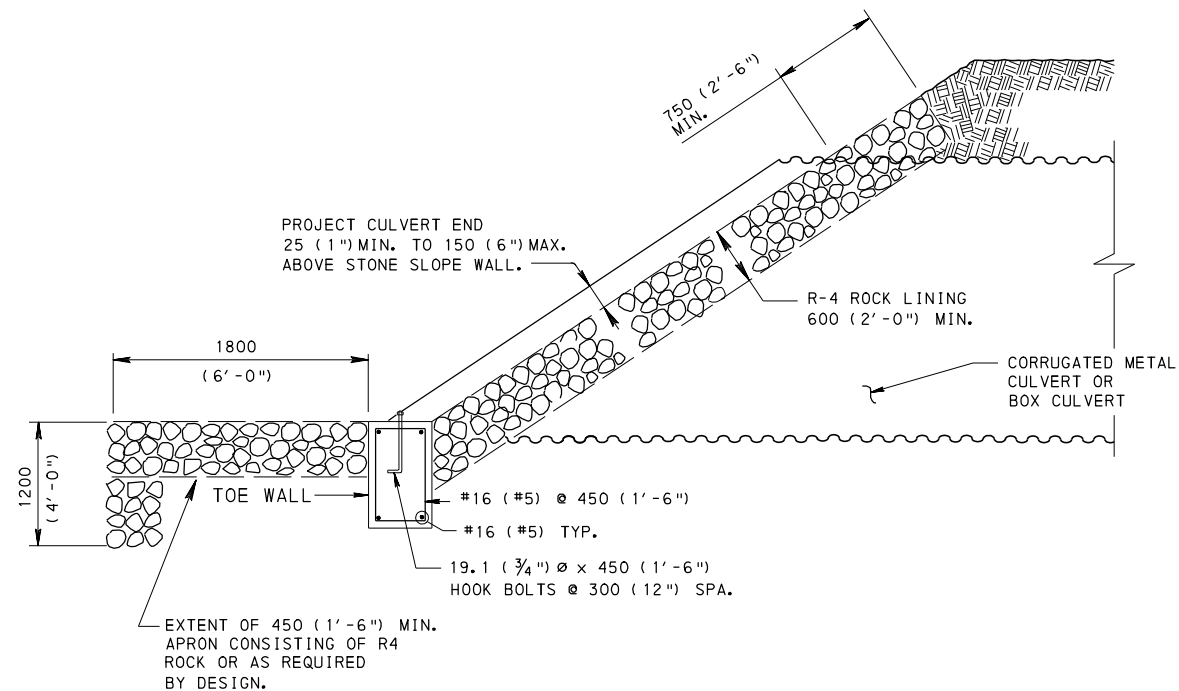
TYPICAL HEADWALL ELEVATION



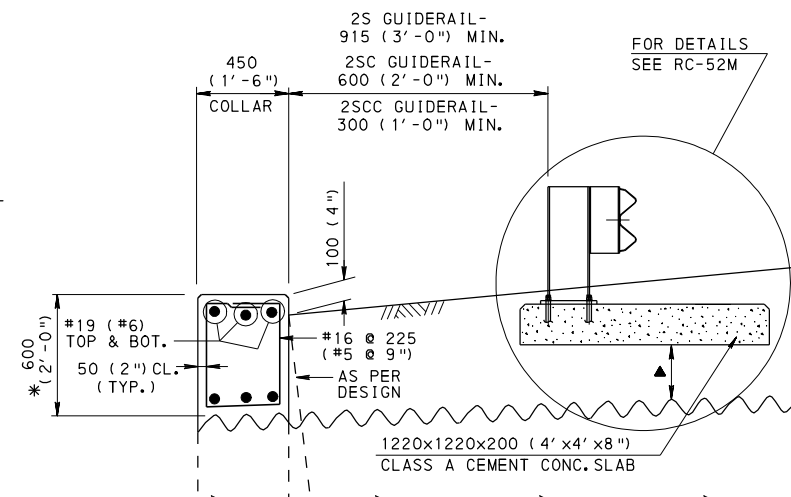
SECTION A-A
ADJACENT TO CULVERT



SECTION B-B
THRU CULVERT



ROCK LINING END WALL
SLOPED END CONDITION



TYPICAL SECTION
(METAL CULVERTS)

▲ REFER TO DETAIL IN STD. DWG. RC-52M FOR "STEEL POSTS OVER UNDERGROUND STRUCTURES" WHEN THIS DIMENSION EXCEEDS 600 (2'-0'')

* WHEN THIS DIMENSION EXCEEDS 600 (2'-0'') CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN.

LEGEND

E.F. : DENOTES EACH FACE
EL : DENOTES ELEVATION

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

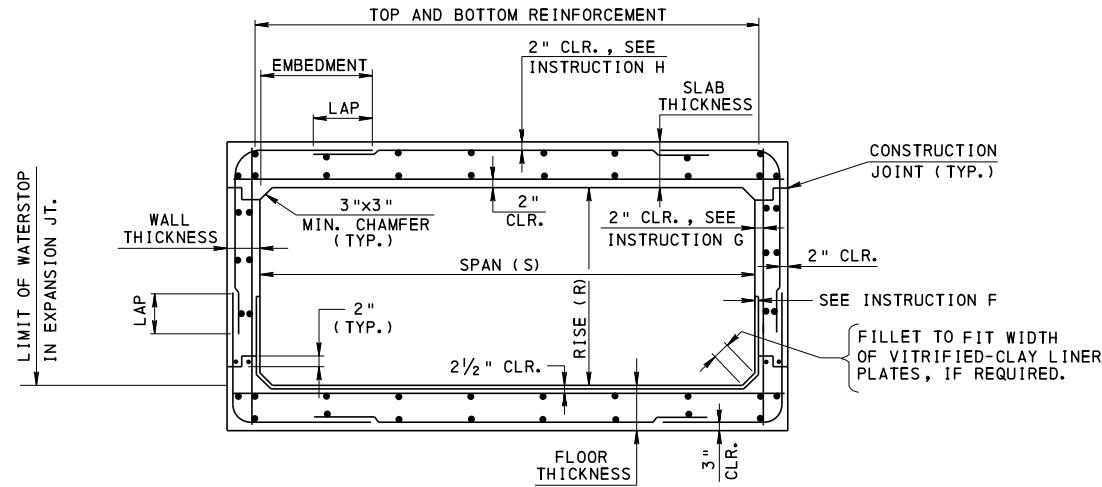
STANDARD
END WALL DETAILS
FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

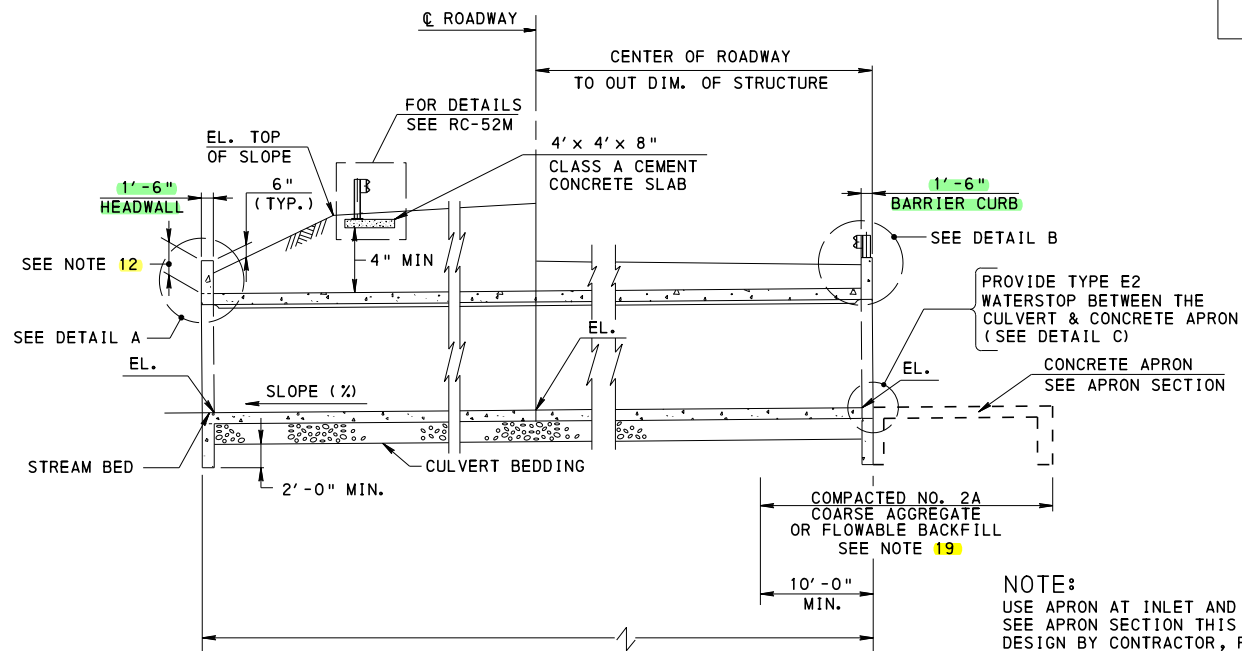
RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 2 OF 2
BD-631M

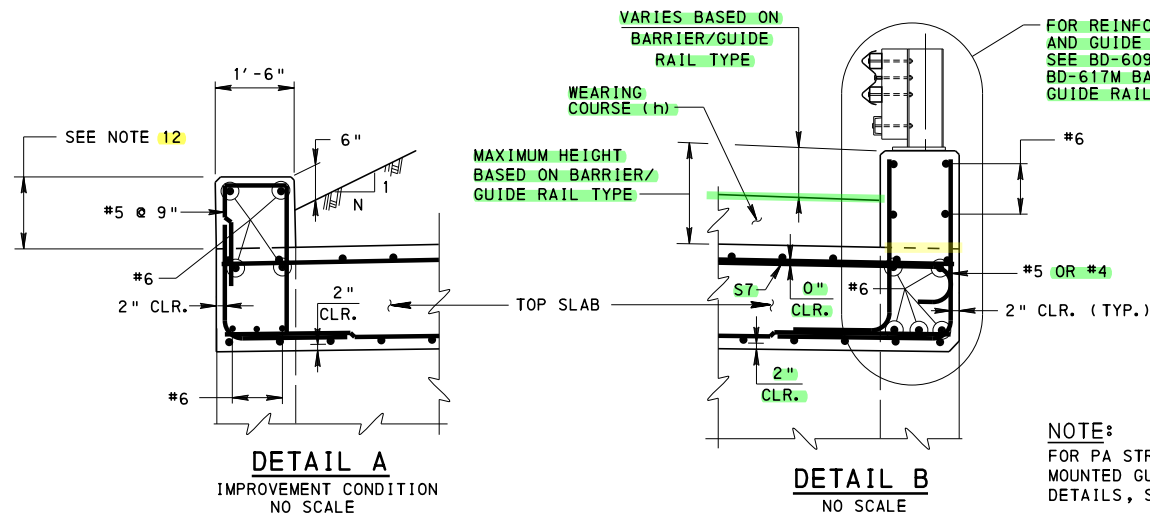
- CHANGE 1
- CHANGE 2
- CHANGE 3



TYPICAL BOX SECTION
NO SCALE



SECTION ALONG CULVERT
NO SCALE



DETAIL A
IMPROVEMENT CONDITION
NO SCALE

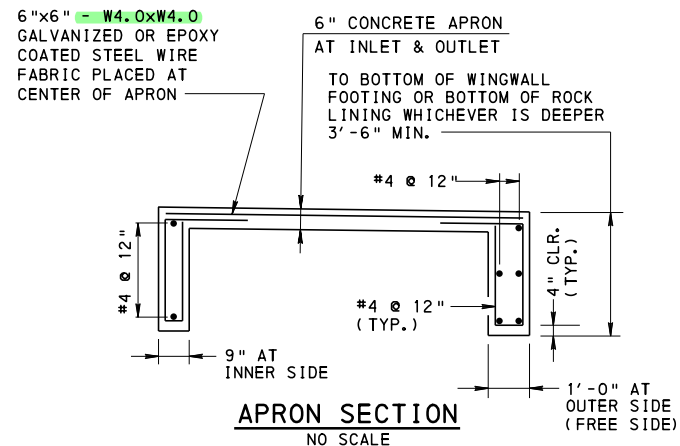
DETAIL B
NO SCALE

DESIGN DATA FOR
CAST-IN-PLACE BOX CULVERT

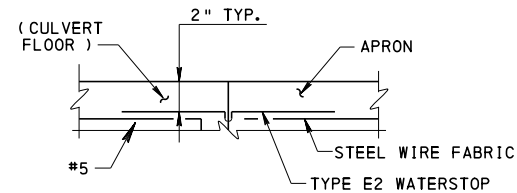
- $f'c = 3000$ P.S.I. FOR CLASS A CEMENT CONCRETE
- $f'c = 4000$ P.S.I. FOR TOP SLAB AT GRADE (CLASS AAAP CEMENT CONCRETE)
- $f_y = 60,000$ P.S.I. FOR REINFORCEMENT BARS
- $f_y = 65,000$ P.S.I. FOR WELDED WIRE FABRIC

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.



APRON SECTION
NO SCALE



DETAIL C
NO SCALE

NOTES

- PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706. DO NOT WELD REINFORCEMENT STEEL. DO NOT USE RAIL STEEL (A 996) 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 WORKMANSHIP IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATIONS AS OUTLINED IN THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408.
- DEAD LOADS: INCLUDES SURFACE AREA DENSITY OF 30 P.S.F. 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 ALLOWABLE 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" ϕ 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 PUB.408 SECTION 623.2(d), WHICH IS 2" MINIMUM THICK \times 4'-0" WIDE CENTERED HORIZONTALLY ON WEEP HOLE, SEE PREFORMED DRAIN DETAIL ON SHEET 5.
- 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 SECTION 705, PUB. 408.
- FOR JOINT DETAILS SEE BC-735M. WHEN EXPANSION JOINTS ARE USED, WATERSTOPS ARE REQUIRED IN THE TOP AND BOTTOM SLABS AND THE WALLS.
- FOR SAFETY WING DETAILS, SEE SHEET 3.
- MODIFIED STRUCTURE MOUNTED GUIDE RAIL BARRIER GRANTED TL3 DESIGNATION BY FHWA.
- 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.

LEGEND

- E.F. : DENOTES EACH FACE
F.F. : DENOTES FRONT FACE
R.F. : DENOTES REAR FACE
EL. : DENOTES ELEVATION
C.I.P. : DENOTES CAST IN PLACE
B.B. : DENOTES BACK BATTER

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BUREAU OF PROJECT DELIVERY

STANDARD
R.C. BOX CULVERT
CAST-IN-PLACE

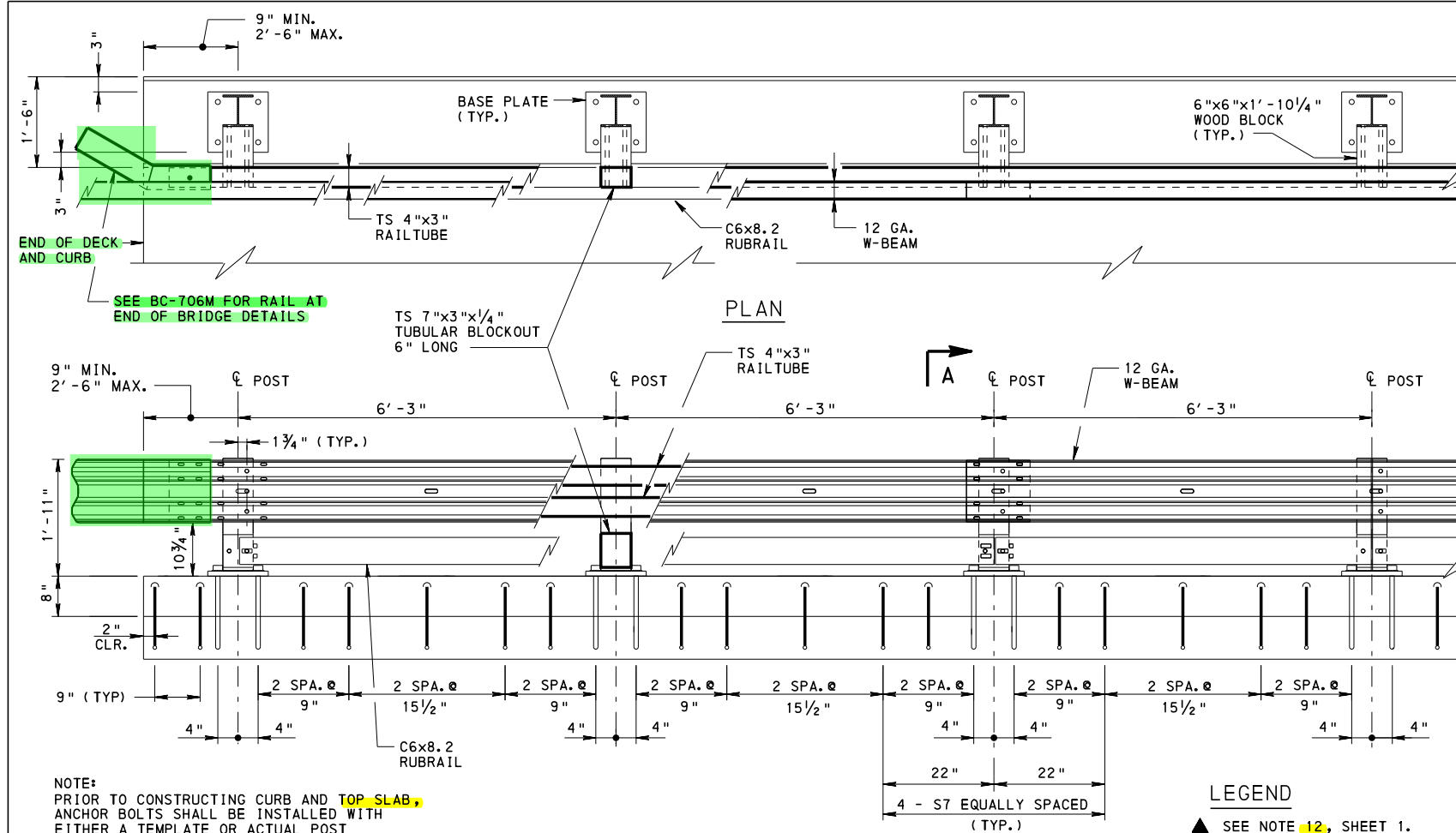
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
BD-601M	CONCRETE DECK SLAB DESIGN & DETAILS
BD-609M	PA STRUCTURE MOUNTED GUIDE RAIL
BD-610M	PA BRIDGE BARRIER
BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-621M	STANDARD REINFORCED CONCRETE ABUTMENTS TYPICAL SECTIONS AND DETAILS
BD-625M	WINGWALL LENGTH
BD-631M	END WALL DETAILS FOR METAL CULVERTS
BC-706M	PA STRUCTURE MOUNTED GUIDE RAIL BARRIER MISCELLANEOUS DETAILS
BC-734M	ANCHOR SYSTEMS
BC-735M	WALL CONSTR. AND EXPANSION JOINT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-739M	BRIDGE BARRIER TO GUIDE RAIL TRANSITION
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
BC-798M	PRECAST R.C. BOX CULVERT MECHANICAL CONNECTION DETAILS

REFERENCE DRAWINGS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
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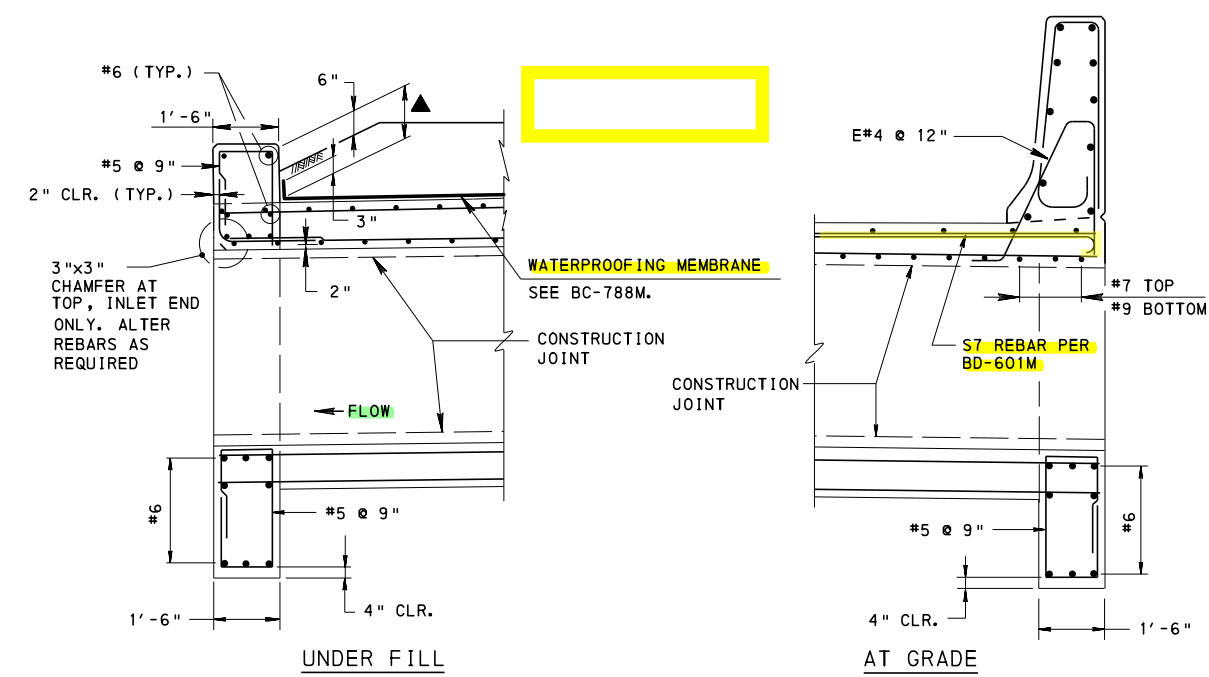
SHEET 1 OF 13
BD-632M



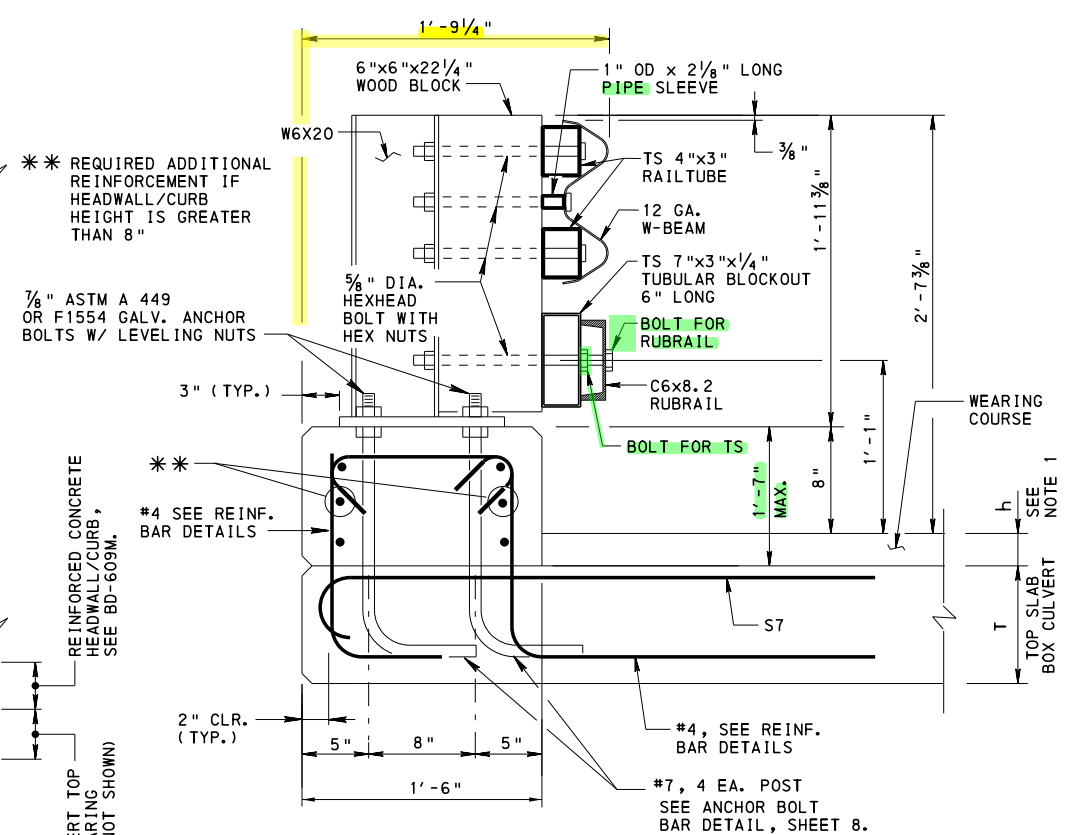
NOTE:
PRIOR TO CONSTRUCTING CURB AND TOP SLAB, ANCHOR BOLTS SHALL BE INSTALLED WITH EITHER A TEMPLATE OR ACTUAL POST W/BASEPLATE INSTALLED TO ENSURE PROPER ANCHOR BOLT ALIGNMENT & PLACEMENT

**PA STRUCTURE MOUNTED GUIDE RAIL
ELEVATION ALONG TOP SLAB OF CULVERT**

- FOR CURB REINFORCEMENT SEE BD-609M.
- TOP SLAB REINFORCEMENT AS DESIGNED.



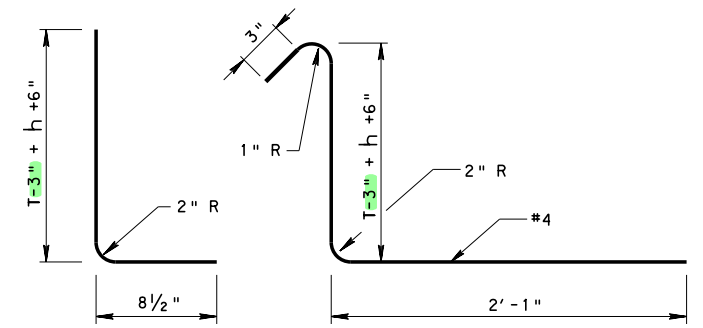
TYPICAL HEADWALL SECTIONS



SECTION A-A

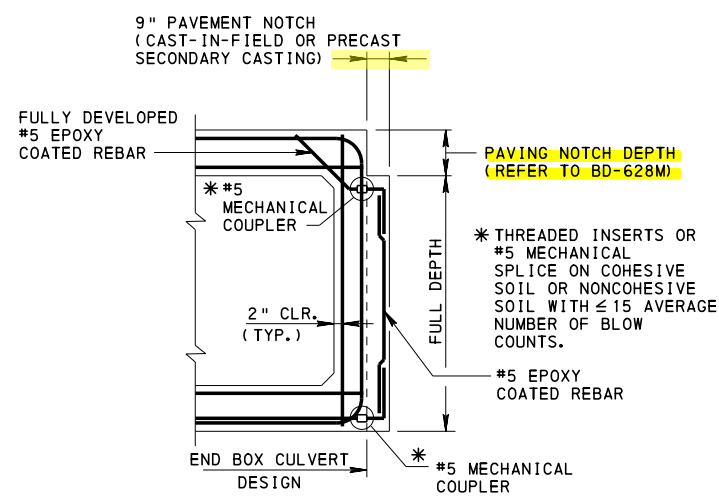
(SLAB BRIDGES & LIKE STRUCTURES)

- CURB REINFORCEMENT SHOWN FOR CLARITY, SEE BD-609M.
- SEE RC-52M FOR TYPE 2 STRONG POST GUIDE RAIL DETAILS
- S7 REINFORCEMENT REQUIRED AT POST LOCATIONS ONLY. SEE SHEET 8 FOR SLAB REINFORCEMENT BAR DETAILS.



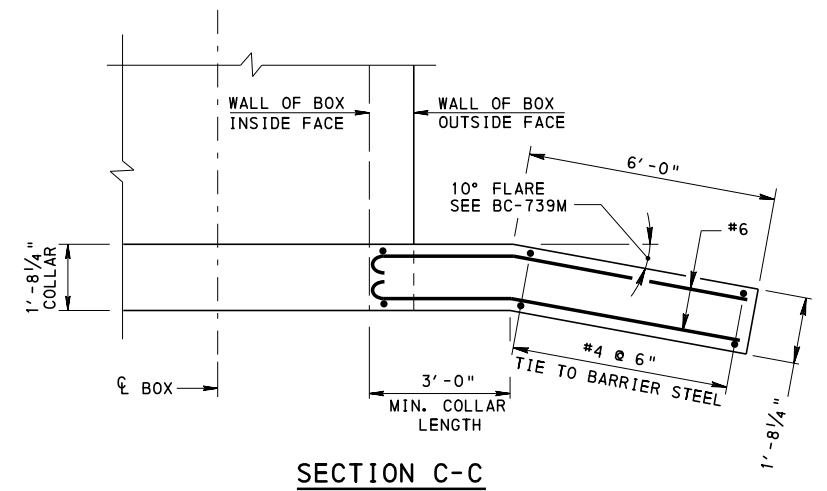
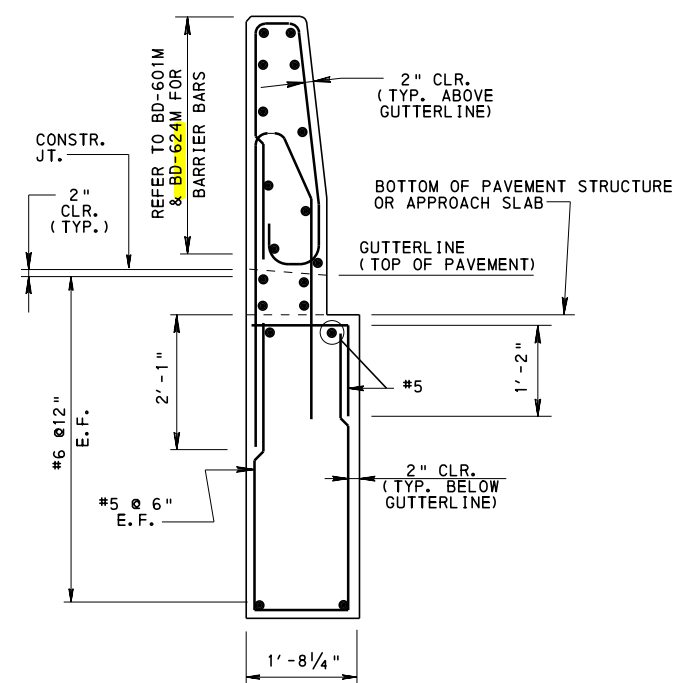
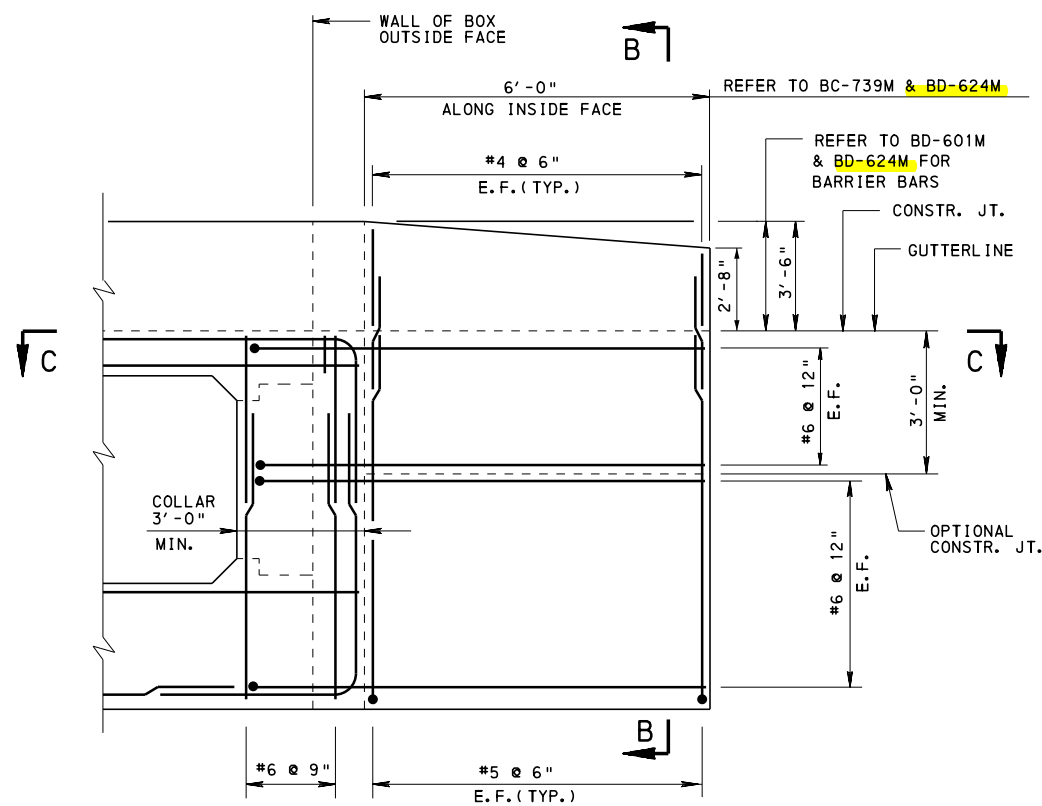
**SLAB TO CURB
REINFORCEMENT BAR DETAILS**

- LEGEND**
- ▲ SEE NOTE 12, SHEET 1.
- NOTES:**
1. 2 1/2\"
 2. SEE DETAIL B SHEET 1 FOR ALTERNATE DETAIL.
 3. SEE BD-601M FOR BARRIER REINFORCEMENT AND DIMENSION DETAILS.

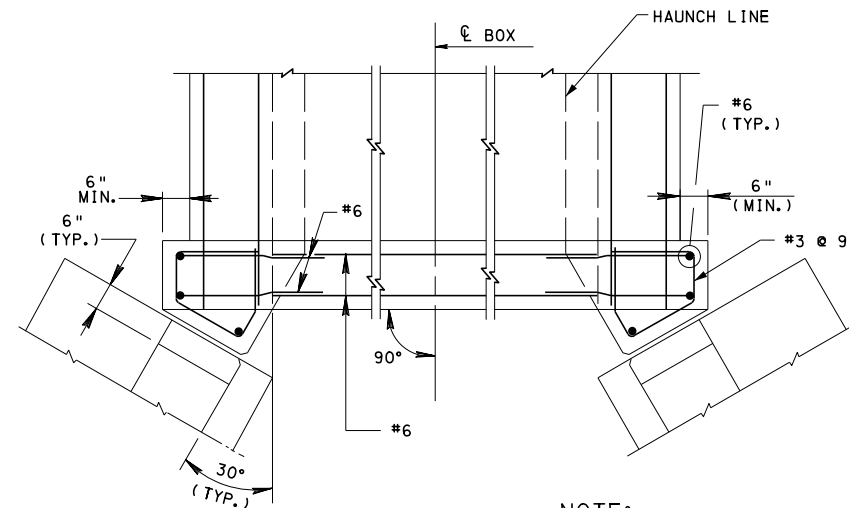
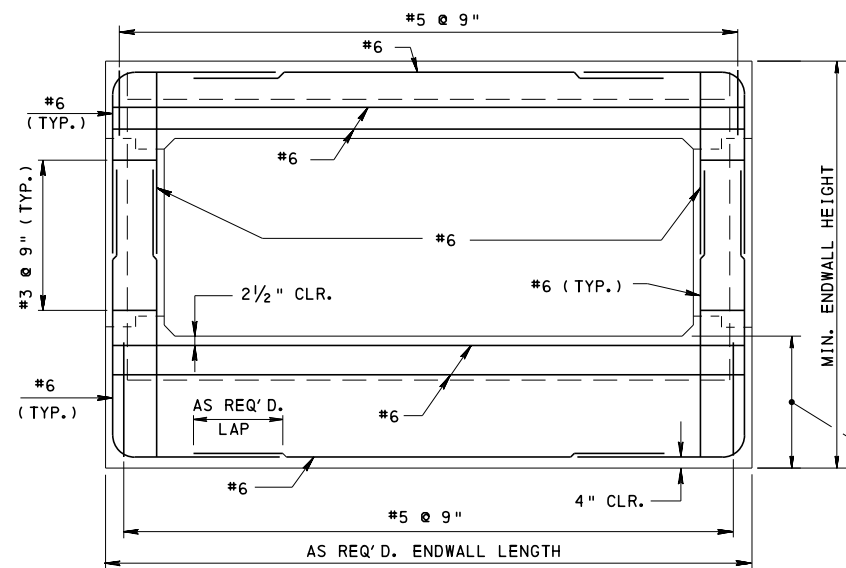


**PAVEMENT NOTCH DETAIL
AT GRADE WHEN APPROACH SLAB IS REQUIRED**

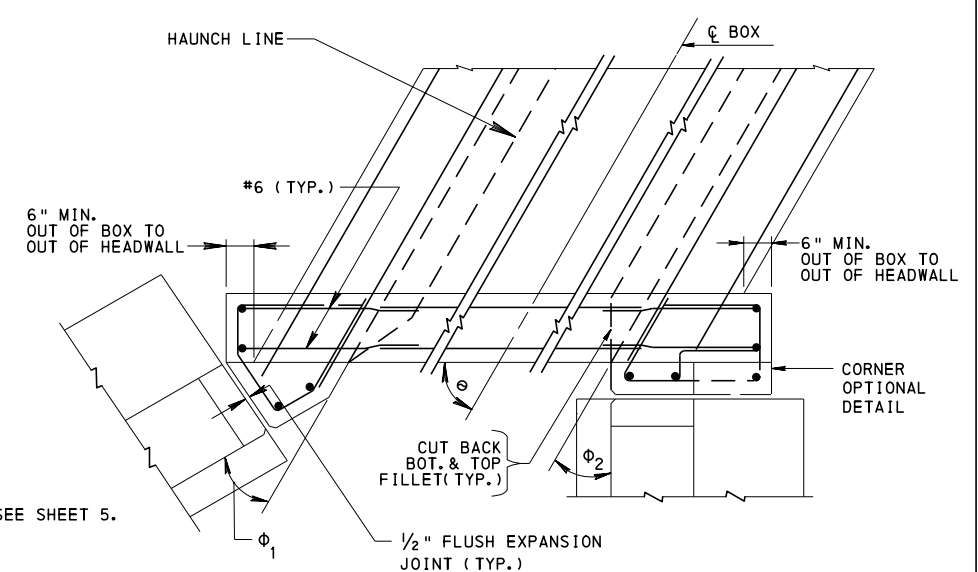
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD R.C. BOX CULVERT HEADWALL DETAILS CAST-IN-PLACE		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian Thompson</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 2 OF 13 BD-632M



NOTE: HOOKS ON BARS EXTENDING FROM BARRIER TRANSITION INTO THE BACKWALL MAY BE TURNED IN ANY DIRECTION.



NOTE: FOR TYPICAL WING DETAILS SEE SHEET 5.



LEGEND:

- Θ SKEW ANGLE
- $\phi_1 = 30^\circ$ FOR $\Theta \geq 60^\circ$
- $\phi_1 = \frac{\Theta}{2}$ FOR $\Theta < 60^\circ$
- $\phi_2 = 30^\circ$ FOR $\Theta \geq 60^\circ$
- $\phi_2 = 90^\circ - \Theta$ FOR $\Theta < 60^\circ$

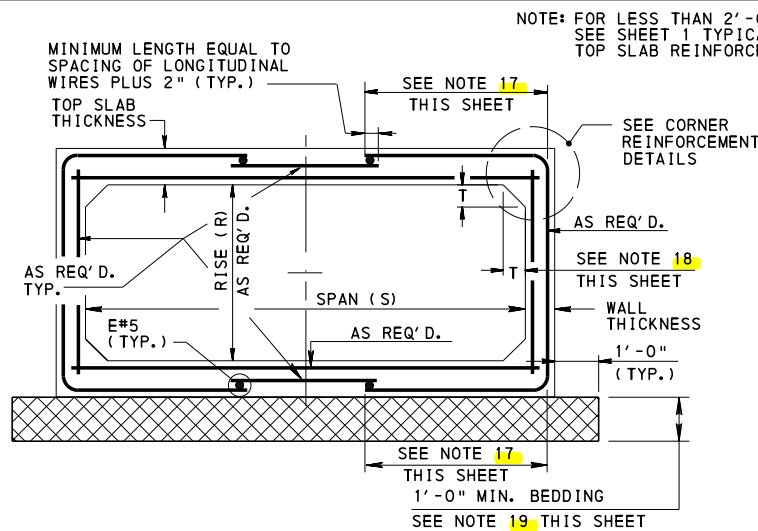
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
R. C. BOX CULVERT
CAST-IN-PLACE

RECOMMENDED NOV. 21, 2014
THOMAS P. MACIORE
CHIEF BRIDGE ENGINEER

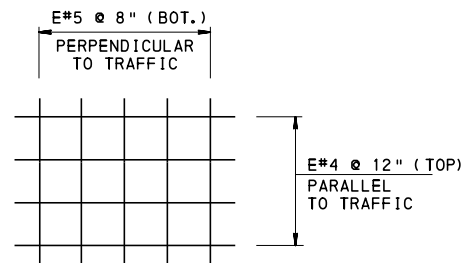
RECOMMENDED NOV. 21, 2014
BRIAN D. THOMPSON
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHEET 3 OF 13
BD-632M

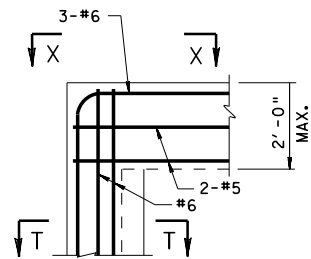


BOX DETAILS - WELDED WIRE FABRIC

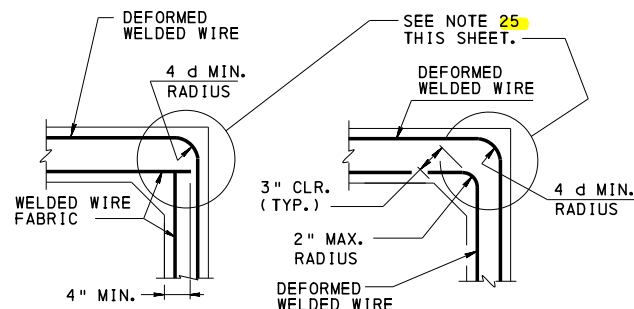
(FOR 2'-0" OR MORE OF COVER)
SEE BC-798M FOR POST TENSION STRAND DETAILS
NO SCALE



TYPICAL DECK REINFORCEMENT



COLLAR CORNER DETAILS



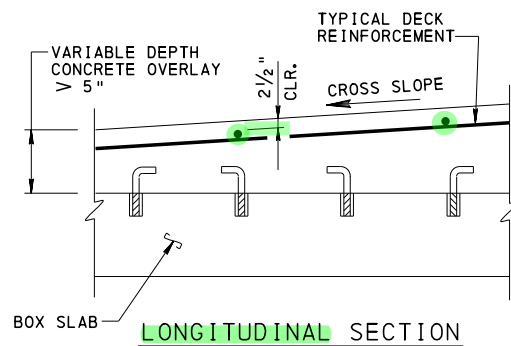
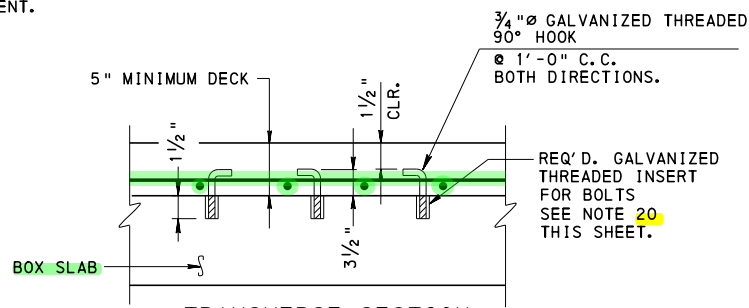
DETAIL OPTION

CORNER REINFORCEMENT DETAILS

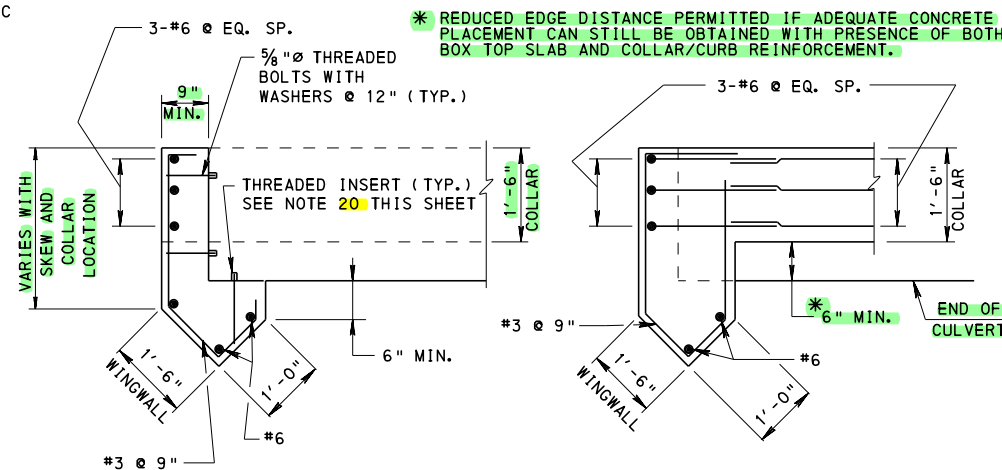
WELDED WIRE FABRIC

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.



DECK CONNECTION DETAILS



SECTION T-T

SECTION X-X

DESIGN DATA:

- $f'c = 5000$ P.S.I. MINIMUM FOR CONCRETE
- $f_y = 60,000$ P.S.I. FOR STEEL REINFORCING BARS
- $f_y = 65,000$ P.S.I. FOR WELDED WIRE FABRIC (IN FLAT SHEET)

INSTRUCTIONS:

- MINIMUM WALL THICKNESS = $S/12$ FOR $S = 8'$ TO $12'$; **13"** FOR $S > 12'$
- MINIMUM SLAB THICKNESS = $S/12$ FOR $S = 8'$ TO $12'$; **13"** FOR $S > 12'$
- MINIMUM COVER FOR WELDED WIRE FABRIC :
 - PROVIDE $1\frac{1}{2}"$, EXCEPT 2" FOR THE TOP WIRES OF THE TOP SLAB WHERE BOX FILL HEIGHT IS LESS THAN 2'-0".
 - USE $\frac{1}{2}"$ 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 $1\frac{1}{2}"$ FOR ALL OTHER BARS, EXCEPT USE $2\frac{1}{2}"$ 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".

NOTES

- PROVIDE GRADE 60 DEFORMED REINFORCING BARS THAT MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706. DO NOT WELD REINFORCEMENT STEEL. DO NOT USE RAIL STEEL (A 996) WHERE BENDING OR WELDING OF REINFORCEMENT BARS IS INDICATED.
- WELDED WIRE FABRIC WILL MEET THE REQUIREMENTS OF AASHTO M55 ASTM (A185), AND DEFORMED WELDED WIRE FABRIC WILL MEET THE REQUIREMENTS OF AASHTO M221 ASTM (A497).
- 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 A 884, TYPE I, CLASS A.
- 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.
- DEAD LOADS: INCLUDE A WEIGHT OF 30 P.S.F. FOR FUTURE WEARING SURFACE FOR BOXES AT GRADE.
- PROVIDE MINIMUM LAP AND EMBEDMENT LENGTH OF REINFORCEMENT IN ACCORDANCE WITH LRFD SPECIFICATIONS: SEE BC-736M.
- PROVIDE 2" CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED IN INSTRUCTIONS BELOW.
- FOR HYDRAULIC DESIGN REFER TO DESIGN MANUAL, PART 2.
- FOR LOW FLOW FISH PASSAGE DESIGN REFER TO DESIGN MANUAL, PART 2, AND SEE SHEETS 13 AND 14.
- INDICATE ALLOWABLE AND MAXIMUM DESIGN FOUNDATION PRESSURE ON PLANS.
- PLACE HEADWALL AND WINGWALL FOOTINGS BELOW FROST DEPTH OR 3'-6" MINIMUM, WHICH EVER IS GREATER.
- PROVIDE 2'-0" MIN. WIDTH OF WATERPROOFING MEMBRANE AS PER PUB. 408, SECTION 680.2(a) OR 680.2(b) ALONG THE TOP AND SIDE JOINTS. FOR ADDITIONAL DETAILS REFER TO BC-788M.
- USE 4" Ø 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 $\frac{1}{2}"$. DO NOT CUT REINFORCEMENT BARS. NO ADDITIONAL 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.
- PRECAST BOX CULVERTS AT GRADE (I.E. $\leq 2'-0"$ 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 SHT.) FOR DETAILS. FOR ADT ≤ 750 AND A.D.T.T. ≤ 25 , A BITUMINOUS OVERLAY MAY BE UTILIZED IN LIEU OF A CONCRETE DECK.
- DESIGN PRECAST REINFORCED CONCRETE BOXES TO HAVE OPENINGS IN 6" INCREMENTS WITH MINIMUM RISE OF 3'-0".
- REQUIRED DIMENSION FOR BAR LENGTH IS THE TOTAL OF THE THEORETICAL CUT-OFF LENGTH PLUS THE REQUIRED ANCHORAGE.
- 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".
- INDICATES ADDITIONAL EXCAVATION FOR BEDDING MATERIAL BELOW THE BOTTOM OF PRECAST R.C. BOX CULVERT WITH LIMITS AS SHOWN. BACKFILL SPACE WITH 2A OR #8 COARSE AGGREGATE.
- THREADED INSERTS TO BE INCORPORATED IN PRECAST BOX BY THE FABRICATOR, SEE SPECIAL PROVISIONS.
- CONCRETE HEADWALL REINFORCEMENT WILL REQUIRE A SEPARATE DESIGN IF HEIGHT IS GREATER THAN 2'-0".
- IF APPROACH ROADWAY UTILIZES CURB, ADJUST DIMENSION TO MATCH CURB HEIGHT.
- 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.
- 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.
- 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 7 AND 9.
- 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.
- 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.
- SPECIFY 4'-0" MINIMUM SEGMENT LENGTH ON THE CONTRACT DRAWINGS.

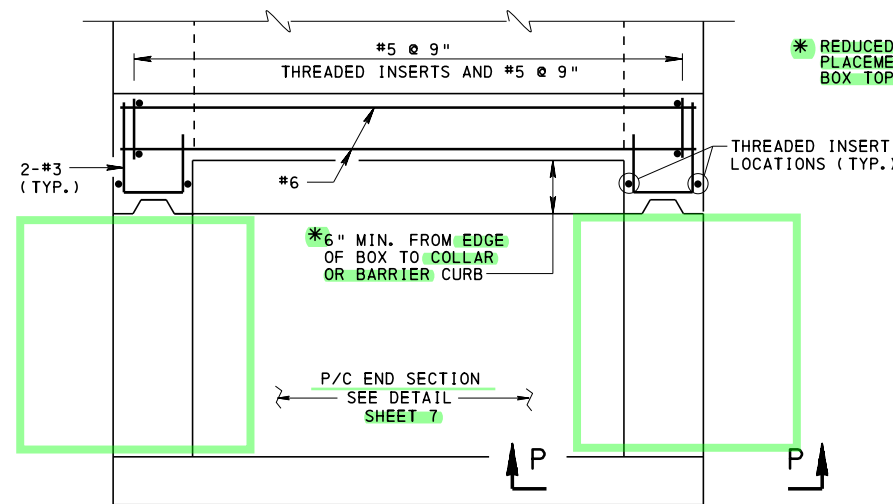
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

STANDARD R.C. BOX CULVERT PRECAST

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

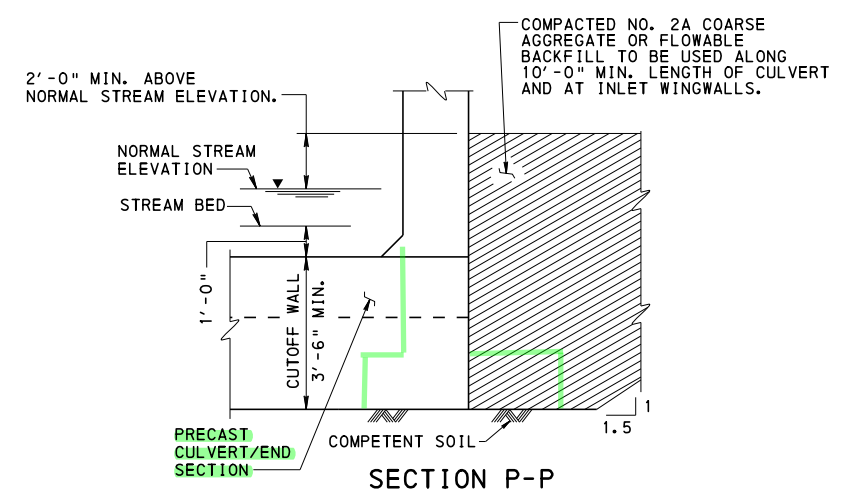
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHEET 4 OF 13
BD-632M



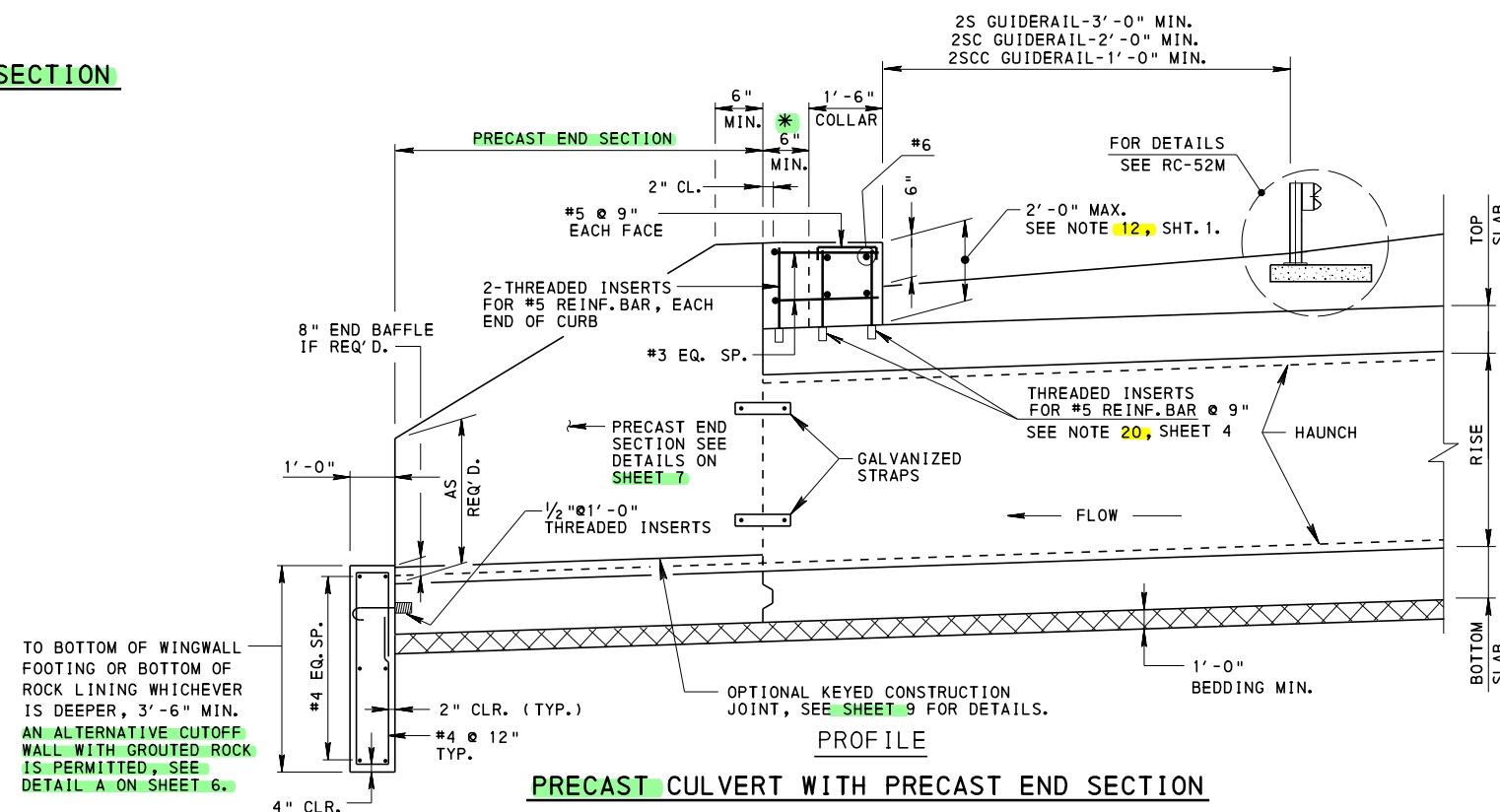
PLAN
PRECAST END SECTION

* REDUCED EDGE DISTANCE PERMITTED IF ADEQUATE CONCRETE PLACEMENT CAN STILL BE OBTAINED WITH PRESENCE OF BOTH BOX TOP SLAB AND COLLAR/CURB REINFORCEMENT.

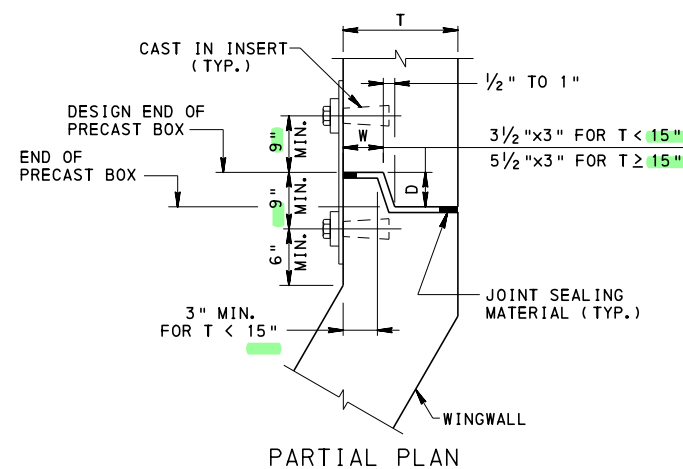


NOTE:
DESIGNER TO MODIFY AMOUNT OF COMPACTED NO. 2A COARSE AGGREGATE OR FLOWABLE BACKFILL TO PROVIDE ADEQUATE PROTECTION AGAINST PIPING OF STREAM FLOW THROUGH FILL AT INLET END OF CULVERT.

- NOTES:
- SEE NOTE 24, SHEET 4.
 - FOR ROCK PROTECTION SEE "CULVERT WITH CAST IN PLACE WINGWALLS" DETAIL, ON SHT. 6.
 - FOR PRECAST END SECTION CONNECTION SEE BC-798M FOR GALVANIZED STRAP CONNECTION DETAIL.
 - POST TENSION BOTTOM SLAB OF END SECTION PRIOR TO INSTALLATION OF CUTOFF WALL.

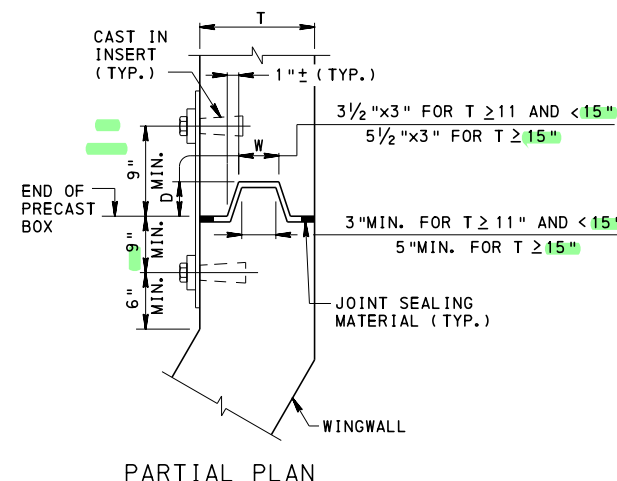


PROFILE
PRECAST CULVERT WITH PRECAST END SECTION



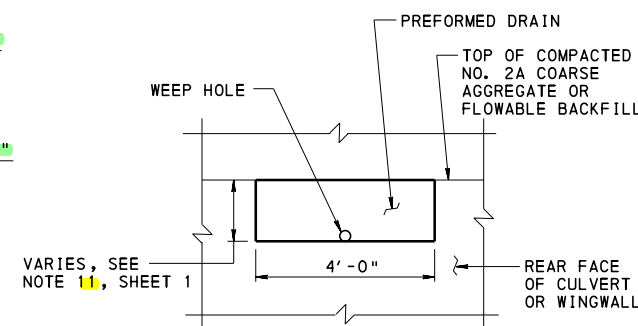
PARTIAL PLAN
SHIP LAP JOINT
DISCONTINUOUS IF POST TENSIONING IS REQUIRED

PRECAST WINGWALL CONNECTION DETAILS



PARTIAL PLAN
KEYED JOINT
DISCONTINUOUS IF POST TENSIONING IS REQUIRED

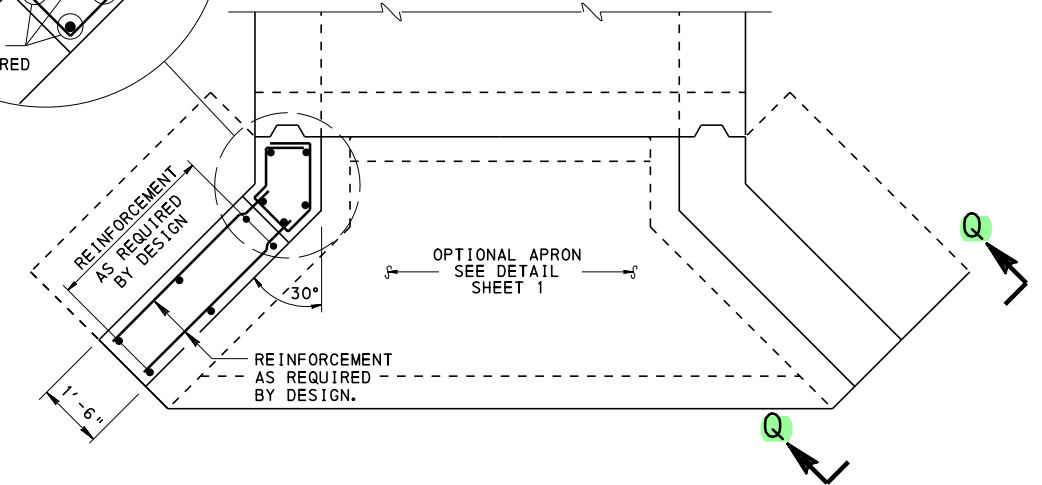
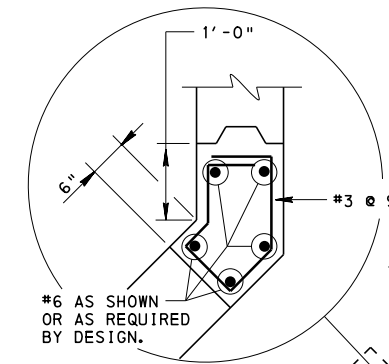
- NOTES:
1. NO BOLT THROUGH CONNECTIONS CAN BE USED.
 2. EITHER SHIP LAP OR KEYWAY JOINTS CAN BE USED. NO FLUSH BUTT JOINTS.
 3. ONE (1) ROW OF JOINT SEALING FLEXIBLE FOAM MATERIAL EACH FACE.
 4. FOR T < 11", USE SHIP LAP DETAIL.



PREFORMED DRAIN DETAIL

CULVERT WITH CAST IN PLACE WINGWALLS moved to next sheet

AN ALTERNATIVE CUTOFF WALL
WITH GROUTED ROCK IS PERMITTED,
SEE DETAIL B THIS SHEET.

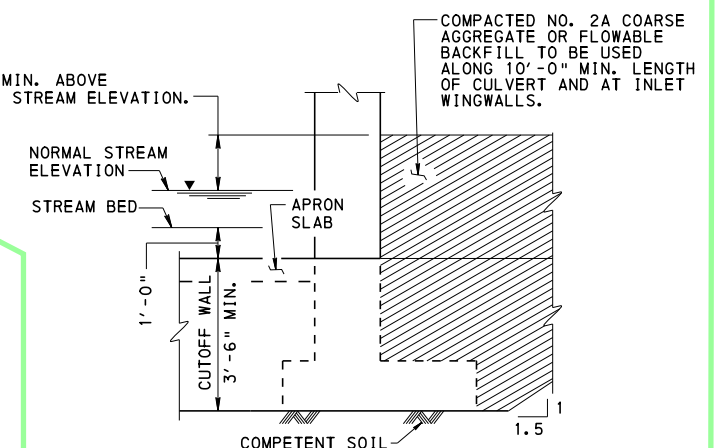


1'-0" CUTOFF WALL TYP. EACH END
TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF
ROCK LINING WHICHEVER IS DEEPER 3'-6" MIN.
(SEE NOTE 12 ON SHEET 4).

PRECAST CULVERT WITH CAST IN PLACE WINGWALLS

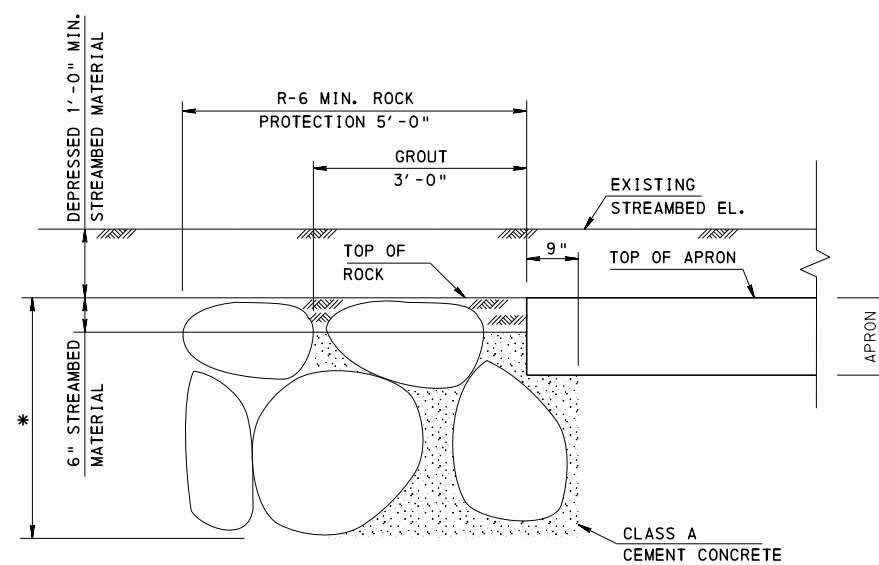
PLAN

2'-0" MIN. ABOVE
NORMAL STREAM ELEVATION.



SECTION Q-Q

NOTE:
DESIGNER TO MODIFY AMOUNT OF COMPACTED NO. 2A
COARSE AGGREGATE OR FLOWABLE BACKFILL TO PROVIDE
ADEQUATE PROTECTION AGAINST PIPING OF STREAM
FLOW THROUGH FILL AT INLET END OF CULVERT.



DETAIL B (WITH APRON)

* TO BOTTOM OF WINGWALL FOOTING OR BOTTOM OF ROCK LINING WHICH EVER IS DEEPER (3'-6" MIN.). FILL VOIDS IN ROCK WITH VIBRATED CLASS A CEMENT CONCRETE 6" BELOW STREAMBED TO BOTTOM OF ROCK. FILL TOP 6" OF ROCK WITH NATURAL STREAMBED MATERIAL

ALTERNATIVE CUTOFF WALL WITH GROUTED ROCK

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DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

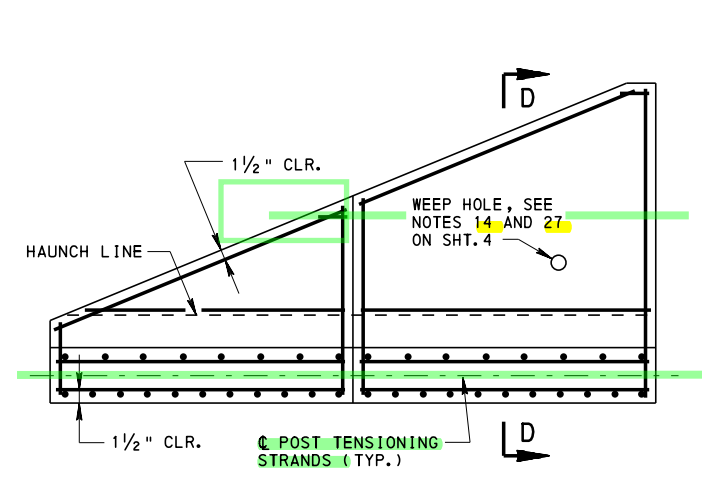
STANDARD
R. C. BOX CULVERT
PRECAST

RECOMMENDED NOV. 21, 2014
Thomas P. Macioce
 CHIEF BRIDGE ENGINEER

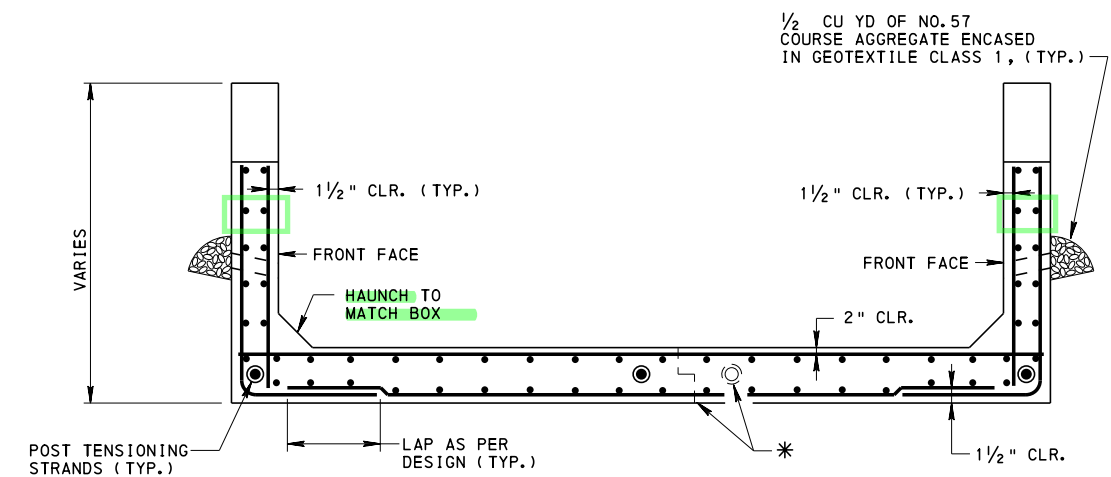
RECOMMENDED NOV. 21, 2014
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SHEET 6 OF 13

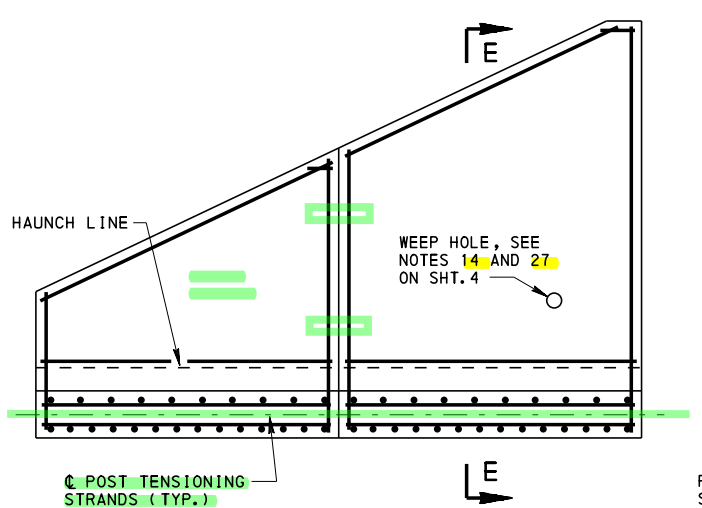
BD-632M



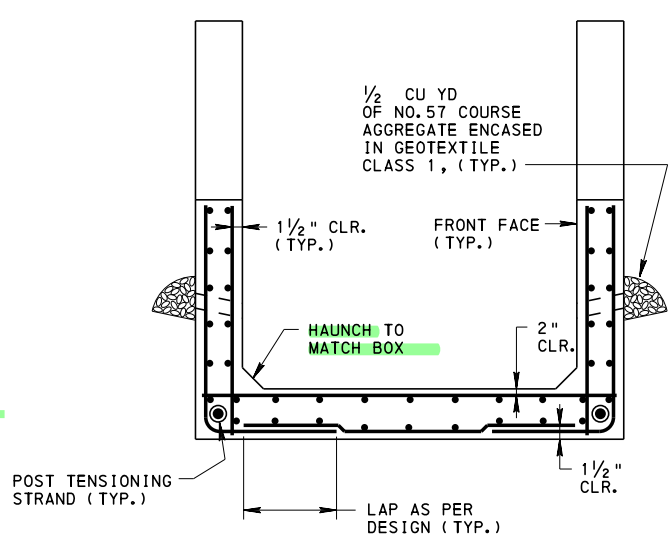
POST-TENSION END SECTION
SPAN > 12 FEET



SECTION D-D
* SPECIFY JOINT AND ADDITIONAL END SECTION POST TENSION STRAND IF WIDTH IS RESTRICTED DUE TO SHIPPING RESTRAINTS.



POST-TENSION END SECTION
SPAN ≤ 12 FEET



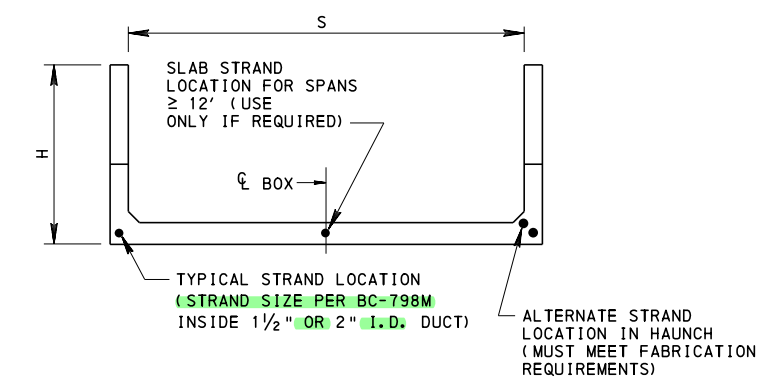
SECTION E-E

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.
4. 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.
5. PRECAST CONCRETE SEGMENT LENGTH TO BE DETERMINED BY THE FABRICATOR.
6. STAGING, SPACING AND POST-TENSION FORCE TO BE SHOWN ON FABRICATOR'S SHOP DRAWINGS.
7. 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.
8. WALL REINFORCEMENT CAN BE ADJUSTED TO ACCOMMODATE WEEPHOLE. DO NOT CUT REINFORCEMENT.

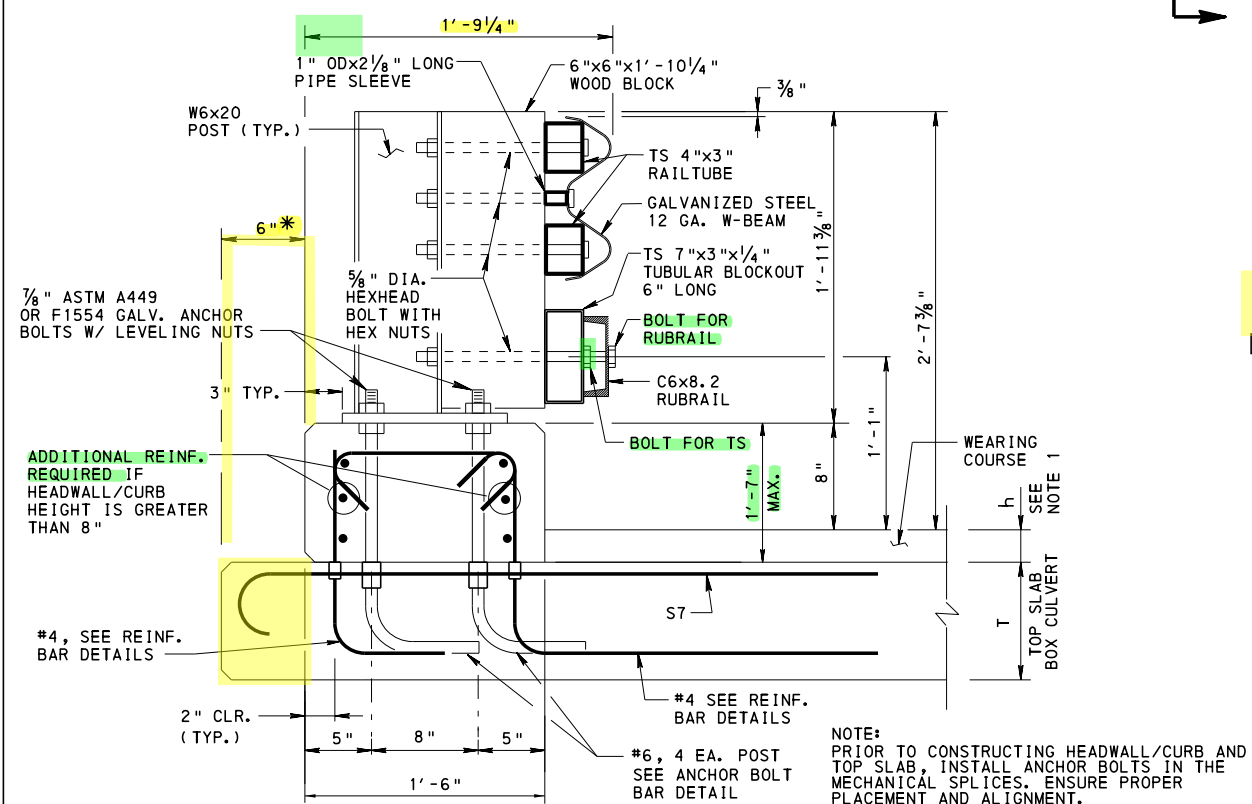
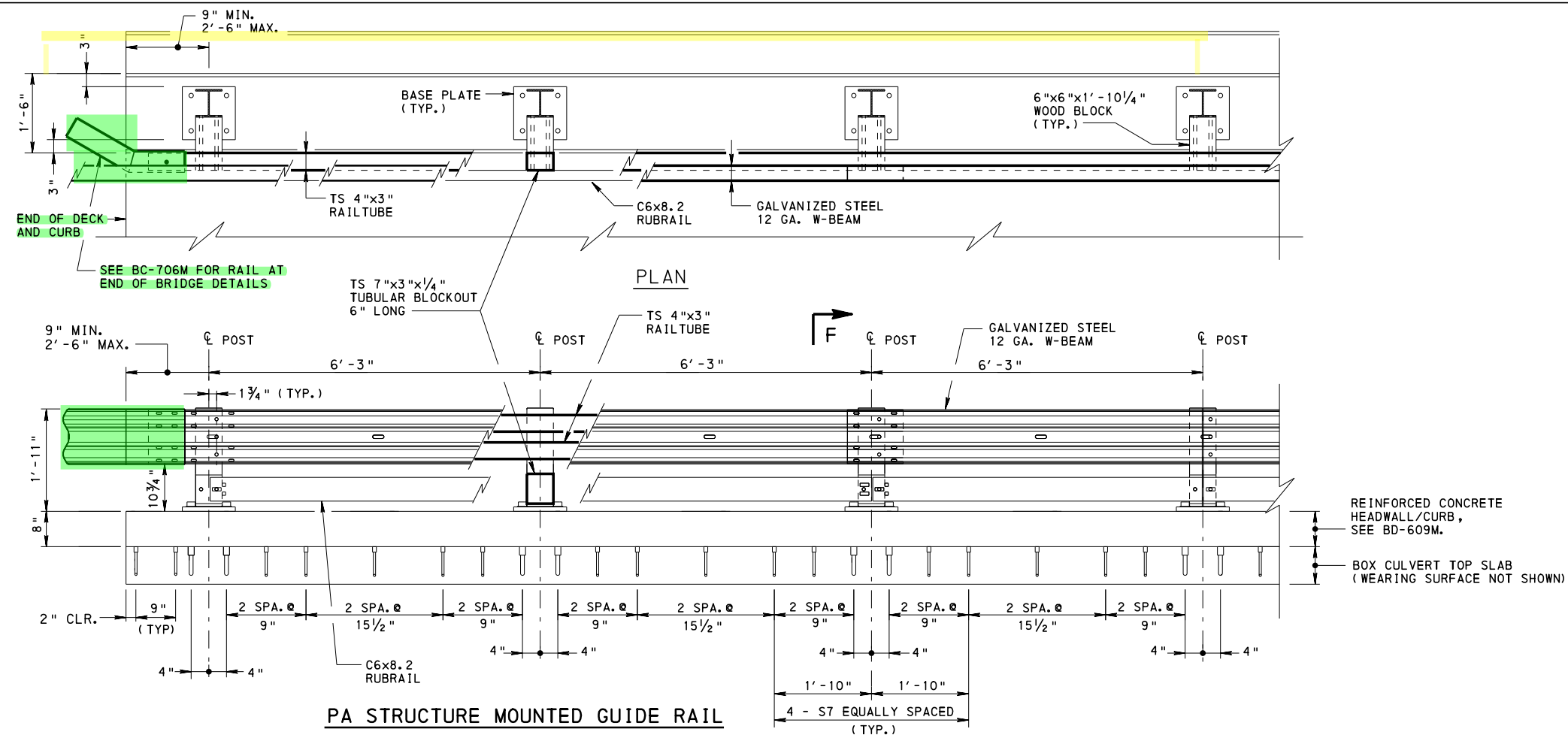
GENERAL NOTES:

1. EPOXY COAT REINFORCEMENT AS PER R.C. BOX CULVERT DESIGN.
2. REBAR SHOWN IS FOR ORIENTATION ONLY, REBAR SIZE AND SPACING AS PER DESIGN.

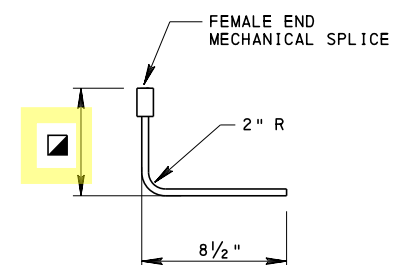
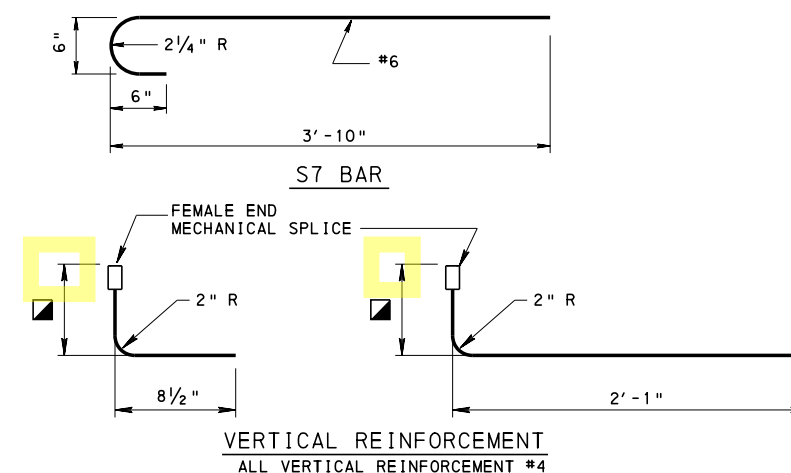


TYP. BOX END SECTION
SHOWING STRAND LOCATIONS

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STANDARD R.C. BOX CULVERT PRECAST POST-TENSIONED END SECTIONS		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR, BUR. OF PROJECT DELIVERY	SHEET 7 OF 13 BD-632M



- CURB REINFORCEMENT SHOWN FOR CLARITY, SEE BD-609M.
- SEE RC-52M FOR TYPE 2 STRONG POST GUIDE RAIL DETAILS
- S7 REINFORCEMENT REQUIRED AT POST LOCATIONS ONLY.
SEE SLAB REINFORCEMENT BAR DETAILS THIS SHEET.



LEGEND

- FOR $T < 10'$: $T - 2'$
 FOR $T \geq 10'$: 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.

NOTE:

1. 2½ MIN., 11" MAX. TOTAL WEARING COURSE THICKNESS (h) (COMBINATION OF FILL OR 5" MIN. REINF. CONC. DECK AND OVERLAY)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

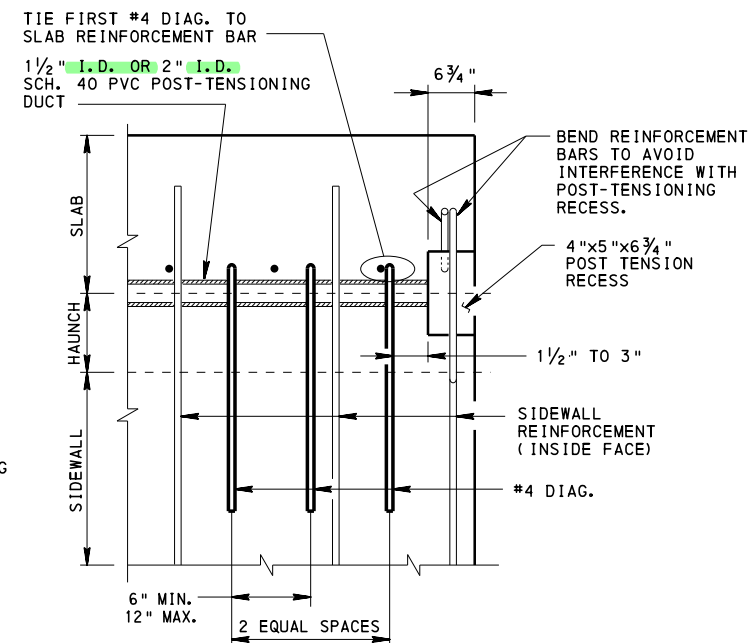
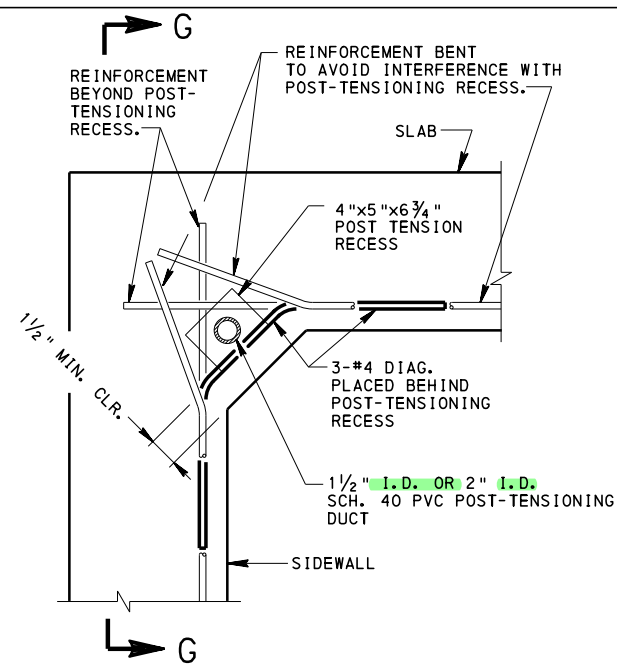
STANDARD
R. C. BOX CULVERT
HEADWALL DETAILS
PRECAST

RECOMMENDED NOV. 21, 2014
Thomas P. Macioce
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
 ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 8 OF 13

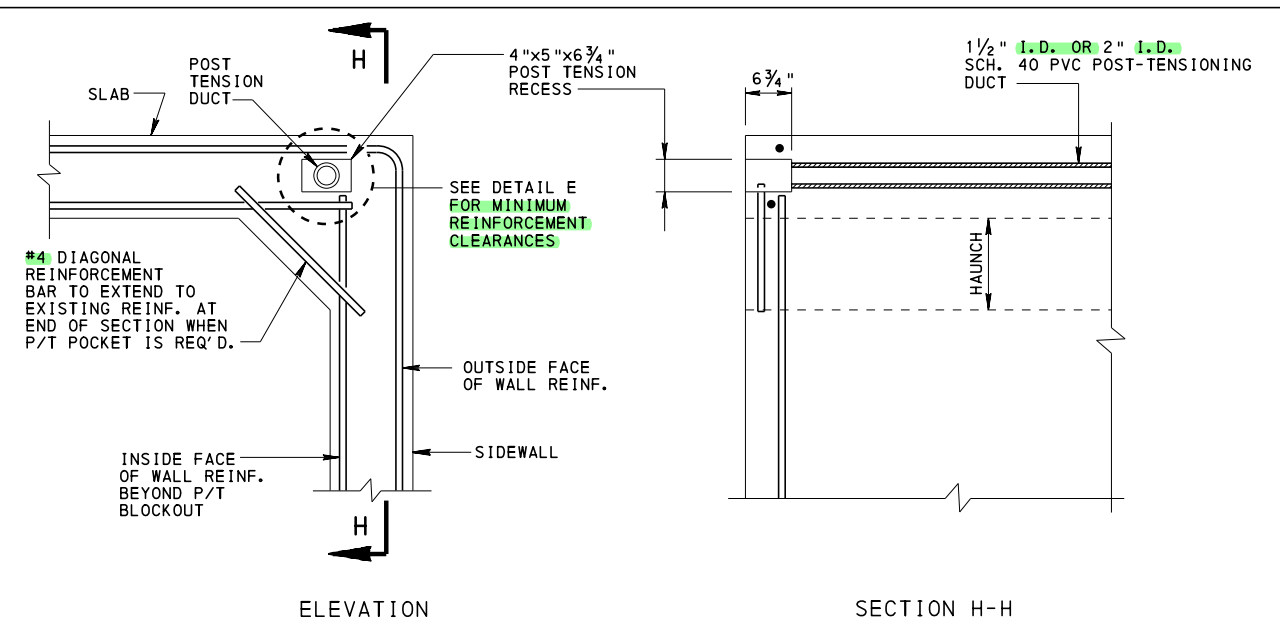
8D-632M



ELEVATION

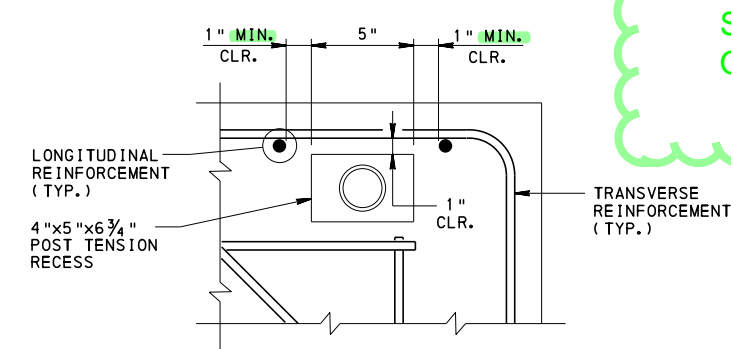
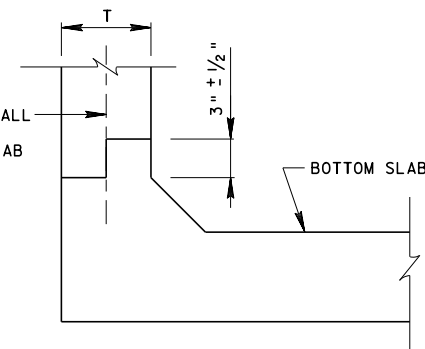
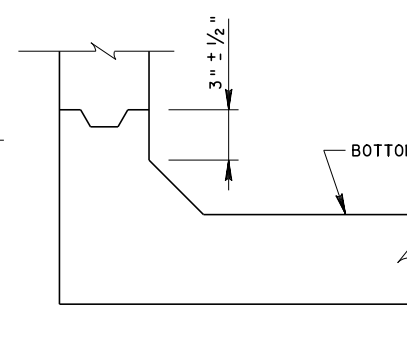
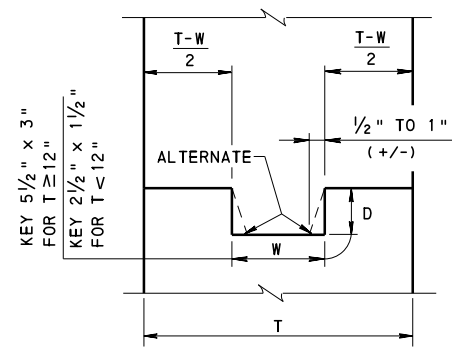
SECTION G-G

ALTERNATE HAUNCH SECTION DETAIL

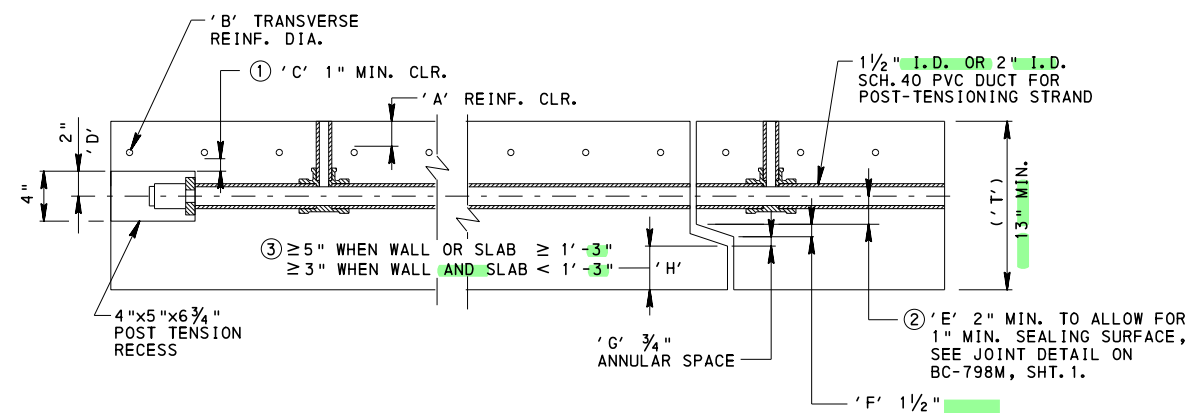


SECTION H-H

TYPICAL HAUNCH SECTION DETAIL



JOINT DETAIL REMOVED
SINCE ALREADY INCLUDED
ON BC-798M, SHT. 1



CONFIGURATION FOR SLAB/WALL WITH POST-TENSIONING

MIN. SLAB/WALL THICKNESS ('T')
DETERMINED TO ENSURE THE MIN.
REQUIREMENTS ① ② & ③ 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 $< 13"$.

DETAIL D MOVED
TO BC-798M, SHT. 1

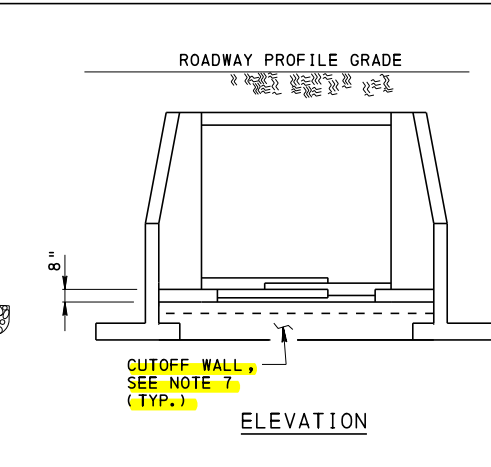
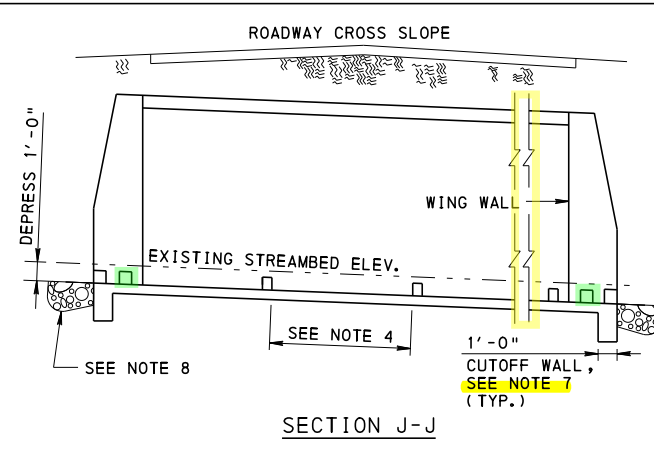
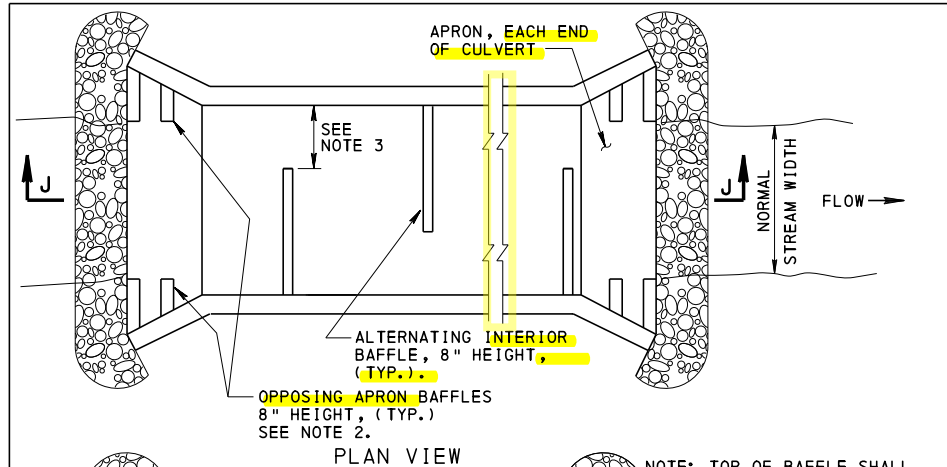
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
R. C. BOX CULVERT
MISCELLANEOUS DETAILS
PRECAST

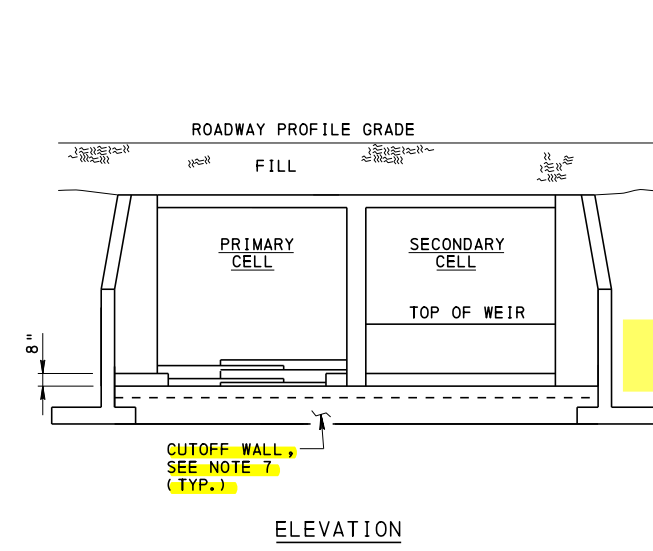
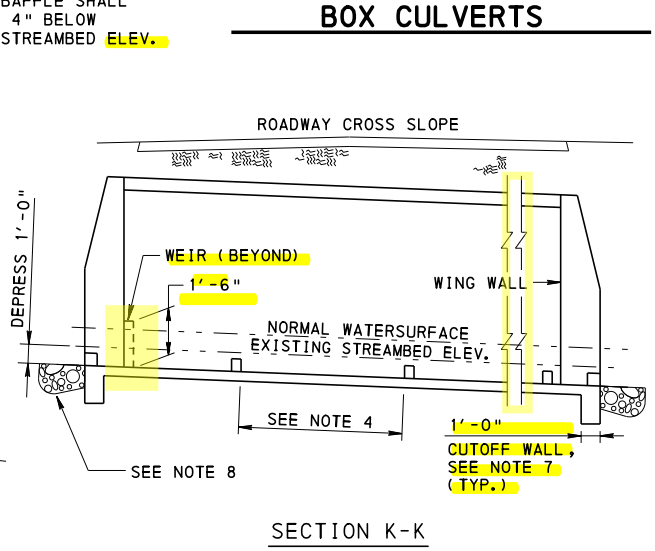
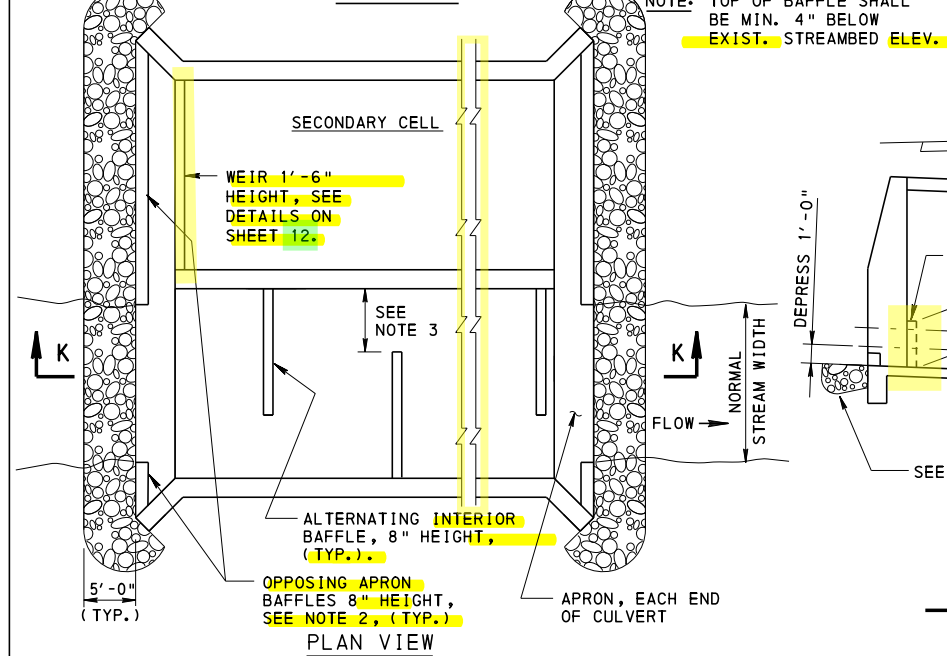
RECOMMENDED NOV. 21, 2014
Thomas P. Macioce
CHIEF BRIDGE ENGINEER

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Brenda Thompson
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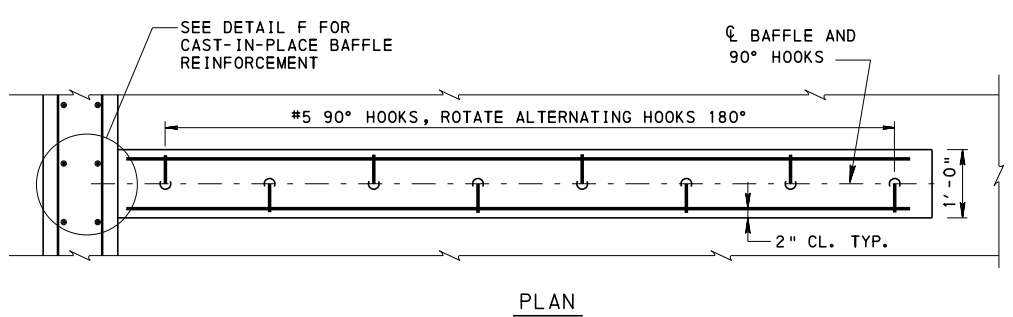
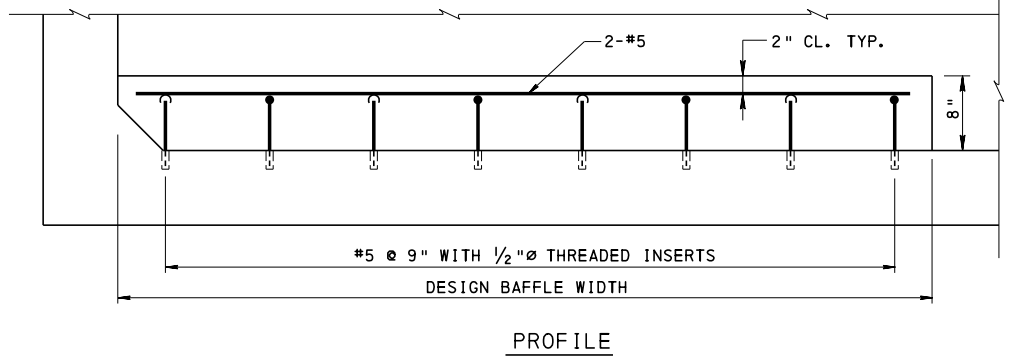
SHEET 9 OF 13



BOX CULVERTS

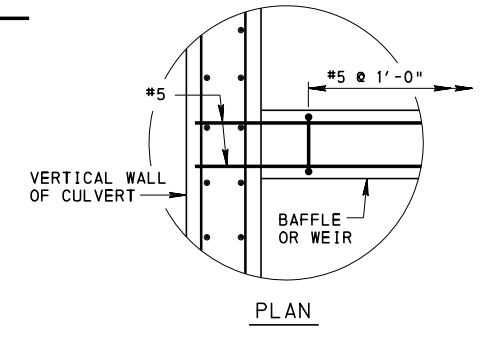


TWIN CELL BOX CULVERTS

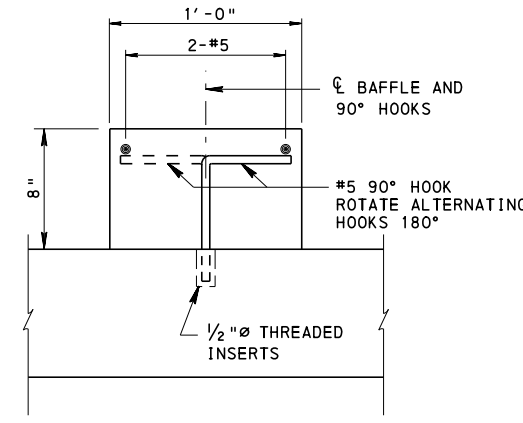


TYPICAL BAFFLE

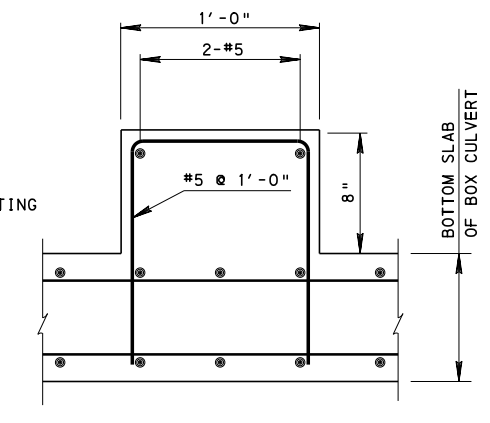
PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.



CAST-IN-PLACE BAFFLE/WEIR REINFORCEMENT



PRECAST BOX CULVERT TYPICAL BAFFLE DETAIL

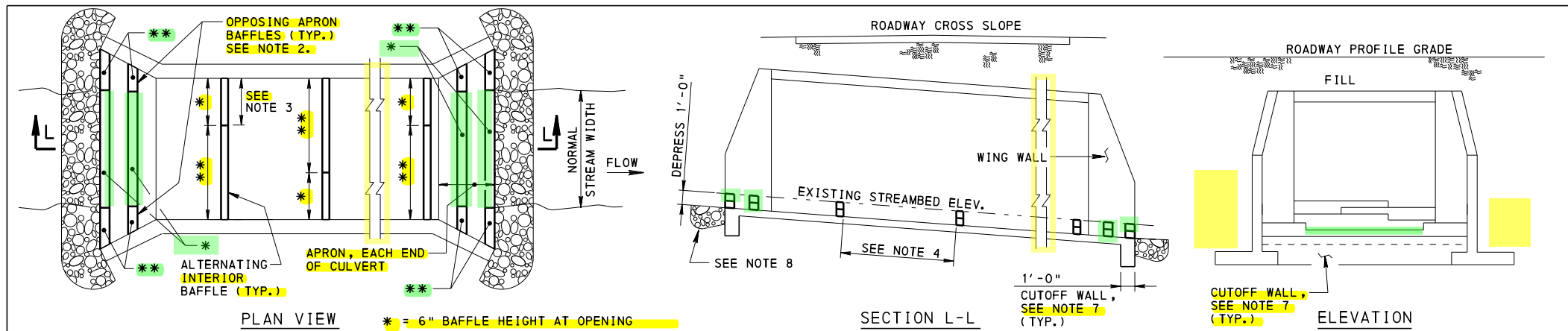


CAST-IN-PLACE BOX CULVERT ALTERNATE BAFFLE DETAIL

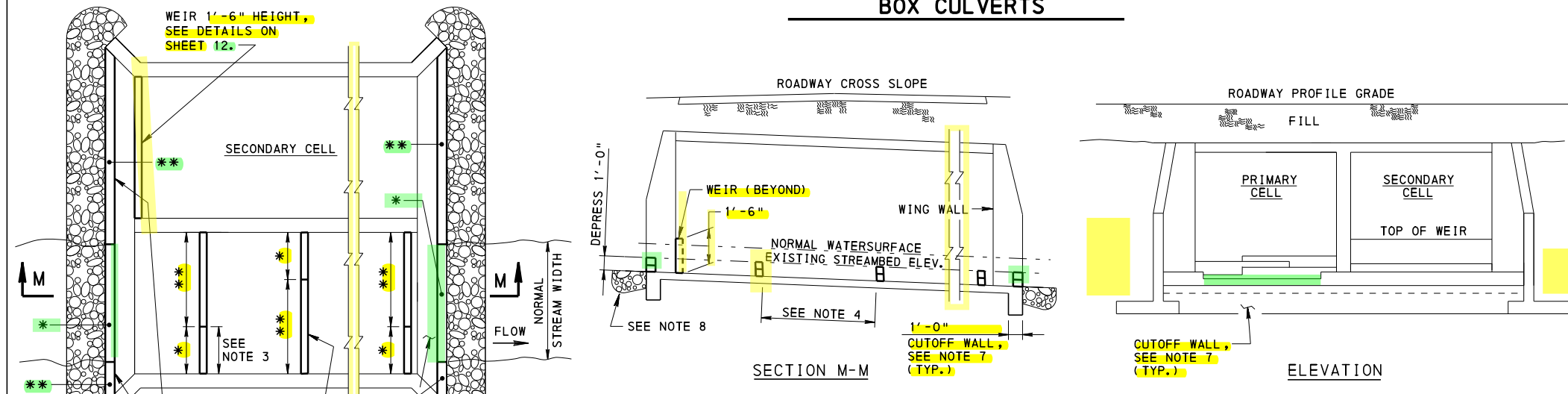
DESIGN NOTES:

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 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).
2. 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.
3. THE OPENING IN THE INTERIOR BAFFLES SHOULD BE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
4. 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.
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 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.
9. THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
10. ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 12.
11. BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.

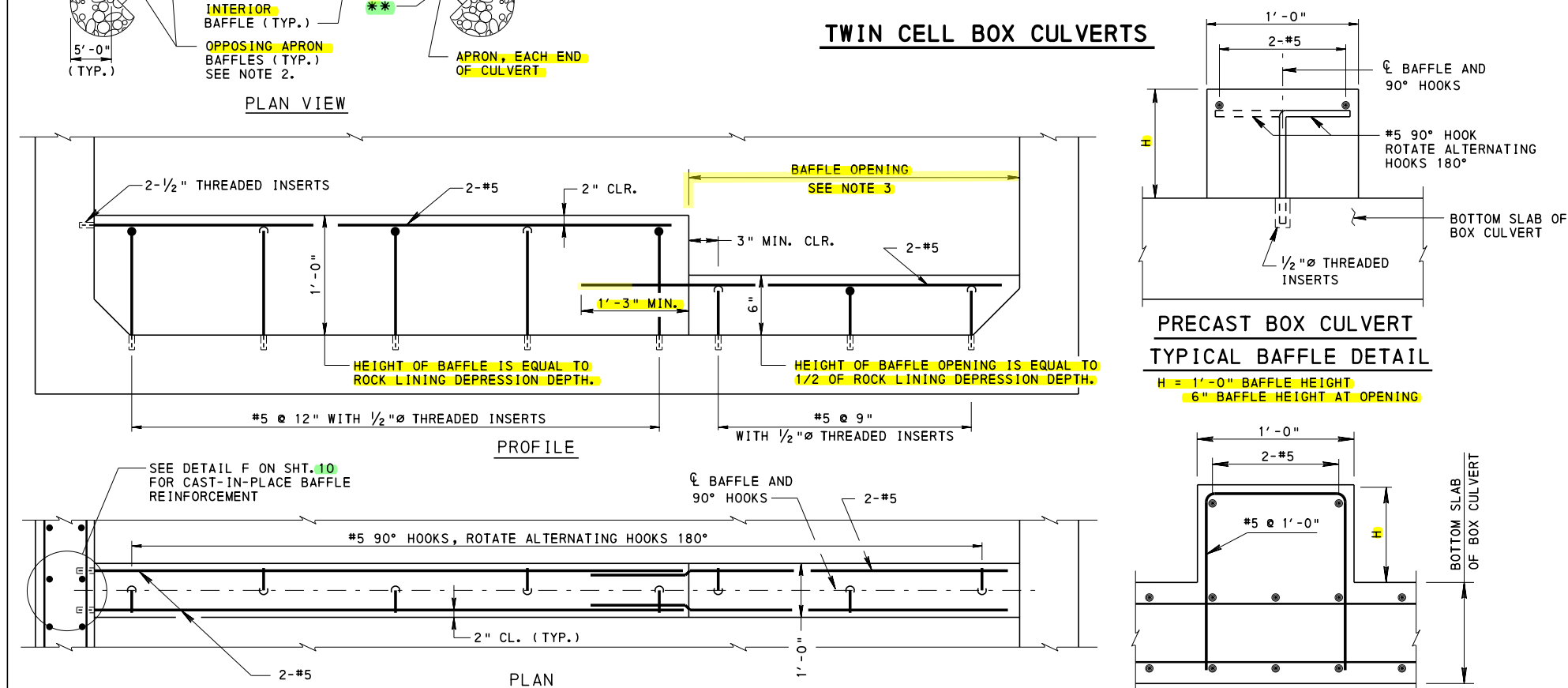
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD R.C. BOX CULVERT MISCELLANEOUS DETAILS STREAM GRADES ≤ 4%		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 10 OF 13 BD-632M



BOX CULVERTS



TWIN CELL BOX CULVERTS



TYPICAL INTERIOR BAFFLE

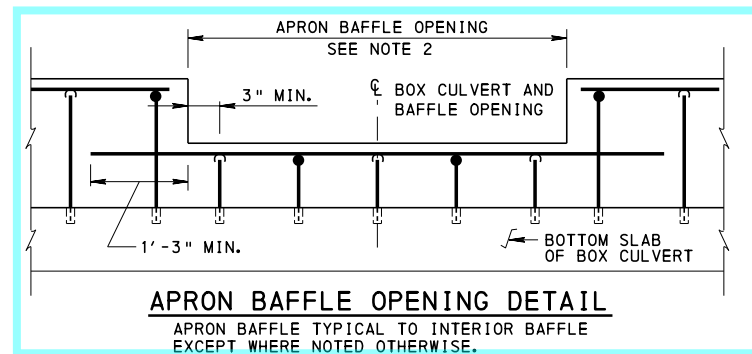
PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.

CAST-IN-PLACE BOX CULVERT

ALTERNATE BAFFLE DETAIL

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 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).
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3. THE OPENING IN THE INTERIOR BAFFLES SHOULD BE EQUAL TO 1/3 THE AVERAGE NORMAL WIDTH OF THE STREAM.
4. 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.
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 AND APRON TO THE MAXIMUM HEIGHT OF THE TOP OF THE BAFFLE TO THE LIMIT OF THE ROCK LINING TO FACILITATE THE DEVELOPMENT 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 12.
11. BAFFLES MAY BE SKEWED RELATIVE TO THE DIRECTION OF FLOW IN ORDER TO BE PARALLEL TO THE SECTION ENDS.



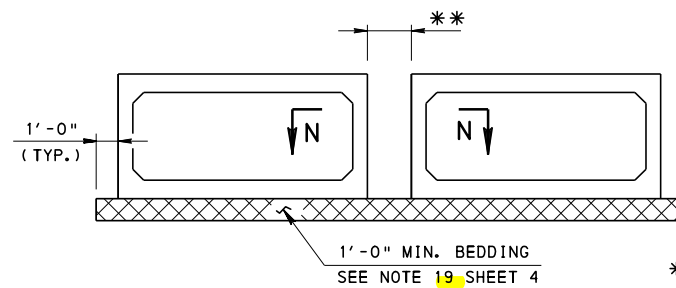
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
 BUREAU OF PROJECT DELIVERY

STANDARD
R.C. BOX CULVERT
MISCELLANEOUS DETAILS
STREAM GRADES > 4%

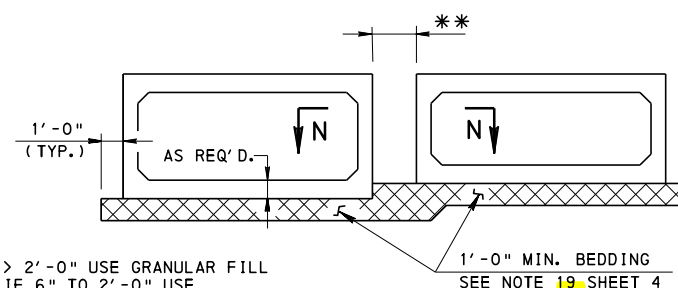
RECOMMENDED NOV. 21, 2014
 Thomas P. Maciore
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
 Bruce S. Thompson
 ACTING DIR. BUR. OF PROJECT DELIVERY

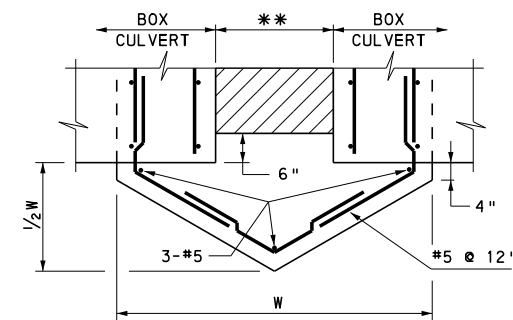
SHEET 11 OF 13
 BD-632M



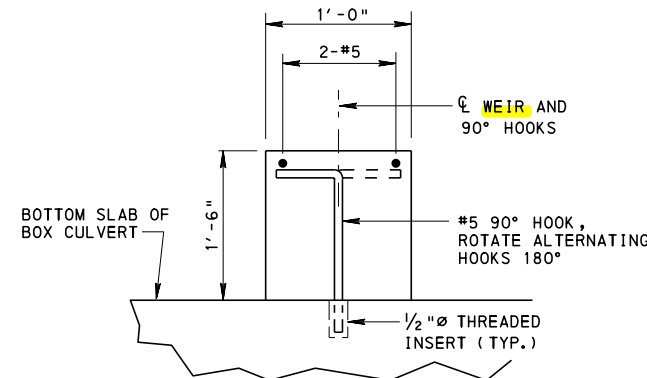
TYP. PRECAST SECTION (NORMAL)
SYMMETRICAL



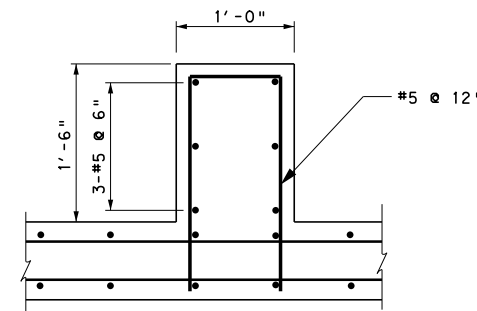
TYP. PRECAST SECTION (NORMAL)
UNSYMMETRICAL - OPTION TO WEIR



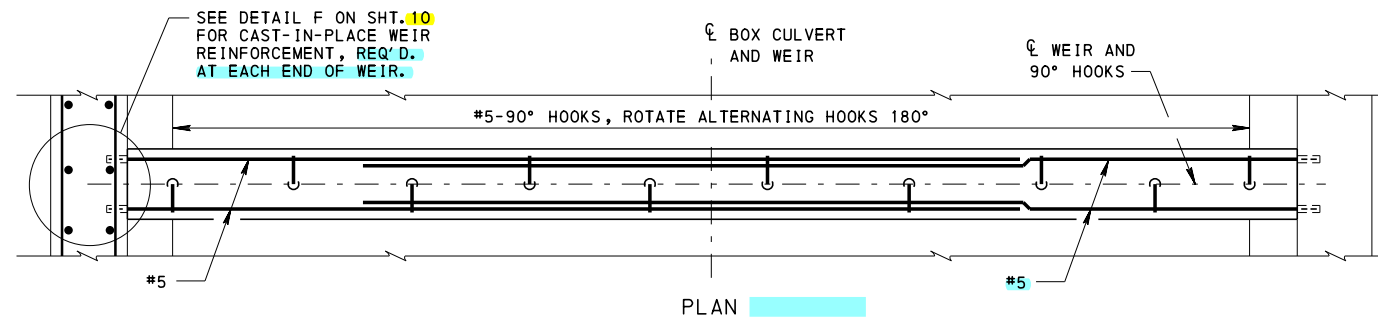
SECTION N-N
CONCRETE PLUG



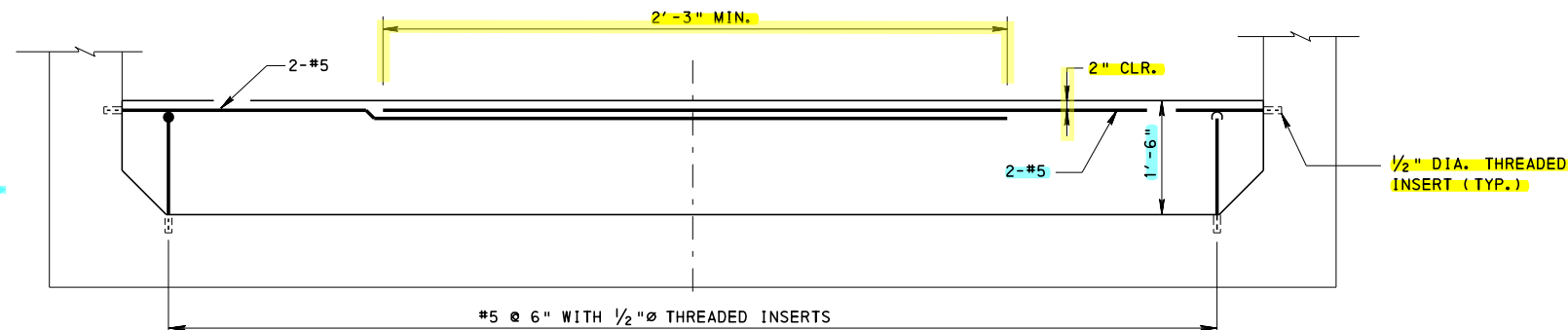
PRECAST BOX CULVERT
TYPICAL WEIR DETAIL
ALL STREAM GRADES



CAST-IN-PLACE BOX CULVERT
ALTERNATE WEIR DETAIL
ALL STREAM GRADES



PLAN



PROFILE

WEIR DETAIL

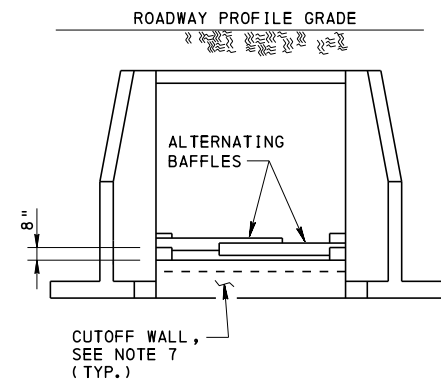
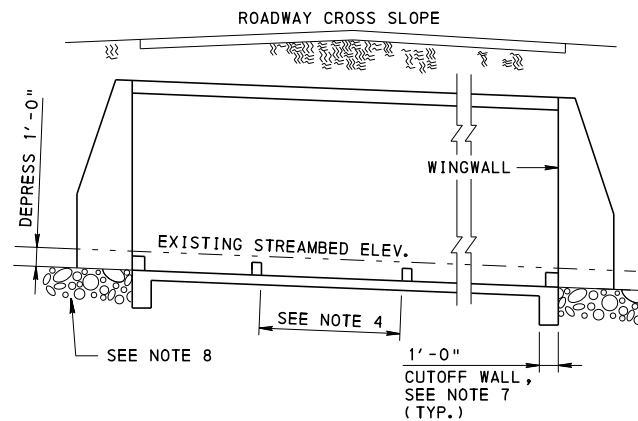
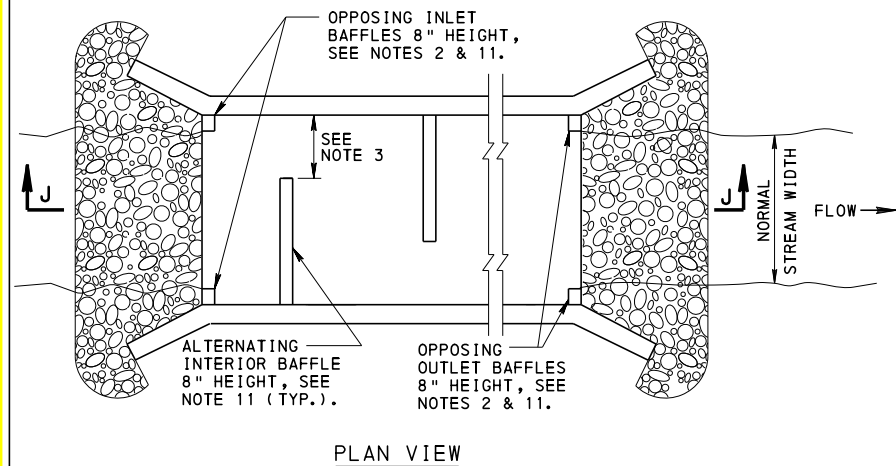
PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT
SIMILAR EXCEPT AS NOTED ON THIS STANDARD.

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 PROJECT DELIVERY

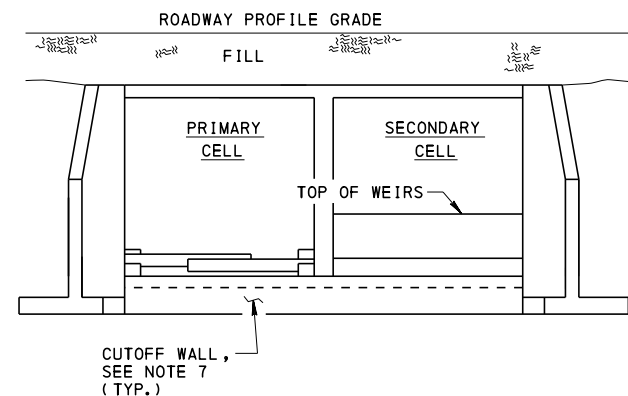
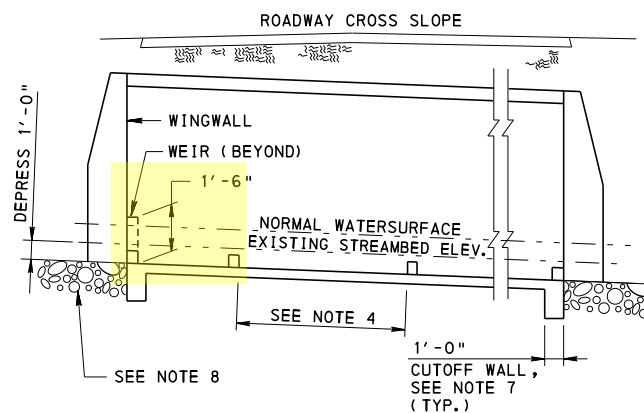
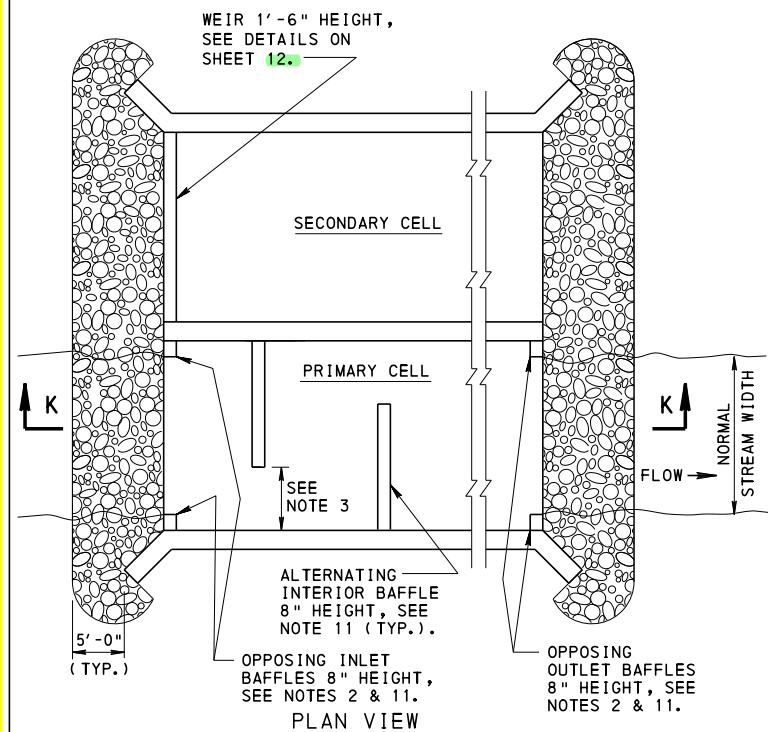
STANDARD
R.C. BOX CULVERT
MISCELLANEOUS TWIN CELL DETAILS

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 12 OF 13 BD-632M
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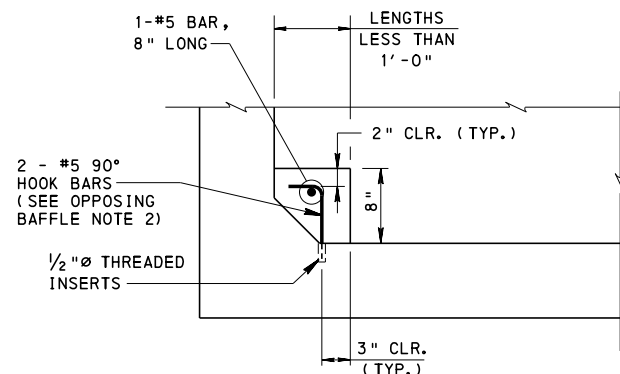


NOTE: TOP OF BAFFLE SHALL BE MIN. 4" BELOW EXIST. STREAMBED ELEV.

BOX CULVERTS



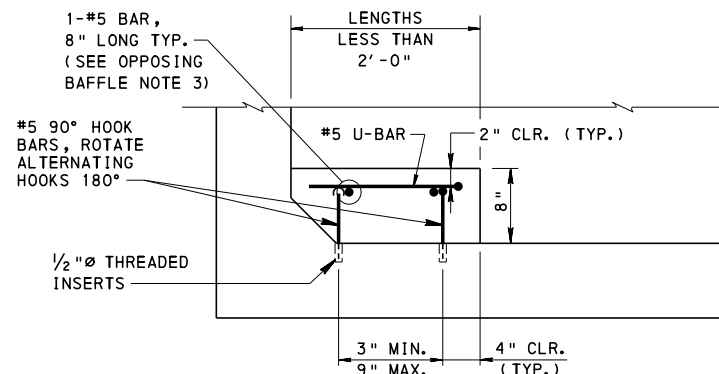
TWIN CELL BOX CULVERTS



OPPOSING BAFFLES LESS THAN 1'-0"

OPPOSING BAFFLE NOTES:

1. PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON SHEET 10.
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 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).
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', WHICH-EVER 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.
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9. THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.
10. ADDITIONAL TWIN CELL DETAILS ARE SHOWN ON SHEET 12.
11. FOR TYPICAL BAFFLE PLAN, PROFILE AND REINFORCEMENT DETAILS, SEE SHEET 10.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

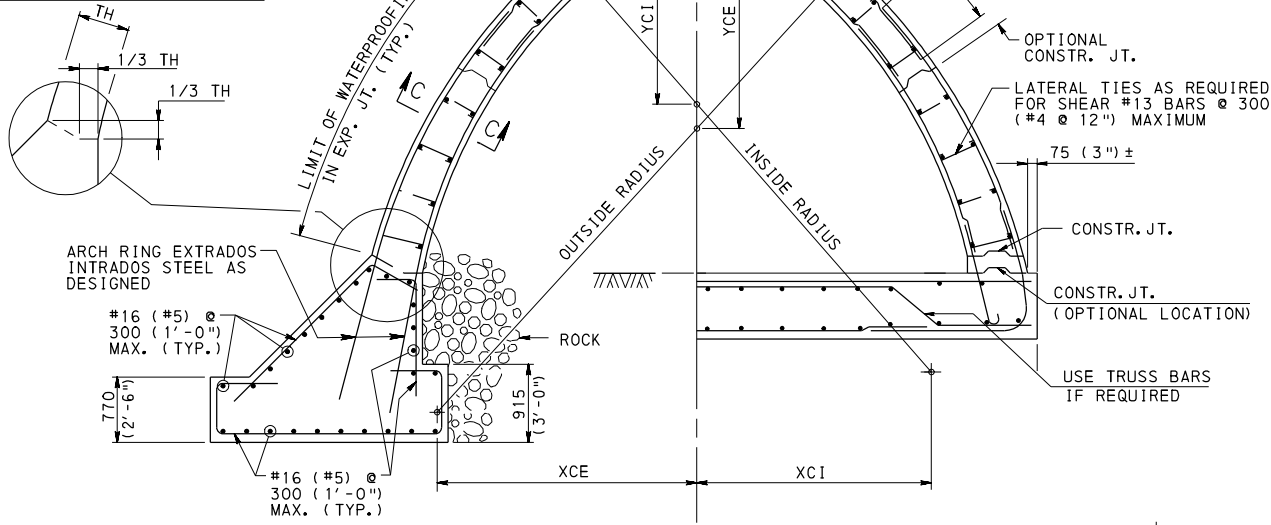
STANDARD
R.C. BOX CULVERT WITHOUT APRONS
MISCELLANEOUS DETAILS
STREAM GRADES ≤ 4%

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 13 OF 13
BD-632M

MARK	DESCRIPTION
XC1	HORIZONTAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES
XCE	HORIZONTAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES
YC1	VERTICAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES
YCE	VERTICAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES



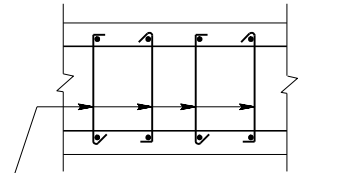
FIXED ARCH

TIED ARCH

(LOW FLOW TREATMENT NOT SHOWN)

TYPICAL ARCH SECTION

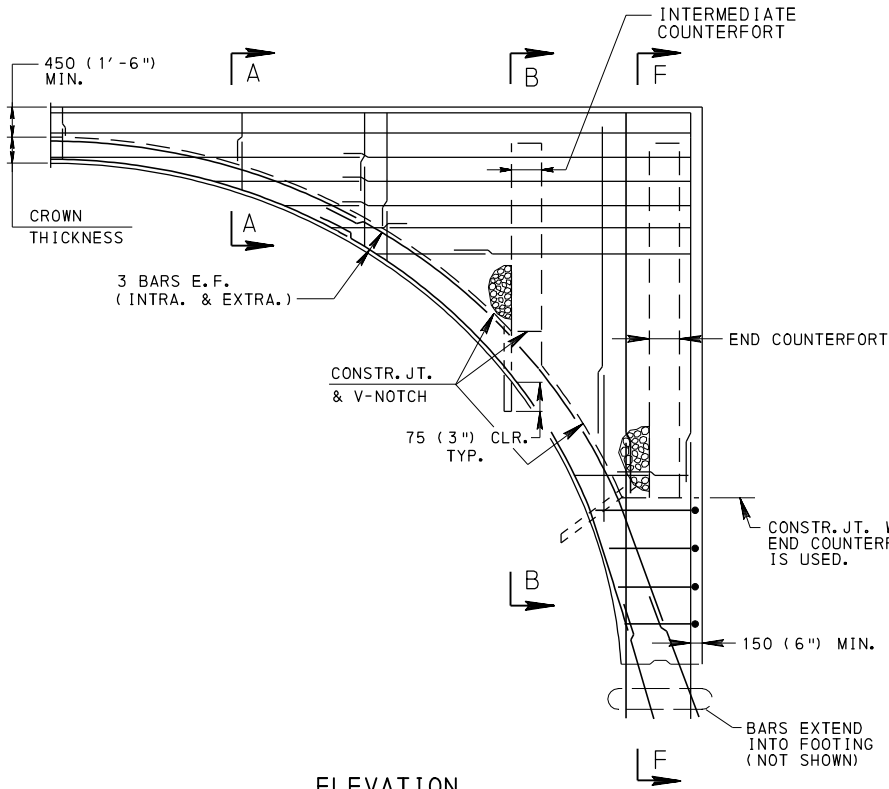
(WEEPHOLES NOT SHOWN-SEE WEEPHOLE DETAIL)



#13 (#4) BAR TIES,
ALTERNATE INTERSECTIONS
OF LONGITUDINAL & TRANSVERSE
BARS AND STAGGER (TYP.)

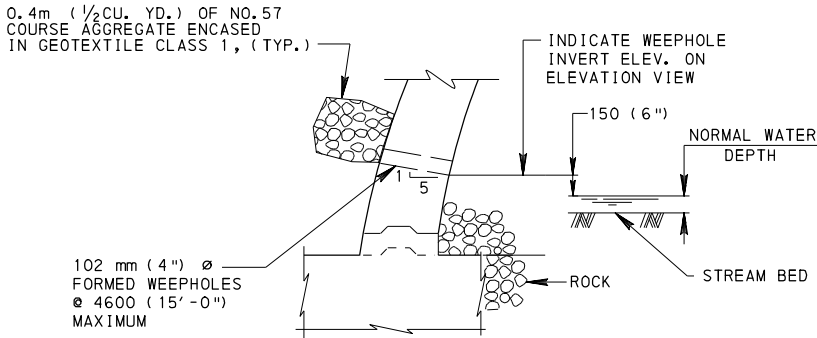
SECTION C-C

(TIE DETAIL)



ELEVATION

ARCH RING AND SPANDREL WALL DETAIL



ARCH WEEPHOLE DETAIL

- ALL DIMENSIONS ARE GIVEN IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES
- DESIGN SPECIFICATIONS: AASHTO LFD "BRIDGE DESIGN SPECIFICATIONS" 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.
- PROVIDE 50 mm (2") CONCRETE COVER ON REINFORCEMENT BARS EXCEPT AS NOTED.
- FOR LOW FLOW FISH PASSAGE DESIGN, REFER TO BD-632M.
- INDICATE ALLOWABLE 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 300 (12") OR SPAN LENGTH/8, WHICH EVER IS GREATER.
- STAGGER ALL LAPS WITH A MINIMUM OF 300 (1'-0") MEASURED ALONG THE CIRCUMFERENCE OF THE ARCH.
- FOOTING DESIGN TO CONFORM TO AASHTO LOAD FACTOR DESIGN, SECTION 4 PART C.
- COUNTERFORT DESIGN REQUIRED FOR SPANDREL WALL OVER 2400 (8'-0").

INSTRUCTIONS

- SPANS \leq 4600 mm (15'-0") DESIGN WITH SEMI-CIRCULAR OR SEGMENTAL INTRADOS. SPANS $>$ 4600 mm (15'-0") DESIGN WITH MULTI-CENTERED INTRADOS.
- MINIMUM THICKNESS OF ARCH RING - 250 mm (10") FOR SPANS \leq 6100 mm (20'-0"). 300 mm (1'-0") FOR SPANS $>$ 6100 mm (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 $f'c = 21$ MPa (3000 P.S.I.) (CLASS A CEMENT CONCRETE)
- REINFORCEMENT BARS $fy = 420$ MPa (60,000 P.S.I.)

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD

R.C. ARCH CULVERT

DETAILS

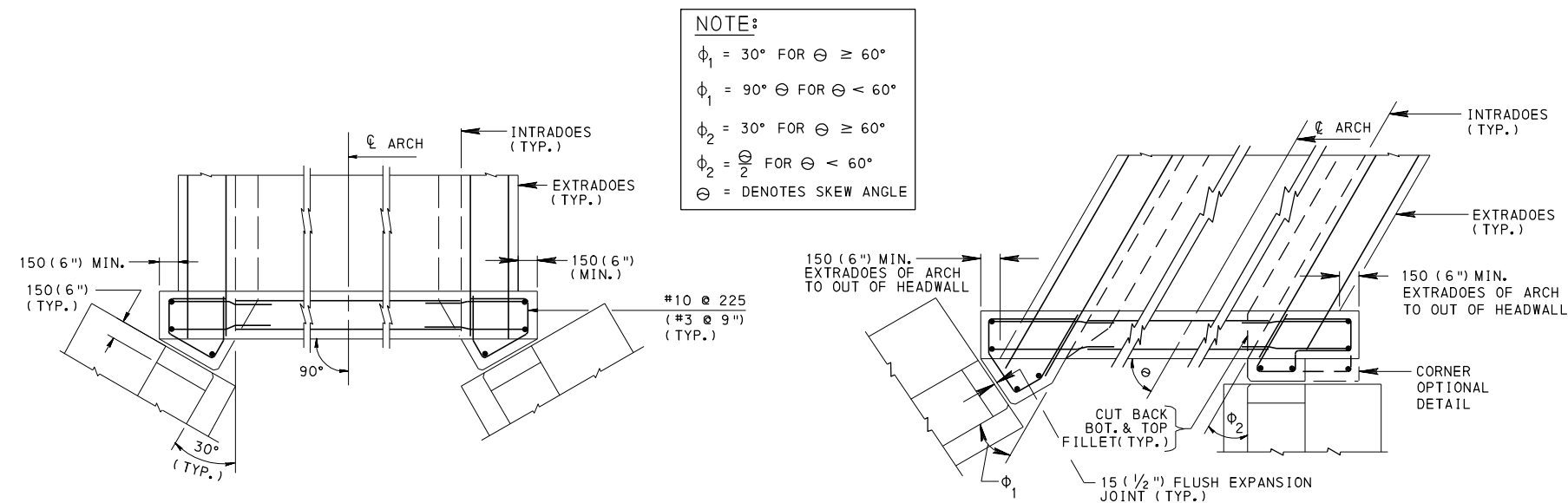
BD-625M	REINF. CONC. ABUTMENTS MISC. DETAILS
BD-631M	END WALL DETAILS FOR METAL CULVERTS
BD-632M	R.C. BOX CULVERT
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
REFERENCE DRAWINGS	

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciara
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

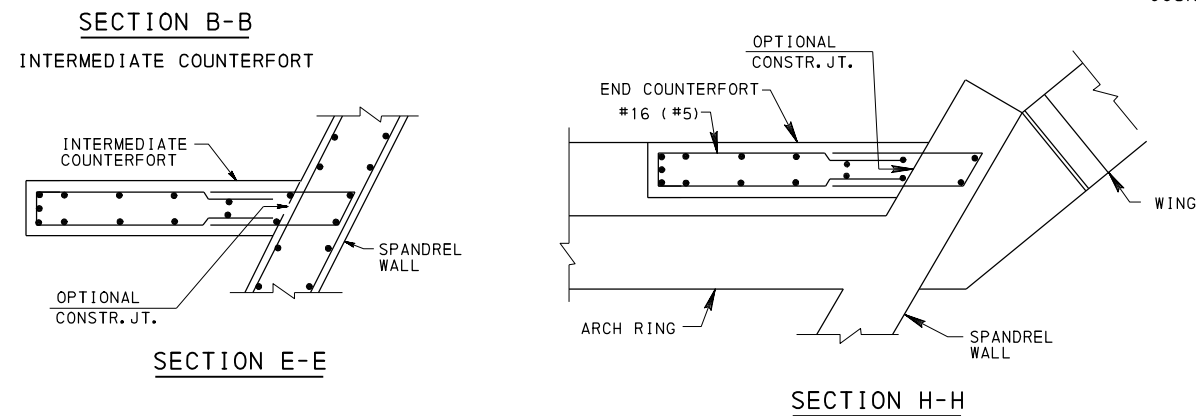
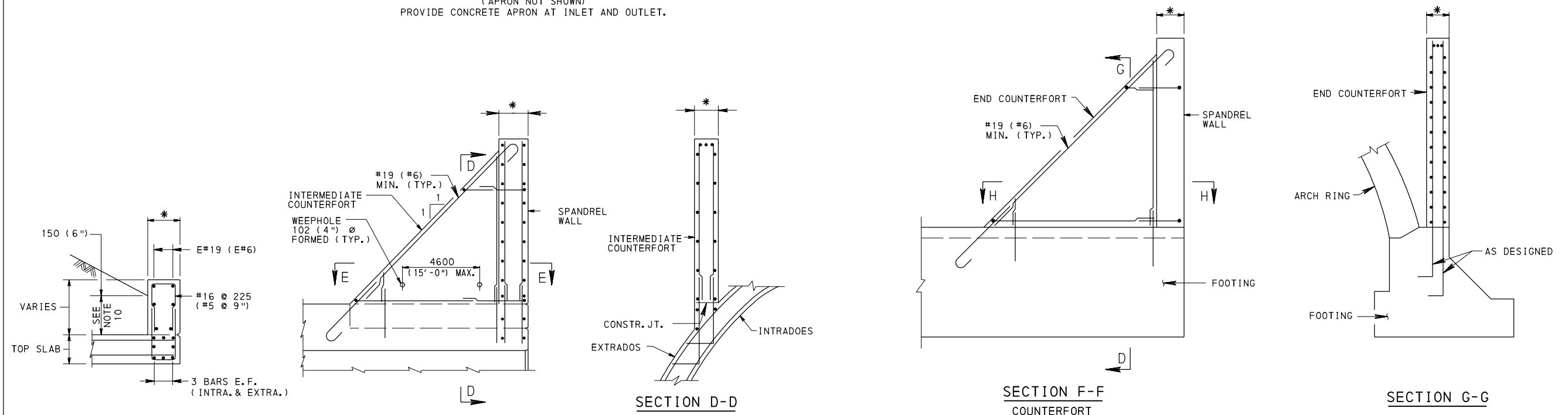
SHEET 1 OF 2

BD-633M



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.)
 * 450 mm (1'-6'') MINIMUM OR AS REQ'D.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
 MUST BE USED ON PLANS. METRIC AND
 ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
 BUREAU OF DESIGN

STANDARD

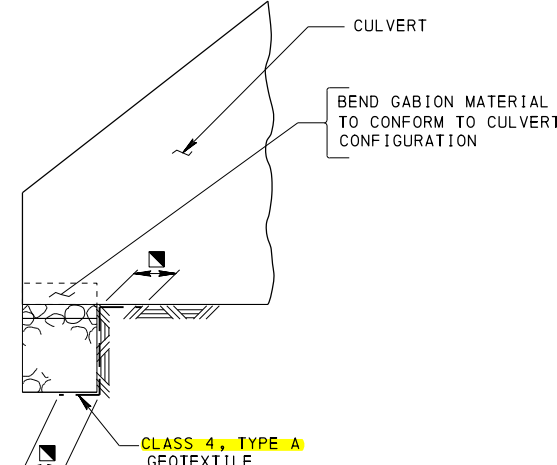
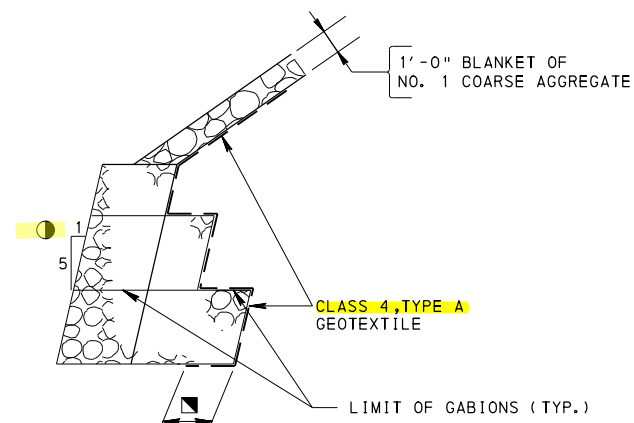
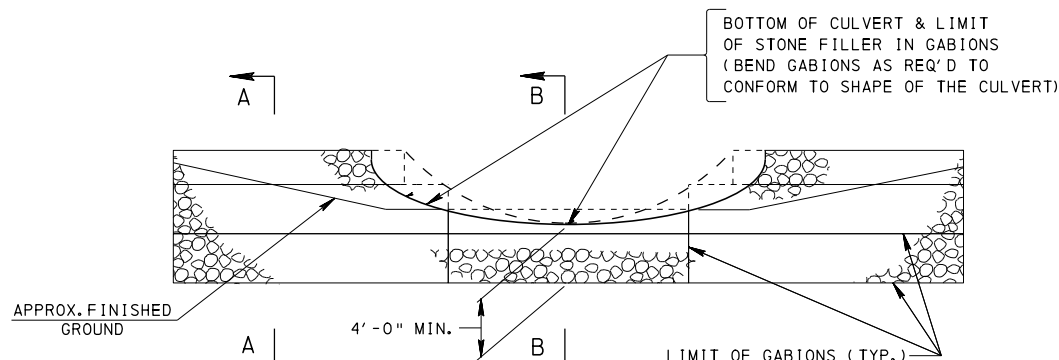
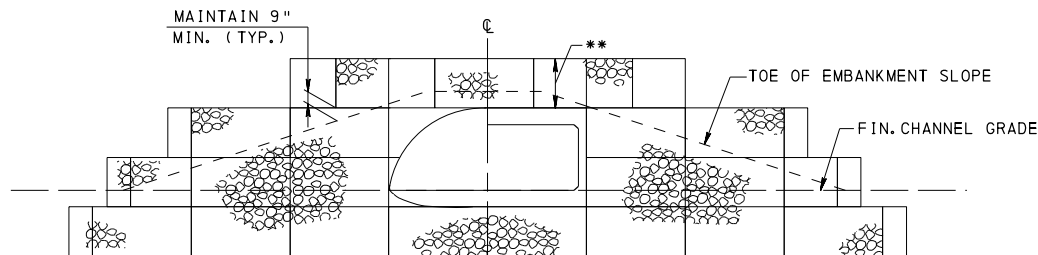
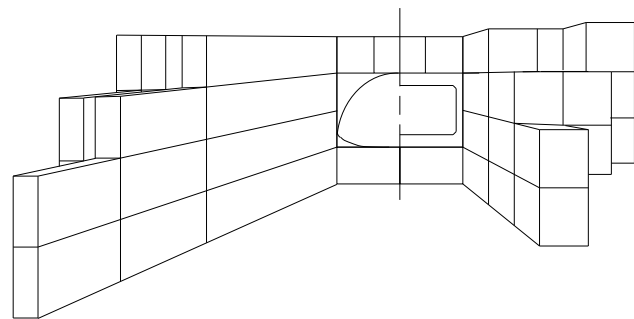
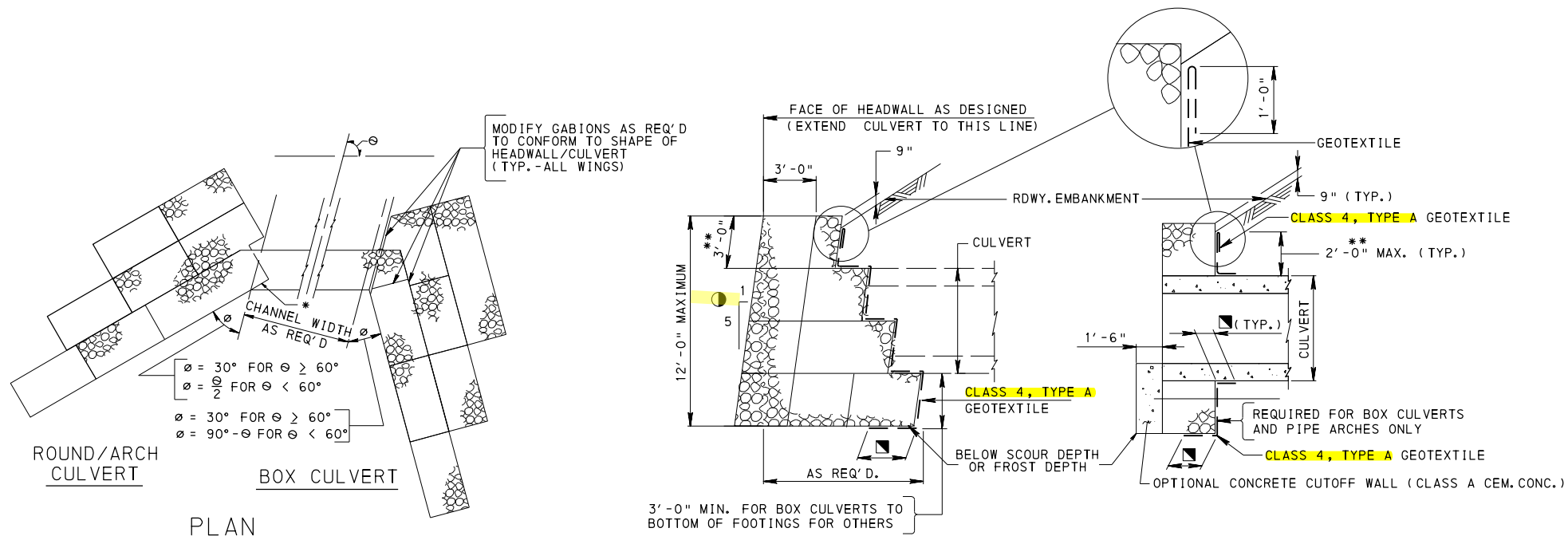
R.C. ARCH CULVERT

DETAILS

RECOMMENDED SEPT. 20, 2010
 Thomas P. Maciore
 CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
 Bruce S. Thomas
 DIRECTOR, BUREAU OF DESIGN

SHEET 2 OF 2
 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" VERTICAL LIFT TO BE PLACED WITH A 7" HORIZONTAL SETBACK.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GABION END WALLS
DETAILS

RECOMMENDED AUG. 31, 2012 Thomas P. Maciara CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 R. W. W. W. W. ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 1 OF 1 BD-634M
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BD-631M	END WALL DETAIL FOR METAL CULVERTS
BC-782M	GABION SLOPE WALL DETAILS
REFERENCE DRAWINGS	

STEEL STRUCTURAL PLATE PIPE THICKNESS REQUIREMENTS
WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION
(BACKFILL UNIT DENSITY = 2250 kg/m³)

D1A.	TOP PLATE THICKNESS 2.82 mm					TOP PLATE THICKNESS 3.56 mm					TOP PLATE THICKNESS 4.32 mm					TOP PLATE THICKNESS 4.79 mm					TOP PLATE THICKNESS 5.54 mm					TOP PLATE THICKNESS 6.32 mm					TOP PLATE THICKNESS 7.11 mm					
	MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				
		50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE		
		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	
(mm)	1500	12800	4.32	2.82	6.32	4.79	18300	4.32	3.56	7.11	5.54	24100	4.79	4.32	7.11	5.54	26800	4.79	4.79	7.11	5.54	31400	5.54	5.54	-	6.32	36000	6.32	6.32	-	6.32	40500	7.11	7.11	-	7.11
	1810	10600					15200					20100					22300					26200					29900					33800				
	2120	9100					13100					17100					19200					22600					25600					29000				
	2430	7900					11600					14900					16800					19500					22300					25300				
	2740	7000					10100					13400					14900					17400					19800					22600				
	3050	6400					9100					11900					13400					15500					18000					20100				
	3360	5800					8200					11000					12200					14300					16200					18300				
	3670	5200					7600					10100					11000					13100					14900					16800				
	3980	4900					7000					9100					10400					11900					13700					15500				
	4290	4600					6400					8500					9400					11300					12800					14300				
	4600	4300	↓	↓	↓	↓	6100					7900					8800					10400					11900					13400				
	4910	—	—	—	—	—	5800					7300					8200					9800					11000					12500				
	5220	—	—	—	—	—	5200	↓	↓	↓	↓	7000					7900					9100					10400					11900				
	5530	—	—	—	—	—	—	—	—	—	—	6700					7300					8500					9800					11300				
	5840	—	—	—	—	—	—	—	—	—	—	6100	↓	↓	↓	↓	7000					8200					9400					10700				
	6150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6700	↓	↓	↓	↓	7600	↓	↓	↓	↓	8800	↓	↓	↓	↓	10000	↓	↓	↓	↓

☆ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.

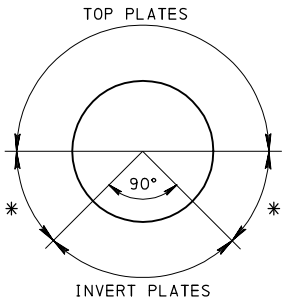
NOTES:

- THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
- 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 50 μm PER YEAR.
- THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.
- 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 0.38 mm LESS THAN THE INVERT PLATES, BUT NO LESS THAN THE UPPER TOP PLATES. (SEE SKETCH)
- ALL STEEL PLATES ARE 152 x 51 CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M 167/M 167M AND MUST BE GALVANIZED.
- MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 300 mm 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 900 mm, 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.

- THESE DESIGN VALUES ARE BASED UPON ASSUMPTION THAT THE EXCAVATION, BACKFILL AND CONSTRUCTION METHODS IN RC STANDARDS AND PUBLICATION 408 ARE USED.
- 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 2400 mm OR THE SPAN LENGTH, WHICHEVER IS GREATER, THE DESIGN OF THE TOP PLATE MUST BE CHECKED FOR WORST LIVE LOAD PLUS DEAD LOAD CONDITION.
- PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

GENERAL NOTE:

FOR SHEETS 1 THROUGH 3, ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. FOR U.S. CUSTOMARY UNIT DETAILS, SEE SHEETS 5 THROUGH 7. SHEET 4 IS IN DUAL UNITS.



*0.38 mm LESS THAN THE INVERT PLATES BUT NO LESS THAN TOP PLATES.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
DESIGN TABLES
FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 1 OF 7

BD-635M

BD-631M	ENDWALL DETAILS FOR METAL CULVERTS
BD-634M	GABION ENDWALL DETAILS
REFERENCE DRAWINGS	

STEEL STRUCTURAL PLATE PIPE-ARCH THICKNESS REQUIREMENTS
WITH MINIMUM ☆ PREDICTED METAL LOSS CONDITION (457 mm CORNER RADIUS)
(BACKFILL UNIT DENSITY = 2250 kg/m³)

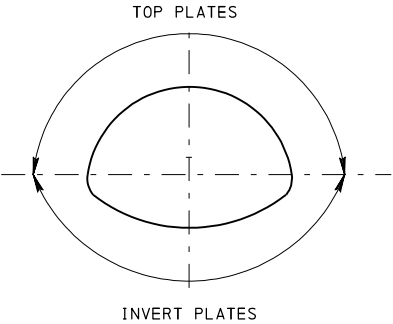
SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (mm)	CORNER BEARING PRESSURE																SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (mm)	CORNER BEARING PRESSURE															
			0.190 MPa				0.290 MPa				0.385 MPa				0.190 MPa							0.290 MPa				0.385 MPa											
			MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)				INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)		MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)									
				50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE		50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE		50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE		50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE		50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE					50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE		50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE		50-YEARS DESIGN LIFE	100-YEARS DESIGN LIFE								
SPAN (mm)	RISE (mm)		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT							
1850	1400	2.82	4300	3.56	2.82	6.32	4.32	6400	3.56	2.82	6.32	4.32	8500	4.32	2.82	6.32	4.79	3530	2260	2.82	1500	3.56	2.82	6.32	4.32	3000	3.56	2.82	6.32	4.79	4300	4.32	2.82	6.32	4.79		
1930	1450		4000					6100					8200					3610	2310		1200	↓	↓	↓	↓	3000					4300						
2060	1500		3700					5800					7600					3760	2360		—	—	—	—	—	2700					4000						
2130	1550		3700					5500					7300					3810	2410		—	—	—	—	—	2700					4000						
2210	1600		3400					5200					7000					3860	2460		—	—	—	—	—	2700					4000						
2340	1650		3400					4900					6700					3910	2540		—	—	—	—	—	2700					4000						
2410	1700		3000					4900					6400					4090	2570		—	—	—	—	—	2400					3700						
2490	1750		3000					4600					6100					4240	2620		—	—	—	—	—	2400					3400						
2620	1800		2700					4300					5800					4290	2670		—	—	—	—	—	2100					3400						
2690	1850		2700					4300					5800					4340	2720		—	—	—	—	—	2100					3400						
2840	1910		2100					4000					5500					4520	2770		—	—	—	—	—	2100					3000						
2900	1960		2100					4000					5500					4670	2820		—	—	—	—	—	1800					3000						
2970	2010		2100					4000					5200					4720	2870		—	—	—	—	—	1800					3000						
3120	2060		1800					3700					4900					4780	2920		—	—	—	—	—	1800					3000						
3250	2110		1800					3700					4900					4830	3000		—	—	—	—	—	1800					2700						
3330	2160		1800					3400					4600					5000	3020		—	—	—	—	—	1800					2700						
3480	2210	↓	1500	↓	↓	↓	↓	3000	↓	↓	↓	↓	4600	↓	↓	↓	↓	5050	3070	↓	—	—	—	—	—	1500	↓	↓	↓	↓	2700	↓	↓	↓	↓		

☆ 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 50 μm 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 152 x 51 CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M 167/M 167M AND MUST BE GALVANIZED.
6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 300 mm 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 900 mm, 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 2400 mm 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. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.



NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
DESIGN TABLES
FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

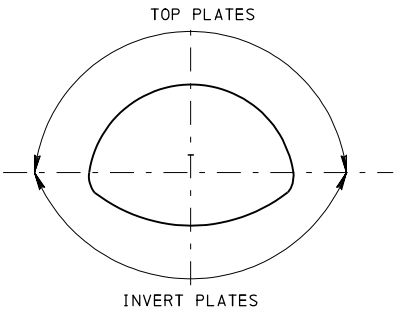
RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 2 OF 7
BD-635M

STEEL STRUCTURAL PLATE PIPE-ARCH THICKNESS REQUIREMENTS
WITH MINIMUM ☆ PREDICTED METAL LOSS CONDITION (787 mm CORNER RADIUS)
(BACKFILL UNIT DENSITY = 2250 kg/m³)

SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (mm)		CORNER BEARING PRESSURE															
				0.190 MPa				0.290 MPa				0.385 MPa							
				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				MAX. FILL HEIGHT (mm)	INVERT PLATE THICKNESS (mm)				
50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE							
WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT			
SPAN (mm)	RISE (mm)			3000	3.56	2.82	6.32	4.32	4900	4.32	2.82	7.11	4.79	6700	4.32	2.82	7.11	5.54	
4040	2840	2.82		3000					4900					6700					
4110	2900			3000					4900					6400					
4270	2950			2700					4600					6400					
4320	3000			2700					4600					6100					
4390	3050			2700					4600					6100					
4550	3100			2400					4300					5800					
4670	3150			2400					4000					5800					
4750	3200			2400					4000					5500					
4830	3250			2400					4000					5500					
4950	3300			2100					4000					5500					
5030	3350			2100					3700					5200					
5180	3400			2100					3700					5200					
5230	3450			2100					3700					4900					
5310	3510			2100					3700					4900					
5460	3560			1800					3400					4900					
5510	3610			1800					3400					4600					
5660	3660			1800					3400					4600					
5720	3710	↓		1800	↓				3400	↓				4600	↓				
5870	3760	3.56		1500	3.56				3000	3.56				4300	3.56				
5940	3810			1500	↓				3000	↓				4300	↓				
5990	3860			1500	↓				3000	↓				4300	↓				
6070	3910			1500	↓				3000	↓				4300	↓				
6220	3960			1200	↓				2700	↓				4000	↓				
6270	4010	↓		1200	↓	↓	↓	↓	2700	↓	↓	↓	↓	4000	↓	↓	↓	↓	

☆ 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 50 μm 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 152 x 51 CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M 167/M 167M AND MUST BE GALVANIZED.
6. MINIMUM FILL HEIGHT FOR DESIGN LOAD IS SPAN/8 BUT NOT LESS THAN 300 mm 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 900 mm, 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.
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9. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
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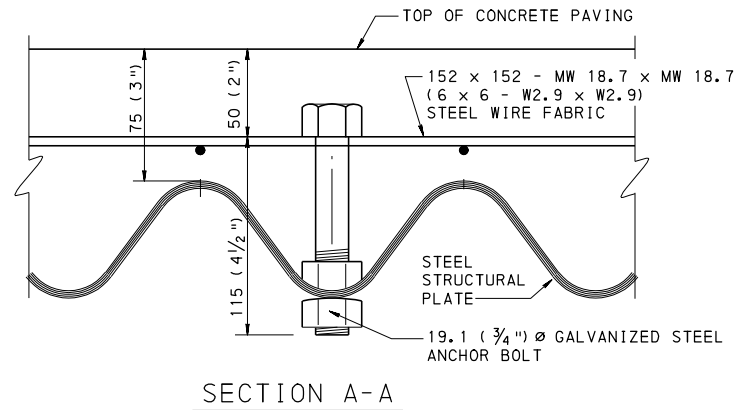
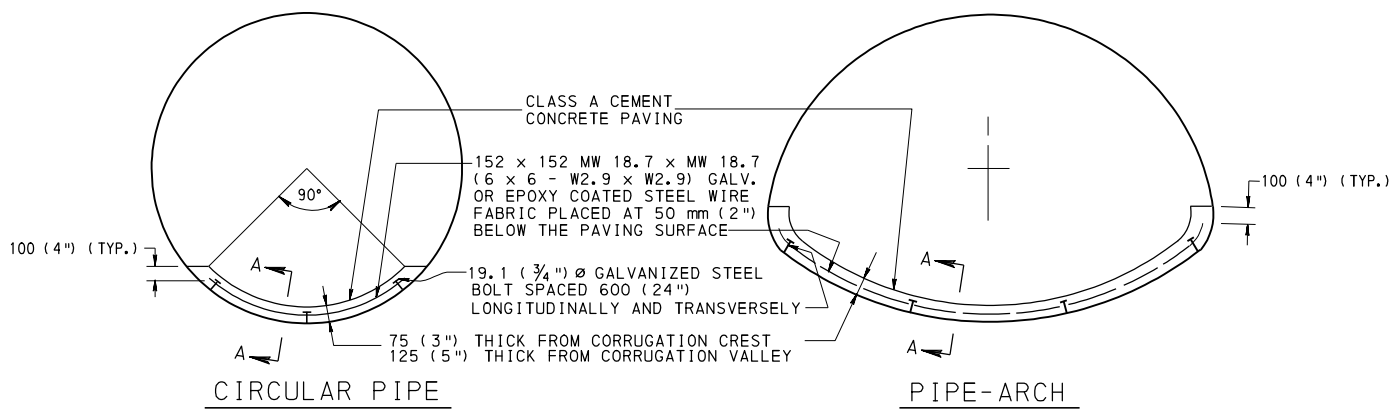
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
DESIGN TABLES
FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 3 OF 7
BD-635M



CONCRETE PAVED INVERT DETAILS

PLATE THICKNESS

PLATE THICKNESS mm(IN.)		PLATE GAGE NO. *
GALVANIZED	UNCOATED	
7.11 (0.280)	7.02 (0.2758)	1
6.32 (0.249)	6.23 (0.2451)	3
5.54 (0.218)	5.45 (0.2145)	5
4.79 (0.188)	4.69 (0.1838)	7
4.32 (0.170)	4.18 (0.1644)	8
3.56 (0.140)	3.42 (0.1345)	10
2.82 (0.111)	2.66 (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 20 mm (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 75 mm (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 50 mm (2") BELOW THE CONCRETE FACE WITH 100 mm (4") CLEARANCE FROM THE EDGES OF CONCRETE PAVING. FASTEN STEEL WIRE FABRIC TO 19.1 mm (3/4") Ø GALVANIZED BOLTS WHICH ARE BOLTED TO THE STEEL CULVERT INVERT AND SPACED 600 mm (24") ON CENTER LONGITUDINALLY AND TRANSVERSELY.
- USE STEEL WIRE FABRIC OF 4.88 mm (#6 GAGE) WIRE AT 152 mm (6") CENTERS LONGITUDINALLY AND TRANSVERSELY. MINIMUM LAP LENGTH IS 200 mm (8"). FOLD STEEL WIRE FABRIC UNDER UPSTREAM AND DOWNSTREAM LIPS OF THE CULVERT AT LEAST 300 mm (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.

GENERAL NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
DESIGN DETAILS
FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thomas
DIRECTOR, BUREAU OF DESIGN

SHEET 4 OF 7
BD-635M

STEEL STRUCTURAL PLATE PIPE THICKNESS REQUIREMENTS
WITH MINIMUM☆ PREDICTED METAL LOSS CONDITION
(BACKFILL UNIT WEIGHT = 140 LBS. PER CU. FT.)

DIAMETER	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 HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)			
		50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE	
		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT
FT. (IN.)	(FT.)					(FT.)					(FT.)					(FT.)					(FT.)					(FT.)					(FT.)				
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	↓	↓	↓	↓

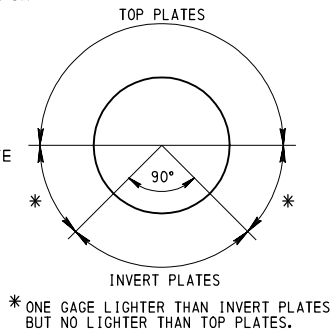
NOTES:

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 F.T., 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 4.
10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

GENERAL NOTE:

FOR SHEETS 5 THROUGH 7, ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS (FEET AND INCHES) UNLESS OTHERWISE NOTED. FOR METRIC UNIT DETAILS, SEE SHEETS 1 THROUGH 3. SHEET 4 IS IN DUAL UNITS.



NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
DESIGN TABLES
FOR METAL CULVERTS

BD-631M	ENDWALL DETAILS FOR METAL CULVERTS
BD-634M	GABION ENDWALL DETAILS
REFERENCE DRAWINGS	

RECOMMENDED SEPT. 20, 2010 <i>Thomas P. Maciara</i> CHIEF BRIDGE ENGINEER	RECOMMENDED SEPT. 20, 2010 <i>Brian S. Thompson</i> DIRECTOR, BUREAU OF DESIGN	SHEET 5 OF 7 BD-635M
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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 REQUIRED TOP PLATE THICKNESS (IN.)	CORNER BEARING PRESSURE																SIZE		MINIMUM REQUIRED TOP PLATE THICKNESS (IN.)	CORNER BEARING PRESSURE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
			2TSF				3TSF				4TSF				2TSF							3TSF				4TSF																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
			MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)				INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
				50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE						50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
				WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT					WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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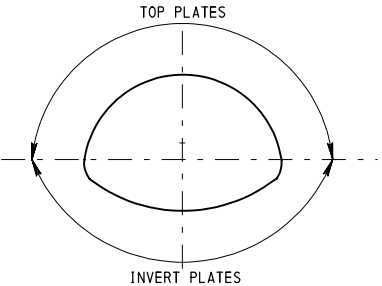
NOTES:

- THE "MAX. FILL HEIGHT" IS COMPUTED IN ACCORDANCE WITH THE LOAD FACTOR DESIGN PROCEDURES AS PER 1992 AASHTO SPECIFICATIONS.
- 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.
- THE CONCRETE PAVED INVERT IS ASSUMED TO HAVE AN EQUIVALENT SERVICE LIFE OF 35 YEARS.
- INVERT PLATES INCLUDE THE CORNER PLATES OF THE PIPE-ARCHES.
- ALL STEEL PLATES ARE 6"x 2" CORRUGATION AND MUST MEET THE REQUIREMENTS OF AASHTO M167 AND MUST BE GALVANIZED.
- 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 F.T., 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.

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- FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 4.
- PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

☆ REFER TO DM4, FIGURE 12.6.9.5P-2 FOR CORROSIVE ENVIRONMENTS.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.



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BUREAU OF DESIGN

STANDARD
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FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

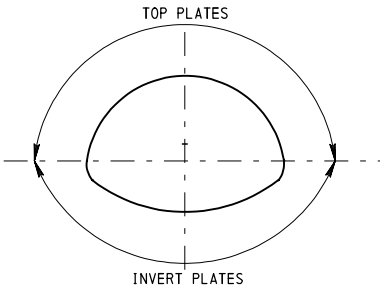
RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 6 OF 7
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 REQUIRED TOP PLATE THICKNESS (IN.)		CORNER BEARING PRESSURE													
				2TSF				3TSF				4TSF					
				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)				MAX. FILL HEIGHT (FT.)	INVERT PLATE THICKNESS (IN.)		
50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE			50-YEARS DESIGN LIFE		100-YEARS DESIGN LIFE					
SPAN (FT.-IN.)	RISE (FT.-IN.)			WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED INVERT		WITHOUT PAVED INVERT	WITH PAVED INVERT	WITHOUT PAVED INVERT	WITH PAVED 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:

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 F.T., 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.
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9. FOR CONVERSION OF GAGE TO THICKNESS TABLE SEE SHEET 4.
10. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
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FOR METAL CULVERTS

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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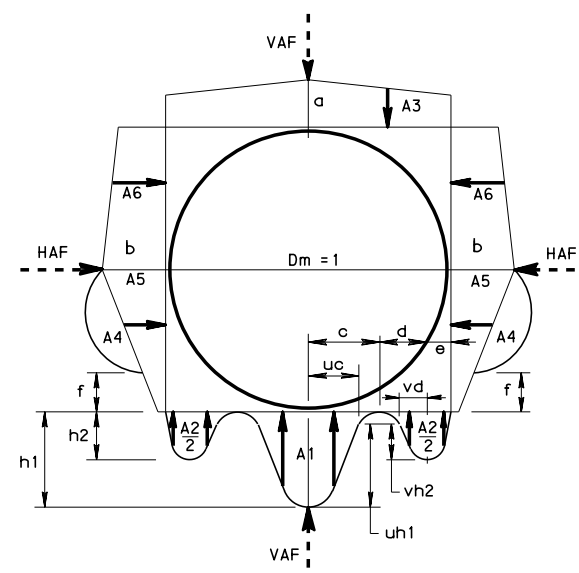
SHEET 7 OF 7

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 PAIDD COMPUTER PROGRAM 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 INSTALLATION	=	HEAVY-DUTY CONCRETE PIPE EMBANKMENT INSTALLATION DESIGN (APPROXIMATELY 100-YEAR LIFE).
TYPE A SHORING/ TRENCH BOX INSTALLATION	=	HEAVY-DUTY CONCRETE PIPE TRENCH BOX OR SHORING INSTALLATION DESIGN (APPROXIMATELY 100-YEAR LIFE).
TYPE B STANDARD INSTALLATION	=	STANDARD DUTY CONCRETE PIPE EMBANKMENT INSTALLATION DESIGN (APPROXIMATELY 50-YEAR LIFE).
TYPE B SHORING/ TRENCH BOX INSTALLATION	=	STANDARD DUTY CONCRETE PIPE TRENCH BOX OR SHORING INSTALLATION DESIGN (APPROXIMATELY 50-YEAR LIFE).
PROOF TEST LOAD	=	THREE EDGE BEARING TEST TO A LOAD EXTRAPOLATED FROM 0.007" DESIGN REQUIREMENT TO PRODUCE A 0.01" CRACK.
PROOF LOAD	=	THE LOAD CARRIED BY A PIPE SUBJECTED TO A THREE EDGE BEARING TEST, EXPRESSED IN POUNDS PER LINEAR FOOT OF INSIDE DIAMETER. THE PROOF LOAD REFLECTS THE FIELD 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 _y	=	SPECIFIED YIELD STRENGTH OF REINFORCEMENT ksi
f' _c	=	SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE ksi
HAF	=	HORIZONTAL ARCHING FACTOR
VAF	=	VERTICAL ARCHING FACTOR
D _m	=	1 FOR UNITY
A1 - A6	=	COEFFICIENTS WHICH REPRESENT THE INTEGRATION OF NON- DIMENSIONAL VERTICAL AND HORIZONTAL COMPONENTS OF SOIL PRESSURE UNDER THE INDICATED PORTIONS OF THE COMPONENT PRESSURE DIAGRAMS (AREA UNDER COMPONENT PRESSURE DIAGRAMS).
a, b, c, d, e, f, u, v	=	NON-DIMENSIONAL COEFFICIENTS DEFINING HORIZONTAL AND VERTICAL DIMENSIONS OF COMPONENT PRESSURE REGIONS.
d	=	0.5-c-e
h ₁	=	$\frac{(1.5a1)}{c(1+u)}$
h ₂	=	$(1.5A2) / [(d) (1+v) + (2e)]$
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 "PENNSYLVANIA INSTALLATION DIRECT DESIGN MANUFACTURING SPECIFICATION".
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 280J. 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 PAIDD SOFTWARE FOR DESIGNS NOT COVERED BY THESE TABLES.
10. STEEL AREAS ARE SHOWN AS, IN^2/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 PAIDD SPECIFICATIONS FOR SKETCH].
14. PIPE MAY NOT BE PLACED WITHIN THE PAVEMENT STRUCTURE WITHOUT CHIEF BRIDGE ENGINEER APPROVAL.

STANDARD
 REINFORCED CONCRETE PIPES
 DESIGN CRITERIA

RC-30M	SUBSURFACE DRAINS - PIPE PLACEMENT EXCAVATION - BEDDING - BACKFILL	RECOMMENDED NOV. 26, 2013 <i>Thomas P. Macieira</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 26, 2013 <i>John P. Kelly</i> ACTING DIR. SUP. OF PROJECT DELIVERY	SHEET 1 OF 10
	REFERENCE DRAWINGS			BD-636M

TABLE A

DESIGN DATA				
ITEMS	STANDARD INSTALLATION		TRENCH BOX/SHORING INSTALLATION	
	TYPE A	TYPE B	TYPE A	TYPE B
INSTALLATION TYPE	PAIDD	PAIDD	PAIDD	PAIDD
HAUNCH COMPACTION	95% MIN.	95% MIN.	60% MIN.	60% MIN.
SOIL WEIGHT	140 lbs./ft. ³	140 lbs./ft. ³	140 lbs./ft. ³	140 lbs./ft. ³
LIVE LOAD	HS 25	HS 25	HS 25	HS 25
fy	65,000 psi	65,000 psi	65,000 psi	65,000 psi
f'c	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): REINFORCEMENT DESIGN CONCRETE COMPRESSION	1.00 1.30	1.00 1.30	1.00 1.30	1.00 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: VAF (VERTICAL) HAF (HORIZONTAL)	1.35 0.45	1.35 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

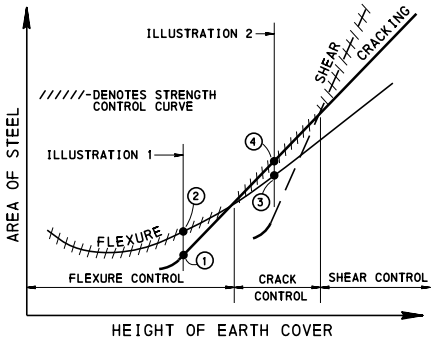
FACTORS FOR TRENCH BOX OR SHORING INSTALLATION [☆]				
REQUIRED FILL HEIGHT FT.	12" THROUGH 36" DIAMETER		42" THROUGH 120" DIAMETER	
	VAF	HAF	VAF	HAF
1.5	1.20	0.29	1.20	0.29
2.0	1.15	0.29	1.20	0.29
3.0	1.00	0.25	1.20	0.25
7.0	0.70	0.18	0.90	0.18
10.0	0.70	0.16	0.90	0.16
15- 25	0.70	0.12	0.80	0.12

☆ 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 INSTALLATION FOR ELLIPTICAL PIPE										
REQUIRED FILL HEIGHT 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:	
INNER CAGE = 0.15 SQ. IN.	0.14 SQ. IN.
OUTER CAGE = 0.09 SQ. IN.	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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUREAU 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 "PAIDD MANUFACTURING SPECIFICATION" 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.² FOR THE INSIDE CAGE AND 0.12 IN.² FOR THE OUTER CAGE.
- * THE PIPE IS TESTED TO A PROOF TEST LOAD OF 867 LBS./LF AND MARKED PA 48A/S10-2.

TYPE B (STANDARD DUTY) SOLUTION:

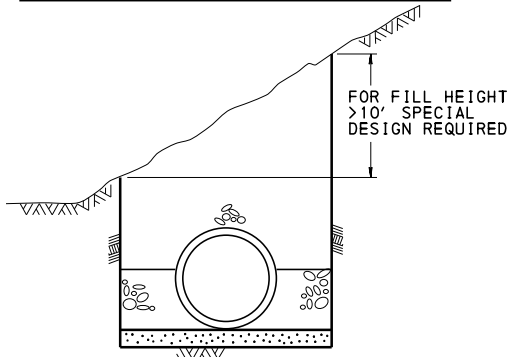
- * DESIGNER DETERMINES THAT A 48" DIAMETER CONCRETE PIPE IS REQUIRED AND THAT THE MAXIMUM FILL HEIGHT IS 3'-0", END TREATMENT AND A STANDARD TYPE B INSTALLATION AS PER RC-30M ARE SPECIFIED.
- * ITEM #0601-7370 IS SPECIFIED. FILL RANGE 10' TO 3'.
- * FABRICATOR REFERENCES PUBLICATION 280 "PAIDD MANUFACTURING SPECIFICATION" FOR A 48" DIAMETER TYPE B STANDARD INSTALLATION PIPE. A $5\frac{3}{4}$ " 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.² FOR THE INSIDE CAGE AND 0.07 IN.² FOR THE OUTER CAGE.
- * THE PIPE IS TESTED TO A PROOF TEST LOAD OF 823 LBS./LF AND MARKED PA 48B/S10-3.

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'.
- * FABRICATOR REFERENCES PUBLICATION 280 "PAIDD MANUFACTURING SPECIFICATION" 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.² FOR THE INSIDE CAGE AND 0.07 IN.² FOR THE OUTER CAGE.
- * THE PIPE IS TESTED TO A PROOF TEST LOAD OF 1174 LBS./LF AND MARKED PA 36A/SH10-7.

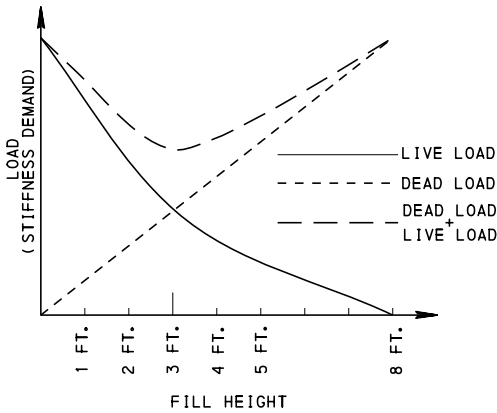
DESIGN EXAMPLE 3 REMOVED

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.

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. $\geq 8'$ 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 MATERIALS AND TESTING DIVISION:

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 OR PAIDD.
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 AND PAIDD THROUGH PENNSYLVANIA CONCRETE PIPE ASSOCIATION.
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.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIPES
DESIGN EXAMPLES/
RESPONSIBILITIES

RECOMMENDED NOV. 26, 2013
Thomas P. MacIsaac
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
[Signature]
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 3 OF 10

BD-636M

TYPE A STANDARD INSTALLATION - STEEL AREAS (in. ² /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	0.08							0.14	**
		5000	*	*	*	*	*	*	*	*	*	0.18
12"	2 3/4"	4000	0.08	0.08							0.09	0.11
		6000	*	*	*	*	*	*	*	*	*	
15"	2 1/4"	4000	0.12	0.08					0.10	0.12	0.22	**
15"	3"	4000	0.08	0.08					0.08	0.09	0.12	0.19
18"	2 1/2"	4000	0.14	0.09	0.08				0.11	0.13	0.16	**
		5000	*	*	*	*	*	*	*	*	0.23	**
18"	3 1/4"	4000	0.14	0.08	0.07				0.08	0.10	0.12	0.18
		6000	0.22	0.12	0.08	0.10	0.13	0.17	0.22	**	**	**
21"	3 1/2"	4000	**	0.10	0.07	0.08	0.10	0.13	0.16	0.27	**	**
		5000	0.22	*	*	*	*	*	*	*	**	**
24"	3"	4000	**	0.15	0.10	0.12	0.16	0.20	0.28	**	**	**
24"	3 3/4"	4000	**	0.13	0.08	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	**	**
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. ² /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	**
		5000	0.13	0.12	0.09	0.07	0.07	0.08	0.11	0.14	0.17	**
		6000	*	*	*	*	*	*	*	*	0.52	**
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
		5000	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	**
		5000	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	**
		5000	0.10	0.10	0.08	0.07	0.07	0.08	0.10	0.12	0.15	**
		6000	*	*	*	*	*	*	*	*	0.53	**
48"	5"	4000	0.18	0.20	0.19	0.19	0.23	0.31	0.45	0.62	**	**
		5000	0.11	0.13	0.12	0.12	0.12	0.16	0.20	0.24	**	**
48"	5 3/4"	4000	0.18	0.17	0.16	0.16	0.20	0.25	0.32	0.52	**	**
		5000	0.11	0.10	0.10	0.10	0.07	0.12	0.15	0.18	**	**
		6000	*	*	*	*	*	*	*	*	0.71	**
54"	5 1/2"	4000	0.21	0.21	0.20	0.20	0.26	0.38	0.55	**	**	**
		5000	0.14	0.13	0.12	0.12	0.14	0.18	0.23	**	**	**
		6000	*	*	*	*	*	*	*	0.64	**	**
54"	6 1/4"	4000	0.19	0.18	0.18	0.18	0.23	0.29	0.45	0.68	**	**
		5000	0.12	0.11	0.10	0.10	0.11	0.14	0.18	0.22	**	**

TYPE A STANDARD INSTALLATION - STEEL AREAS (in. ² /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	**	**
		5000	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	**	**
		5000	0.12	0.11	0.11	0.10	0.10	0.13	0.17	0.21	**	**
66"	6 1/2"	4000	0.24	0.23	0.25	0.35	0.53	**	**	**	**	**
		5000	0.14	0.14	0.14	0.18	0.23	**	**	**	**	**
		6000	*	*	*	*	*	*	0.66	**	**	**
66"	7 1/4"	4000	0.21	0.21	0.23	0.30	0.43	0.71	**	**	**	**
		5000	0.12	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	**	**	**
		5000	0.15	0.15	0.14	0.14	0.15	0.20	0.26	**	**	**
		6000	*	*	*	*	*	*	0.76	**	**	**
72"	7 3/4"	4000	0.23	0.23	0.22	0.24	0.26	0.34	0.53	0.86	**	**
		5000	0.13	0.13	0.12	0.12	0.13	0.17	0.22	0.27	**	**
		6000	*	*	*	*	*	*	*	0.72	**	**
78"	7 1/2"	4000	0.26	0.26	0.26	0.29	0.32	0.47	0.78	**	**	**
		5000	0.15	0.15	0.15	0.15	0.17	0.22	0.28	**	**	**
		6000	*	*	*	*	*	*	*	0.80	**	**
78"	8 1/4"	4000	0.24	0.24	0.24	0.27	0.29	0.38	0.66	**	**	**
		5000	0.14	0.13	0.13	0.13	0.14	0.19	0.24	**	**	**
		6000	*	*	*	*	*	*	*	0.76	**	**
		7000	*	*	*	*	*	*	*	0.29	**	**
		8000	*	*	*	*	*	*	*	0.86	**	**
		9000	*	*	*	*	*	*	*	0.34	**	**

TYPE A STANDARD INSTALLATION - STEEL AREAS (in. ² /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	**	**	
		5000	0.16	0.16	0.16	0.16	0.18	0.24	0.31	**	**	
		6000	*	*	*	*	*	*	*	0.90	**	
84"	8 3/4"	4000	0.26	0.26	0.27	0.30	0.33	0.43	0.79	**	**	
		5000	0.14	0.14	0.14	0.15	0.16	0.21	0.27	**	**	
		6000	*	*	*	*	*	*	*	0.90	**	
90"	8 1/2"	4000	0.30	0.30	0.32	0.36	0.39	0.64	**	**	**	
		5000	0.17	0.17	0.17	0.19	0.20	0.27	**	**	**	
		6000	*	*	*	*	*	*	0.80	**	**	
90"	9 1/4"	4000	0.28	0.28	0.30	0.33	0.36	0.52	0.94	**	**	
		5000	0.15	0.15	0.15	0.17	0.18	0.23	0.30	**	**	
		6000	*	*	*	*	*	*	0.82	**	**	
96"	9"	4000	0.32	0.32	0.35	0.39	0.43	0.74	**	**	**	
		5000	0.18	0.17	0.18	0.20	0.22	0.29	**	**	**	
		6000	*	*	*	*	*	*	0.91	**	**	
96"	9 3/4"	4000	0.30	0.30	0.33	0.37	0.40	0.62	**	**	**	
		5000	0.16	0.16	0.17	0.18	0.20	0.26	**	**	**	
		6000	*	*	*	*	*	*	0.79	**	**	
		7000	*	*	*	*	*	*	0.32	**	**	
		8000	*	*	*	*	*	*	0.95	**	**	
		9000	*	*	*	*	*	*	0.37	**	**	
102"	9 1/2"	4000	0.34	0.35	0.38	0.43	0.50	0.86	**	**	**	
		5000	0.18	0.18	0.20	0.22	0.24	0.31	**	**	**	
		6000	*	*	*	*	*	*	1.04	**	**	
102"	10 1/4"	4000	0.32	0.33	0.36	0.40	0.44	0.75	**	**	**	
		5000	0.17	0.17	0.18	0.20	0.22	0.28	**	**	**	
		6000	*	*	*	*	*	*	0.92	**	**	
		7000	*	*	*	*	*	*	0.34	**	**	
		8000	*	*	*	*	*	*	0.75	**	**	
		9000	*	*	*	*	*	*	0.34	**	**	

TYPE A STANDARD INSTALLATION - STEEL AREAS (in ² /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 REQUIRED FILL/COVER HEIGHT (FT.) - PROOF TEST LOAD (lbs./LF/FT.OF DIAMETER)																																				
DIA. (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'	DIA. (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'			
12	1720	1237	912	752	911	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.																			

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.

LEGEND
= FOR INFORMATION ONLY. PROOF LOAD TEST MUST BE PERFORMED TO THE MAXIMUM PROOF TEST LOAD FOR THE RANGE OF ITEM NUMBER.

NOTE:
THESE PROOF LOADS INCLUDE A FACTOR OF SAFETY OF 1.43 FOR FIELD CRACK CONTROL.
USE PAIDD PROGRAM TO DETERMINE PROOF LOAD VALUES FOR FILL HEIGHTS GREATER THAN 100' -0".

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
REINFORCED CONCRETE PIPES
DESIGN TABLES

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 5 OF 10
BD-636M

TYPE B STANDARD INSTALLATION - STEEL AREAS (in. ² /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"	2¾"	4000	0.08	←		0.08					→	0.08	**	**
15"	2¼"	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"	2½"	4000	0.13	←		0.08			→	0.10	0.12	0.15	**	**
		5000	*	*	*	*	*	*	*	*	*	*	0.21	**
18"	3¼"	4000	0.12	←		0.07			→	0.08	0.10	0.11	0.16	**
21"	2¾"	4000	0.17	0.11	←	0.07	→	0.09	0.12	0.16	0.19	**	**	**
21"	3½"	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"	3¾"	4000	0.22	0.12	←	0.08	→	0.09	0.12	0.15	0.18	0.30	**	**
27"	3¼"	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"	3½"	4000	**	0.18	←	0.13	→	0.16	0.21	0.26	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.31	**	**	**
		6000	0.29	*	*	*	*	*	*	*	*	**	**	**
30"	4¼"	4000	**	0.16	←	0.12	→	0.13	0.17	0.21	0.25	**	**	**
		6000	0.27	*	*	*	*	*	*	*	*	**	**	**
33"	3¾"	4000	**	0.21	←	0.16	→	0.18	0.24	0.31	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.39	**	**	**
33"	4½"	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"	4¾"	4000	**	0.19	0.16	0.12	0.13	0.18	0.23	0.28	**	**	**	**
		5000	**	*	*	*	*	*	*	*	0.32	**	**	**
		6000	**	*	*	*	*	*	*	*	*	0.46	**	**
36"	4"	4000	0.18	0.17	0.09	0.11	0.11	0.15	0.20	0.26	0.36	**	**	**
			0.12	0.11	0.07	0.07	0.07	0.08	0.10	0.13	0.16	**	**	**
		5000	*	*	*	*	*	*	*	*	*	0.53	**	**
			*	*	*	*	*	*	*	*	*	0.21	**	**
36"	4¾"	4000	0.15	0.14	0.11	0.09	0.09	0.13	0.16	0.20	0.23	0.43	**	**
			0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.09	0.11	0.15	**	**
42"	4½"	4000	0.19	0.18	0.16	0.14	0.14	0.18	0.24	0.34	0.46	**	**	**
			0.12	0.12	0.09	0.08	0.08	0.10	0.13	0.16	0.19	**	**	**
		6000	*	*	*	*	*	*	*	*	*	0.62	**	**
			*	*	*	*	*	*	*	*	*	0.25	**	**
42"	5¼"	4000	0.16	0.15	0.13	0.12	0.12	0.15	0.20	0.24	0.30	0.61	**	**
			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	**	**	**
			0.12	0.12	0.11	0.09	0.09	0.11	0.15	0.19	0.23	**	**	**
		6000	*	*	*	*	*	*	*	*	*	0.74	**	**
			*	*	*	*	*	*	*	*	*	0.29	**	**
48"	5¾"	4000	0.17	0.16	0.15	0.14	0.14	0.18	0.23	0.28	0.44	**	**	**
			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 REQUIRED FILL/COVER HEIGHT FT. / PROOF TEST LOAD (lbs. /LF/FT.OF DIAMETER)																
DIA. (in.)	1.0 FT. TO 1.5 FT.	1.5 FT. TO 2 FT.	2 FT. TO 3 FT.	3 FT. TO 4 FT.	4 FT. TO 7 FT.	5 FT. TO 10 FT.	10 FT. TO 15 FT.	15 FT. TO 20 FT.	20 FT. TO 30 FT.	30 FT. TO 40 FT.	40 FT. TO 50 FT.	50 FT. TO 60 FT.	60 FT. TO 70 FT.	70 FT. TO 80 FT.	80 FT. TO 90 FT.	90 FT. TO 100 FT.
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 PAIDD 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 PAIDD 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
DESIGN TABLES

RECOMMENDED NOV. 26, 2013

CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013

ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 6 OF 10
BD-636M

TYPE A SHORING/TRENCH BOX - STEEL AREAS (in. ² /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"	¾"	4000	↑		0.11	0.08	0.09
21"	2¾"	4000	↑		0.14	0.11	0.13
21"	¾"	4000	↑		0.14	0.10	0.11
24"	3"	4000	↑		0.18	0.14	0.12
24"	¾"	4000	↑		0.17	0.12	0.09
27"	¾"	4000	↑		0.20	0.16	0.14
27"	4"	4000	↑		0.17	0.14	0.12
30"	¾"	4000	**	0.33	0.24	0.19	0.16
30"	4¼"	4000	**	0.26	0.20	0.16	0.20
33"	¾"	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. ² /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. ² /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 S/T BOX - STEEL AREAS (in. ² /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 REQUIRED FILL/COVER HEIGHT (FT.)/ PROOF TEST LOAD (lbs/LF/FT. OF DIAMETER)								
DIA. (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	1496	1196	1295	1818	2376	2945	
15	1621	1393	1135	1260	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	1125	1467	2105	2767	3439	
48	1023	936	1114	1457	2093	2753	3422	
54	1015	895	1104	1449	2084	2742	3409	
60	961	858	1096	1442	2077	2733	3398	
66	965	858	1089	1436	2070	2726	3389	
72	922	829	1082	1431	2065	2719	3382	
78	882	802	1076	1426	2061	2714	3375	
84	847	778	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 PAIDD 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 PAIDD PROGRAM.
- 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 PAIDD 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 PAIDD SOFTWARE FOR SPECIAL DESIGN.

TYPE B SHORING/TRENCH BOX - STEEL AREAS (in. ² /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"	¾"	4000	↑		0.09	0.07	0.07
21"	2¾"	4000	↑		0.13	0.11	0.09
21"	¾"	4000	↑		0.11	0.09	0.09
24"	3"	4000	↑		0.16	0.13	0.11
24"	¾"	4000	↑		0.13	0.11	0.09
27"	¾"	4000	↑		0.19	0.15	0.13
27"	4"	4000	↑		0.16	0.13	0.11
30"	¾"	4000	**	0.29	0.22	0.17	0.15
30"	4¼"	4000	**	0.25	0.18	0.15	0.16
33"	¾"	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. ² /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	0.08
36"	4¾"	4000	**	0.22	0.17	0.14	0.13</

TYPE A STANDARD INSTALLATION HORIZONTAL ELLIPTICAL PIPE H<1.5 ft				
Equi- valent Round	Rise /Span (in.)	Wall Thick.	f' c (psi)	Steel Area (in. ² /ft.)
18"	14x23	2¾"	4000	**
			5000	0.20
24"	19x30	3¼"	4000	**
27"	22x34	3½"	4000	**
			5000	**
			6000	**
30"	24x38	3¾"	4000	0.22
				0.22
33"	27x42	3¾"	4000	0.25
				0.25
36"	29x45	4½"	4000	0.21
				0.21
42"	34x53	5"	4000	0.23
				0.23
48"	38x60	5½"	4000	0.24
				0.24
54"	43x68	6"	4000	0.26
				0.26
60"	48x76	6½"	4000	0.28
				0.28
66"	53x83	7"	4000	0.30
				0.30
72"	58x91	7½"	4000	0.33
				0.33
78"	63x98	8"	4000	0.36
				0.36
84"	68x106	8½"	4000	0.44
				0.44
90"	72x113	9"	4000	0.50
				0.50
96"	77x121	9½"	4000	0.60
				0.60
102"	82x128	9¾"	4000	0.71
				0.71
108"	87x136	10"	4000	0.86
				0.86
114"	92x143	10½"	4000	0.95
				0.95
120"	97x151	11"	4000	1.08
				1.08

TYPE B STANDARD INSTALLATION HORIZONTAL ELLIPTICAL PIPE H<1.5 ft.				
Equi- valent Round	Rise /Span (in.)	Wall Thick.	f' c (psi)	Steel Area (in. ² /ft.)
18"	14x23	2¾"	4000	0.20
24"	19x30	3¼"	4000	**
			5000	**
			6000	0.29
27"	22x34	3½"	4000	**
			5000	**
			6000	**
30"	24x38	3¾"	4000	0.21
				0.21
33"	27x42	3¾"	4000	0.23
				0.23
36"	29x45	4½"	4000	0.20
				0.20
42"	34x53	5"	4000	0.22
				0.22
48"	38x60	5½"	4000	0.23
				0.23
54"	43x68	6"	4000	0.25
				0.25
60"	48x76	6½"	4000	0.27
				0.27
66"	53x83	7"	4000	0.29
				0.29
72"	58x91	7½"	4000	0.32
				0.32
78"	63x98	8"	4000	0.34
				0.34
84"	68x106	8½"	4000	0.42
				0.42
90"	72x113	9"	4000	0.47
				0.47
96"	77x121	9½"	4000	0.56
				0.56
102"	82x128	9¾"	4000	0.71
				0.71
108"	87x136	10"	4000	0.82
				0.82
114"	92x143	10½"	4000	0.90
				0.90
120"	97x151	11"	4000	1.02
				1.02

- NOTES:
- 1) * INDICATES SAME STEEL AREA AS SHOWN FOR THE LESSER CONCRETE STRENGTH.
- 2) ** INDICATES A SPECIAL DESIGN IS REQUIRED. USE PAIDD 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) 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) 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.]
(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 PAIDD 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 VERTICAL ELLIPTICAL PIPE -STEEL AREAS (in ² /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 ≤ 7'	7' ≤ H ≤ 10'	15'	20'	25'
36"	45/29	4 1/2"	4000	**	0.23	0.19	0.14	0.12	0.15	0.19	0.23
				**	0.12	0.10	0.07	0.07	0.07	0.08	0.09
42"	53/34	5"	4000	**	0.28	0.23	0.17	0.15	0.18	0.23	0.28
				**	0.14	0.12	0.09	0.08	0.07	0.09	0.12
48"	60/38	5 1/2"	4000	**	0.20	0.18	0.15	0.15	0.20	0.25	0.31
				**	0.10	0.09	0.08	0.08	0.08	0.11	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
				**	*	*	*	*	*	*	0.13
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
				**	*	*	*	*	*	*	0.15
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
				**	*	*	*	*	*	*	0.17
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
				**	*	*	*	*	*	0.16	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
				**	*	*	*	*	*	0.18	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	**
				**	*	*	*	*	*	*	0.23
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
				**	*	*	*	*	*	*	0.24
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
				**	*	*	*	*	*	*	0.26
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	**
				**	*	*	*	*	*	0.30	**
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
				**	*	*	*	*	*	*	0.33
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	**

PROOF TEST LOAD TABLE FOR VERTICAL ELLIPTICAL PIPE 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 ≤ 7'	7' ≤ H ≤ 10'	10' ≤ H ≤ 15'	15' ≤ H ≤ 20'	20' ≤ H ≤ 25'			
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			

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				HORIZONTAL AREAS (in ² /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	**	0.25	0.19	0.14	0.13
24"	19x30	3¼"	4000	**	0.37	0.27	0.20	0.18
27"	22x34	3½"	4000	**	0.39	0.33	0.25	0.22
30"	24x38	3¾"	4000	**	0.39	0.29	0.24	0.28
				**	0.39	0.29	0.24	0.28
33"	27x42	3¾"	4000	**	0.48	0.35	0.29	0.40
				**	0.48	0.35	0.29	0.40
36"	29x45	4½"	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	5½"	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	6½"	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	7½"	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	8½"	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	9½"	4000	**	1.06	**	**	**
				**	1.06	**	**	**
			5000	**	*	1.04	**	**
				**	*	1.04	**	**
			7000	**	*	*	1.31	**
				**	*	*	1.31	**
102"	82x128	9¾"	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	10½"	5000	**	1.43	**	**	**
				**	1.43	**	**	**
			6000	**	*	1.44	**	**
				**	*	1.44	**	**
120"	97x151	11"	4000	**	**	**	**	**
				**	**	**	**	**

TYPE B SHORING/TRENCH BOX VERTICAL ELLIPTICAL PIPE -STEEL AREAS (in ² /ft.)											
Equiv- alent Round (in.)	Rise /Span (in.)	Wall Thick. (in.)	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	4½"	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	5½"	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	6½"	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	7½"	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	8½"	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	9½"	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	9¾"	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	10½"	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 LOAD TABLE FOR VERTICAL ELLIPTICAL PIPE 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 AREAS (in ² /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	**	**	
			5000	**	0.74	0.74	**	**	
				**	*	*	0.93	**	
			6000	**	*	*	0.93	**	
				**	*	*	*	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 LOAD TABLE FOR HORIZONTAL ELLIPTICAL PIPE 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	
30	24x38"	1319	1126	1091	1408	2011	2642	3282	
33	27x42"	1265	1089	1084	1401	2003	2631	3268	
36	29x45"	1228	1064	1079	1396	1997	2624	3260	
42	34x53"	1205	1006	1068	1386	1985	2608	3241	
48	38x60"	1138	962	1060	1379	1977	2599	3229	
54	43x68"	1134	957	1052	1372	1969	2590	3218	
60	48x76"	1073	917	1045	1367	1963	2582	3210	
66	53x83"	1026	887	1039	1362	1959	2577	3204	
72	58x91"	921	892	1034	1358	1955	2572	3198	
78	63x98"	950	837	1029	1355	1951	2568	3193	
84	68x106"	863	776	1024	1351	1948	2565	3189	
90	72x113"	799	762	1020	1348	1946	2562	3186	
96	77x121"	738	715	1016	1345	1943	2559	3182	
102	82x128"	693	681	1012	1343	1941	2557	3180	
108	87x136"	649	647	1009	1340	1939	2554	3177	
114	92x143"	621	621	1006	1338	1937	2552	3175	
120	97x151"	595	595	1002	1336	1935	2550	3173	

- CHANGE 1
- CHANGE 2
- CHANGE 3

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.
- 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 MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY **II**. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE **I** FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD ARE 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.

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. PROVIDE BOLT HOLES $\frac{1}{16}$ " LARGER THAN BOLT DIAMETER.
13. PROVIDE ANCHOR BOLT HOLES $\frac{1}{4}$ " LARGER THAN BOLT DIAMETER.
14. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
15. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
16. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS

SIGN PANELS

TC-8701E OR TC-8701S

LIGHT FIXTURES

BC-741M, SHT. 6

SIGN SUPPORT BEAM

BC-741M, SHT. 6

COLUMNS, STRUTS

CALCULATED INTERNALLY WITHIN PROGRAM
- DYNAMIC/VARIABLE MESSAGE SIGN (DMS/VMS) STRUCTURES

DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) ARE PROHIBITED ON OVERHEAD CANTILEVER STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS. THE CHIEF BRIDGE ENGINEER MUST REVIEW AND APPROVE ALL STRUCTURES DESIGNED TO CARRY A DYNAMIC/VARIABLE MESSAGE SIGN (DMS/VMS).
- EXTERNAL LOADS

AASHTO SIGN SPECS.

ICE LOAD

3.7

WIND LOAD

APPENDIX C, SECTION C.3,
EQ. C-1, WITH 80 MPH
WIND AND 30% GUST FACTOR
- GROUP LOADS

AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA

AASHTO SIGN SPECS. (U.N.O.)

SECTION PROPERTIES FOR TUBULAR SHAPES

APPENDIX B, TABLE B-1

MAXIMUM STRESSES IN TUBULAR SHAPES

APPENDIX B, TABLE B-2

ALLOWABLE STRESSES FOR TUBULAR SHAPES

5.6 (TABLE 5-3) & 5.11

ALLOWABLE STRESSES FOR SIGN SUPPORTS

5.12

ALLOWABLE STRESSES FOR BASE PLATES

5.8

ALLOWABLE STRESSES FOR COMBINED STEEL STRESS

5.12

FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)

SECTION 11

ALLOWABLE DEFLECTION

10.4

PERMANENT CAMBER

10.5

ALLOWABLE STRESSES FOR STRUCTURAL STEEL

SECTION 5
- BOLT CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)
- CONCRETE CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE

1.5 TONS PER SQUARE FOOT

MINIMUM AREA IN BEARING

95%

UNIT WEIGHT OF SOIL

100 POUNDS PER CUBIC FOOT

DRILLED SHAFTS (CAISSONS) DM-4 SEC. **D4.6**, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE

1.5 TONS PER SQUARE FOOT

MAXIMUM DESIGN LATERAL DISPLACEMENT

0.5"

MODULUS OF SUBGRADE REACTION

10.0 POUNDS PER CUBIC INCH

UNIT WEIGHT OF SOIL

100 POUNDS PER CUBIC FOOT

ANGLE OF INTERNAL FRICTION

25°

COHESION

0 KIPS PER SQUARE FOOT

SEISMIC DESIGN CRITERIA

STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, ANSI/AWS WELDING CODE **D1.5**, **CONTRACT** SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE ANSI/AWS **D1.1** FOR WELDING NOT COVERED IN ANSI/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
ASTM A709, GRADE 36
- 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 $\frac{3}{16}$ ". 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 A-325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 (INDICATE CHANGE NUMBER), ANSI/AASHTO/AWS D1.5, BRIDGE WELDING CODE AND **CONTRACT** SPECIAL PROVISIONS. USE ANSI/AWS **D1.1** FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS **D1.5**".
- DYNAMIC\ VARIABLE MESSAGE SIGNS (DMS\ VMS) ARE PROHIBITED ON OVERHEAD CANTILEVER STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS. OVERHEAD SIGN STRUCTURES INTENDED TO CARRY DYNAMIC\ VARIABLE MESSAGE SIGNS (DMS\ VMS) MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THESE STANDARDS MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF OVERHEAD SIGN STRUCTURES CARRYING DYNAMIC\ VARIABLE MESSAGE SIGNS (DMS\ VMS).

* **LEGEND:**

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- **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 318-99).
- CVN: CHARPY V-NOTCH.

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

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. BUREAU OF **PROJECT DELIVERY**

SHT. 1 OF 8
BD-641M

REFERENCE DRAWINGS

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/MERCURY VAPOR LAMPS

TC-8716

ERECTION DETAILS/EXTRUDED ALUMINUM CHANNEL SIGNS
FLAT SHEET ALUMINUM WITH STIFFENERS/OVERHEAD STRUCTURES

BC-736M

REINFORCEMENT BAR FABRICATION DETAILS

BC-741M

OVERHEAD SIGN STRUCTURES

RC-11M

CLASSIFICATION OF EARTHWORK FOR STRUCTURES

RC-52M

TYPE 2 STRONG POST GUIDE RAIL

RC-53M

TYPE 2 WEAK POST GUIDE RAIL

RC-54M

BARRIER PLACEMENT AT OBSTRUCTIONS

RC-58M

SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF FOOTING ELEVATION SO THAT A MINIMUM 2' - 0" COVER IS PROVIDED OVER THE FOOTING AT ALL LOCATIONS.

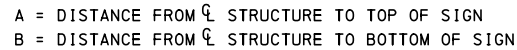
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- 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:

$$\begin{aligned} \text{AREA OF SIGN NO. 1} &= (X_1) \times (Y_1) \\ \text{AREA OF SIGN NO. 2} &= (X_2) \times (B_2) \times 2 \\ \text{AREA OF SIGN NO. 3} &= (X_3) \times (A_3) \times 2 \end{aligned}$$



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 = $(X_3 A_3) \times 2$

- FOR ILLUSTRATIVE EXAMPLES OF HOW TO POSITION SIGN PANELS AND SIGN STRUCTURES, SEE CASES A-F ON THE NEXT SHEET.

- 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.

- 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.

Diagram illustrating the elevation of a structure with dimensions in feet:

- Overall width: 38'
- Overall height: 10'
- Horizontal dimensions from left to right: 5', 12', 7', 14'.
- Vertical dimensions from bottom to top: 7', 3'.
- Structure components:
 - ① (Left structure)
 - ② (Right structure)
- Labels:
 - CL STRUCTURE &
 - CL SIGN PANEL NO. 2
 - CL COLUMN
- Elevations:
 - ELEV. 1000.00
 - ELEV. 998.75

NOTE:
ELEVATIONS ARE IN FEET

NOTE:
ELEVATIONS ARE IN
FEET

- $\Delta \text{ ELEV.} = 1000.00 - 998.75 = 1.25 < 2'-6"$
 $\left. \begin{array}{l} Y_1 = 10' \\ Y_2 = 14' \end{array} \right\} Y_1 < Y_2$
- USE CASE B

- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION
ELEV. $1000.00 + 17'-6" + 1'-6" = 1019.00$
[1'-6" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]

- SET \odot STRUCTURE AT \odot OF SIGN PANEL NO. 2
ELEV. $1019.00 + 14' / 2 = 1026.00$

- DESIGN COLUMN HEIGHT (H):
 $H = 1026.00 - 1000.00 = 26.00' \rightarrow \text{USE } H = 28'$

- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:

$$A_1 = 12' \times 7' \times 2 = 168.0 \text{ SF}$$

$$A_2 = 14' \times 14' = 196.0 \text{ SF}$$

$$364.0 \text{ SF}$$

→ USE 400.0 SF

- COMPUTE CENTER OF GRAVITY OF SIGN AREA (X):

$$X = \frac{[168.0 \text{ SF} \times (5' + 12' / 2)] + [196.0 \text{ SF} \times (24' + 14' / 2)]}{364 \text{ SF}}$$

X = 21.77' → USE X = 24' WITH A SIGN AREA OF 400 SF

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

DESIGN INSTRUCTIONS

RECOMMENDED NOV. 21, 2014

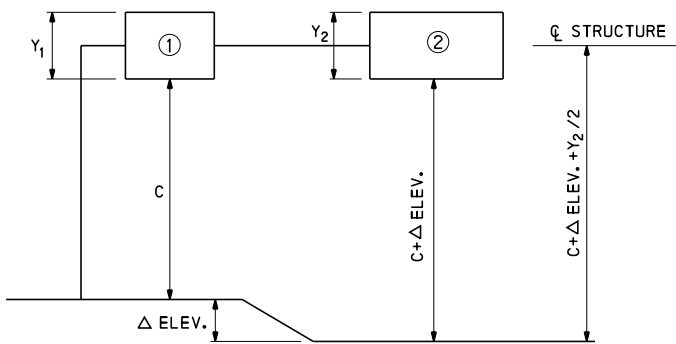
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED	NOV. 21, 2014
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Brenda Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

SHT. 2 OF 8

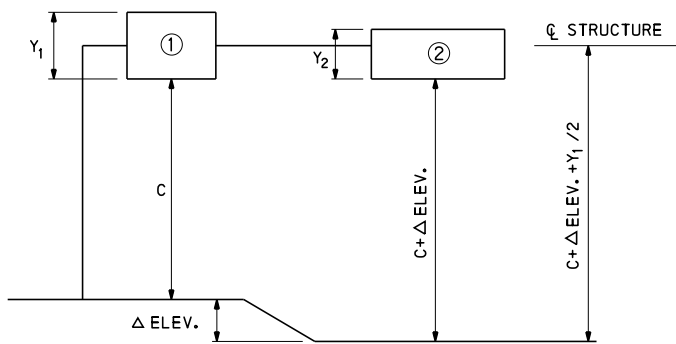
BD-641M



CASE A

$$Y_1 = Y_2$$
$$\Delta \text{ ELEV.} \leq 2' - 6''$$

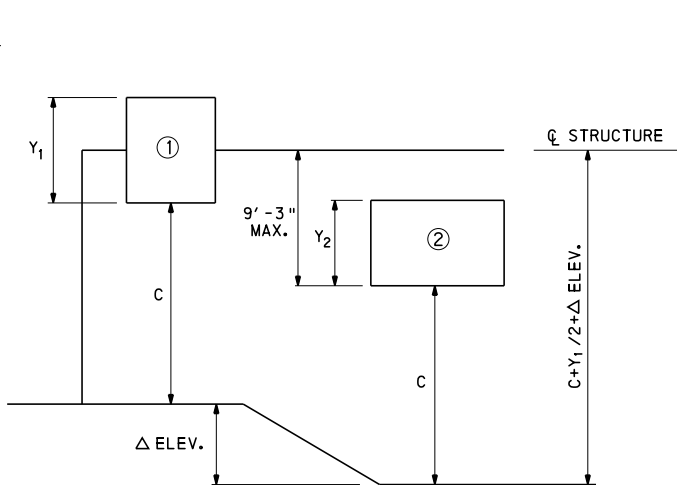
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET CL OF STRUCTURE AT CL OF SIGN PANELS.



CASE C

$$Y_1 \geq Y_2$$
$$\Delta \text{ ELEV.} \leq 2' - 6''$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 1.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF
Y₁ AND Y₂ WHERE Y₁ ≥ Y₂.



CASE E

$$Y_1 \geq Y_2$$
$$\Delta \text{ ELEV.} > 2' - 6''$$

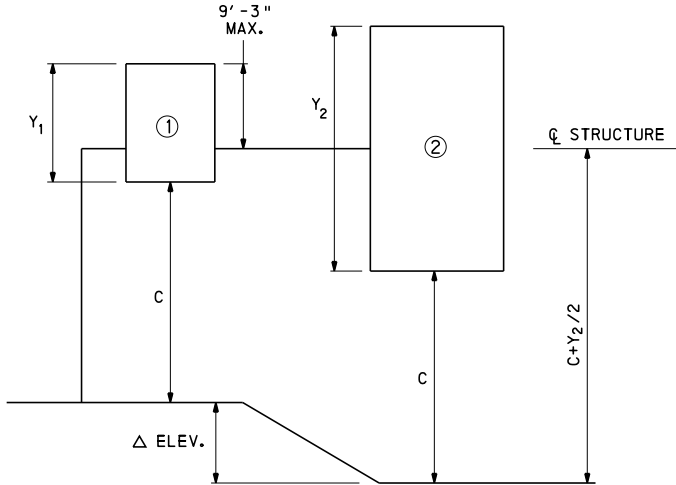
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL
CLEARANCE.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 1.
THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF Δ ELEV. AND Y₂ WHERE Y₁ ≥ Y₂:

Δ 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 Y₂ EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE
FOR A PARTICULAR VALUE OF Δ 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 CL OF STRUCTURE AT CL OF SIGN PANEL NO. 2.
THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF Δ ELEV., Y₁, AND Y₂ WHERE Y₁ < Y₂:

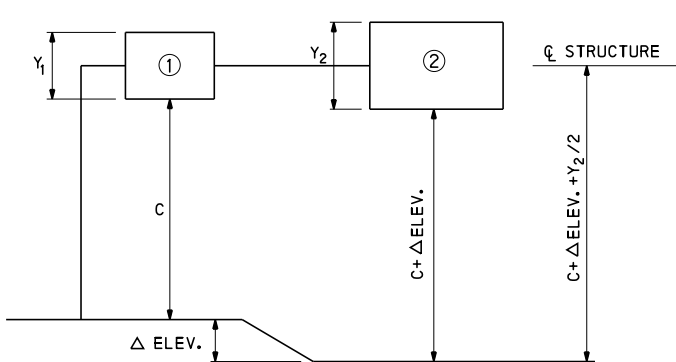
Δ ELEV.	LIMITS OF Y ₁ AND Y ₂
3' - 0"	2Y ₁ - Y ₂ ≤ 12' - 6"
4' - 0"	2Y ₁ - Y ₂ ≤ 10' - 6"
5' - 0"	2Y ₁ - Y ₂ ≤ 8' - 6"
6' - 0"	2Y ₁ - Y ₂ ≤ 6' - 6"
7' - 0"	2Y ₁ - Y ₂ ≤ 4' - 6"

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:

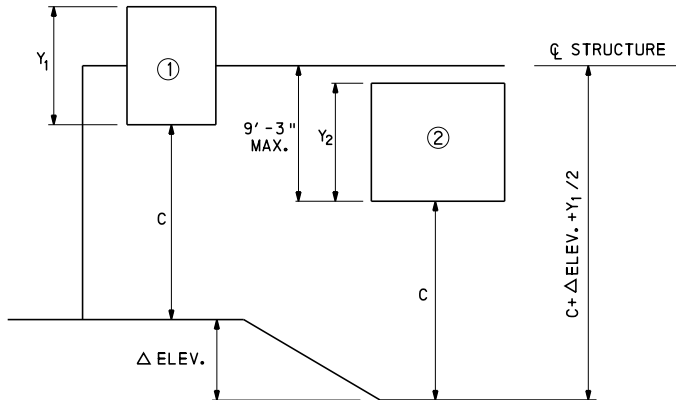
- 1) RESET CL OF STRUCTURE SO THAT PARAMETERS ARE MET
- 2) USE SEPARATE STRUCTURES
- 3) USE A SPECIAL DESIGN
- 4) IN ALL CASES, THE MINIMUM VERTICAL CLEARANCE
OF 17' - 6" MUST BE MAINTAINED



CASE B

$$Y_1 \leq Y_2$$
$$\Delta \text{ ELEV.} \leq 2' - 6''$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 2.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF
Y₁ AND Y₂ WHERE Y₁ ≤ Y₂.



CASE D

$$Y_1 = Y_2$$
$$\Delta \text{ ELEV.} > 2' - 6''$$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 1.
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF
Δ ELEV. AND Y_{1,2}:

Δ 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 Δ ELEV., THIS CASE DOES NOT
APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A
SPECIAL DESIGN.

COMMONWEALTH OF PENNSYLVANIA
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OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

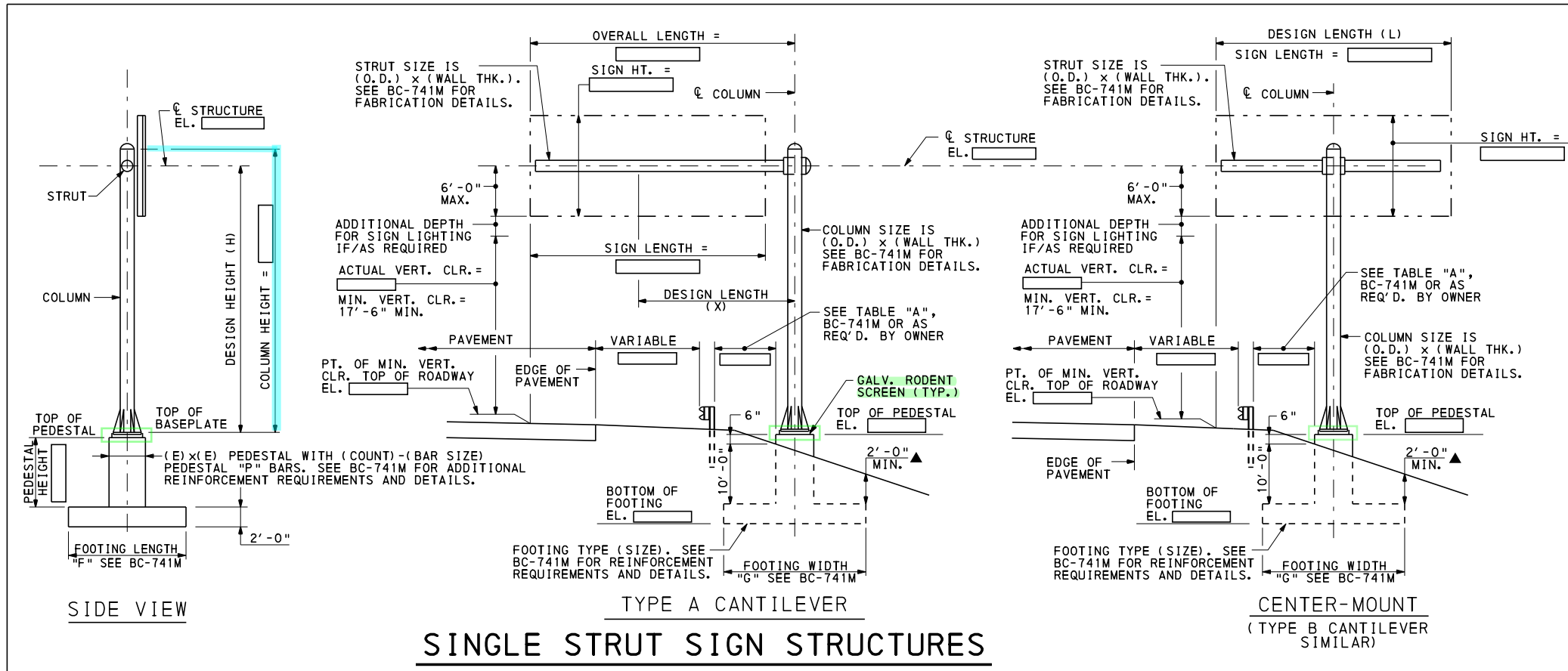
INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 3 OF 8

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▲ DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS < 10'.

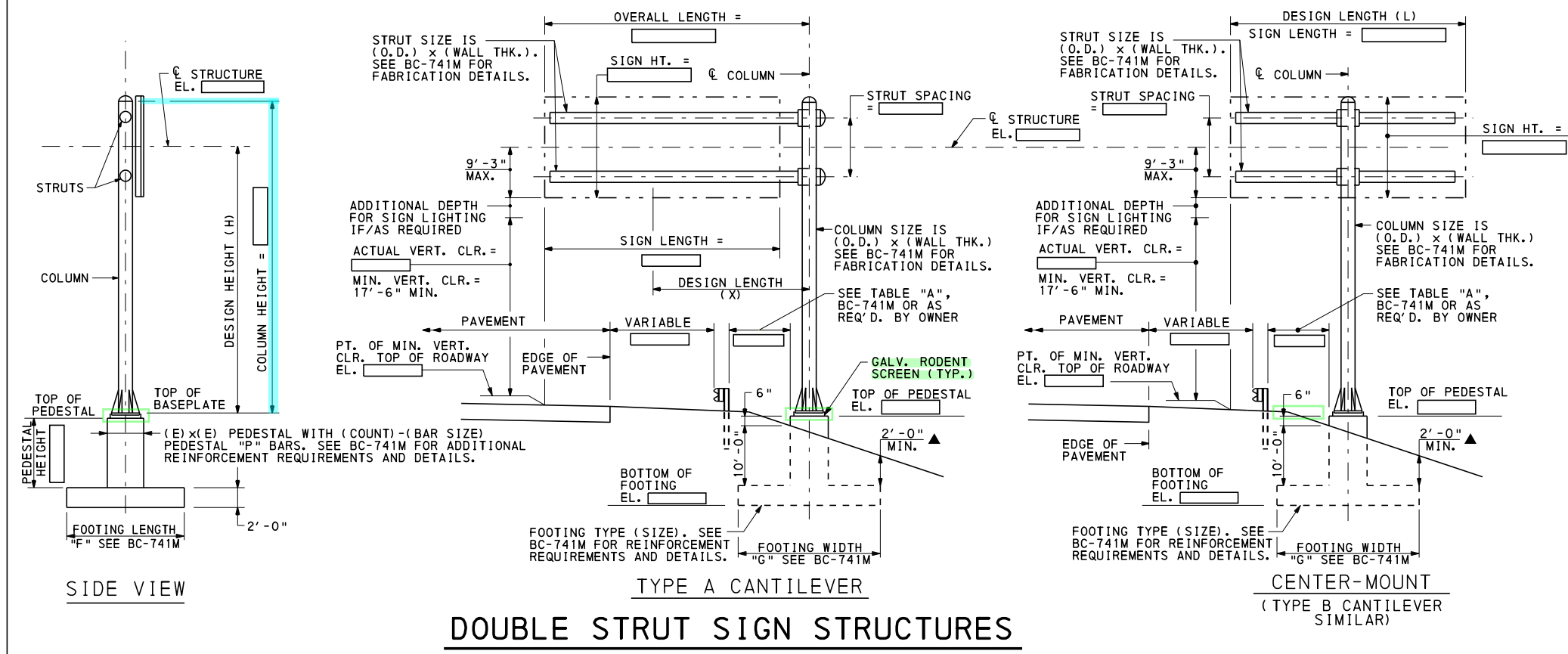


TABLE OF ESTIMATED QUANTITIES			
ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CY	
0000-0000	CLASS A CEMENT CONCRETE	CY	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. 0000 - 0000

DESIGN CRITERIA

DESIGN SIGN AREA (A) =

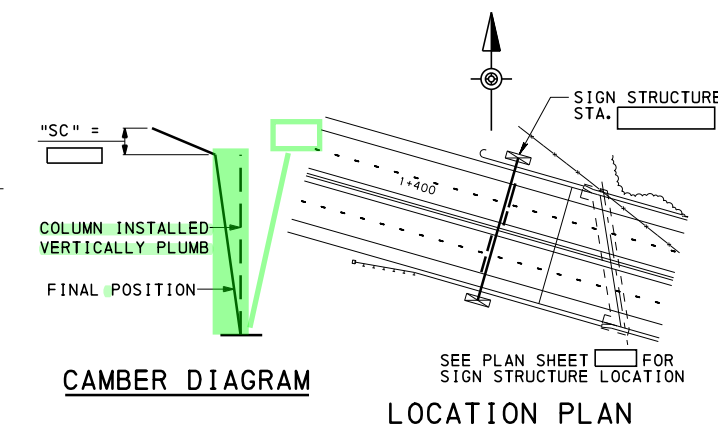
DESIGN LENGTH (X OR L) =

DESIGN HEIGHT (H) =

FATIGUE CATEGORY =

NOTE:
DESIGN FOR (ULTIMATE OR ACTUAL) 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.
 - 1. (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-741M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
 - 2. FOOTING TYPE (SIZE). SEE BC-741M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
 - 3. COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-741M FOR FABRICATION DETAILS.
 - 4. 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

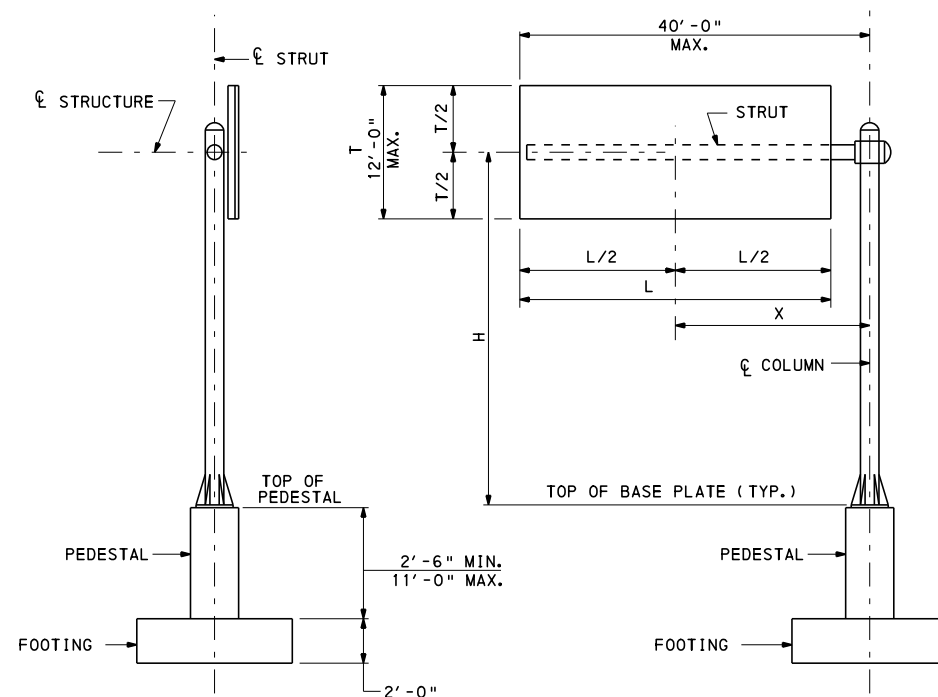


COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

SAMPLE CONTRACT DRAWING

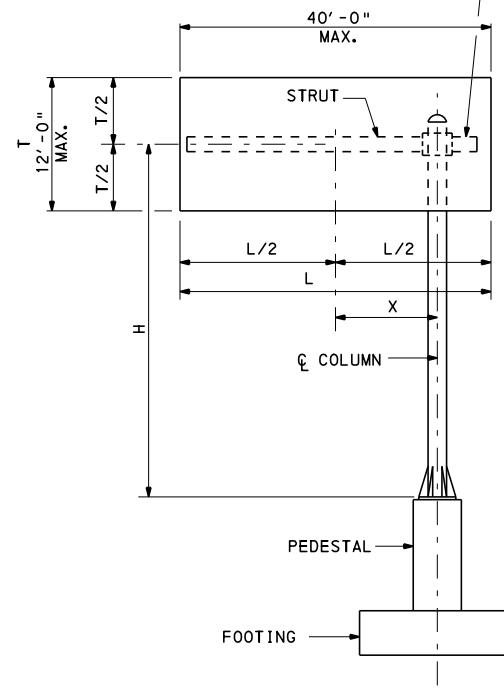
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHT. 4 OF 8 BD-641M
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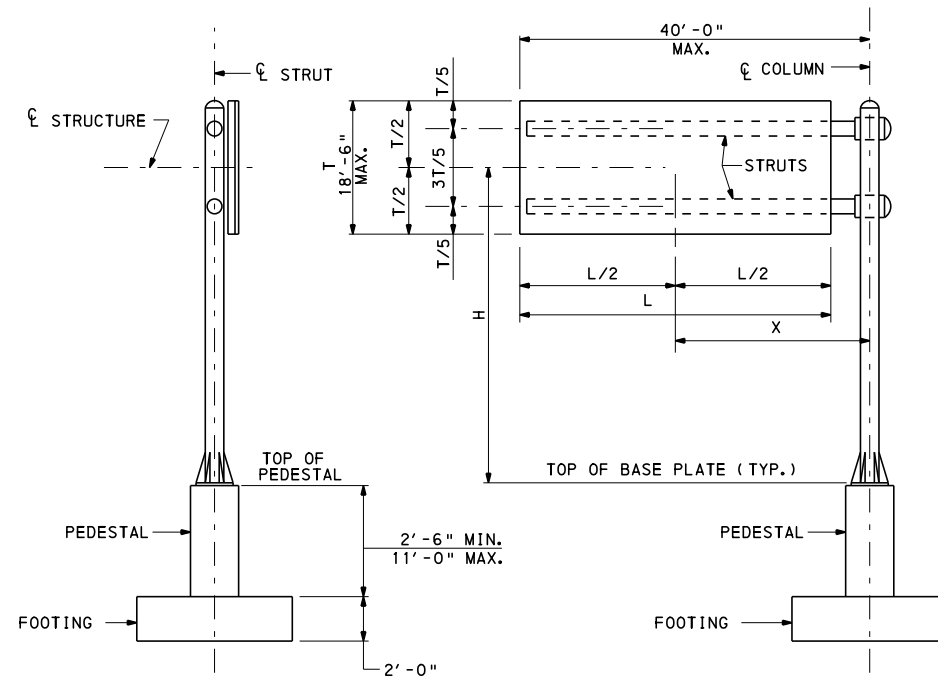
SIDE VIEW

FRONT VIEW (TYPE A)
SINGLE STRUT SIGN

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.

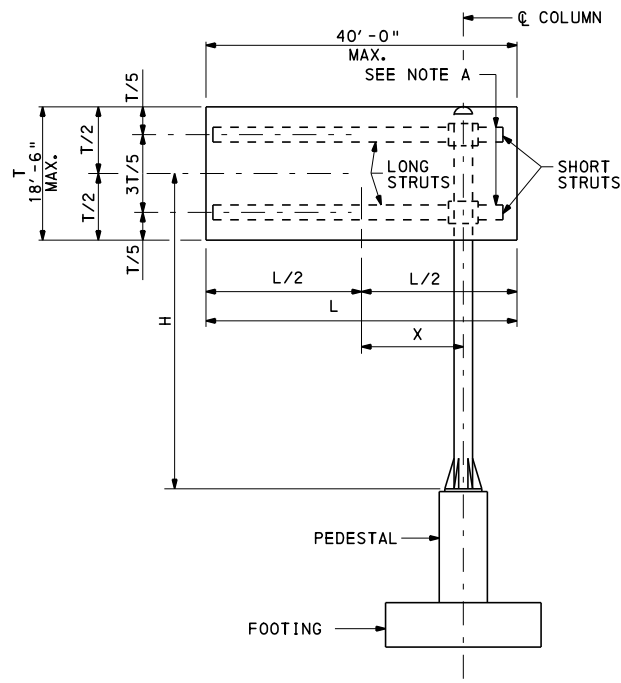


FRONT VIEW (TYPE B)

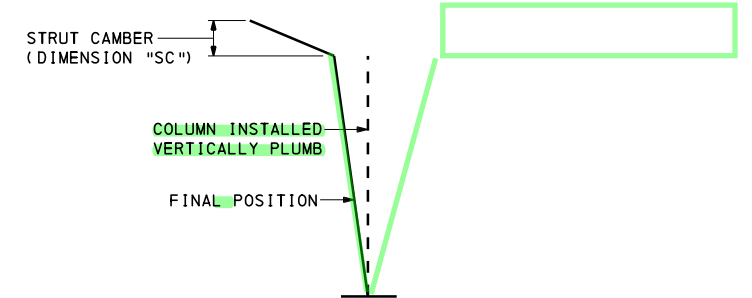


SIDE VIEW

FRONT VIEW (TYPE A)
DOUBLE STRUT SIGN



FRONT VIEW (TYPE B)



CAMBER DIAGRAM

NOTES:

CAMBERS SHOWN IN THE DESIGN TABLES ARE BASED ON SIGN HEIGHTS OF 12'-0" FOR THE SINGLE STRUT STRUCTURE AND 18'-6" FOR THE DOUBLE STRUT STRUCTURE.

STRUT CAMBER (SC) INCLUDES CAMBER OF STRUT FROM SIGN PROGRAM WHICH INCLUDES DOWNWARD MOVEMENT OF THE STRUT CAUSED BY THE DEFLECTION OF THE COLUMN.

Example Eliminated

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

CANTILEVER SINGLE AND DOUBLE
STRUT STRUCTURES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 5 OF 8

BD-641M

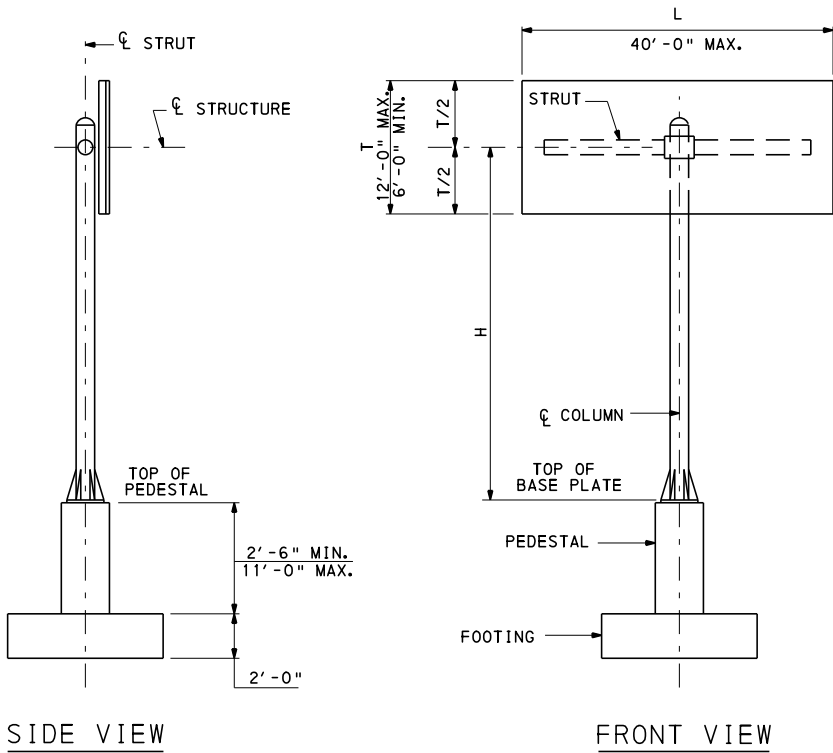
COLUMN AND FOOTING DATA																											
X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE	X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE	X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE	X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE
4'-0"	12'-0"	50	10x.365 *	0.50	16-#6	609	8'-0"	12'-0"	50	12x.375 *	1.16	16-#8	609	12'-0"	12'-0"	50	14x.375 *	1.62	16-#8	609	16'-0"	12'-0"	50	14x.375 *	2.90	16-#8	609
		100	12x.375 *	0.46	16-#8	609			100	14x.375 *	1.09	16-#8	711			100	16x.375 *	1.48	16-#9	711			100	16x.375 *	2.43	16-#9	710
		150	14x.375	0.51	16-#8	713			150	16x.375 *	0.80	16-#9	711			150	18x.375 *	1.60	16-#10	711			150	20x.375 *	1.92	16-#11	812
		200	14x.375	0.83	16-#8	1010			200	16x.375	1.35	16-#9	713			200	20x.375 *	1.66	16-#11	1010			200	24x.375 *	1.93	16-#10	1112
		250	16x.375 *	0.79	16-#9	1112			250	18x.375	1.44	16-#10	1010			250	24x.375 *	1.67	16-#10	814			250	24x.375	2.32	16-#10	1112
		300	18x.375 *	1.17	16-#10	1112			300	24x.375 *	1.13	16-#10	1112			300	24x.375	1.85	16-#10	1112			300	24x.500 *	2.32	16-#11	915
		400	20x.375 *	1.55	16-#11	917			400	24x.375 *	1.87	16-#10	1213			400	26x.500 *	2.16	20-#11	1213			400	26x.562	2.80	24-#11	1213
		480	24x.375 *	1.51	16-#10	1215			480	24x.375 *	2.30	16-#10	1018			480	26x.500 *	2.74	20-#11	1414			480	24x.969	3.73	32-#11	1414
		500	24x.375 *	1.05	16-#10	1215			500	26x.375 *	1.23	16-#11	1018			500	26x.562	1.86	24-#11	1215			500	24x.969	2.31	32-#11	1215
		600	24x.375 *	1.21	16-#10	918			600	24x.500	1.92	16-#11	1019			600	24x.969	2.11	32-#11	1414			600	24x1.219	2.85	32-#11	1317
		700	26x.375 *	1.60	16-#11	1317			700	26x.500	1.95	20-#11	1516			700	24x.969	2.46	32-#11	1516			700	24x.969	3.73	32-#11	1414
		740	24x.500 *	1.66	16-#11	1218			740	26x.562	2.25	24-#11	1516			740	24x.969	2.88	32-#11	1516			740	24x.969	2.31	32-#11	1215
	16'-0"	50	12x.375 *	0.46	16-#8	609		16'-0"	50	12x.375 *	1.27	16-#8	609		16'-0"	50	14x.375 *	1.79	16-#8	609		16'-0"	50	14x.375 *	2.70	16-#9	711
		100	12x.375 *	0.51	16-#8	711			100	14x.375 *	1.21	16-#8	711			100	16x.375 *	1.66	16-#9	711			100	16x.375 *	2.07	16-#10	1112
		150	14x.375	0.57	16-#8	713			150	16x.375 *	0.90	16-#9	713			150	18x.375 *	1.76	16-#10	1010			150	20x.375 *	2.54	16-#10	1213
		200	16x.375 *	0.78	16-#9	1112			200	16x.375	1.53	16-#9	815			200	20x.375 *	1.84	16-#11	1112			200	24x.500 *	2.54	16-#11	915
		250	18x.375 *	0.77	16-#10	1112			250	18x.375	1.64	16-#10	1112			250	24x.375 *	1.80	16-#10	1112			250	26x.562	3.09	24-#11	1215
		300	20x.375 *	1.16	16-#11	1114			300	24x.375 *	1.25	16-#10	1114			300	24x.375	2.04	16-#10	1213			300	24x.969	4.06	32-#11	1414
		400	24x.375 *	1.47	16-#10	1215			400	24x.375	2.04	16-#10	1215			400	26x.500 *	2.38	20-#11	1215			400	24x.969	2.55	32-#11	1317
		480	24x.375	1.61	16-#10	918			480	26x.375 *	2.33	16-#11	1215			480	26x.500 *	3.00	20-#11	1414			480	24x.969	2.55	32-#11	1317
		500	24x.375 *	1.12	16-#10	1215			500	26x.375 *	1.33	16-#11	1020			500	26x.562	2.05	24-#11	1317			500	24x.969	2.55	32-#11	1317
		600	26x.375	1.23	16-#11	1020			600	24x.500	2.11	16-#11	1020			600	24x.969	2.33	32-#11	1516			600	24x1.219	3.09	32-#11	1218
		700	26x.500 *	1.60	20-#11	922			700	26x.500	2.13	20-#11	1418			700	24x.969	2.70	32-#11	1418			700	24x.969	2.55	32-#11	1317
		740	26x.500 *	1.67	20-#11	1218			740	26x.562	2.44	24-#11	1418			740	24x.969	3.16	32-#11	1418			740	24x.969	2.55	32-#11	1317
	20'-0"	50	16x.375 *	0.40	16-#9	609		20'-0"	50	16x.375 *	1.11	16-#9	609		20'-0"	50	16x.375 *	1.67	16-#9	609		20'-0"	50	16x.375 *	3.03	16-#9	609
		100	16x.375 *	0.44	16-#9	711			100	16x.375 *	1.13	16-#9	711			100	16x.375 *	1.84	16-#9	711			100	16x.375 *	2.97	16-#9	711
		150	16x.375 *	0.53	16-#9	713			150	16x.375 *	1.01	16-#9	713			150	18x.375 *	1.91	16-#10	713			150	20x.375 *	2.34	16-#11	1010
		200	18x.375 *	0.73	16-#10	1112			200	18x.375 *	1.44	16-#10	1112			200	20x.375 *	2.01	16-#11	1112			200	24x.375 *	2.77	16-#10	915
		250	18x.375	0.84	16-#10	1114			250	20x.375 *	1.56	16-#11	1114			250	24x.375 *	1.94	16-#10	1114			250	24x.500 *	2.77	16-#11	1213
		300	20x.375	1.23	16-#11	1114			300	24x.375 *	1.37	16-#10	916			300	24x.375	2.22	16-#10	916			300	26x.562	3.38	24-#11	1215
		400	24x.375 *	1.53	16-#10	1215			400	26x.375 *	2.03	16-#11	1215			400	26x.500 *	2.59	20-#11	1414			400	24x.969	2.78	32-#11	1219
		480	26x.375	1.61	16-#11	1020			480	24x.500 *	2.49	16-#11	1020			480	26x.500 *	3.25	20-#11	1516			480	24x.969	2.78	32-#11	1219
		500	26x.375	1.12	16-#11	1317			500	24x.500 *	1.41	16-#11	1020			500	26x.562	2.24	24-#11	1219			500	24x.969	2.78	32-#11	1418
		600	26x.500 *	1.21	20-#11	922			600	26x.500 *	2.09	20-#11	1418			600	24x.969	2.56	32-#11	1418			600	24x.969	2.94	32-#11	1418
		700	26x.562	1.63	24-#11	1024			700	24x.969	2.06	32-#11	1418			700	24x.969	2.94	32-#11	1418			700	24x.969	2.94	32-#11	1418
		740	26x.562	1.71	24-#11	1320			740	24x.969	2.44	32-#11	1418			740	24x.969	3.44	32-#11	1520			740	24x.969	2.94	32-#11	1418
	24'-0"	50	18x.375 *	0.39	16-#10	609		24'-0"	50	18x.375 *	1.07	16-#10	609		24'-0"	50	18x.375 *	1.58	16-#10	711		24'-0"	50	18x.375 *	2.80	16-#10	710
		100	18x.375 *	0.42	16-#10	713			100	18x.375 *	1.06	16-#10	713			100	18x.375 *	1.69	16-#10	713			100	18x.375 *	2.75	16-#10	713
		150	18x.375 *	0.50	16-#10	713			150	18x.375 *	0.92	16-#10	713			150	18x.375 *	2.06	16-#10	713			150	20x.375 *	2.56	16-#11	814
		200	18x.375	0.79	16-#10	1112			200	20x.375 *	1.36	16-#11	1114			200	20x.375 *	2.19	16-#11	1114			200	24x.375 *	2.36	16-#10	1112
		250	20x.375	0.79	16-#11	1114			250	24x.375 *	1.34	16-#10	1015			250	24x.375 *	2.08	16-#10	1213			250	24x.375 *	3.00	16-#10	1213
		300	24x.375 *	1.12	16-#10	1215			300	24x.375 *	1.49	16-#10	916			300	24x.375	2.41	16-#10	916			300	24x.375 *	3.00	16-#10	1213
		400	26x.375 *	1.51	16-#11	1215			400	26x.375	2.16	16-#11	1020			400	26x.500 *	2.81	20-#11	1317			300	24x.500 *	2.99	16-#11	1215
		480	24x.500	1.67	16-#11	922			480	26x.500 *	2.44	20-#11	1516			480	26x.500	3.50	20-#11	1516			400	26x.562	3.68	24-#11	1317
		500	24x.500	1.16	16-#11	922			500	26x.500 *	1.38	20-#11	921	500	26x.562	2.43	24-#11	1219	480	24x.969	4.72	32-#11	1516				
28'-0"	50	20x.375 *	0.38	16-#11	609	28'-0"	50	20x.375 *	1.04	16-#11	711	28'-0"	50	20x.375 *	1.50	16-#11	711	28'-0"	50	20x.375 *	2.50	16-#10	916				
	100	20x.375 *	0.41	16-#11	713		100	20x.375 *	1.01	16-#11	1010		100	20x.375 *	1.57	16-#11	1010		200	24x.375 *	2.50	16-#10	916				
	150	20x.375 *	0.47	16-#11	1112		150	20x.375 *	0.85	16-#11	1112		150	20x.375 *	1.92	16-#11	815		250	24x.375 *	3.23	16-#10	1215				
	200	20x.375 *	0.73	16-#11	1114		200	20x.375	1.45	16-#11	1114		200	24x.375 *	1.84	16-#10	815		300	24x.375 *	3.22	16-#11	1018				
	250	24x.375 *	0.70	16-#10	916		250	24x.375	1.42	16-#10	1213		250	24x.375 *	2.22	16-#10	1213		400	26x.562	3.97	24-#11	1219				
	300	24x.375 *	1.16	16-#10	1215		300	24x.375	1.61	16-#10	1215		300	26x.375 *	2.31	16-#11	1215		480	24x.969	5.05	32-#11	1516				
	400	24x.500 *	1.56	16-#11	1317		400	24x.500	2.27	16-#11	1020		400	26x.500 *	3.03	20-#11	1516		500	24x.969	3.26	32-#11	1219				
	480	26x.500	1.63	20-#11	922		480	26x.562	2.48	24-#11	1418		480	26x.562	3.57	24-#11	1418		600	24x1.219	3.82	32-#11	1321				
	500	26x.500	1.13	20-#11	922		500	26x.562	1.40	24-#11	1418	500	24x.969	2.36	32-#11	1420	600	24x1.219	3.82	32-#11	1321						
600	24x.969	1.21	32-#11	1024	600	24x.969	2.10	32-#11	1418	600	24x.969	3.00	32-#11	1520	600	24x1.219	3.82	32-#11	1321								
700	24x.969	1.67	32-#11	1221	700	24x.969	2.32	32-#11	1420	700	24x1.219	3.08	32-#11	1420	700	24x.969	3.26	32-#11	1219								
740	24x.969	1.76	32-#11	1422	740	24x1.219	2.53	32-#11	1420	740	24x1.219	3.60	32-#11	1522	740	24x.969	3.26	32-#11	1219								

COLUMN AND FOOTING DATA (CONTINUED)																											
X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE	X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE	X	H	SIGN AREA (SQ. FT.)	COLUMN **	SC (in.)	PEDESTAL "P" BARS	FOOTING TYPE							
20'-0"	12'-0"	50	16x.375 *	4.43	16-#9	906	24'-0"	12'-0"	50	16x.375 *	5.37	16-#9	1008	28'-0"	12'-0"	50	18x.375 *	6.65	16-#10	1008	32'-0"	12'-0"	50	18x.375 *	9.73	16-#10	1007
		100	18x.375 *	3.12	16-#10	1010			100	20x.375 *	4.49	16-#11	811			100	20x.375	5.25	16-#11	1010			100	24x.375 *	6.42	16-#10	1010
		150	24x.375 *	2.84	16-#10	1010			150	24x.375 *	3.36	16-#10	1010			150	26x.375 *	4.77	16-#11	1010			150	26x.375	5.90	16-#11	1210
		200	24x.375	2.84	16-#10	814			200	26x.375	3.62	16-#11	1111			200	26x.500 *	4.34	20-#11	1111			200	26x.500	4.99	20-#11	1111
		250	24x.500 *	2.82	16-#11	913			250	26x.500 *	3.33	20-#11	1212			250	26x.562	4.27	24-#11	1212			250	24x.969	4.32	32-#11	1212
		300	26x.500	2.82	20-#11	1213			300	24x.969	3.52	32-#11	1213			300	24x.969	4.01	32-#11	1212		50	18x.375 *	10.75	16-#10	1008	
		400	24x.969	3.80	32-#11	1315			400	24x.969	3.73	32-#11	1314			50	18x.375 *	7.40	16-#10	1008		100	24x.375 *	6.93	16-#10	1010	
		500	24x1.219	2.81	32-#11	1316			50	16x.375 *	5.88	16-#9	1008			100	20x.375	5.91	16-#11	1010		150	26x.375	6.37	16-#11	1111	
	16'-0"	50	16x.375 *	4.87	16-#9	1008		16'-0"	100	20x.375 *	4.92	16-#11	1010		16'-0"	150	26x.375 *	5.11	16-#11	1111		200	26x.500	5.42	20-#11	1212	
		100	18x.375 *	3.51	16-#10	1010			150	24x.375 *	3.67	16-#10	1010			200	26x.500 *	4.64	20-#11	1111		250	24x.969	4.69	32-#11	1212	
		150	24x.375 *	3.04	16-#10	1010			200	26x.375	3.89	16-#11	913			250	26x.562	4.68	24-#11	1213		50	18x.375 *	11.77	16-#10	1008	
		200	24x.375	3.10	16-#10	1112			250	26x.500 *	3.62	20-#11	1213			300	24x.969	4.37	32-#11	1213		100	24x.375 *	7.45	16-#10	1010	
		250	24x.500 *	3.08	16-#11	915			300	24x.969	3.81	32-#11	1213			50	18x.375 *	8.15	16-#10	1008		150	26x.375	6.85	16-#11	1111	
		300	26x.500	3.08	20-#11	1213			400	24x.969	4.08	32-#11	1215			100	20x.375	6.57	16-#11	1010		200	26x.500	5.85	20-#11	1212	
		400	24x.969	4.13	32-#11	1215		50	16x.375 *	6.54	16-#9	1008	150			26x.375 *	5.45	16-#11	912	250		24x.969	5.06	32-#11	1213		
		500	24x1.219	3.10	32-#11	1317		100	20x.375 *	5.35	16-#11	1010	20'-0"		200	26x.500 *	4.94	20-#11	1213	50		20x.375 *	11.10	16-#11	1010		
	20'-0"	50	16x.375 *	5.32	16-#9	710		150	24x.375 *	3.98	16-#10	1112			250	26x.562	5.09	24-#11	1213	100		24x.375 *	7.96	16-#10	1111		
		100	18x.375 *	3.91	16-#10	1010		200	26x.375	4.16	16-#11	915			300	24x.969	4.73	32-#11	1314	150		26x.375	7.33	16-#11	1212		
		150	24x.375 *	3.23	16-#10	814		300	26x.500 *	3.92	20-#11	1213	50		18x.375 *	8.89	16-#10	811	200	26x.500		6.29	20-#11	1213			
		200	24x.375	3.37	16-#10	1111		400	24x.969	4.11	32-#11	1315	100		20x.375	7.23	16-#11	1010	250	24x.969		5.44	32-#11	1314			
		250	24x.500 *	3.35	16-#11	915		50	24x.969	4.43	32-#11	1316	150		26x.375 *	5.78	16-#11	1111	50	24x.375 *		9.63	16-#10	1010			
		300	26x.500	3.35	20-#11	1213		50	18x.375 *	5.98	16-#10	1010	200		26x.500 *	5.24	20-#11	1213	100	24x.375 *		8.48	16-#10	1111			
		400	24x.969	4.45	32-#11	1317		100	20x.375 *	5.78	16-#11	1010	250		26x.562	5.50	24-#11	1314	150	26x.375		7.81	16-#11	1213			
		500	24x1.219	3.38	32-#11	1218		150	24x.375 *	4.28	16-#10	1112	300		24x.969	5.10	32-#11	1215	200	26x.500		6.72	20-#11	1213			
	24'-0"	50	18x.375 *	4.95	16-#10	710		24'-0"	200	26x.375	4.43	16-#11	915		28'-0"	250	26x.500 *	4.22	20-#11	1213		250	24x.969	5.81	32-#11	1315	
		100	18x.375 *	4.31	16-#10	812			300	24x.969	4.40	32-#11	1215			50	24x.375 *	6.58	16-#10	1010		50	20x.375 *	9.47	16-#11	1107	
		150	24x.375 *	3.42	16-#10	1112			400	24x.969	4.78	32-#11	1317			100	24x.375 *	5.92	16-#10	1010		12'-0"	100	24x.375 *	7.73	16-#10	1109
		200	24x.375	3.63	16-#10	1213			50	20x.375 *	5.64	16-#11	1010			150	26x.375 *	6.12	16-#11	915			150	24x.500	6.56	16-#11	1210
		250	24x.500 *	3.61	16-#11	1016			100	20x.375 *	6.21	16-#11	1010			200	26x.500 *	5.54	20-#11	1213			50	20x.375 *	10.55	16-#11	1108
		300	26x.500	3.61	20-#11	1215			150	24x.375 *	4.59	16-#10	915			250	26x.562	5.90	24-#11	1315			100	24x.375 *	8.45	16-#10	1109
		400	24x.969	4.78	32-#11	1317			200	26x.375	4.70	16-#11	1213			300	24x.969	5.46	32-#11	1316			150	24x.500	7.21	16-#11	1111
		500	24x1.219	3.67	32-#11	1219			250	26x.500 *	4.52	20-#11	1215			50	20x.375 *	11.62	16-#11	1109		20'-0"	50	20x.375 *	11.62	16-#11	1109
	28'-0"	50	20x.375 *	4.66	16-#11	711		28'-0"	300	24x.969	4.70	32-#11	1215			50	24x.375 *	9.94	16-#10	1010			100	24x.375 *	9.89	16-#10	1111
		100	20x.375 *	3.94	16-#11	1010			400	24x.969	5.14	32-#11	1218			150	24x.500	8.52	16-#11	1212			150	24x.500	8.52	16-#11	1212
		150	24x.375 *	3.61	16-#10	814							50		24x.375 *	10.56	16-#10	1010	50	24x.375 *		10.56	16-#10	1010			
		200	24x.375	3.89	16-#10	915							100		24x.500	9.41	16-#11	1111	100	24x.500		9.17	16-#11	1212			
		250	24x.500 *	3.88	16-#11	1017							150		24x.500	9.17	16-#11	1212									
		300	26x.500	3.88	20-#11	1215																					
		400	24x.969	5.11	32-#11	1219																					
		500	24x1.219	3.96	32-#11	1320																					

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 609 INDICATES A FOOTING 6' WIDE x 9' LONG). SEE BC-741M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
- STRUT AND COLUMN DESIGN BASED ON MAXIMUM SIGN HEIGHT FOR THE INDICATED SIGN AREA. DESIGNER MUST CHECK ADEQUACY OF STRUT AND COLUMN MEMBER SIZES FOR SIGN HEIGHTS LESS THAN 12'-0" FOR SINGLE STRUT STRUCTURES AND LESS THAN 18' 6" FOR DOUBLE STRUT STRUCTURES.
- CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
- * - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 3/16" FOR COLUMNS.
- * *- PIPE NOMINAL DIA. X WALL THICKNESS, SEE GENERAL NOTE 11 ON SHEET 1.

SINGLE STRUT DATA **									
SIGN AREA (SQ. FT.)	X								
	4'-0"	8'-0"	12'-0"	16'-0"	20'-0"	24'-0"	28'-0"	32'-0"	36'-0"
50	5x.258 *	6x.280	8x.322 *	10x.365 *	10x.365 *	10x.365 *	12x.375 *	12x.375 *	14x.375 *
100	6x.280 *	8x.322 *	10x.365 *	10x.365 *	12x.375 *	12x.375	14x.375	16x.375 *	_____
150	8x.322 *	10x.365 *	10x.365 *	12x.375 *	14x.375 *	16x.375	18x.375 *	18x.375	_____
200	10x.365 *	10x.365 *	12x.375 *	16x.375 *	16x.375	18x.375	20x.375 *	_____	_____
250	10x.365 *	12x.375 *	14x.375 *	16x.375	18x.375	20x.375 *	20x.500 *	_____	_____
300	10x.365 *	16x.375 *	16x.375 *	18x.375 *	20x.375	20x.500 *	_____	_____	_____
400	12x.375	16x.375 *	20x.375 *	20x.500 *	20x.500	_____	_____	_____	_____
480	16x.375 *	18x.375 *	20x.375	20x.500	_____	_____	_____	_____	_____

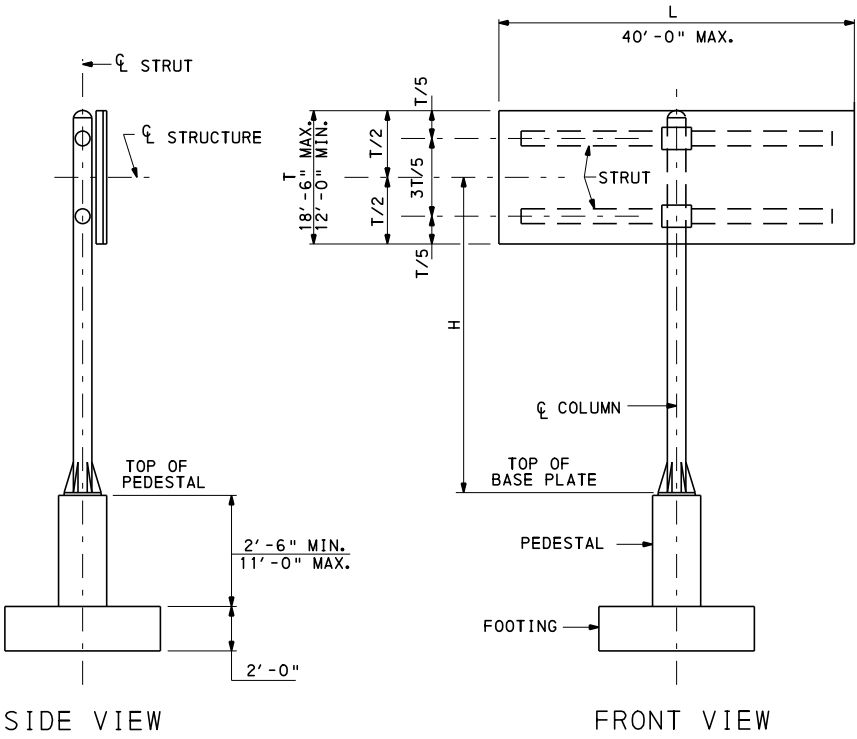


SINGLE STRUT SIGN

SINGLE STRUT DATA **									
SIGN AREA (SQ. FT.)	L								
	8'-0"	12'-0"	16'-0"	20'-0"	24'-0"	28'-0"	32'-0"	36'-0"	40'-0"
50	4x.237 *	—	—	—	—	—	—	—	—
100	—	4x.237 *	5x.258 *	—	—	—	—	—	—
150	—	—	6x.280 *	6x.280 *	6x.280	—	—	—	—
200	—	—	—	8x.322 *	8x.322 *	8x.322 *	8x.322 *	—	—
250	—	—	—	—	8x.322 *	8x.322 *	10x.365 *	10x.365 *	10x.365 *
300	—	—	—	—	—	10x.365 *	10x.365 *	10x.365 *	10x.365 *
400	—	—	—	—	—	—	—	10x.365	12x.375 *
480	—	—	—	—	—	—	—	—	12x.375 *

PEDESTAL	
COLUMN	PEDESTAL SIZE
10" DIA.	2'-6" x 2'-6"
12" DIA.	2'-9" x 2'-9"
14" DIA.	3'-0" x 3'-0"
16" DIA.	3'-3" x 3'-3"
18" DIA.	3'-3" x 3'-3"
20" DIA.	3'-9" x 3'-9"
24" DIA.	4'-3" x 4'-3"
26" DIA.	4'-3" x 4'-3"

DOUBLE STRUT DATA **										
SIGN AREA (SQ. FT.)	L									
	4'-0"	8'-0"	12'-0"	16'-0"	20'-0"	24'-0"	28'-0"	32'-0"	36'-0"	40'-0"
50	3.5x.226	—	—	—	—	—	—	—	—	—
100	—	3.5x.226	—	—	—	—	—	—	—	—
150	—	—	3.5x.226	—	—	—	—	—	—	—
200	—	—	4x.237 *	5x.258 *	—	—	—	—	—	—
250	—	—	—	5x.258 *	6x.280 *	—	—	—	—	—
300	—	—	—	—	6x.280 *	6x.280	—	—	—	—
400	—	—	—	—	—	8x.322 *	8x.322 *	8x.322 *	—	—
500	—	—	—	—	—	—	8x.322 *	10x.365 *	10x.365 *	10x.365 *
600	—	—	—	—	—	—	—	10x.365 *	10x.365 *	—
700	—	—	—	—	—	—	—	—	—	12x.375 *
740	—	—	—	—	—	—	—	—	—	12x.375 *



DOUBLE STRUT SIGN

COLUMN AND FOOTING DATA									
H	SIGN AREA (SQ. FT.)	COLUMN **	PEDESTAL "P" BARS	FOOTING TYPE	H	SIGN AREA (SQ. FT.)	COLUMN **	PEDESTAL "P" BARS	FOOTING TYPE
12'-0"	50	10x.365 *	16-#6	609	24'-0"	50	18x.375 *	16-#10	609
	100	10x.365 *	16-#6	711		100	18x.375 *	16-#10	713
	150	12x.375 *	16-#8	713		150	18x.375 *	16-#10	713
	200	14x.375 *	16-#8	713		200	20x.375 *	16-#11	815
	250	16x.375 *	16-#9	815		250	24x.375 *	16-#10	916
	300	18x.375 *	16-#10	815		300	24x.375 *	16-#10	918
	400	20x.375 *	16-#11	916		400	26x.375 *	16-#11	918
	480	24x.375 *	16-#10	916		480	24x.500 *	16-#11	922
	500	24x.375 *	16-#10	918		500	24x.688	24-#11	922
	600	24x.375 *	16-#10	918		600	24x.688	24-#11	922
	700	26x.375 *	16-#11	922		700	24x.969	32-#11	1024
	740	26x.375 *	16-#11	922		740	24x.969	32-#11	1026
16'-0"	50	14x.375 *	16-#8	609	28'-0"	50	20x.375 *	16-#11	609
	100	14x.375 *	16-#8	711		100	20x.375 *	16-#11	713
	150	14x.375 *	16-#8	713		150	20x.375 *	16-#11	815
	200	16x.375 *	16-#9	713		200	20x.375	16-#11	817
	250	18x.375 *	16-#10	815		250	24x.375 *	16-#10	916
	300	20x.375 *	16-#11	817		300	24x.375	16-#10	918
	400	24x.375 *	16-#10	916		400	24x.500 *	16-#11	922
	480	24x.375 *	16-#10	918		480	24x.688	24-#11	922
	500	24x.375 *	16-#10	918		500	24x.688	24-#11	922
	600	26x.375 *	16-#11	918		600	24x.969	32-#11	1024
	700	24x.500	16-#11	922		700	24x.969	32-#11	1221
	740	24x.688	24-#11	922		740	24x.969	32-#11	1323
20'-0"	50	16x.375 *	16-#9	609					
	100	16x.375 *	16-#9	713					
	150	16x.375 *	16-#9	713					
	200	18x.375 *	16-#10	815					
	250	20x.375 *	16-#11	817					
	300	24x.375 *	16-#10	817					
	400	24x.375 *	16-#10	918					
	480	26x.375 *	16-#11	918					
	500	26x.375	16-#11	918					
	600	24x.688	24-#11	922					
	700	24x.688	24-#11	922					
	740	24x.688	24-#11	1024					

- 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 609 INDICATES A FOOTING 6' WIDE x 9' LONG). SEE BC-741M, SHEET 2 FOR FOUNDATION DETAILS.
 - FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
 - STRUT AND COLUMN DESIGN BASED ON MAXIMUM SIGN HEIGHT FOR THE INDICATED SIGN AREA. DESIGNER MUST CHECK ADEQUACY OF STRUT AND COLUMN MEMBER SIZES FOR SIGN HEIGHTS LESS THAN 12'-0" FOR SINGLE STRUT STRUCTURES AND LESS THAN 18'-6" FOR DOUBLE STRUT STRUCTURES.
 - CVN REQUIRED FOR COLUMN AND STRUT WALL THICKNESSES EXCEEDING 1/2" (0.500").
 - * - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS.
 - ** - PIPE NOMINAL DIA. x WALL THICKNESS, SEE GENERAL NOTE 11 ON SHEET 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
CANTILEVER AND CENTER-MOUNT STRUCTURES
STRUT LENGTHS UP TO 40'

CENTER-MOUNT DESIGN TABLES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 8 OF 8

BD-641M

- CHANGE 1
- CHANGE 2
- CHANGE 3

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 CRASH WORTHY BARRIER, SEE TABLE A, BC-742M, 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, EXCEPT, THE MEMBER SIZES INDICATED DO NOT INCLUDE THE FATIGUE REQUIREMENTS INDICATED IN THE DESIGN CRITERIA.
- THE MEMBER SIZES INDICATED IN THE DESIGN TABLES **SHOULD** MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY III. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I OR II FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD ARE AS FOLLOWS:

BD-642M: TAPERED TUBE STRUCTURES, SPANS FROM 30’ TO 80’
- 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-742M.

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. PROVIDE BOLT HOLES $\frac{1}{16}$ " LARGER THAN BOLT DIAMETER.
13. PROVIDE ANCHOR BOLT HOLES $\frac{1}{4}$ " LARGER THAN BOLT DIAMETER.
14. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
15. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
16. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS

PENNDOT STD. DWGS. (U.N.O.)*

SIGN PANELS

TC-8701E OR TC-8701S

LIGHT FIXTURES

BC-742M, SHT. 5

SIGN SUPPORT BEAM

BC-742M, SHT. 5

COLUMNS, CHORDS

CALCULATED INTERNALLY WITHIN PROGRAM
- DYNAMIC/VARIABLE MESSAGE SIGN (DMS/VMS) STRUCTURES

DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) ARE NOT RECOMMENDED ON TAPERED TUBE STRUCTURE TYPE AS PRESENTED IN THESE STANDARDS. THE CHIEF BRIDGE ENGINEER MUST REVIEW AND APPROVE ALL STRUCTURES DESIGNED TO CARRY A DYNAMIC/VARIABLE MESSAGE SIGN (DMS/VMS).
- EXTERNAL LOADS

AASHTO SIGN SPECS.

ICE LOAD

3.7

WIND LOAD

APPENDIX C, SECTION C.3,

EQ. C-1, WITH 80 MPH

WIND AND 30% GUST FACTOR
- GROUP LOADS

AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA

AASHTO SIGN SPECS. (U.N.O.)

SECTION PROPERTIES FOR TUBULAR SHAPES

MAXIMUM STRESSES IN TUBULAR SHAPES

ALLOWABLE STRESSES FOR TUBULAR SHAPES

ALLOWABLE STRESSES FOR SIGN SUPPORTS

ALLOWABLE STRESSES FOR BASE PLATES

ALLOWABLE STRESSES FOR COMBINED STEEL STRESS

FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)

ALLOWABLE DEFLECTION

PERMANENT CAMBER

ALLOWABLE STRESSES FOR STRUCTURAL STEEL

APPENDIX B, TABLE B-1

APPENDIX B, TABLE B-2

5.6 (TABLE 5-3) & 5.11

5.12

5.8

5.12

SECTION 11

10.4

10.5

SECTION 5
- BOLT CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES

SLIP-CRITICAL BOLT ALLOWABLE

BOLT PRYING ACTION

COMBINED BOLT SHEAR AND TENSION

BOLT DESIGN CRITERIA

ALLOWABLE ANCHOR BOLT STRESSES

TABLE 10.32.3B

10.32.3.2.1

10.32.3.3.2

10.32.3.3.3

10.32.3.3.3

AASHTO SIGN SPECS. 5.16

AASHTO SIGN SPECS. 5.17
- CONCRETE CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS

REINFORCEMENT TENSILE STRESS

SHEAR CAPACITY OF FOOTINGS

SHEAR STRESS IN FOOTINGS

ALLOWABLE SHEAR STRESS

SLENDERNESS OF COLUMNS

MINIMUM REINF. OF FLEXURAL MEMBERS

SPACING LIMITS FOR REINFORCEMENT

MINIMUM CONCRETE COVER

PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS

DISTRIBUTION OF REINFORCEMENT

FOOTING STABILITY REQUIREMENTS

TORSION

COLUMN DESIGN (PEDESTALS)

8.15.2.1.3

8.15.2.2

8.15.5.6.1

8.15.5.6.2

8.15.5.6.4

8.16.5.2

8.17.1

8.21

DM-4 D8.22.1*

FIG. 4.4.7.1.1.1C

4.4.11.2.2

DM-4**D5.5.5.**

ACI SECTION A.7.3*

8.15.4
- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE

MINIMUM AREA IN BEARING

UNIT WEIGHT OF SOIL

1.5 TONS PER SQUARE FOOT

95%

100 POUNDS PER CUBIC FOOT
- DRILLED SHAFTS (CAISSONS) DM-4 SEC. **D4.6**, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE

MAXIMUM DESIGN LATERAL DISPLACEMENT

MODULUS OF SUBGRADE REACTION

UNIT WEIGHT OF SOIL

ANGLE OF INTERNAL FRICTION

COHESION

1.5 TONS PER SQUARE FOOT

0.5"

10.0 POUNDS PER CUBIC INCH

100 POUNDS PER CUBIC FOOT

25°

0 KIPS PER SQUARE FOOT
- SEISMIC DESIGN CRITERIA

STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, ANSI/AWS WELDING **CODE D1.5**, **CONTRACT** SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE ANSI/AWS **D1.1** FOR WELDING NOT COVERED IN ANSI/**AASHTO/AWS D1.5**.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS & CHORDS: **SEE PUBLICATION 408, SECTION 948.2**

ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36

ASTM A709, GRADE 36
- 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 $\frac{5}{16}$ ". 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 CHORDS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS: ASTM F1554 GRADE 55 PER PUBLICATION 408

SECTION 1105.02(c) 3.

BOLTS: ASTM A-325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH **SPECIFICATIONS, PUBLICATION 408** - (INDICATE CHANGE NUMBER), ANSI/**AASHTO/AWS D1.5** **BRIDGE WELDING CODE** AND **CONTRACT** SPECIAL PROVISIONS. / USE ANSI/**AWS D1.1** FOR WELDING NOT COVERED IN ANSI/**AASHTO/AWS D1.5**."
- DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) ARE NOT RECOMMENDED ON TAPERED TUBE STRUCTURES. OVERHEAD SIGN STRUCTURES INTENDED TO CARRY DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THESE STANDARDS MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF OVERHEAD SIGN STRUCTURES CARRYING DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS).

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- **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 318-99).
- CVN: CHARPY V-NOTCH.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

BUREAU OF **PROJECT DELIVERY**

OVERHEAD SIGN STRUCTURES

TAPERED TUBE STRUCTURE
SPANS FROM 30’ TO 80’

NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore

CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson

ACTING DIR. BUREAU OF **PROJECT DELIVERY**

SHT. 1 OF 6

BD-642M

REFERENCE DRAWINGS

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/MERCURY VAPOR LAMPS
TC-8716	ERECTION DETAILS/EXTRUDED ALUMINUM CHANNEL SIGNS
	FLAT SHEET ALUMINUM WITH STIFFENERS/OVERHEAD STRUCTURES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-742M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION SO THAT THE BOTTOM OF BASE PLATE ELEVATION IS 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.

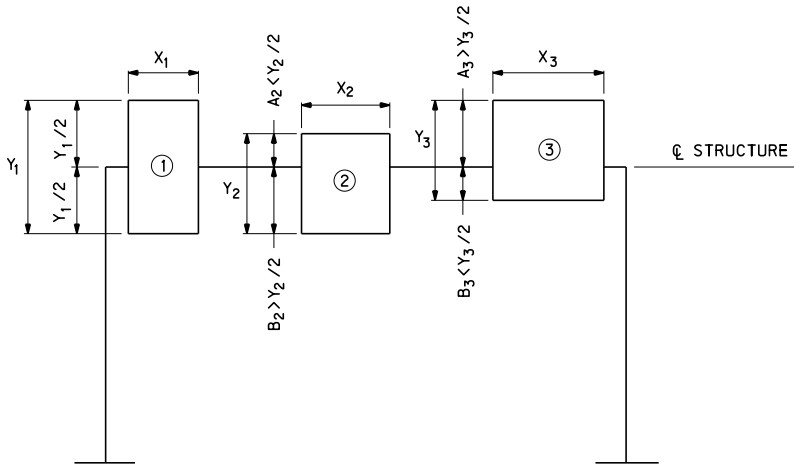
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- 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").
- 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) × (Y)

THE SIGN AREA FOR ANY SIGN PANEL OFF-CENTER IN THE VERTICAL DIRECTION IS (X) × (B) × 2 WHEN B>A OR (X) × (A) × 2 WHEN A>B.

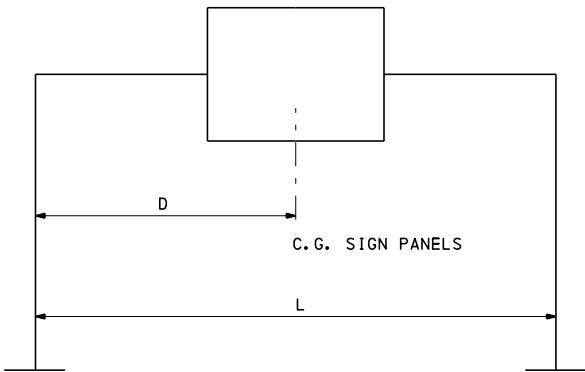
EXAMPLE:
AREA OF SIGN NO. 1 = (X₁) × (Y₁)
AREA OF SIGN NO. 2 = (X₂) × (B₂) × 2
AREA OF SIGN NO. 3 = (X₃) × (A₃) × 2



A = DISTANCE FROM CL STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM CL STRUCTURE TO BOTTOM OF SIGN

DESIGN AREA OF SIGN NO.1 = X₁ Y₁
DESIGN AREA OF SIGN NO.2 = (X₂ B₂) × 2
DESIGN AREA OF SIGN NO.3 = (X₃ A₃) × 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 6'-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 ULTIMATE SIGN AREA IS USED FOR DESIGN, SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT 6'-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 6'-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 CASES A-F ON THE NEXT SHEET.
- DESIGNS FOR TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 X SPAN LENGTH AND 0.58 X SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE BEGINNING OF THE SPAN AND 0.42 X SPAN LENGTH OR 0.58 X SPAN LENGTH AND END OF SPAN. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.



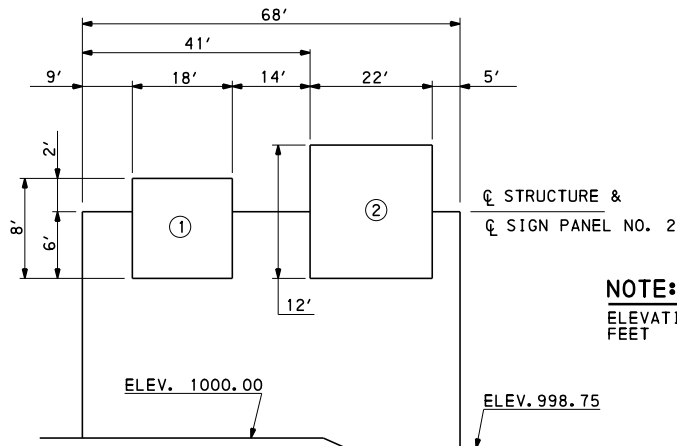
IF $0.42L \geq D \leq 0.58L$, USE LOADING TYPE 1

IF $D < 0.42L$, OR $D > 0.58L$, USE LOADING TYPE 2

LOADING TYPE DIAGRAM

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- 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.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SPAN LENGTH, & POST HEIGHT



NOTE:
ELEVATIONS ARE IN FEET

$$\Delta \text{ ELEV.} = 1000.00 - 998.75 = 1.25 < 2' - 6" \\ \left. \begin{array}{l} Y_1 = 8' \\ Y_2 = 12' \end{array} \right\} Y_1 < Y_2 \quad \text{USE CASE B}$$

- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION:
 $\text{ELEV.} = 1000.00 + 17' - 6" + 1' - 6" = 1019.00$
[1'-6" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]

- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2
 $\text{ELEV.} = 1019.00 + 12/2 = 1025.00$

- ACTUAL SPAN LENGTH = 68'. USE 70'
POST HEIGHT = 1025.00 - 998.75 = 26.25'. USE OVER 24' TO 33'

- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:

$$\begin{array}{rcl} A_1 & = & 18' \times 6' \times 2 = 216 \text{ SF} \\ A_2 & = & 22' \times 12' = 264 \text{ SF} \\ \hline & & 480 \text{ SF} \\ & \rightarrow & \text{USE } 550 \text{ SF} \end{array}$$

- LOCATE C.G. SIGN AREA:
(FROM LEFT POST) C.G. = $\frac{[216 \text{ SF} \times (9' + 18'/2)] + [264 \text{ SF} \times (41' + 22'/2)]}{480}$
 $= 36.7'$ $36.7' / 68' = 0.54$; $0.42 < 0.54 < 0.58$
THEREFORE, USE LOADING TYPE 1

- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.
- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

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OVERHEAD SIGN STRUCTURES

TAPERED TUBE STRUCTURE
SPANS FROM 30' TO 80'

DESIGN INSTRUCTIONS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Stroman
ACTING DIR, BUR. OF PROJECT DELIVERY

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$$Y_1 = Y_2$$

$$\Delta \text{ ELEV.} \leq 2' - 6''$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ℓ OF STRUCTURE AT ℓ OF SIGN PANELS UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ℓ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.



$$Y_1 \leq Y_2$$

Δ ELEV. \leq 2' - 6"

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET \mathcal{C} OF STRUCTURE AT \mathcal{C} OF SIGN PANEL NO. 2 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET \mathcal{C} STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \leq Y_2$.



$$Y_1 \geq Y_2$$

$$\Delta \text{ ELEV.} \leq 2' - 6''$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET \mathcal{Q} OF STRUCTURE AT \mathcal{Q} OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET \mathcal{Q} STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF Y_1 AND Y_2 WHERE $Y_1 \geq Y_2$.



$$Y_1 = Y_2$$

Δ ELEV. > 2' - 6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ϕ OF STRUCTURE AT ϕ OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF Δ ELEV. AND $Y_{1,2}$:

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.



$$Y_1 \geq Y_2$$

Δ ELEV. > 2' - 6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ζ OF STRUCTURE AT ζ OF SIGN PANEL NO. 1 UNLESS STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN THIS CASE, RESET ζ STRUCTURE TO OBTAIN ADEQUATE CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF Δ ELEV. AND Y_2 WHERE $Y_1 > Y_2$:

WHEN Y_2 EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE FOR A PARTICULAR VALUE OF $\Delta ELEV.$, 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.



$$Y_1 < Y_2$$

Δ ELEV. > 2' - 6"

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL CLEARANCE.

SET ℓ OF STRUCTURE AT ℓ OF SIGN PANEL NO. 2 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ℓ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF $\Delta ELEV.$, Y_1 , AND Y_2 WHERE $Y_1 < Y_2$:

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 & 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

BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

TAPERED TUBE STRUCTURE
SPANS FROM 30' TO 80'

INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED NOV. 21, 2014

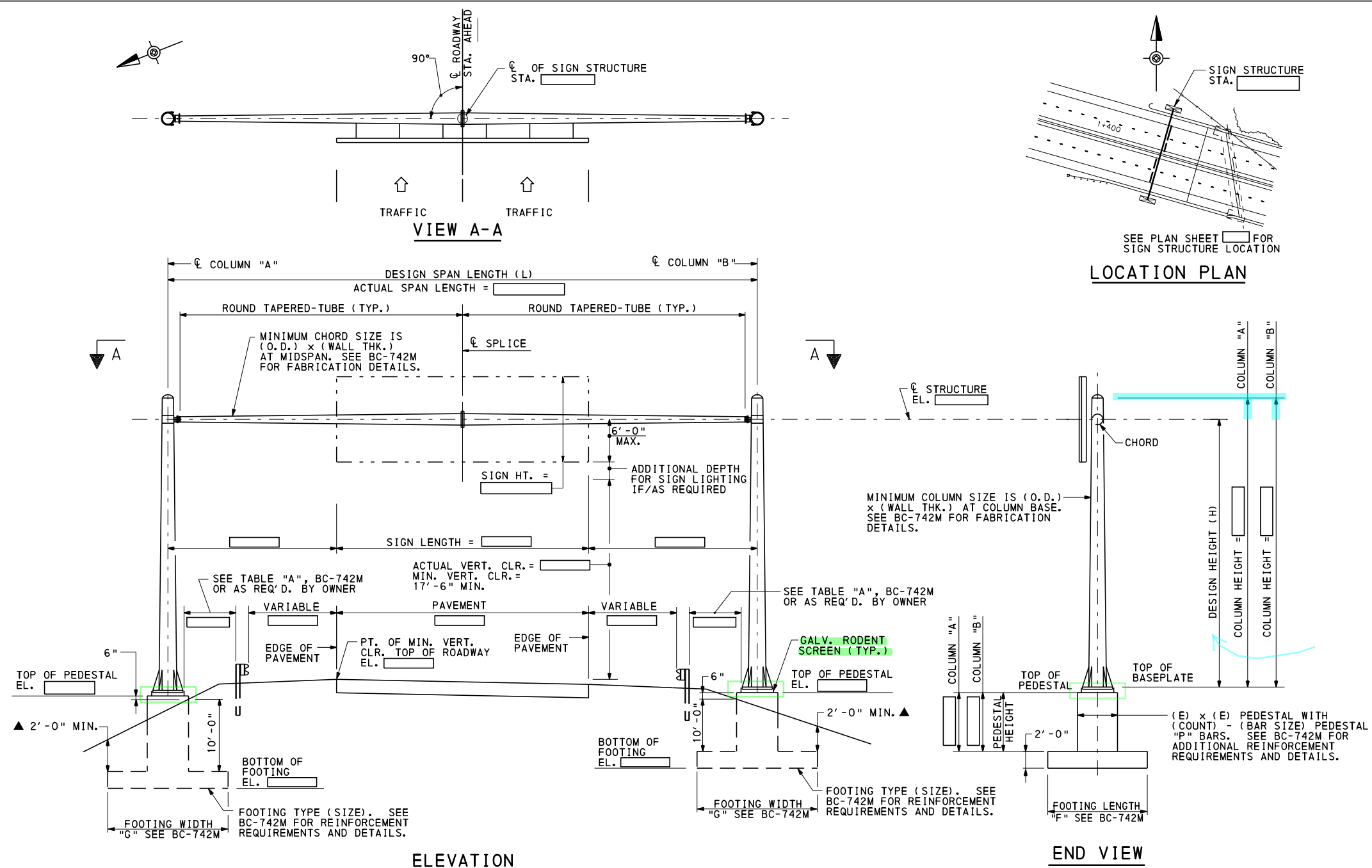
Thomas P Macioce
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

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SHT. 3 OF 6

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DESIGN CRITERIA	
DESIGN SIGN AREA (A) =	[]
DESIGN SPAN LENGTH (L) =	[]
DESIGN HEIGHT (H) =	[]
LOADING TYPE=	(1 OR 2)
FATIGUE CATEGORY=	[]

NOTE:
DESIGN FOR (ULTIMATE OR ACTUAL) 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.
 - (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-742M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
 - FOOTING TYPE (SIZE). SEE BC-742M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
 - MINIMUM COLUMN SIZE IS (O.D.) x (WALL THK.) AT COLUMN BASE. SEE BC-742M FOR FABRICATION DETAILS.
 - MINIMUM CHORD SIZE IS (O.D.) x (WALL THK.) AT MIDSPAN. SEE BC-742M 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 []

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]

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OVERHEAD SIGN STRUCTURES

TAPERED TUBE STRUCTURE
SPANS FROM 30' TO 80'

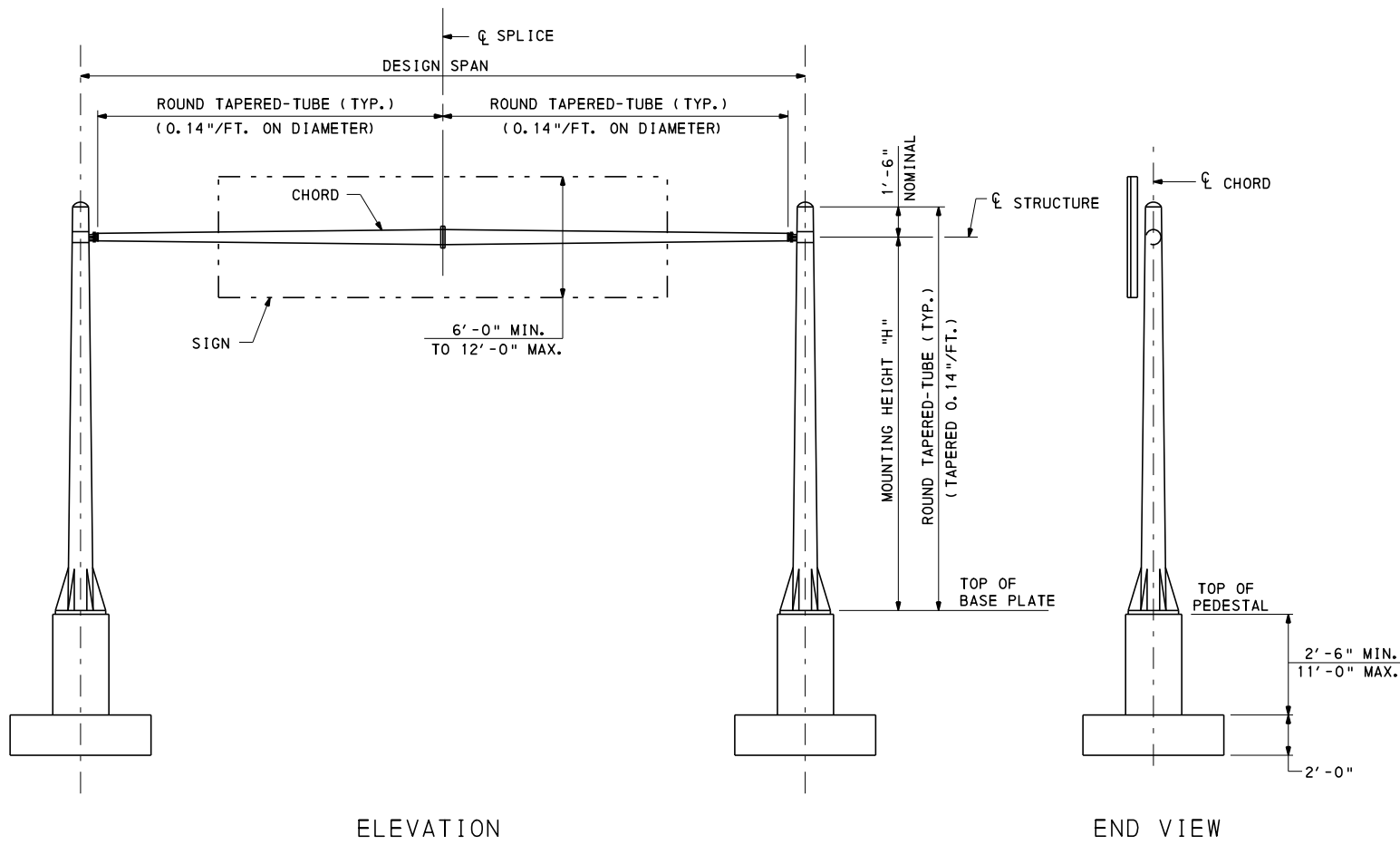
SAMPLE CONTRACT DRAWING

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

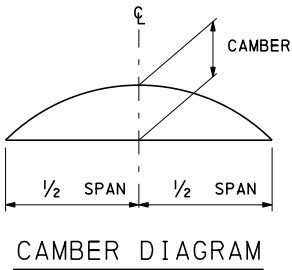
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BD-642M



CAMBER TABLE	
SPAN	CAMBER
30'	1.92"
40'	2.67"
50'	3.16"
60'	3.59"
70'	4.15"
80'	5.49"



PEDESTAL	
COLUMN	PEDESTAL SIZE
9" TO 11" DIA.	2'-6" x 2'-6"
12" TO 13" DIA.	2'-9" x 2'-9"
14" TO 15" DIA.	3'-0" x 3'-0"
16" TO 18" DIA.	3'-3" x 3'-3"
19" TO 23" DIA.	3'-9" x 3'-9"
24" TO 26" DIA.	4'-3" x 4'-3"

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6' WIDE x 9' LONG.) SEE BC-742M SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").

LOADING TYPE 1														
DESIGN SPAN	SIGN AREA (SQ. FT.)	COLUMN * (O.D. x WALL THICKNESS)				CHORD * (O.D. x WALL THICKNESS)	PEDESTAL "P" BARS (COUNT-BAR SIZE)				FOOTING TYPE			
		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'
TO 30'	100	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	10 x 3/8	16-#6	16-#8	16-#10	16-#10	609	609	609	710
	175	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	10 x 3/8	16-#6	16-#8	16-#10	16-#10	609	711	711	812
	250	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	12 x 3/8	16-#8	16-#8	16-#10	16-#10	711	713	713	814
	325	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	12 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	1112	814
	360	14 x 3/8	16 x 3/8	19 x 3/8	24 x 3/8	12 x 3/8	16-#8	16-#9	16-#11	16-#10	713	815	1114	1213
OVER 30' TO 40'	150	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	11 x 3/8	16-#6	16-#8	16-#10	16-#10	609	609	711	710
	225	10 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	12 x 3/8	16-#6	16-#8	16-#10	16-#10	711	713	713	814
	300	11 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	13 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	1112	814
	375	13 x 3/8	16 x 3/8	19 x 3/8	24 x 3/8	15 x 3/8	16-#8	16-#9	16-#11	16-#10	713	713	1114	916
	450	14 x 3/8	17 x 3/8	20 x 3/8	24 x 3/8	15 x 3/8	16-#8	16-#10	16-#11	16-#10	713	1114	817	1215
OVER 40' TO 50'	480	15 x 3/8	18 x 3/8	21 x 3/8	25 x 3/8	16 x 3/8	16-#9	16-#10	16-#10	16-#11	1112	1114	916	1215
	150	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	14 x 3/8	16-#6	16-#8	16-#10	16-#10	609	609	711	710
	250	11 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	14 x 3/8	16-#8	16-#8	16-#10	16-#10	711	713	713	814
	350	13 x 3/8	16 x 3/8	19 x 3/8	24 x 3/8	17 x 3/8	16-#8	16-#9	16-#11	16-#10	713	713	815	916
	450	14 x 3/8	17 x 3/8	20 x 3/8	24 x 3/8	18 x 3/8	16-#8	16-#10	16-#11	16-#10	1112	1114	817	916
OVER 50' TO 60'	550	15 x 3/8	19 x 3/8	22 x 3/8	26 x 3/8	19 x 3/8	16-#9	16-#11	16-#10	16-#11	1114	1114	1215	918
	600	17 x 3/8	20 x 3/8	23 x 3/8	24 x 1/2	19 x 3/8	16-#10	16-#11	16-#10	16-#11	817	1114	918	1020
	125	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	17 x 3/8	16-#6	16-#8	16-#10	16-#10	609	609	711	710
	250	11 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	17 x 3/8	16-#8	16-#8	16-#10	16-#10	711	713	713	814
	375	13 x 3/8	16 x 3/8	18 x 3/8	24 x 3/8	19 x 3/8	16-#8	16-#9	16-#10	16-#10	713	1112	1114	916
OVER 60'	500	15 x 3/8	19 x 3/8	21 x 3/8	24 x 3/8	21 x 3/8	16-#9	16-#11	16-#10	16-#10	815	815	916	918
	625	17 x 3/8	20 x 3/8	23 x 3/8	25 x 1/2	20 x 1/2	16-#10	16-#11	16-#10	20-#11	815	1114	918	918
	720	18 x 3/8	22 x 3/8	25 x 3/8	25 x 1/2	21 x 1/2	16-#10	16-#10	16-#11	20-#11	1114	1215	1215	1020

FOR CONTINUATION OF CHART, SEE SHEET 6.

* CHORD SIZE SHOWN REPRESENTS SIZE AT MIDSPAN.
COLUMN SIZE SHOWN REPRESENTS SIZE AT COLUMN BASE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

TAPERED TUBE STRUCTURE
SPANS FROM 30' TO 80'

DESIGN TABLES - LOADING TYPE I

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
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RECOMMENDED NOV. 21, 2014
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SHT. 5 OF 6

BD-642M

LOADING TYPE 1 (CONTINUED)														
DESIGN SPAN	SIGN AREA (SQ. FT.)	COLUMN * (O.D. x WALL THICKNESS)				CHORD * (O.D. x WALL THICKNESS)	PEDESTAL "P" BARS (COUNT - BAR SIZE)				FOOTING TYPE			
		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'
OVER 60' TO 70'	175	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	20 x 3/8	16-#6	16-#8	16-#10	16-#10	609	711	713	812
	300	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	22 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	713	814
	425	14 x 3/8	18 x 3/8	20 x 3/8	24 x 3/8	22 x 3/8	16-#8	16-#10	16-#11	16-#10	713	815	1114	1215
	550	16 x 3/8	20 x 3/8	22 x 3/8	26 x 3/8	24 x 3/8	16-#9	16-#11	16-#10	16-#11	815	1114	916	918
	675	17 x 3/8	22 x 3/8	24 x 3/8	26 x 1/2	23 x 1/2	16-#10	16-#10	16-#10	20-#11	1114	916	918	1020
	800	19 x 3/8	22 x 3/8	26 x 3/8	26 x 1/2	24 x 1/2	16-#11	16-#10	16-#11	20-#11	1114	1215	1020	1317
	840	20 x 3/8	24 x 3/8	26 x 1/2	26 x 5/8	24 x 1/2	16-#11	16-#10	20-#11	24-#11	1216	1317	1020	1024
OVER 70' TO 80'	150	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	22 x 3/8	16-#6	16-#8	16-#10	16-#10	609	711	711	812
	300	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	24 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	1112	814
	450	14 x 3/8	18 x 3/8	20 x 3/8	24 x 3/8	24 x 3/8	16-#8	16-#10	16-#11	16-#10	1112	815	1114	1215
	600	16 x 3/8	20 x 3/8	23 x 3/8	26 x 3/8	23 x 11/16	16-#9	16-#11	16-#10	16-#11	1114	817	918	1215
	750	18 x 3/8	22 x 3/8	26 x 3/8	26 x 1/2	24 x 11/16	16-#10	16-#10	16-#11	20-#11	1114	918	918	1317
	900	20 x 3/8	24 x 3/8	26 x 1/2	26 x 9/16	24 x 11/16	16-#11	16-#10	20-#11	24-#11	1114	1215	1317	922
	960	22 x 3/8	26 x 3/8	26 x 1/2	26 x 3/4	25 x 11/16	16-#10	16-#11	20-#11	24-#11	918	1020	1319	924

LOADING TYPE 2														
DESIGN SPAN	SIGN AREA (SQ. FT.)	COLUMN * (O.D. x WALL THICKNESS)				CHORD * (O.D. x WALL THICKNESS)	PEDESTAL "P" BARS (COUNT - BAR SIZE)				FOOTING TYPE			
		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'
TO 30'	150	10 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	10 x 3/8	16-#6	16-#8	16-#10	16-#10	711	711	713	814
	250	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	12 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	713	814
	300	14 x 3/8	16 x 3/8	19 x 3/8	24 x 3/8	12 x 3/8	16-#8	16-#9	16-#11	16-#10	713	815	815	916
OVER 30' TO 40'	125	9 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	11 x 3/8	16-#6	16-#8	16-#10	16-#10	609	711	713	812
	225	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	12 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	713	814
	325	13 x 3/8	16 x 3/8	19 x 3/8	24 x 3/8	15 x 3/8	16-#8	16-#9	16-#11	16-#10	713	815	815	916
	400	15 x 3/8	18 x 3/8	20 x 3/8	24 x 3/8	15 x 3/8	16-#9	16-#10	16-#11	16-#10	815	1114	817	918
OVER 40' TO 50'	175	11 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	14 x 3/8	16-#8	16-#8	16-#10	16-#10	711	713	713	814
	275	13 x 3/8	16 x 3/8	19 x 3/8	24 x 3/8	17 x 3/8	16-#8	16-#9	16-#11	16-#10	713	713	815	916
	375	15 x 3/8	18 x 3/8	20 x 3/8	24 x 3/8	18 x 3/8	16-#9	16-#10	16-#11	16-#10	815	815	817	918
	475	16 x 3/8	19 x 3/8	22 x 3/8	26 x 3/8	19 x 3/8	16-#9	16-#11	16-#10	16-#11	815	1114	916	918
OVER 50' TO 60'	500	17 x 3/8	20 x 3/8	23 x 3/8	24 x 1/2	19 x 3/8	16-#10	16-#11	16-#10	16-#11	817	817	918	1020
	200	11 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	17 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	713	814
	325	15 x 3/8	19 x 3/8	21 x 3/8	24 x 3/8	19 x 3/8	16-#9	16-#11	16-#10	16-#10	713	815	814	916
	450	17 x 3/8	20 x 3/8	23 x 3/8	25 x 1/2	21 x 3/8	16-#10	16-#11	16-#10	20-#11	815	817	918	918
	575	18 x 3/8	22 x 3/8	25 x 3/8	25 x 1/2	20 x 1/2	16-#10	16-#10	16-#11	20-#11	817	918	918	1020
OVER 60' TO 70'	600	19 x 3/8	23 x 3/8	24 x 1/2	26 x 11/16	21 x 1/2	16-#11	16-#10	16-#11	24-#11	1114	918	1317	1020
	225	12 x 3/8	15 x 3/8	18 x 3/8	24 x 3/8	22 x 3/8	16-#8	16-#9	16-#10	16-#10	713	713	815	814
	350	15 x 3/8	18 x 3/8	21 x 3/8	24 x 3/8	22 x 3/8	16-#9	16-#10	16-#10	16-#10	815	815	916	918
	475	17 x 3/8	22 x 3/8	24 x 3/8	26 x 1/2	23 x 1/2	16-#10	16-#10	16-#10	20-#11	815	916	918	918
	600	19 x 3/8	22 x 3/8	26 x 3/8	26 x 1/2	23 x 1/2	16-#11	16-#10	16-#11	20-#11	817	918	918	1020
OVER 70' TO 80'	700	20 x 3/8	24 x 3/8	26 x 1/2	26 x 5/8	24 x 1/2	16-#11	16-#10	20-#11	24-#11	817	918	1020	1022
	200	12 x 3/8	14 x 3/8	18 x 3/8	24 x 3/8	24 x 3/8	16-#8	16-#8	16-#10	16-#10	713	713	713	814
	350	15 x 3/8	18 x 3/8	21 x 3/8	24 x 3/8	24 x 3/8	16-#9	16-#10	16-#10	16-#10	815	817	916	918
	500	18 x 3/8	21 x 3/8	24 x 3/8	26 x 1/2	23 x 11/16	16-#10	16-#10	16-#10	20-#11	817	916	918	1020
	650	19 x 3/8	23 x 3/8	26 x 3/8	26 x 11/16	24 x 11/16	16-#11	16-#10	16-#11	24-#11	817	918	1020	1319
	800	21 x 3/8	25 x 3/8	26 x 1/2	26 x 11/16	24 x 11/16	16-#10	16-#11	20-#11	24-#11	918	1020	1020	1022

* CHORD SIZE SHOWN REPRESENTS SIZE AT MIDSPAN.
COLUMN SIZE SHOWN REPRESENTS SIZE AT COLUMN BASE.

NOTES:

- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6' WIDE x 9' LONG.) SEE BC-742M SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
- FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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OVERHEAD SIGN STRUCTURES

TAPERED TUBE STRUCTURE
SPANS FROM 30' TO 80'

DESIGN TABLES - LOADING TYPES 1 & 2

RECOMMENDED NOV. 21, 2014
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SHT. 6 OF 6

BD-642M

- CHANGE 1
- CHANGE 2
- CHANGE 3

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-743M, 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 MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD ARE AS FOLLOWS:

BD-643M#

TWO-POST PLANAR TRUSS, SPANS FROM 30' TO 100'.
- 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. FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-743M.

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. PROVIDE BOLT HOLES 1/16" LARGER THAN BOLT DIAMETER.
13. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
14. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
15. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
16. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS

PENNDOT STD. DWGS. (U.N.O.)*

SIGN PANELS
LIGHT FIXTURES
SIGN SUPPORT BEAM
COLUMNS, CHORDS

TC-8701E OR TC-8701S
BC-743M, SHT. 9
BC-743M, SHT. 10
CALCULATED INTERNALLY WITHIN PROGRAM
- DYNAMIC/VARIABLE MESSAGE SIGN (DMS/VMS) STRUCTURES

DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) ARE PROHIBITED ON 2-POST PLANAR TRUSS STRUCTURE TYPE AS PRESENTED IN THESE STANDARDS. THE CHIEF BRIDGE ENGINEER MUST REVIEW AND APPROVE ALL STRUCTURES DESIGNED TO CARRY A DYNAMIC/VARIABLE MESSAGE SIGN (DMS/VMS).
- EXTERNAL LOADS

AASHTO SIGN SPECS. (U.N.O.)

ICE LOAD
WIND LOAD

3.7
APPENDIX C, SECTION C.3,
EQ. C-1, WITH 80 MPH
WIND AND 30% GUST FACTOR
- GROUP LOADS

AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA

AASHTO SIGN SPECS. (U.N.O.)

SECTION PROPERTIES FOR TUBULAR SHAPES
MAXIMUM STRESSES IN TUBULAR SHAPES
ALLOWABLE STRESSES FOR TUBULAR SHAPES
ALLOWABLE STRESSES FOR SIGN SUPPORTS
ALLOWABLE STRESSES FOR BASE PLATES
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)

APPENDIX B, TABLE B-1
APPENDIX B, TABLE B-2
5.6 (TABLE 5-3) & 5.11
5.12
5.8
5.12
SECTION 11
- BOLT CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES
SLIP-CRITICAL BOLT ALLOWABLE
BOLT PRYING ACTION
COMBINED BOLT SHEAR AND TENSION
BOLT DESIGN CRITERIA
ALLOWABLE ANCHOR BOLT STRESSES

TABLE 10.32.3B
10.32.3.2.1
10.32.3.3.2
10.32.3.3.3
AASHTO SIGN SPECS. 5.16
AASHTO SIGN SPECS. 5.17
- CONCRETE CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS
REINFORCEMENT TENSILE STRESS
SHEAR CAPACITY OF FOOTINGS
SHEAR STRESS IN FOOTINGS
ALLOWABLE SHEAR STRESS
SLENDERNESS OF COLUMNS
MINIMUM REINF. OF FLEXURAL MEMBERS
SPACING LIMITS FOR REINFORCEMENT
MINIMUM CONCRETE COVER
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS
DISTRIBUTION OF REINFORCEMENT
FOOTING STABILITY REQUIREMENTS
TORSION
COLUMN DESIGN (PEDESTALS)

8.15.2.1.3
8.15.2.2
8.15.5.6.1
8.15.5.6.2
8.15.5.6.4
8.16.5.2
8.17.1
8.21
DM-4 D8.22.1*
FIG. 4.4.7.1.1.1C
4.4.11.2.2
DM-4 D5.5.5
ACI SECTION A.7.3*
8.15.4
- SPREAD FOOTINGS

1.5 TONS PER SQUARE FOOT
95%
100 POUNDS PER CUBIC FOOT
- DRILLED SHAFTS (CAISSONS) DM-4 SEC. D4.6, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE
MAXIMUM DESIGN LATERAL DISPLACEMENT
MODULUS OF SUBGRADE REACTION
UNIT WEIGHT OF SOIL
ANGLE OF INTERNAL FRICTION
COHESION

1.5 TONS PER SQUARE FOOT
0.5"
10.0 POUNDS PER CUBIC INCH
100 POUNDS PER CUBIC FOOT
25°
0 KIPS PER SQUARE FOOT
- SEISMIC DESIGN CRITERIA

STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, ANSI/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE ANSI/AWS D1.1 FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS & PIPE CHORDS:

SEE PUBLICATION 408, SECTION 948.2.

ANGLES, SHAPES, AND PLATES:

AASHTO M270, GRADE 36
ASTM A709, GRADE 36
- 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 MEMBER FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR CHORDS
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS:

ASTM, F1554 GRADE 55 PER PUBLICATION 408
SECTION 1105.02(c) 3.

BOLTS:

ASTM A-325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408, (INDICATE CHANGE NUMBER), ANSI/AASHTO/AWS D1.5 BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE ANSI/AWS D1.1 FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS D1.5."
- DYNAMIC\ VARIABLE MESSAGE SIGNS (DMS\ VMS) ARE PROHIBITED ON 2-POST PLANAR TRUSS STRUCTURE TYPE AS PRESENTED IN THESE STANDARDS. OVERHEAD SIGN STRUCTURES INTENDED TO CARRY DYNAMIC\ VARIABLE MESSAGE SIGNS (DMS\ VMS) MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THESE STANDARDS MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF OVERHEAD SIGN STRUCTURES CARRYING DYNAMIC\ VARIABLE MESSAGE SIGNS (DMS\ VMS).

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- 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 318-99).
- CVN: CHARPY V-NOTCH.

COMMONWEALTH OF PENNSYLVANIA
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OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 21, 2014
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SHT. 1 OF 6
BD-643M

REFERENCE DRAWINGS

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/MERCURY VAPOR LAMPS
TC-8716	ERECTION DETAILS/EXTRUDED ALUMINUM CHANNEL SIGNS FLAT SHEET ALUMINUM WITH STIFFENERS/OVERHEAD STRUCTURES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-743M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

HOW TO USE THE DESIGN TABLES

SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION SO THAT THE BOTTOM OF BASE PLATE ELEVATION IS APPROXIMATELY 6" 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.

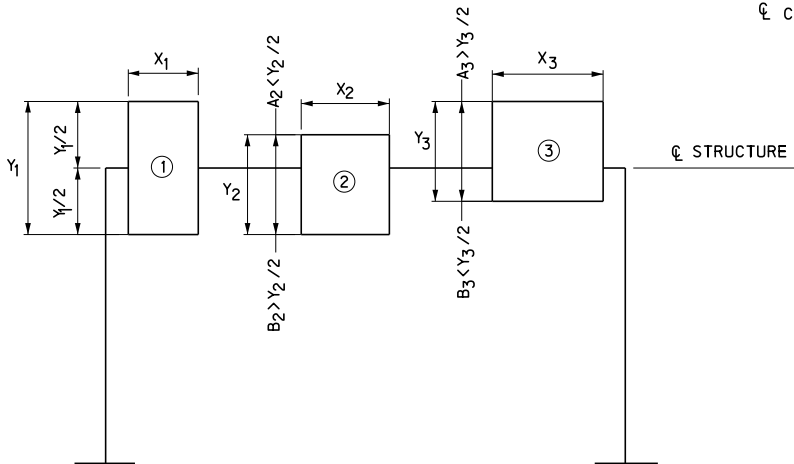
POSITIONING OF SIGN PANELS AND SIGN STRUCTURE

- 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").
- 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)

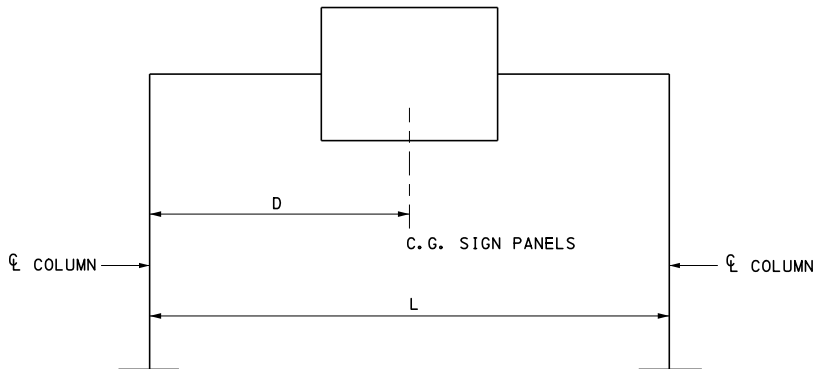
THE SIGN AREA FOR ANY SIGN PANEL PLACED OFF-CENTER IN THE VERTICAL DIRECTION IS (X) x (B) x 2 WHEN B>A OR (X) x (A) x 2 WHEN A>B.

EXAMPLE:
AREA OF SIGN NO. 1 = (X1) x (Y1)
AREA OF SIGN NO. 2 = (X2) x (B2) x 2
AREA OF SIGN NO. 3 = (X3) x (A3) x 2



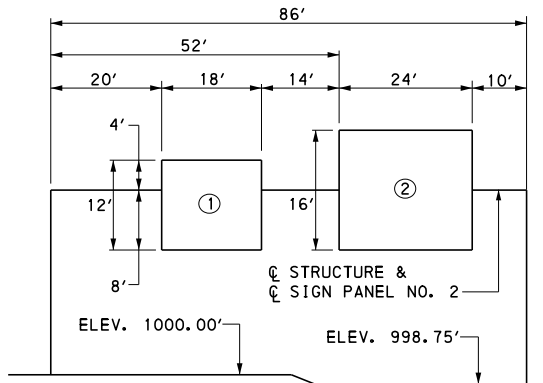
A = DISTANCE FROM CL STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM CL STRUCTURE TO BOTTOM OF SIGN
DESIGN AREA OF SIGN NO. 1 = X1 Y1
DESIGN AREA OF SIGN NO. 2 = (X2 B2) x 2
DESIGN AREA OF SIGN NO. 3 = (X3 A3) x 2

- SET THE TRUSS BETWEEN COLUMNS TO AN ELEVATION THAT PLACES THE VERTICAL CENTERLINE OF THE TRUSS 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 TRUSS BETWEEN COLUMNS, 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 ULTIMATE SIGN AREA IS USED FOR DESIGN, SET THE TRUSS TO AN ELEVATION THAT PLACES THE VERTICAL CENTERLINE OF THE TRUSS 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 TRUSS TO AN ELEVATION THAT PLACES THE VERTICAL CENTERLINE OF THE TRUSS 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 TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 x SPAN LENGTH AND 0.58 x SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE END OF THE SPAN AND 0.42 x SPAN LENGTH OR THE OTHER END OF THE SPAN AND 0.58 x SPAN LENGTH. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.



IF $0.42L \leq D \leq 0.58L$, USE LOADING TYPE 1
IF $D < 0.42L$, OR $D > 0.58L$, USE LOADING TYPE 2

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- 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.



EXAMPLE TO SHOW PROCEDURE FOR SELECTING SIGN AREA, SPAN LENGTH & POST HEIGHT

- $\Delta \text{ELEV.} = 1000.00 - 998.75 = 1.25 < 2'-6"$ } USE CASE B
 $\left. \begin{matrix} Y_1 = 12' \\ Y_2 = 16' \end{matrix} \right\} Y_1 < Y_2$
- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION:
ELEV. $1000.00 + 17'-6" + 1'-6" = 1019.00$
 $1'-6" = \text{BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL}$
- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2
ELEV = $1019.00 + 16/2 = 1027.00$
- ACTUAL SPAN LENGTH = 86'. USE 90'
- POST HEIGHT = $1027.00 - 998.75 = 28.25'$
USE OVER 24' TO 33'

- FROM DESIGN TABLES, IT IS DETERMINED THAT THE TOTAL STRUCTURE DEPTH IS 9'-6".
 - CL SIGN TO BOTTOM OF LUMINAIRE SUPPORT = $8'-0" + 1'-6" = 9'-6"$
 - $1/2$ OF THE STRUCTURE DEPTH = $4'-9"$
 - THEREFORE, STRUCTURE DEPTH DOES NOT GOVERN VERTICAL CLEARANCE; DO NOT RESET CL STRUCTURE.

- BECAUSE SIGN PANEL NO. 1 IS NOT CENTERED VERTICALLY ON THE STRUCTURE, THE DESIGN AREAS ARE COMPUTED AS FOLLOWS:

$A_1 = 18'-0" \times 8'-0" \times 2 = 288 \text{ SF}$
 $A_2 = 24'-0" \times 16'-0" = 384 \text{ SF}$
TOTAL SIGN AREA = 672 SF; USE 750 SF

- LOCATE C.G. SIGN AREA:
(FROM LEFT POST) C.G. = $\frac{[288 \text{ SF} \times (20' + 18'/2)] + [384 \text{ SF} \times (52' + 24'/2)]}{672 \text{ SF}} = 49'$
 $= 49' / 86' = 0.57 \quad 0.42 < 0.57 < 0.58$
THEREFORE, USE LOADING TYPE 1

- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.
- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

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DEPARTMENT OF TRANSPORTATION
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OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

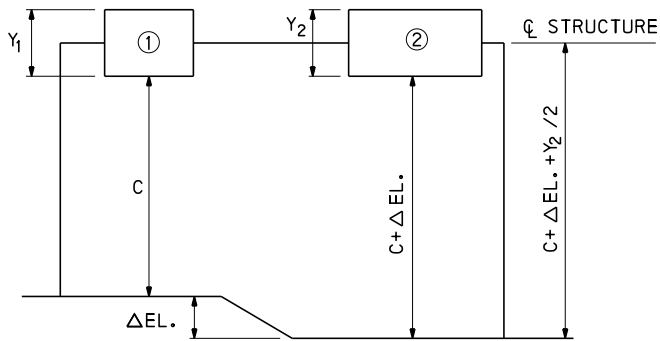
DESIGN INSTRUCTIONS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHT. 2 OF 6

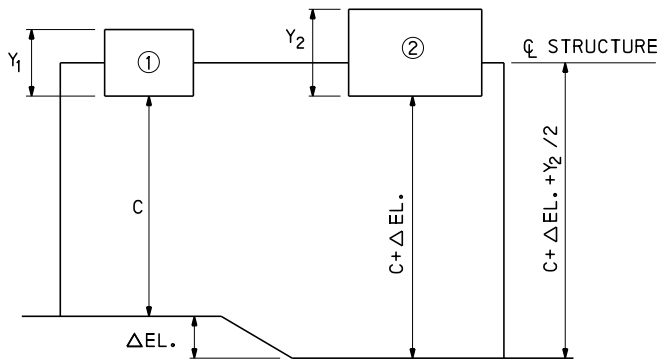
BD-643M



CASE A

$$Y_1 = Y_2$$
$$\Delta EL. < 2' - 6"$$

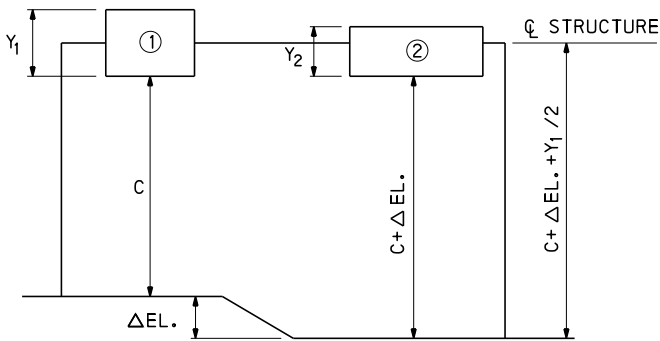
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET CL OF STRUCTURE AT CL OF SIGN PANELS UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET CL STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.



CASE B

$$Y_1 \leq Y_2$$
$$\Delta EL. < 2' - 6"$$

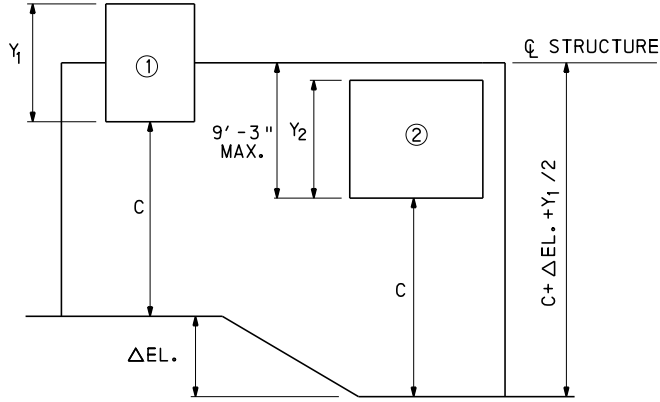
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 2 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET CL STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF
 Y_1 AND Y_2 WHERE $Y_1 \leq Y_2$.



CASE C

$$Y_1 \geq Y_2$$
$$\Delta EL. < 2' - 6"$$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 1
UNLESS STRUCTURE DEPTH GOVERNS VERTICAL
CLEARANCE. IN THIS CASE, RESET CL 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 D

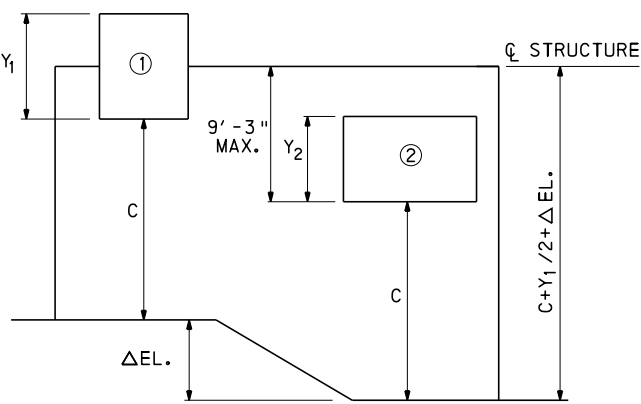
$$Y_1 = Y_2$$
$$\Delta EL. > 2' - 6"$$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL
CLEARANCE.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET CL STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF
 $\Delta EL.$ AND $Y_{1,2}$:

$\Delta EL.$	$Y_{1,2}$
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 $\Delta EL.$, THIS CASE DOES NOT
APPLY. USE EITHER 1) SEPARATE STRUCTURES, OR 2) A
SPECIAL DESIGN.



CASE E

$$Y_1 \geq Y_2$$
$$\Delta EL. > 2' - 6"$$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL
CLEARANCE.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET CL STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

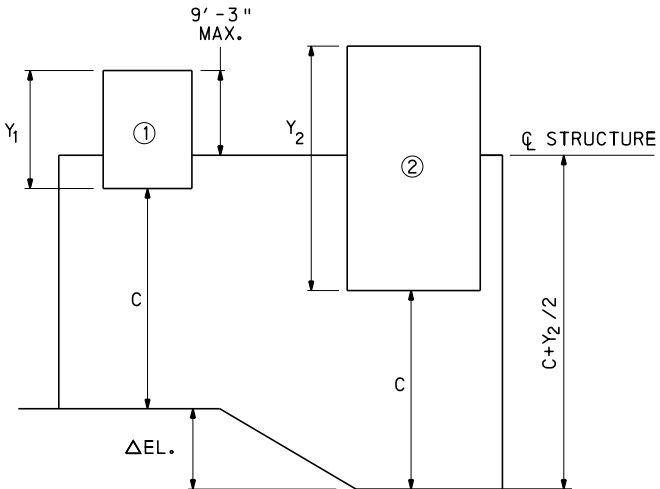
THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF $\Delta EL.$ AND Y_2 WHERE $Y_1 > Y_2$:

$\Delta EL.$	$Y_{1,2}$
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_2 EXCEEDS THE RANGE SHOWN IN THE ABOVE TABLE
FOR A PARTICULAR VALUE OF $\Delta EL.$, 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

$$Y_1 < Y_2$$
$$\Delta EL. > 2' - 6"$$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL
CLEARANCE.
SET CL OF STRUCTURE AT CL OF SIGN PANEL NO. 2 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET CL STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.

THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF $\Delta EL.$, Y_1 , AND Y_2 WHERE $Y_1 < Y_2$:

$\Delta EL.$	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:
 $2(\Delta EL.) + 2(Y_1) - Y_2 \leq 18' - 6"$

IF THE PARAMETERS OF THE GENERAL EQUATION ARE
EXCEEDED, ONE OF THE FOLLOWING STEPS IS REQUIRED:

- 1) RESET CL 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
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

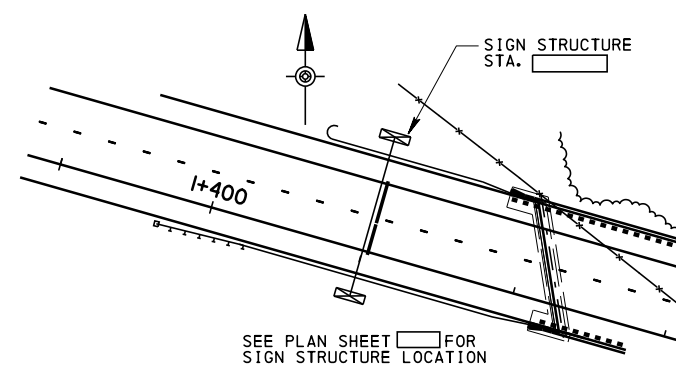
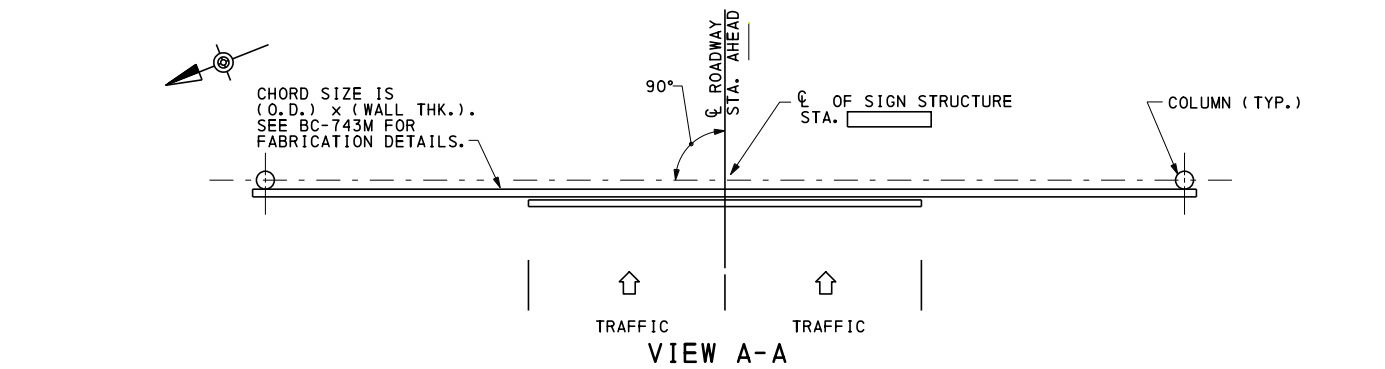
INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

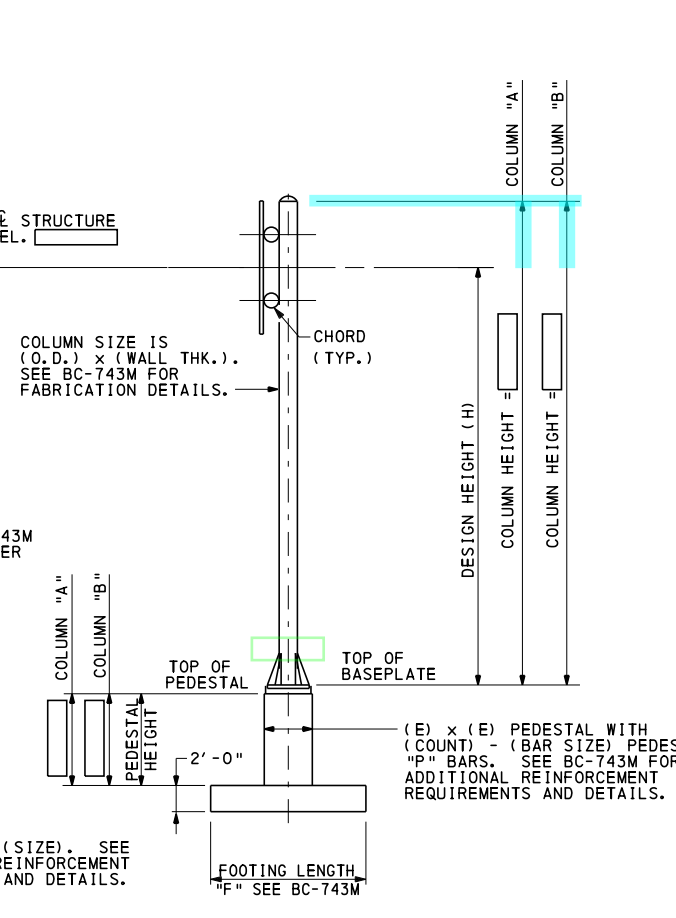
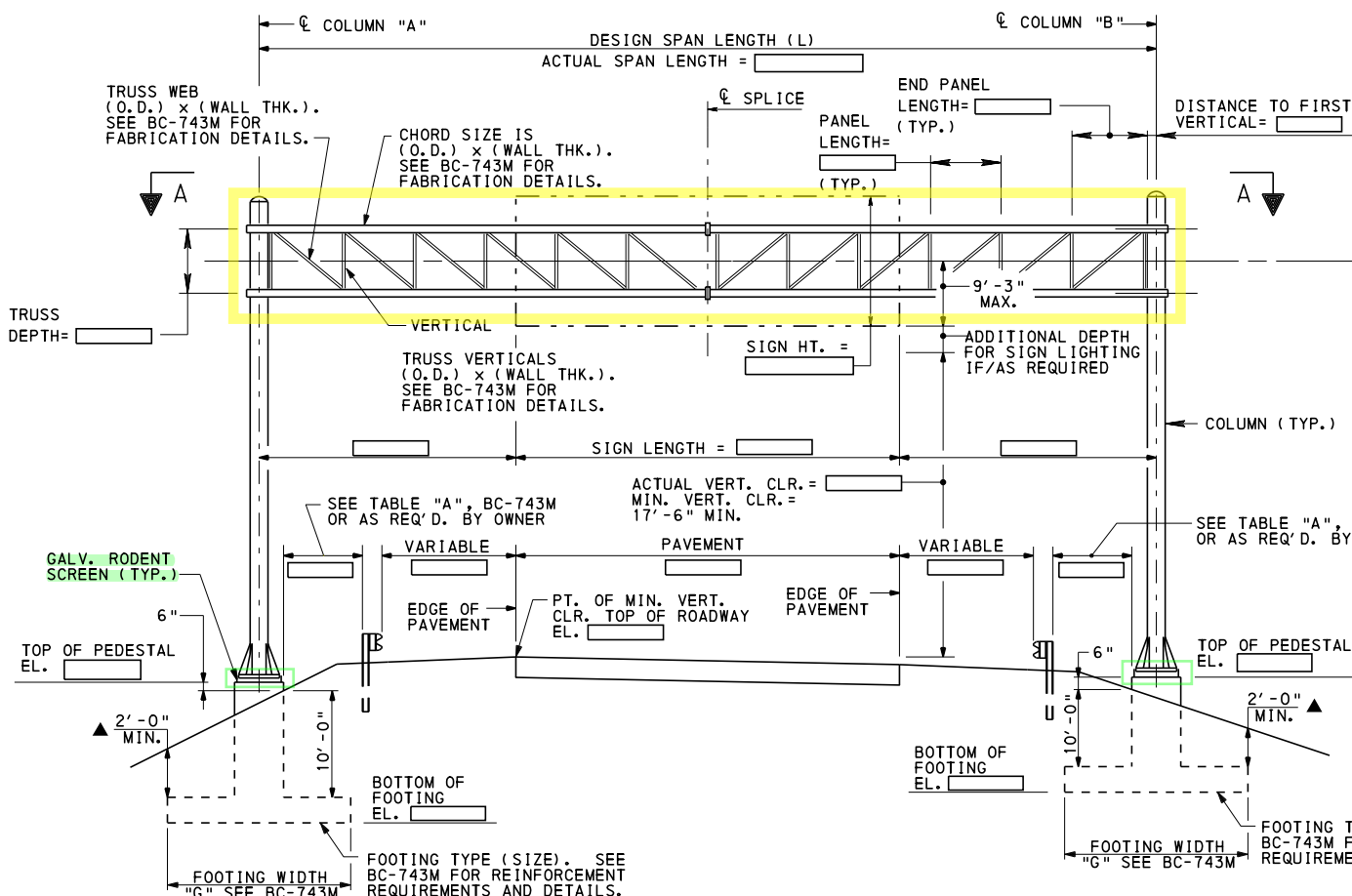
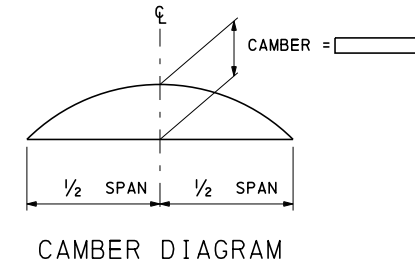
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DESIGN CRITERIA	
DESIGN SIGN AREA (A) =	
DESIGN SPAN LENGTH (L) =	
DESIGN HEIGHT (H) =	
LOADING TYPE=	(1 OR 2)
FATIGUE CATEGORY=	

NOTE:
DESIGN FOR (ULTIMATE OR ACTUAL) SIGN AREA.
(DESIGNER TO INDICATE CONTROLLING CONDITION)



ELEVATION

END VIEW

▲ DESIGNER MUST CHECK ADEQUACY OF FOOTINGS FOR FILL HEIGHTS < 10'.

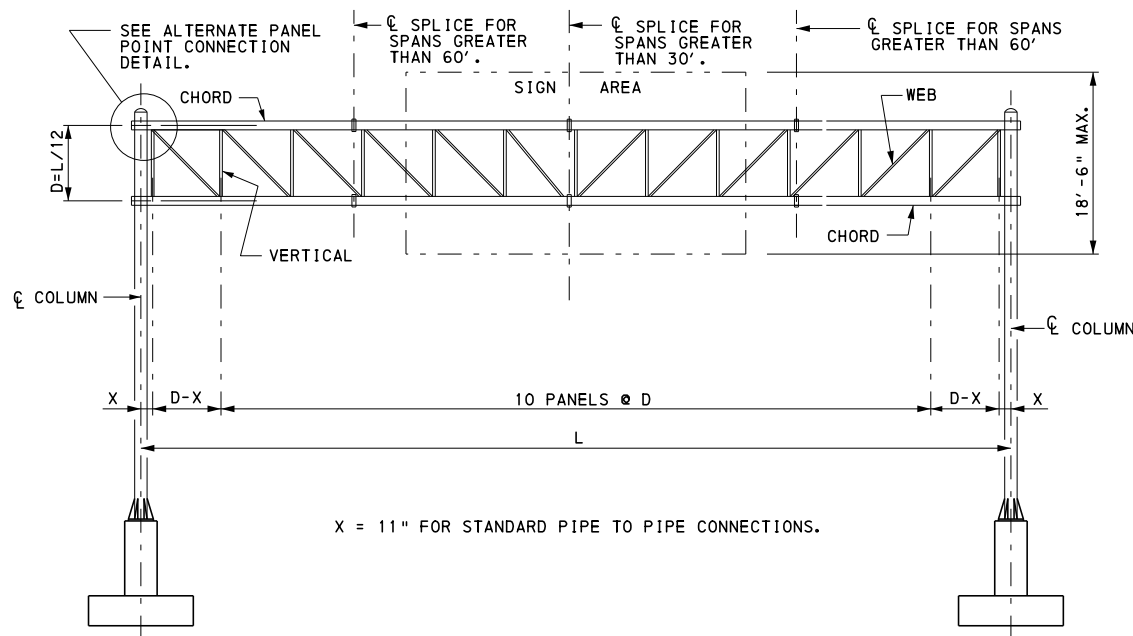
NOTES TO DESIGNER:

- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS BASED ON INFORMATION OBTAINED FROM DESIGN TABLES AS INDICATED. DESIGNER MUST PROVIDE INFORMATION IN () PARENTHESES.
 - (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-743M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
 - FOOTING TYPE (SIZE). SEE BC-743M FOR REINFORCEMENT REQUIREMENTS AND DETAILS.
 - COLUMN SIZE IS (O.D.) x (WALL THK.). SEE BC-743M FOR FABRICATION DETAILS.
 - CHORD SIZE IS (O.D.) x (WALL THK.). SEE BC-743M FOR FABRICATION DETAILS.
 - TRUSS WEBS (O.D.)x(WALL THK.) AND TRUSS VERTICALS (O.D.)x(WALL THK.). SEE BC-743M 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.

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	

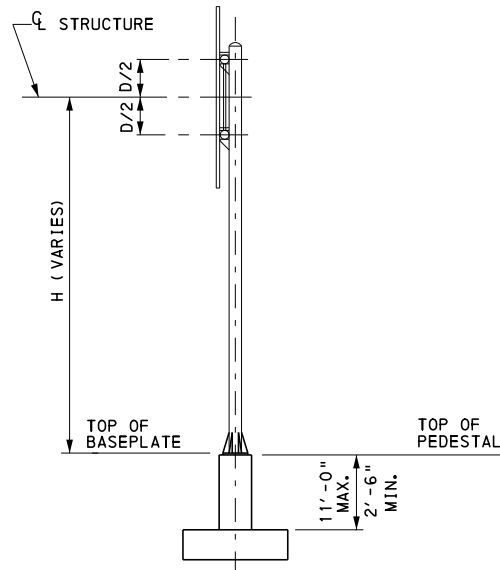
* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000]

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
OVERHEAD SIGN STRUCTURES 2 POST PLANAR TRUSS SPANS FROM 30' TO 100'		
SAMPLE CONTRACT DRAWING		
RECOMMENDED NOV. 21, 2014 Thomas P. Maciore CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 Brenda S. Thompson ACTING DIR, BUR. OF PROJECT DELIVERY	SHT. 4 OF 6 BD-643M

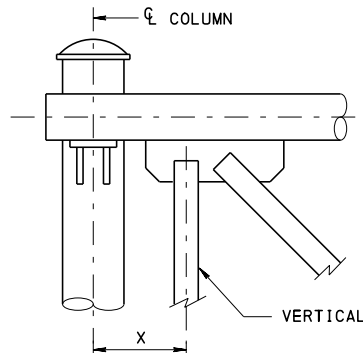


X = 11" FOR STANDARD PIPE TO PIPE CONNECTIONS.

ELEVATION



END VIEW



ALTERNATE PANEL POINT CONNECTION DETAIL

FOR VERTICALS LESS THAN 3" DIA. , X= 12.5"
FOR VERTICALS 3" TO 4" DIA. AND
COLUMNS 20" DIA. OR LARGER, X=15"
FOR VERTICALS 5" DIA. OR LARGER, X=17"

NOTES:

- FOR GENERAL NOTES, SEE SHEET 1.
- FOR DESIGN INSTRUCTIONS, SEE SHEETS 2 AND 3.
- "FOOTING TYPE" DESIGNATION INDICATES FOOTING WIDTH x LENGTH. (FOR EXAMPLE, FOOTING TYPE 609 INDICATES A FOOTING 6' WIDE x 9' LONG.) SEE BC-743M, SHEET 2 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
- FOR STRUCTURAL DETAILS, SEE BC-743M.
- FOR PEDESTAL DETAILS, SEE BC-743M, SHEET 2.
- ONE OR MORE SPLICES IN THE TRUSS MAY BE ADDED OR ELIMINATED AT THE OPTION OF THE FABRICATOR.

CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").

LOADING TYPE 1																
L	SIGN AREA (FT. 2)	TRUSS			COLUMN				PEDESTAL "P" BARS				FOOTING TYPE			
		CHORD	WEB	VERTICAL	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'
TO 30'	100	8x.322 *	2.5x.203	2.5x.203	8x.322 *	12x.375 *	16x.375 *	20x.375 *	16#5	16#8	16#9	16#11	508	609	609	711
	175	8x.322 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	20x.375 *	16#6	16#8	16#9	16#11	609	711	713	713
	250	8x.322 *	2.5x.203	2.5x.203	10x.365	14x.375 *	16x.375 *	20x.375 *	16#6	16#8	16#9	16#11	711	713	713	815
	325	8x.322 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	1114
	400	8x.322 *	2.5x.203	2.5x.203	14x.375 *	16x.375	20x.375 *	24x.375 *	16#8	16#9	16#11	16#10	713	1112	1114	1215
	475	8x.322	2.5x.203	2.5x.203	16x.375 *	18x.375 *	20x.375	24x.375	16#9	16#10	16#11	16#10	815	1114	1114	918
OVER 30' TO 40'	555	10x.365 *	2.5x.203	2.5x.203	16x.375 *	18x.375	20x.375	26x.375 *	16#9	16#10	16#11	16#11	815	716	718	918
	150	8x.322 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	609	711	713	812
	225	8x.322	2.5x.203	2.5x.203	10x.365	12x.375	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	711	713	713	814
	300	10x.365 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	815
	375	10x.365 *	2.5x.203	2.5x.203	14x.375 *	16x.375	20x.375 *	24x.375 *	16#8	16#9	16#11	16#10	713	1112	1114	916
	450	10x.365 *	2.5x.203	2.5x.203	16x.375 *	18x.375	20x.375	24x.375	16#9	16#10	16#11	16#10	815	1114	817	918
OVER 40' TO 50'	525	10x.365	3x.216	3x.216	16x.375 *	20x.375 *	24x.375 *	26x.375	16#9	16#11	16#10	16#11	815	817	916	1215
	600	10x.365	3x.216	3x.216	18x.375 *	20x.375	24x.375 *	24x.500	16#10	16#11	16#10	16#11	1114	718	918	1317
	675	12x.375 *	3x.216	3x.216	18x.375 *	20x.375	24x.375 *	26x.500 *	16#10	16#11	16#10	20#11	718	718	1215	922
	740	12x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	26x.500 *	16#10	16#10	16#10	20#11	718	916	920	922
	150	10x.365 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	609	711	713	812
	250	10x.365 *	2.5x.203	2.5x.203	12x.375 *	14x.375 *	16x.375 *	24x.375 *	16#8	16#8	16#9	16#10	713	713	713	814
OVER 50' TO 60'	350	12x.375 *	2.5x.203	2.5x.203	14x.375 *	16x.375 *	20x.375	24x.375 *	16#8	16#9	16#11	16#10	713	815	1114	916
	450	12x.375 *	2.5x.203	2.5x.203	16x.375 *	18x.375	24x.375 *	26x.375 *	16#9	16#10	16#10	16#11	1112	1114	718	918
	550	12x.375	3x.216	3x.216	16x.375	20x.375 *	24x.375 *	24x.500 *	16#9	16#11	16#10	16#11	1114	718	918	1215
	650	14x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	26x.500 *	16#10	16#10	16#10	20#11	817	916	1215	1317
	750	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	26x.375	26x.562	16#11	16#10	16#11	24#11	718	1215	1317	922
	850	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	26x.375	26x.562	16#11	16#10	16#11	24#11	820	918	922	922
OVER 60' TO 70'	925	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	24x.500 *	26x.562	16#11	16#10	16#11	24#11	820	820	922	922
	125	12x.375 *	2.5x.203	2.5x.203	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	609	711	713	812
	250	12x.375 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	713	814
	375	12x.375	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375 *	24x.375 *	16#8	16#10	16#11	16#10	713	1112	1114	916
	500	14x.375	3x.216	3x.216	16x.375 *	20x.375 *	24x.375 *	26x.375	16#9	16#11	16#10	16#11	1114	718	916	918
	625	16x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	26x.500 *	16#10	16#10	16#10	20#11	718	916	1215	922
OVER 70' TO 80'	750	16x.375	3x.216	3x.216	20x.375 *	24x.375 *	26x.375	26x.562	16#11	16#10	16#11	24#11	718	1215	1317	922
	875	16x.375	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	24x.969	16#11	16#10	16#11	32#11	820	1020	922	1024
	1000	18x.375 *	3.5x.226	3.5x.226	24x.375 *	26x.375	26x.500 *	24x.969	16#10	16#11	20#11	32#11	918	922	922	924
	1110	18x.375 *	3.5x.226	3.5x.226	24x.375 *	26x.375	26x.500 *	24x.969	16#10	16#11	20#11	32#11	920	922	922	1026
	175	16x.375 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	711	713	713	814
	300	16x.375 *	2.5x.203	2.5x.203	14x.375 *	18x.375 *	20x.375 *	24x.375 *	16#8	16#10	16#11	16#10	713	1112	1114	916
OVER 80' TO 90'	425	16x.375 *	2.5x.203	2.5x.203	16x.375 *	20x.375 *	24x.375 *	26x.375	16#9	16#11	16#10	16#11	815	815	1215	918
	550	16x.375	3x.216	3x.216	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	1114	718	918	1317
	675	18x.375 *	3x.216	3x.216	20x.375 *	24x.375 *	26x.375	26x.500	16#11	16#10	16#11	20#11	718	1215	1317	922
	800	18x.375	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	24x.969	16#11	16#10	16#11	32#11	820	1215	922	1024
	925	20x.375 *	3.5x.226	3.5x.226	24x.375 *	26x.375	26x.500 *	24x.969	16#10	16#11	20#11	32#11	918	922	922	924
	1050	20x.375 *	4x.237	4x.237	24x.375 *	24x.500 *	26x.562	24x.969	16#10	16#11	24#11	32#11	1317	922	1024	1221
OVER 90' TO 100'	1175	20x.375	4x.237	4x.237	24x.375 *	24x.500	26x.562	24x1.219	16#10	16#11	24#11	32#11	922	922	1024	1323
	1295	20x.375	4x.237	4x.237	24x.375 *	24x.500	26x.562	24x1.219	16#10	16#11	24#11	32#11	922	922	1024	1323

FOR CONTINUATION OF CHART, SEE SHEET 6.

* MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD. , XS OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-98, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 3/16" FOR COLUMNS AND CHORDS.

CAMBER TABLE	
SPAN	CAMBER
30'	0.43 "
40'	0.60 "
50'	0.78 "
60'	0.97 "
70'	1.18 "
80'	1.38 "
90'	1.61 "
100'	1.81 "

PEDESTAL	
COLUMN	PEDESTAL SIZE
8" DIA.	2'-6" x 2'-6"
10" DIA.	2'-6" x 2'-6"
12" DIA.	2'-9" x 2'-9"
14" DIA.	3'-0" x 3'-0"
16" DIA.	3'-3" x 3'-3"
18" DIA.	3'-3" x 3'-3"
20" DIA.	3'-9" x 3'-9"
24" DIA.	4'-3" x 4'-3"
26" DIA.	4'-3" x 4'-3"

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST PLANAR TRUSS
SPANS FROM 30' TO 100'

DESIGN TABLE LOADING TYPE 1

RECOMMENDED NOV. 21, 2014
Thomas P. Maciara
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Stroman
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHT. 5 OF 6

BD-643M

L	SIGN AREA (FT. 2)	LOADING TYPE 2														L	SIGN AREA (FT. 2)	LOADING TYPE 1 (CONTINUED)															
		TRUSS			COLUMN				PEDESTAL "P" BARS				FOOTING TYPE					TRUSS			COLUMN				PEDESTAL "P " BARS				FOOTING TYPE				
		CHORD	WEB	VERTICAL	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'	CHORD	WEB	VERTICAL	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'
TO 30'	150	8x.322 *	2.5x.203	2.5x.203	10x.365 *	12x.375	16x.375 *	20x.375 *	16#6	16#8	16#9	16#11	711	713	713	713	OVER 70' TO 80'	150	18x.375 *	3x.216	3x.216	12x.375	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	711	713	713	814
	250	8x.322 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	815		300	18x.375 *	3x.216	3x.216	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916
	350	8x.322 *	2.5x.203	2.5x.203	14x.375 *	18x.375 *	20x.375 *	24x.375 *	16#8	16#10	16#11	16#10	713	815	815	916		450	18x.375 *	3x.216	3x.216	16x.375	20x.375	24x.375 *	24x.500 *	16#9	16#11	16#10	16#11	1112	718	1215	1215
	450	8x.322	2.5x.203	2.5x.203	16x.375 *	18x.375 *	20x.375	24x.375	16#9	16#10	16#11	16#10	815	1114	1114	918		600	18x.375	3x.216	3x.216	18x.375	24x.375 *	26x.375 *	26x.500	16#10	16#10	16#11	20#11	718	1215	918	922
	OVER 30' TO 40'	125	10x.365 *	2.5x.203	2.5x.203	10x.365 *	12x.375	16x.375 *	24x.375 *	16#6	16#8	16#9	16#10	711	713	713	814	OVER 80' TO 90'	750	20x.375	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	24x.969	16#11	16#10	16#11	32#11	820	918	922
225		10x.365 *	2.5x.203	2.5x.203	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	815	900		24x.375 *	3.5x.226	3.5x.226	24x.375 *	26x.375	26x.500	24x.969	16#10	16#11	20#11	32#11	1215	922	922	1024
325		10x.365 *	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	817	916	1050		24x.375 *	4x.237	4x.237	24x.375 *	24x.500	26x.562	24x.969	16#10	16#11	24#11	32#11	1317	922	1024	1323
425		10x.365 *	2.5x.203	2.5x.203	16x.375 *	20x.375 *	24x.375 *	26x.375	16#9	16#11	16#10	16#11	815	1114	916	918	1200		24x.375 *	4x.237	4x.237	26x.375 *	26x.500 *	24x.969	24x1.219	16#11	20#11	32#11	32#11	922	1024	1026	1323
OVER 40' TO 50'		525	10x.365 *	3x.216	3x.216	16x.375	20x.375	24x.375 *	24x.500	16#9	16#11	16#10	16#11	815	817	1215	1317	OVER 90' TO 100'	1350	24x.375 *	5x.258	5x.258	26x.375 *	26x.562	24x.969	24x1.219	16#11	24#11	32#11	32#11	922	1024	1221
	625	10x.365	3x.216	3x.216	18x.375 *	20x.375	24x.375 *	24x.500	16#10	16#11	16#10	16#11	1114	718	918	1317	1480		24x.375 *	5x.258	5x.258	26x.375 *	26x.562	24x.969	24x1.219	16#11	24#11	32#11	32#11	922	1024	1323	1323
	175	12x.375 *	2.5x.203	2.5x.203	12x.375	16x.375 *	18x.375 *	24x.375 *	16#8	16#9	16#10	16#10	713	713	713	814	150		20x.375 *	3x.216	3x.216	12x.375	16x.375	18x.375	24x.375 *	16#8	16#9	16#10	16#10	713	713	713	814
	275	12x.375 *	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916	300		20x.375 *	3x.216	3x.216	16x.375 *	18x.375	24x.375 *	26x.375 *	16#9	16#10	16#10	16#11	713	815	716	916
	OVER 50' TO 60'	375	12x.375 *	2.5x.203	2.5x.203	16x.375 *	20x.375 *	24x.375 *	26x.375	16#9	16#11	16#10	16#11	815	817	916	918	OVER 100'	450	20x.375 *	3x.216	3x.216	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	815	718	916
475		12x.375 *	2.5x.203	2.5x.203	18x.375 *	20x.375	24x.375 *	24x.500	16#10	16#11	16#10	16#11	815	1114	918	918	600		20x.375	3.5x.226	3.5x.226	18x.375	24x.375 *	26x.375	26x.500	16#10	16#10	16#11	20#11	718	1215	1215	922
575		12x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	26x.500	16#10	16#10	16#10	20#11	817	918	918	1020	750		24x.375 *	4x.237	4x.237	24x.375 *	26x.375 *	26x.500 *	24x.969	16#10	16#11	20#11	32#11	1215	1317	922	1024
675		12x.375	3x.216	3x.216	18x.375	24x.375 *	26x.375 *	26x.500	16#10	16#10	16#11	20#11	1114	1215	918	1317	900		24x.375 *	4x.237	4x.237	24x.375 *	26x.375	26x.500	24x.969	16#10	16#11	20#11	32#11	918	922	922	1024
OVER 60' TO 70'		775	14x.375	3x.216	3x.216	20x.375 *	24x.375 *	26x.375	26x.562	16#11	16#10	16#11	24#11	718	918	1317	922	OVER 70' TO 80'	1050	24x.375	5x.258	5x.258	24x.375 *	26x.562	24x.969	24x1.219	16#10	16#11	24#11	32#11	922	922	1024
	200	14x.375 *	2.5x.203	2.5x.203	12x.375	16x.375	18x.375	24x.375 *	16#8	16#9	16#10	16#10	713	713	815	916	1200		24x.375	5x.258	5x.258	26x.375 *	26x.500	24x.969	24x1.219	16#11	20#11	32#11	32#11	922	1024	1026	1323
	325	14x.375 *	2.5x.203	2.5x.203	16x.375 *	18x.375	24x.375 *	26x.375	16#9	16#10	16#10	16#11	815	815	916	918	1350		24x.375	5x.258	5x.258	26x.375	26x.562	24x.969	24x1.531	16#11	24#11	32#11	36#11	922	1024	1323	1323
	450	14x.375 *	3x.216	3x.216	18x.375 *	24x.375 *	24x.375	26x.500 *	16#10	16#10	16#10	20#11	817	916	918	1020	1500		26x.375	5x.258	5x.258	24x.500 *	26x.562	24x.969	24x1.531	16#11	24#11	32#11	36#11	922	1026	1323	1425
	OVER 70' TO 80'	575	16x.375 *	3x.216	3x.216	20x.375 *	24x.375 *	26x.375	26x.562	16#11	16#10	16#11	24#11	1114	918	918	1020	OVER 80' TO 90'	1665	26x.375	5x.258	5x.258	24x.500 *	24x.969	24x.969	24x1.531	16#11	32#11	32#11	36#11	1024	1221	1323
700		16x.375 *	3x.216	3x.216	20x.375 *	24x.375	24x.500 *	24x.688	16#11	16#10	16#11	24#11	817	918	1317	1022	200		24x.375 *	3.5x.226	3.5x.226	16x.375 *	18x.375	24x.375 *	26x.375 *	16#9	16#10	16#10	16#11	713	713	716	916
825		16x.375	3.5x.226	3.5x.226	24x.375 *	26x.375 *	26x.500 *	24x.969	16#10	16#11	20#11	32#11	918	1317	1317	1024	350		24x.375 *	3.5x.226	3.5x.226	18x.375 *	20x.375	24x.375	24x.500	16#10	16#11	16#10	16#11	815	716	916	918
930		18x.375 *	3.5x.226	3.5x.226	24x.375 *	26x.375 *	26x.500 *	24x.969	16#10	16#11	20#11	32#11	1215	922	922	924	500		24x.375 *	3.5x.226	3.5x.226	18x.375	24x.375 *	26x.375	26x.500	16#10	16#10	16#11	20#11	818	916	1215	922
OVER 80' TO 90'		225	16x.375 *	2.5x.203	2.5x.203	14x.375	18x.375 *	20x.375	24x.375	16#8	16#10	16#11	16#10	713	815	815	916	OVER 90' TO 100'	650	24x.375 *	3.5x.226	3.5x.226	20x.375 *	24x.375	24x.500	24x.688	16#11	16#10	16#11	24#11	718	918	922
	350	16x.375 *	2.5x.203	2.5x.203	16x.375	20x.375	24x.375 *	24x.500	16#9	16#11	16#10	16#11	815	817	918	918	800		24x.375	4x.237	4x.237	24x.375 *	26x.375	26x.500	24x.969	16#10	16#11	20#11	32#11	918	922	922	1024
	475	16x.375 *	2.5x.203	2.5x.203	18x.375	24x.375 *	26x.375 *	26x.500	16#10	16#10	16#11	20#11	8																				

- CHANGE 1
- CHANGE 2
- CHANGE 3

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, EXCEPT, THE MEMBER SIZES INDICATED DO NOT INCLUDE THE FATIGUE REQUIREMENTS INDICATED IN THE DESIGN CRITERIA.
- THE MEMBER SIZES INDICATED IN THE DESIGN TABLES **SHOULD** MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY III. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I OR II FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD ARE AS FOLLOWS:

BD-644M:

TWO-POST TRI-CHORD TRUSS, SPANS FROM 60’ TO 100’. FOUR-POST TRI-CHORD TRUSS, SPANS FROM 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 2 POST STRUCTURES ONLY 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. THE CORRESPONDING FABRICATION AND CONSTRUCTION DETAILS ARE CONTAINED ON STANDARD DRAWING BC-744M.

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. PROVIDE BOLT HOLES 1/16" LARGER THAN BOLT DIAMETER.
13. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
14. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
15. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
16. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS

PENNDOT STD. DWGS. (U.N.O.)*

SIGN PANELS

TC-8701E OR TC-8701S

LIGHT FIXTURES

BC-744M, SHT. 12

SIGN SUPPORT BEAM

BC-744M, SHT. 8

COLUMNS, CHORDS

CALCULATED INTERNALLY WITHIN PROGRAM

CATWALK

BC-744M, SHT. 10
- DYNAMIC\VARIABLE MESSAGE SIGN (DMS\VMS) STRUCTURES

DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) ARE PROHIBITED ON 2-POST TRI-CHORD STRUCTURE TYPE AS PRESENTED IN THESE STANDARDS. THE CHIEF BRIDGE ENGINEER MUST REVIEW AND APPROVE ALL STRUCTURES DESIGNED TO CARRY A DYNAMIC\VARIABLE MESSAGE SIGN (DMS\VMS).
- EXTERNAL LOADS

AASHTO SIGN SPECS. (U.N.O.)

ICE LOAD

3.7

WIND LOAD

APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR

CATWALK

1994 SIGN SPEC. COMMENTARY 1.2.2
- GROUP LOADS

AASHTO SIGN SPECS. 3.4
- STEEL CRITERIA

AASHTO SIGN SPECS. (U.N.O.)

SECTION PROPERTIES FOR TUBULAR SHAPES

APPENDIX B, TABLE B-1

MAXIMUM STRESSES IN TUBULAR SHAPES

APPENDIX B, TABLE B-2

ALLOWABLE STRESSES FOR TUBULAR SHAPES

5.6 (TABLE 5-3) & 5.11

ALLOWABLE STRESSES FOR SIGN SUPPORTS

5.12

ALLOWABLE STRESSES FOR BASE PLATES

5.8

ALLOWABLE STRESSES FOR COMBINED STEEL STRESS FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)

5.12

ALLOWABLE DEFLECTION

10.4

PERMANENT CAMBER

10.5

ALLOWABLE STRESSES FOR STRUCTURAL STEEL

SECTION 5
- BOLT CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BOLT STRESSES

TABLE 10.32.3B

SLIP-CRITICAL BOLT ALLOWABLE

10.32.3.2.1

BOLT PRYING ACTION

10.32.3.3.2

COMBINED BOLT SHEAR AND TENSION

10.32.3.3.3

BOLT DESIGN CRITERIA

AASHTO SIGN SPECS. 5.16

ALLOWABLE ANCHOR BOLT STRESSES

AASHTO SIGN SPECS. 5.17
- CONCRETE CRITERIA

AASHTO HIGHWAY BRIDGES (U.N.O.)

ALLOWABLE BEARING STRESS

8.15.2.1.3

REINFORCEMENT TENSILE STRESS

8.15.2.2

SHEAR CAPACITY OF FOOTINGS

8.15.5.6.1

SHEAR STRESS IN FOOTINGS

8.15.5.6.2

ALLOWABLE SHEAR STRESS

8.15.5.6.4

SLENDERNESS OF COLUMNS

8.16.5.2

MINIMUM REINF. OF FLEXURAL MEMBERS

8.17.1

SPACING LIMITS FOR REINFORCEMENT

8.21

MINIMUM CONCRETE COVER

DM-4 D8.22.1 *

PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS

FIG. 4.4.7.1.1.1C

DISTRIBUTION OF REINFORCEMENT

4.4.11.2.2

FOOTING STABILITY REQUIREMENTS

DM-4 D5.5.5

TORSION

ACI SECTION A.7.3 *

COLUMN DESIGN (PEDESTALS)

8.15.4
- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE

1.5 TONS PER SQUARE FOOT

MINIMUM AREA IN BEARING

95%

UNIT WEIGHT OF SOIL

100 POUNDS PER CUBIC FOOT
- DRILLED SHAFTS (CAISSONS) DM-4 SEC. **D4.6**, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE

1.5 TONS PER SQUARE FOOT

MAXIMUM DESIGN LATERAL DISPLACEMENT

0.5"

MODULUS OF SUBGRADE REACTION

10.0 POUNDS PER CUBIC INCH

UNIT WEIGHT OF SOIL

100 POUNDS PER CUBIC FOOT

ANGLE OF INTERNAL FRICTION

25°

COHESION

0 KIPS PER SQUARE FOOT
- SEISMIC DESIGN CRITERIA

STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, ANSI/AWS WELDING **CODE D1.5**, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE ANSI/AWS **D1.1** FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS **D1.5**.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS & PIPE CHORDS: **SEE PUBLICATION 408, SECTION 948.2.**

ANGLES, SHAPES, AND PLATES: AASHTO M270, GRADE 36
ASTM A709, GRADE 36
- 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 MEMBER FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR CHORDS
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS: ASTM, F1554 GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c) 3.

BOLTS: ASTM A-325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, **PUBLICATION 408** - (INDICATE CHANGE NUMBER), ANSI/AASHTO/AWS **D1.5** **BRIDGE WELDING CODE** AND CONTRACT SPECIAL PROVISIONS. USE ANSI/AWS **D1.1** FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS **D1.5**."
- DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) ARE PROHIBITED ON 2-POST TRI-CHORD STRUCTURE TYPE AS PRESENTED IN THESE STANDARDS. 4-POST TRICHORD SIGN STRUCTURES INTENDED TO CARRY DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THESE STANDARDS MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF OVERHEAD SIGN STRUCTURES CARRYING DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS).

* **LEGEND:**

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- **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 318-99).
- CVN: CHARPY V-NOTCH.

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF TRANSPORTATION

BUREAU OF **PROJECT DELIVERY**

OVERHEAD SIGN STRUCTURES

2 POST AND 4 POST TRI-CHORD TRUSS

SPANS FROM 60’ TO 240’

NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 21, 2014

RECOMMENDED NOV. 21, 2014

SHT. 1 OF 13

Thomas P. Maciore

CHIEF BRIDGE ENGINEER

Brian Stroman

ACTING DIR. BUREAU OF **PROJECT DELIVERY**

BD-644M

REFERENCE DRAWINGS

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/MERCURY VAPOR LAMPS
TC-8716	ERECTION DETAILS/EXTRUDED ALUMINUM CHANNEL SIGNS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-744M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

HOW TO USE THE DESIGN TABLES
SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION SO THAT THE BOTTOM OF BASE PLATE ELEVATION IS 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").

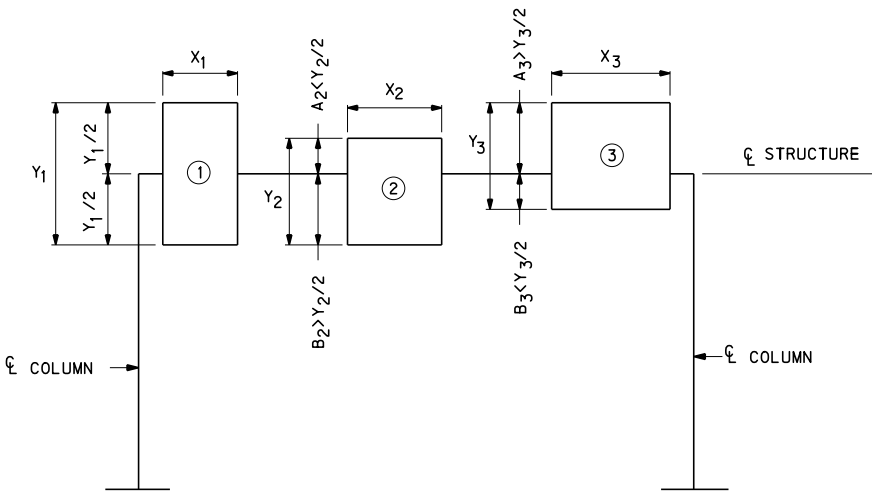
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.

- 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 = (X₁) x (Y₁)
AREA OF SIGN NO. 2 = (X₂) x (B₂) x 2
AREA OF SIGN NO. 3 = (X₃) x (A₃) 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 = X₁Y₁
DESIGN AREA OF SIGN NO.2 = (X₂B₂)x2
DESIGN AREA OF SIGN NO.3 = (X₃A₃)x2

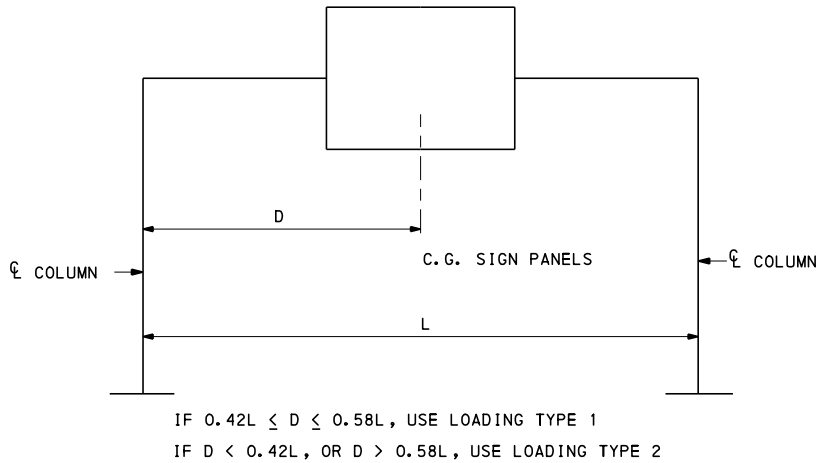
- SET THE STRUCTURE TO AN ELEVATION THAT PLACES THE CENTER OF THE STRUCTURE AT THE MID-HEIGHT OF THE DEEPEST SIGN OR A MAXIMUM OF 9'-3" ABOVE THE BOTTOM OF THE SIGN PANEL. (SIGN HEIGHT INCLUDES "EXIT PANEL" SIGN IF PRESENT.)

- 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 ULTIMATE SIGN AREA 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 TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 X SPAN LENGTH AND 0.58 X SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE BEGINNING OF THE SPAN AND 0.42 X SPAN LENGTH OR 0.58 X SPAN LENGTH AND END OF SPAN. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.

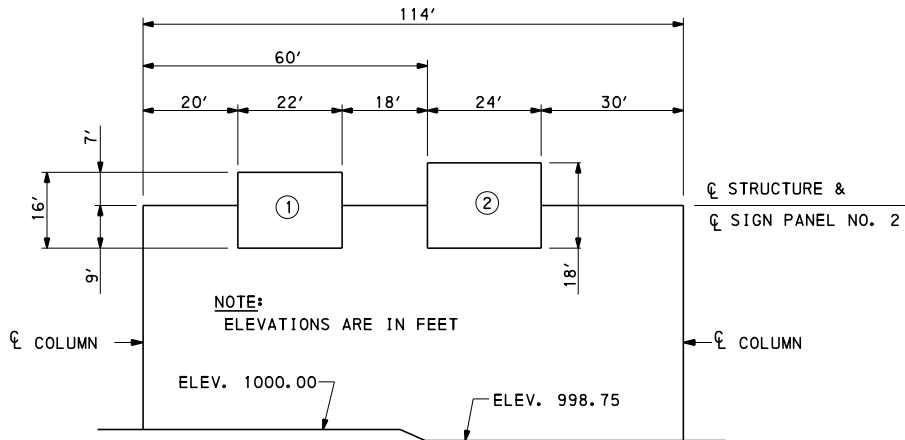


IF $0.42L \leq D \leq 0.58L$, USE LOADING TYPE 1
IF $D < 0.42L$, OR $D > 0.58L$, USE LOADING TYPE 2

LOADING TYPE DIAGRAM

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- 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.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING
SIGN AREA, SPAN LENGTH, & POST HEIGHT



$$\begin{aligned} \Delta \text{ELEV.} &= 1000.00 - 998.75 = 1.25 < 2'-6" \\ Y_1 &= 16' \\ Y_2 &= 18' \end{aligned} \left. \vphantom{\begin{aligned} \Delta \text{ELEV.} &= 1000.00 - 998.75 = 1.25 < 2'-6" \\ Y_1 &= 16' \\ Y_2 &= 18' \end{aligned}} \right\} Y_1 < Y_2 \quad \text{USE CASE B}$$

- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION
ELEV. 1000.00 + 17'-6" + 1'-8" = 1019.17
[1'-8" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]

- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2
ELEV. 1019.17 + 18' / 2 = 1028.17

- ACTUAL SPAN LENGTH = 114' → USE: 120'

- DESIGN COLUMN HEIGHT (H):
H = 1028.17 - 998.750 = 29.42' → USE H = OVER 24' TO 33'

- CL SIGN TO BOTTOM OF CATWALK IS 9'-0" + 1'-8 7/8" = 10'-8 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:
 $A_1 = 22' \times 9' \times 2 = 396.0 \text{ SF}$
 $A_2 = 24' \times 18' = 432.0 \text{ SF}$
 $\quad \quad \quad = 828.0 \text{ SF}$

→ USE 830.0 SF

- LOCATE C.G. OF SIGN AREA (FROM LEFT)
 $(X = \frac{[396.0 \text{ SF} \times (20' + 22' / 2)] + [432.0 \text{ SF} \times (60' + 24' / 2)]}{828 \text{ SF}})$

$$X = 52.40' \quad 52.4' / 114' = 0.46; \quad 0.42 < 0.46 < 0.58$$

- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.

- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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OVERHEAD SIGN STRUCTURES
2 POST AND 4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

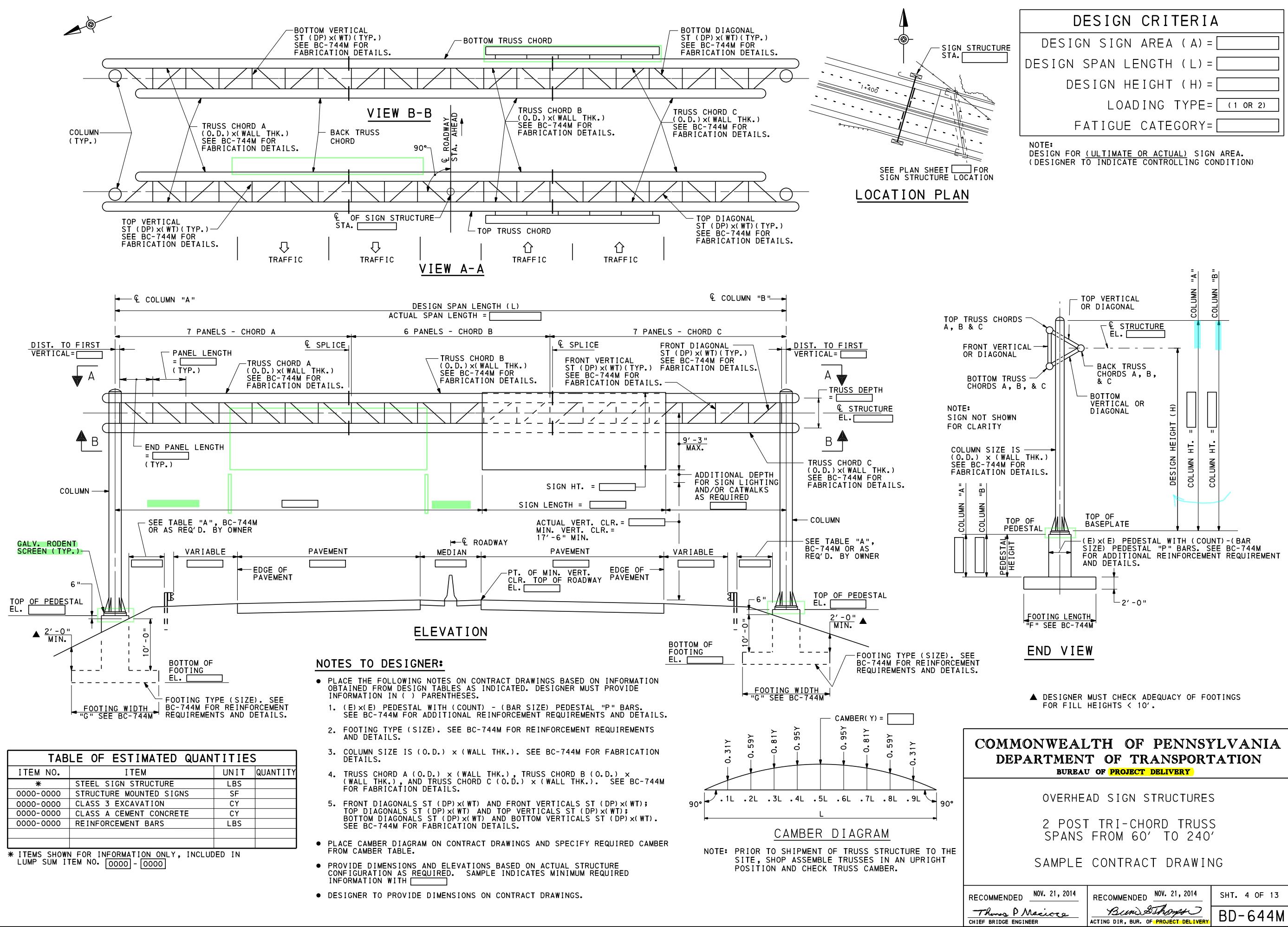
DESIGN INSTRUCTIONS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

SHT. 2 OF 13

BD-644M



DESIGN CRITERIA

DESIGN SIGN AREA (A) =

DESIGN SPAN LENGTH (L) =

DESIGN HEIGHT (H) =

LOADING TYPE=

FATIGUE CATEGORY=

NOTE:
DESIGN FOR (ULTIMATE OR ACTUAL) 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

- 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.
 - (E) x (E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. SEE BC-744M FOR ADDITIONAL 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.
 - TRUSS CHORD A (O.D.) x (WALL THK.), TRUSS CHORD B (O.D.) x (WALL THK.), AND TRUSS CHORD C (O.D.) x (WALL THK.). SEE BC-744M FOR FABRICATION DETAILS.
 - FRONT DIAGONALS ST (DP) x (WT) AND FRONT VERTICALS ST (DP) x (WT); TOP DIAGONALS ST (DP) x (WT) AND TOP VERTICALS ST (DP) x (WT); BOTTOM DIAGONALS ST (DP) x (WT) AND BOTTOM VERTICALS ST (DP) x (WT). 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.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
2 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'
SAMPLE CONTRACT DRAWING

RECOMMENDED NOV. 21, 2014
THOMAS P. MACIORE
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
BRIAN D. THOMPSON
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHT. 4 OF 13
BD-644M

LOADING TYPE 1

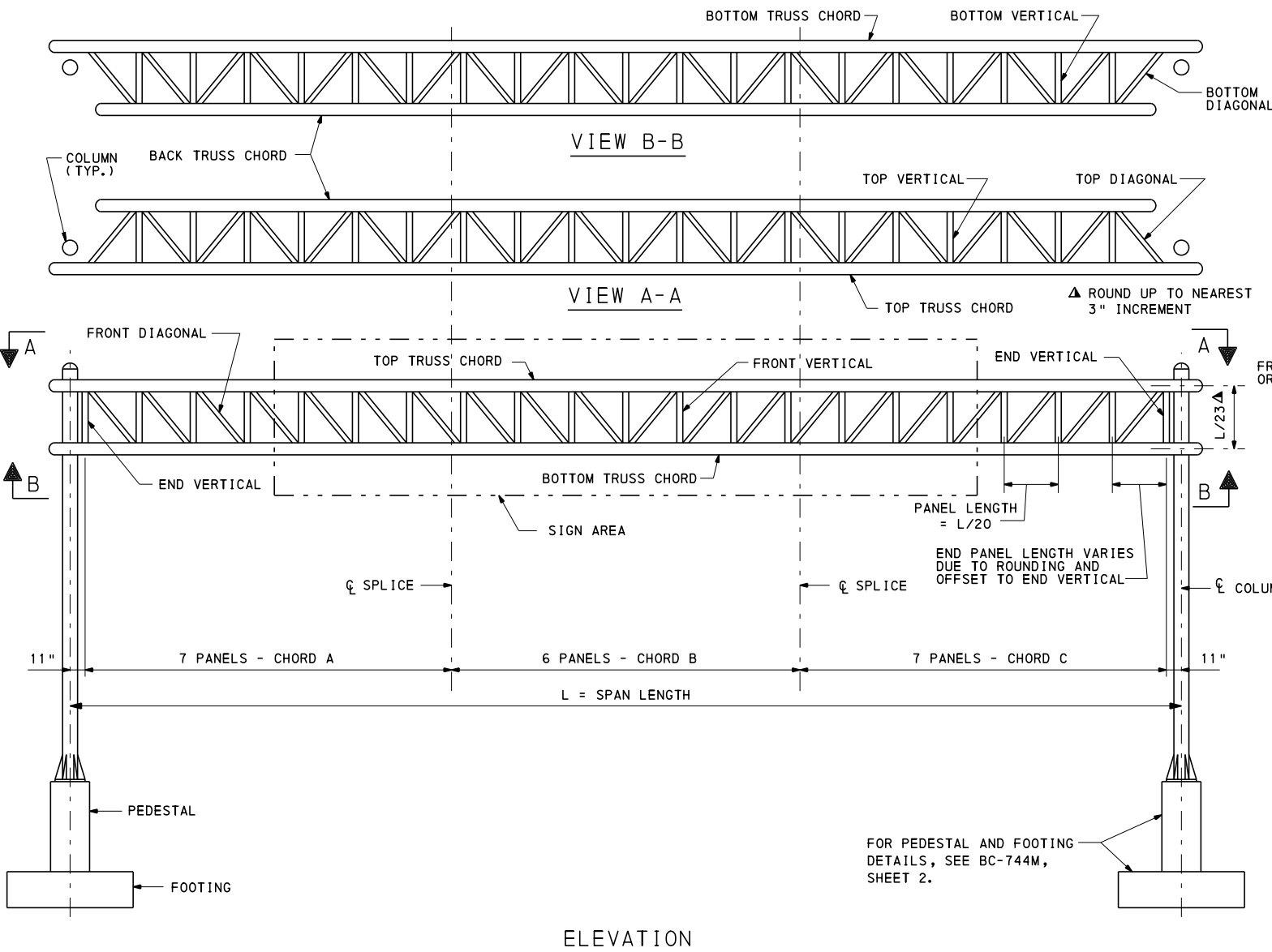
LOADING TYPE 1																				
DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS				FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)**			DIAGONALS ▲		VERTICALS ▲		(PIPE NOMINAL SIZE x WALL THK.) **				PEDESTAL "P" BARS				FOOTING TYPE			
		A	B	C	FRONT	TOP & BOTTOM	FRONT	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'
TO 60'	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	1.5x2.85	1.5x2.85	10x.365 *	12x.375 *	16x.375 *	24x.375 *	16-#6	16-#8	16-#9	16-#10	711	713	713	814
	250	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x3.75	1.5x3.75	1.5x3.75	12x.375 *	16x.375 *	18x.375 *	24x.375 *	16-#8	16-#9	16-#10	16-#10	1010	1112	1112	916
	375	6x.432 *	6x.432 *	6x.432 *	1.5x3.75	1.5x3.75	3.0x8.625	2.0x4.75	16x.375 *	18x.375	20x.375	24x.375	16-#9	16-#10	16-#11	16-#10	1112	1114	1114	918
	500	8x.500	8x.322 *	8x.500	3.0x8.625	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375	24x.375 *	24x.500	16-#10	16-#11	16-#10	16-#11	815	1114	918	1020
	625	8x.500	8x.322 *	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x6.25	18x.375	24x.375 *	26x.375	26x.500	16-#10	16-#10	16-#11	20-#11	1114	1215	1317	922
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375	24x.375	24x.500	24x.688	16-#11	16-#10	16-#11	24-#11	1216	1215	1317	1024
	875	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	24x.500 *	26x.500	24x.969	16-#10	16-#11	20-#11	32-#11	918	1317	922	924
	1000	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x11.5	24x.375 *	24x.500 *	24x.688	24x.969	16-#10	16-#11	24-#11	32-#11	1215	1317	1219	1221
1110	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x9.2	24x.375 *	26x.500 *	26x.562	24x.969	16-#10	20-#11	24-#11	32-#11	1317	1317	1219	1221	
OVER 60' TO 70'	175	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x3.85	1.5x2.85	12x.375 *	14x.375	16x.375	24x.375 *	16-#8	16-#8	16-#9	16-#10	713	713	713	814
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	2.0x3.85	2.0x4.75	2.0x3.85	14x.375	18x.375 *	20x.375 *	24x.375 *	16-#8	16-#10	16-#11	16-#10	713	815	1114	916
	425	8x.500	8x.322 *	8x.500	2.5x5.0	2.5x5.0	3.0x8.625	2.5x5.0	16x.375	20x.375 *	24x.375 *	26x.375	16-#9	16-#11	16-#10	16-#11	1114	817	1215	1215
	550	8x.500	8x.322 *	8x.500	2.5x5.0	2.5x5.0	4.0x11.5	2.5x5.0	18x.375	24x.375 *	26x.375 *	24x.688	16-#10	16-#10	16-#11	24-#11	1114	918	1215	1317
	675	8x.500	8x.322	8x.500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x6.25	20x.375 *	24x.375 *	24x.500 *	24x.688	16-#11	16-#10	16-#11	24-#11	1213	1215	1020	922
	800	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	26x.375	26x.500 *	24x.969	16-#10	16-#11	20-#11	32-#11	1018	1317	922	1024
	925	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x.375 *	24x.500 *	24x.688	24x.969	16-#10	16-#11	24-#11	32-#11	1317	1317	1024	1221
	1050	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375	26x.500 *	24x.969	24x.969	16-#10	20-#11	32-#11	32-#11	1019	1319	1221	1323
	1175	12x.500	12x.375 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	4.0x9.2	24x.500 *	26x.500	24x.969	24x1.219	16-#11	20-#11	32-#11	32-#11	1317	1319	1221	1323
	1295	12x.500	12x.375 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	4.0x9.2	24x.500 *	24x.688	24x.969	24x1.219	16-#11	24-#11	32-#11	32-#11	1317	1319	1221	1323

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 3/16" FOR COLUMNS AND CHORDS.

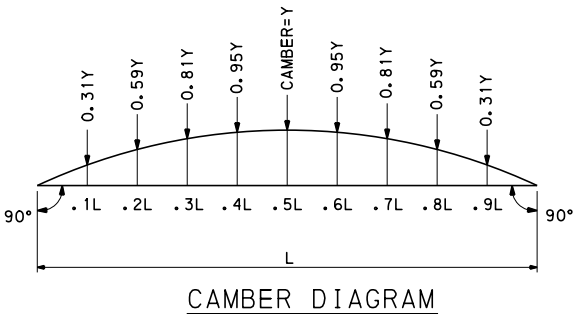
** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

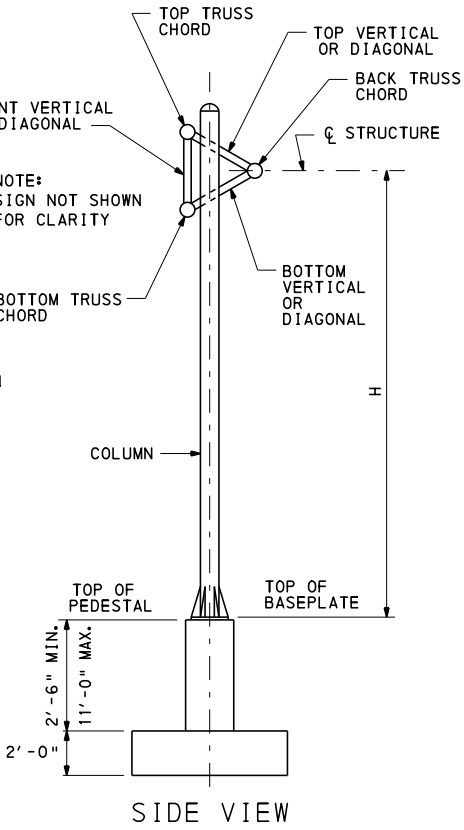
FOR CONTINUATION OF CHART, SEE SHEET 6



CAMBER TABLE	
SPAN	CAMBER (IN.)
60'	1.62
70'	1.90
80'	2.40
90'	2.75
100'	2.98



- 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 609 INDICATES A FOOTING 6' WIDE x 9' LONG). SEE BC-744M, SHEET 2 FOR FOUNDATION DETAILS.
 - FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
 - FOR STRUCTURAL DETAILS, SEE BC-744M.
 - FOR PEDESTAL SIZES, SEE SHEET 6.
 - FOR PEDESTALS DETAILS, SEE BC-744M, SHEET 2.
 - **CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").**



COMMONWEALTH OF PENNSYLVANIA
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OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 100'

DESIGN TABLES
LOADING TYPE 1

LOADING TYPE 1 (CONTINUED)																				
DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS				FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.) **			DIAGONALS ▲		VERTICALS ▲		(PIPE NOMINAL SIZE x WALL THK.) **				PEDESTAL "P" BARS				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'
OVER 70' TO 80'	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x3.85	1.5x2.85	12x.375 *	14x.375	16x.375	24x.375 *	16-#8	16-#8	16-#9	16-#10	713	713	713	814
	300	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	2.0x3.85	2.0x4.75	1.5x3.75	16x.375 *	18x.375 *	20x.375 *	24x.375 *	16-#9	16-#10	16-#11	16-#10	814	815	1114	1215
	450	8x.500	8x.322 *	8x.500	2.0x4.75	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375	24x.375 *	24x.500 *	16-#10	16-#11	16-#10	16-#11	1114	1114	918	1317
	600	8x.500	8x.500 *	8x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375 *	24x.375 *	26x.375	26x.500	16-#11	16-#10	16-#11	20-#11	1213	918	1317	922
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	26x.375 *	26x.500 *	24x.969	16-#10	16-#11	20-#11	32-#11	1215	1020	1317	1024
	900	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	24x.500 *	26x.562	24x.969	16-#10	16-#11	24-#11	32-#11	1317	1020	1219	1221
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.375	26x.500 *	24x.969	24x1.219	16-#10	20-#11	32-#11	32-#11	1317	1319	1221	1323
	1200	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	26x.375	26x.562	24x.969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1221	1221	1323
	1350	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	26x.375	26x.562	24x.969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1420	1420	1522
1480	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	26x.562	24x.969	24x1.531	16-#11	24-#11	32-#11	36-#11	1516	1420	1420	1522	
OVER 80' TO 90'	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	12x.375 *	16x.375 *	16x.375	24x.375 *	16-#8	16-#9	16-#9	16-#10	713	1010	713	814
	300	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	2.0x3.85	2.5x5.0	1.5x3.75	16x.375 *	18x.375 *	20x.375	24x.375 *	16-#9	16-#10	16-#11	16-#10	814	815	1114	916
	450	8x.500	8x.322 *	8x.500	2.0x4.75	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375	24x.375	24x.500	16-#10	16-#11	16-#10	16-#11	1114	817	918	1317
	600	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375 *	24x.375 *	24x.500 *	26x.562	16-#11	16-#10	16-#11	24-#11	1213	918	1317	922
	750	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	26x.375	26x.500 *	24x.969	16-#10	16-#11	20-#11	32-#11	1215	1317	922	1221
	900	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	24x.500	26x.562	24x.969	16-#10	16-#11	24-#11	32-#11	1317	1317	1023	1026
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	26x.375 *	26x.500 *	24x.969	24x1.219	16-#11	20-#11	32-#11	32-#11	1516	1121	1221	1323
	1200	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.500 *	26x.562	24x.969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1418	1323	1522
	1350	12x.500	12x.375	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	24x.969	24x.969	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1420	1522	1522
OVER 90' TO 100'	1500	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	24x.969	24x1.219	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1420	1522	1821
	1665	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	26x.500 *	24x.969	24x1.219	24x1.531	20-#11	32-#11	32-#11	36-#11	1518	1420	1522	1524
	200	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	2.0x3.85	2.5x5.0	1.5x3.75	16x.375 *	16x.375	20x.375 *	24x.375 *	16-#9	16-#9	16-#11	16-#10	1010	1112	1114	1213
	350	8x.500	8x.322 *	8x.500	2.0x4.75	3.0x8.625	3.0x8.625	2.5x5.0	18x.375 *	20x.375 *	24x.375 *	26x.375	16-#10	16-#11	16-#10	16-#11	1114	1114	1215	918
	500	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	20x.375 *	24x.375 *	26x.375	26x.562	16-#11	16-#10	16-#11	24-#11	1213	918	1317	922
	650	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x6.25	5.0x12.7	3.0x8.625	24x.375 *	24x.375	24x.500	24x.969	16-#10	16-#10	16-#11	32-#11	1215	1020	1020	1024
	800	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x.375 *	26x.375	26x.500	24x.969	16-#10	16-#11	20-#11	32-#11	1317	1317	1219	1221
	950	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	26x.375 *	26x.500 *	24x.969	24x1.219	16-#11	20-#11	32-#11	32-#11	1516	1319	1221	1323
	1100	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x.500 *	26x.500	24x.969	24x1.219	16-#11	20-#11	32-#11	32-#11	1516	1418	1420	1522
	1250	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500 *	26x.562	24x.969	24x1.531	16-#11	24-#11	32-#11	36-#11	1518	1420	1420	1522
	1400	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x.500	24x.969	24x1.219	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1420	1522	1524
	1550	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	26x.500 *	24x.969	24x1.219	24x1.531	20-#11	32-#11	32-#11	36-#11	1917	1522	1522	1524
	1700	12x.500	12x.500 *	12x.500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	26x.562	24x.969	24x1.219	24x1.812	24-#11	32-#11	32-#11	36-#11	1620	1522	1522	1524
	1850	14x.500	14x.500 *	14x.500	3.0x8.625	5.0x12.7	6.0x25.0	4.0x11.5	26x.562	24x.969	24x1.219	24x1.812	24-#11	32-#11	32-#11	36-#11	1620	1522	1522	1626

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

PEDESTAL	
COLUMN	PEDESTAL SIZE
10" DIA.	2'-6" x 2'-6"
12" DIA.	2'-9" x 2'-9"
14" DIA.	3'-0" x 3'-0"
16" DIA.	3'-3" x 3'-3"
18" DIA.	3'-3" x 3'-3"
20" DIA.	3'-9" x 3'-9"
24" DIA.	4'-3" x 4'-3"
26" DIA.	4'-3" x 4'-3"

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 100'

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Stachura
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 6 OF 13

BD-644M

LOADING TYPE 2																				
DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS				FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.) **			DIAGONALS ▲		VERTICALS ▲		COLUMNS (PIPE NOMINAL SIZE x WALL THK.) **				PEDESTAL "P" BARS				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'
TO 60'	125	5x. 375 *	5x. 375 *	5x. 375 *	1.5x2.85	1.5x2.85	1.5x2.85	1.5x2.85	12x. 375 *	14x. 375	16x. 375	24x. 375 *	16-#8	16-#8	16-#9	16-#10	713	713	713	814
	250	5x. 375 *	5x. 375 *	5x. 375 *	1.5x3.75	1.5x3.75	1.5x3.75	1.5x3.75	14x. 375	18x. 375 *	20x. 375	24x. 375 *	16-#8	16-#10	16-#11	16-#10	713	815	817	918
	375	6x. 432 *	6x. 432 *	6x. 432 *	2.0x3.85	2.5x5.00	3.0x8.625	3.0x6.25	18x. 375 *	24x. 375 *	24x. 375	24x. 562	16-#10	16-#10	16-#10	16-#11	817	916	918	1020
	500	6x. 432	6x. 432	6x. 432	3.0x8.625	3.0x8.625	4.0x11.5	3.0x6.25	20x. 375 *	24x. 375 *	26x. 375	24x. 688	16-#11	16-#10	16-#11	24-#11	1114	918	1317	1020
	625	8x. 500	8x. 322 *	8x. 500	3.0x8.625	3.0x8.625	4.0x11.5	4.0x11.5	20x. 375	24x. 375	24x. 500	24x. 688	16-#11	16-#10	16-#11	24-#11	1216	918	1020	1022
	750	8x. 500	8x. 500 *	8x. 500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x. 375 *	26x. 375	24x. 562	24x. 969	16-#10	16-#11	16-#11	32-#11	1215	1317	1020	1022
	875	8x. 500	8x. 500 *	8x. 500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x. 375 *	24x. 500 *	24x. 688	24x. 969	16-#10	16-#11	24-#11	32-#11	1215	1317	1319	1221
	930	8x. 500	8x. 500 *	8x. 500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x. 375 *	24x. 500 *	24x. 688	24x. 969	16-#10	16-#11	24-#11	32-#11	1019	1020	1319	1221
OVER 60' TO 70'	175	5x. 375 *	5x. 375 *	5x. 375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	14x. 375 *	18x. 375 *	20x. 375 *	24x. 375 *	16-#8	16-#10	16-#11	16-#10	713	815	815	916
	300	5x. 375 *	5x. 375 *	5x. 375 *	2.0x3.85	2.0x4.75	3.0x8.625	2.0x3.85	16x. 375	20x. 375 *	24x. 375 *	26x. 375	16-#9	16-#11	16-#10	16-#11	815	817	916	918
	425	6x. 432 *	6x. 432 *	6x. 432 *	2.5x5.0	3.0x8.625	4.0x11.5	3.0x8.625	18x. 375	24x. 375 *	26x. 375	24x. 688	16-#10	16-#10	16-#11	24-#11	1114	918	918	1317
	550	8x. 500	8x. 322 *	8x. 500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x8.625	20x. 375	24x. 375	24x. 500	24x. 688	16-#11	16-#10	16-#11	24-#11	1114	918	1020	1319
	675	8x. 500	8x. 322	8x. 500	3.0x8.625	3.0x8.625	4.0x11.5	3.0x8.625	24x. 375 *	26x. 375	26x. 500 *	24x. 969	16-#10	16-#11	20-#11	32-#11	918	1020	1319	1022
	800	8x. 500	8x. 500 *	8x. 500	3.0x6.25	3.0x8.625	5.0x17.5	3.0x8.625	24x. 375 *	24x. 500 *	26x. 562	24x. 969	16-#10	16-#11	24-#11	32-#11	1019	1317	1319	1421
	925	10x. 500	10x. 365 *	10x. 500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	26x. 375 *	24x. 500	24x. 688	24x. 969	16-#11	16-#11	24-#11	32-#11	1317	1319	1319	1026
	1050	10x. 500	10x. 365 *	10x. 500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x. 500 *	26x. 500 *	24x. 969	24x1.219	16-#11	20-#11	32-#11	32-#11	1516	1319	1319	1323
OVER 70' TO 80'	1090	10x. 500	10x. 365 *	10x. 500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x. 500 *	26x. 500 *	24x. 969	24x1.219	16-#11	20-#11	32-#11	32-#11	1516	1319	1319	1323
	150	5x. 375 *	5x. 375 *	5x. 375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	14x. 375 *	18x. 375 *	18x. 375	24x. 375 *	16-#8	16-#10	16-#10	16-#10	713	713	815	916
	300	5x. 375 *	5x. 375 *	5x. 375 *	1.5x2.85	2.5x5.0	4.0x11.5	1.5x3.75	18x. 375 *	20x. 375	24x. 375 *	26x. 375	16-#10	16-#11	16-#10	16-#11	815	1114	918	918
	450	6x. 432	6x. 432	6x. 432	2.0x4.75	3.0x8.625	4.0x11.5	2.5x5.0	20x. 375 *	24x. 375 *	26x. 375	26x. 562	16-#11	16-#10	16-#11	24-#11	1114	918	1020	1020
	600	8x. 500	8x. 500 *	8x. 500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x. 375 *	26x. 375	26x. 500 *	24x. 969	16-#10	16-#11	20-#11	32-#11	918	1317	1020	1319
	750	10x. 500	10x. 365 *	10x. 500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x11.5	24x. 375 *	24x. 500	26x. 562	24x. 969	16-#10	16-#11	24-#11	32-#11	1317	1020	1022	1421
	900	10x. 500	10x. 365 *	10x. 500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	24x. 375	26x. 500 *	24x. 969	24x1.219	16-#10	20-#11	32-#11	32-#11	1019	1319	1022	1720
	1050	10x. 500	10x. 500 *	10x. 500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	26x. 375 *	26x. 562	24x. 969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1319	1421	1323
OVER 80' TO 90'	1200	10x. 500	10x. 500 *	10x. 500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x. 500 *	26x. 562	24x. 969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1518	1221	1522
	1240	10x. 500	10x. 500 *	10x. 500	3.0x8.625	3.0x8.625	6.0x17.5	4.0x11.5	24x. 500 *	26x. 562	24x. 969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1518	1420	1522
	150	5x. 375 *	5x. 375 *	5x. 375 *	1.5x2.85	1.5x3.75	2.0x3.85	1.5x2.85	14x. 375 *	18x. 375 *	24x. 375 *	24x. 375 *	16-#8	16-#10	16-#10	16-#10	713	815	814	916
	300	6x. 432 *	6x. 432 *	6x. 432 *	1.5x2.85	2.5x5.0	4.0x11.5	1.5x3.75	18x. 375 *	24x. 375 *	24x. 375 *	24x. 500	16-#10	16-#10	16-#10	16-#11	1114	1215	918	918
	450	6x. 432	6x. 432	6x. 432	2.0x4.75	3.0x8.625	4.0x11.5	2.5x5.0	20x. 375 *	24x. 375	24x. 500 *	26x. 562	16-#11	16-#10	16-#11	24-#11	1114	918	1020	1020
	600	8x. 500	8x. 500 *	8x. 500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x. 375 *	24x. 500 *	26x. 500	24x. 969	16-#10	16-#11	20-#11	32-#11	918	1317	1020	1022
	750	10x. 500	10x. 365 *	10x. 500	3.0x8.625	3.0x8.625	5.0x12.7	4.0x11.5	24x. 375	26x. 500 *	26x. 562	24x. 969	16-#10	20-#11	24-#11	32-#11	1317	1319	1022	1124
	900	10x. 500	10x. 500 *	10x. 500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	26x. 375 *	26x. 562	24x. 969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1319	1421	1421
OVER 90' TO 100'	1050	10x. 500	10x. 500 *	10x. 500	3.0x8.625	4.0x11.5	6.0x17.5	4.0x11.5	26x. 375	26x. 562	24x. 969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1518	1421	1622
	1200	12x. 500	12x. 375	12x. 500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x. 500 *	24x. 969	24x. 969	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1518	1522	1522
	1350	12x. 500	12x. 375	12x. 500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x. 500	24x. 969	24x. 969	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1620	1522	1522
	1400	12x. 500	12x. 375	12x. 500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x. 500	24x. 969	24x. 969	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1620	1522	1624
	200	5x. 375 *	5x. 375 *	5x. 375 *	1.5x2.85	2.5x5.0	2.5x5.0	1.5x3.75	16x. 375 *	18x. 375	24x. 375 *	24x. 375	16-#9	16-#10	16-#10	16-#10	815	1114	916	918
	350	6x. 432 *	6x. 432 *	6x. 432 *	2.0x4.75	3.0x8.625	4.0x11.5	2.5x5.0	18x. 375	24x. 375 *	26x. 375	26x. 500	16-#10	16-#10	16-#11	20-#11	1114	918	918	1317
	500	8x. 500	8x. 322	8x. 500	3.0x8.625	3.0x8.625	5.0x12.7	3.0x8.625	24x. 375 *	26x. 375	26x. 500 *	24x. 969	16-#10	16-#11	20-#11	32-#11	1018	1317	1317	1022
	650	8x. 500	8x. 500 *	8x. 500	3.0x8.625	4.0x11.5	5.0x12.7	3.0x8.625	24x. 375 *	26x. 500 *	26x. 562	24x. 969	16-#10	20-#11	24-#11	32-#11	1317	1020	1319	1421
OVER 100'	800	10x. 500	10x. 500 *	10x. 500	3.0x8.625	4.0x11.5	5.0x17.5	4.0x11.5	24x. 375	26x. 500	24x. 969	24x1.219	16-#10	20-#11	32-#11	32-#11	1317	1319	1421	1421
	950	10x. 500	10x. 500 *	10x. 500	3.0x8.625	4.0x11.5	6.0x17.5	4.0x11.5	26x. 375	26x. 562	24x. 969	24x1.219	16-#11	24-#11	32-#11	32-#11	1516	1518	1421	1423
	1100	12x. 500	12x. 375	12x. 500	3.0x8.625	4.0x11.5	6.0x17.5	4.0x11.5	24x. 500 *	24x. 969	24x. 969	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1518	1620	1522
	1250	12x. 500	12x. 500 *	12x. 500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	24x. 500	24x. 969	24x1.219	24x1.531	16-#11	32-#11	32-#11	36-#11	1518	1620	1522	1524
	1400	12x. 500	12x. 500 *	12x. 500	3.0x8.625	4.0x11.5	6.0x20.4	4.0x11.5	26x. 500 *	24x. 969	24x1.219	24x1.531	20-#11	32-#11	32-#16					

- * - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.
- ** - SEE GENERAL NOTE 11 ON SHEET 1.
- ▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF TRANSPORTATION

BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

2 POST TRI-CHORD TRUSS

SPANS FROM 60' TO 100'

DESIGN TABLES

LOADING TYPE 2

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore

CHIEF BRIDGE ENGINEER

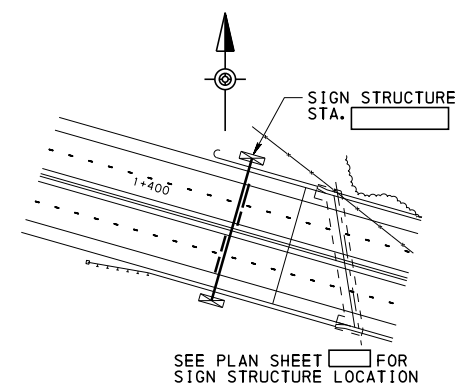
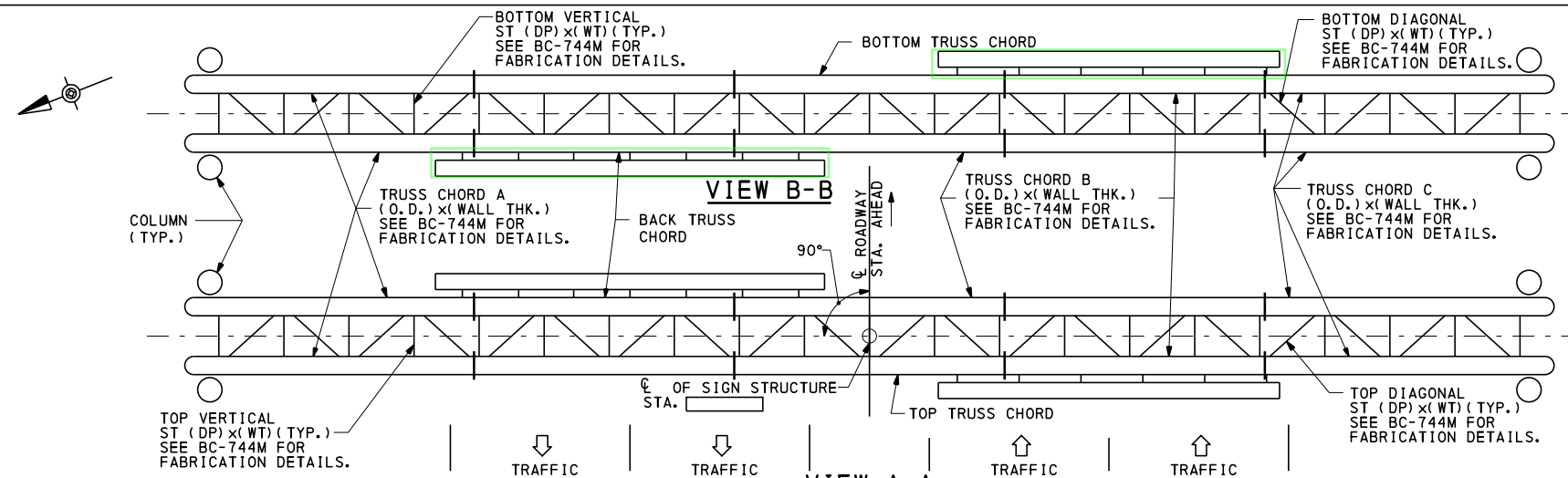
RECOMMENDED NOV. 21, 2014

Brian S. Thompson

ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 7 OF 13

BD-644M



LOCATION PLAN

DESIGN CRITERIA

SIGN AREA (A) =

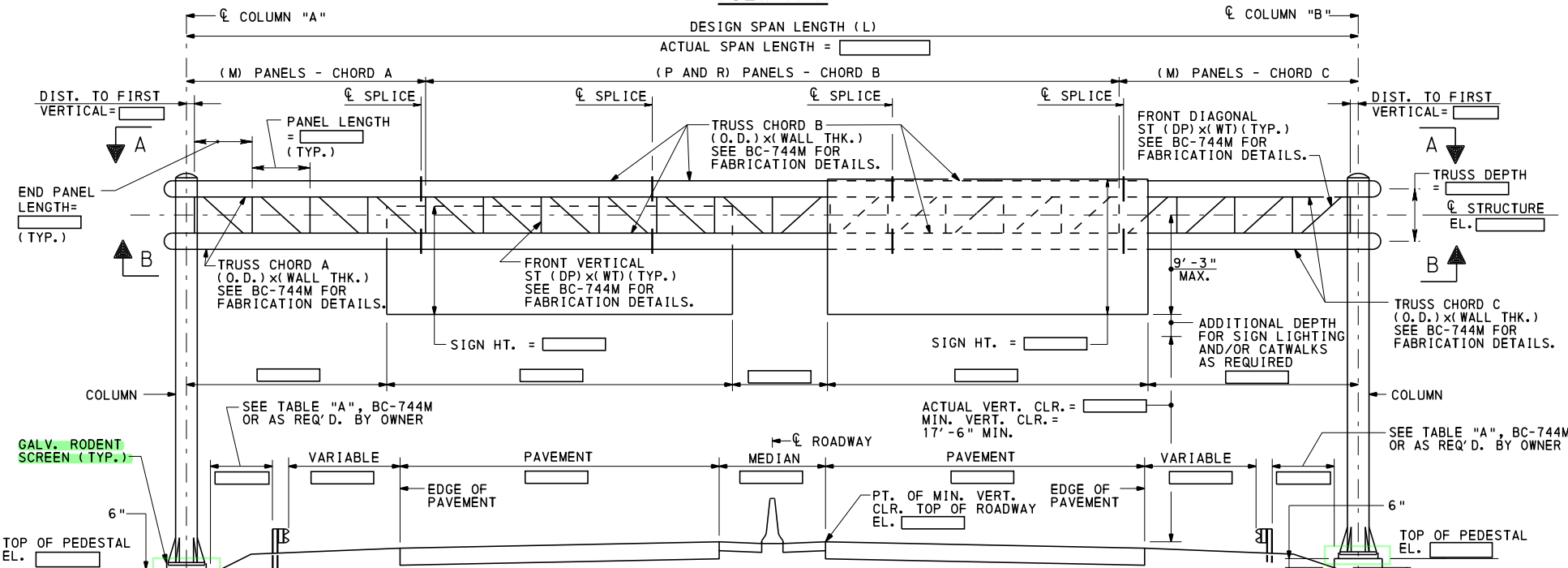
SPAN LENGTH (L) =

STRUCTURE HEIGHT (H) =

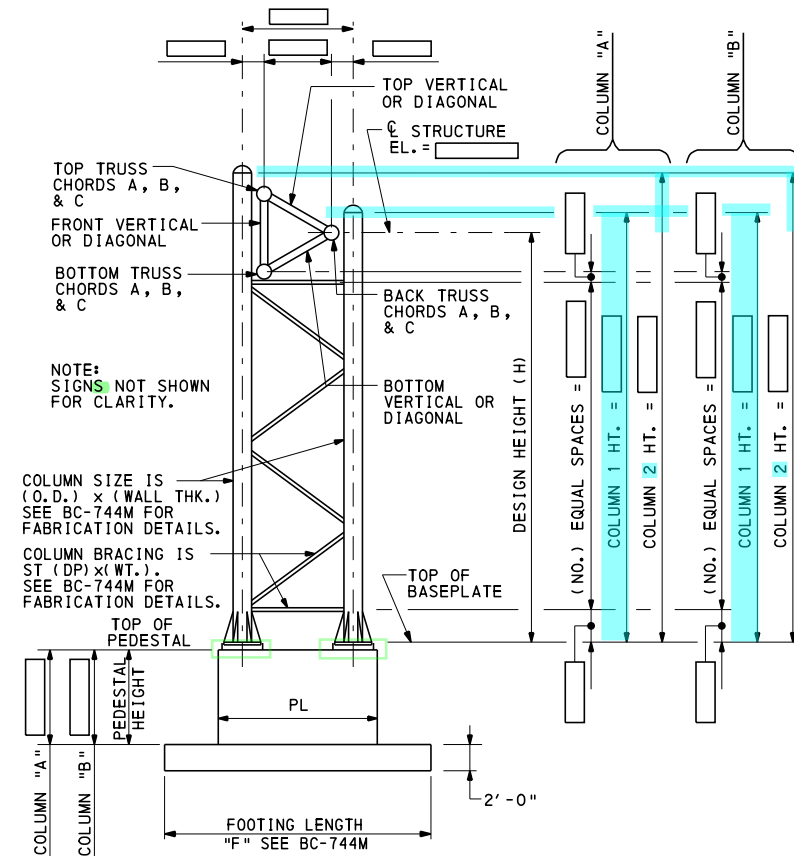
LOADING TYPE = (1 OR 2)

FATIGUE CATEGORY =

NOTE: DESIGN FOR (ULTIMATE OR ACTUAL) SIGN AREA. (DESIGNER TO INDICATE CONTROLLING CONDITION)



ELEVATION

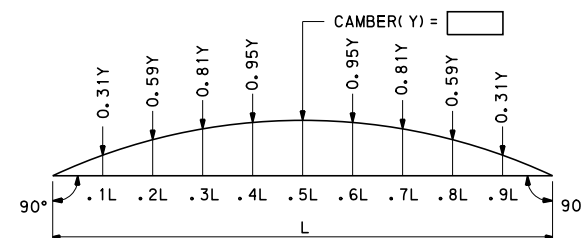


END VIEW

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 (SIZE). 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 (WALLTHK.). 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 (WALLTHK.), TRUSS CHORD B (O.D.) x (W. THK.), AND TRUSS CHORD C (O.D.) x (WALLTHK.). SEE BC-744M FOR FABRICATION DETAILS.
 - FRONT DIAGONALS ST (DP) x (WT) AND FRONT VERTICALS ST (DP) x (WT); TOP DIAGONALS ST (DP) x (WT) AND TOP VERTICALS ST (DP) x (WT); BOTTOM DIAGONALS ST (DP) x (WT) AND BOTTOM VERTICALS ST (DP) x (WT). 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.



CAMBER DIAGRAM

NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

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. 9948-0106.

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

OVERHEAD SIGN STRUCTURES

4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

SAMPLE CONTRACT DRAWING

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Stroman
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 8 OF 13

BD-644M

LOADING TYPE 1

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)**			DIAGONALS ▲		VERTICALS ▲		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'	
		A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	COLUMN **	BRACING▲	COLUMN **	BRACING▲	COLUMN **	BRACING▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
TO 60'	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	1.5x3.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	612	FP122	612	FP126	614	FP131	714
	250	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x4.75	1.5x3.75	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	614	FP122	614	FP126	716	FP131	716
	375	6x.432 *	6x.432 *	6x.432 *	1.5x2.85	1.5x3.75	3.0x8.625	3.0x6.25	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	716	FP122	716	FP126	718	FP131	818
	500	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x3.85	3.0x8.625	4.0x11.5	10x.365 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	716	FP122	718	FP126	820	FP131	820
	625	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x3.85	3.0x8.625	6.0x15.9	10x.365 *	2.0x3.85	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	3.0x8.625	FP122	718	FP122	820	FP126	820	FP131	922
	750	8x.500	8x.500 *	8x.500	2.5x5.0	2.0x3.85	3.0x8.625	6.0x20.4	10x.365 *	2.0x4.75	12x.375	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	820	FP122	820	FP126	1119	FP131	1024
	875	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x3.85	3.0x8.625	6.0x25.0	12x.375 *	2.0x4.75	14x.375 *	3.0x8.625	16x.375	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	922	FP126	924	FP136	924
	1000	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x3.85	3.0x8.625	9.0x27.35	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	1221	FP136	1026
	1100	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	4.0x11.5	9.0x27.35	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	1221	FP136	1323
OVER 60' TO 70'	175	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	1.5x3.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	613	FP122	613	FP126	615	FP131	715
	300	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x3.75	2.0x4.75	1.5x3.75	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	615	FP122	717	FP126	717	FP131	819
	425	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	1.5x3.75	2.0x4.75	3.0x6.25	8x.322 *	2.0x4.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	717	FP122	717	FP126	719	FP131	819
	550	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	4.0x11.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	821	FP131	821
	675	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	6.0x15.9	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	1118	FP131	923
	800	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x20.4	10x.365	2.0x4.75	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375	3.0x8.625	FP122	821	FP126	1118	FP126	1120	FP131	1025
	925	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x25.0	12x.375 *	3.0x8.625	14x.375	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	1118	FP131	1120	FP136	1025
	1050	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	3.0x8.625	9.0x27.35	12x.375*	3.0x8.625	16x.375 *	3.0x8.625	18x.375	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	1120	FP131	1222	FP136	1324
	1175	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	3.0x8.625	16x.375 *	3.0x8.625	18x.375	3.0x8.625	24x.375 *	3.0x8.625	FP122	1118	FP126	1120	FP131	1222	FP136	1324
	1295	10x.500	10x.365	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	4.0x11.5	16x.375 *	4.0x9.2	18x.375	4.0x9.2	24x.375 *	4.0x9.2	FP122	1118	FP126	1120	FP131	1222	FP136	1324

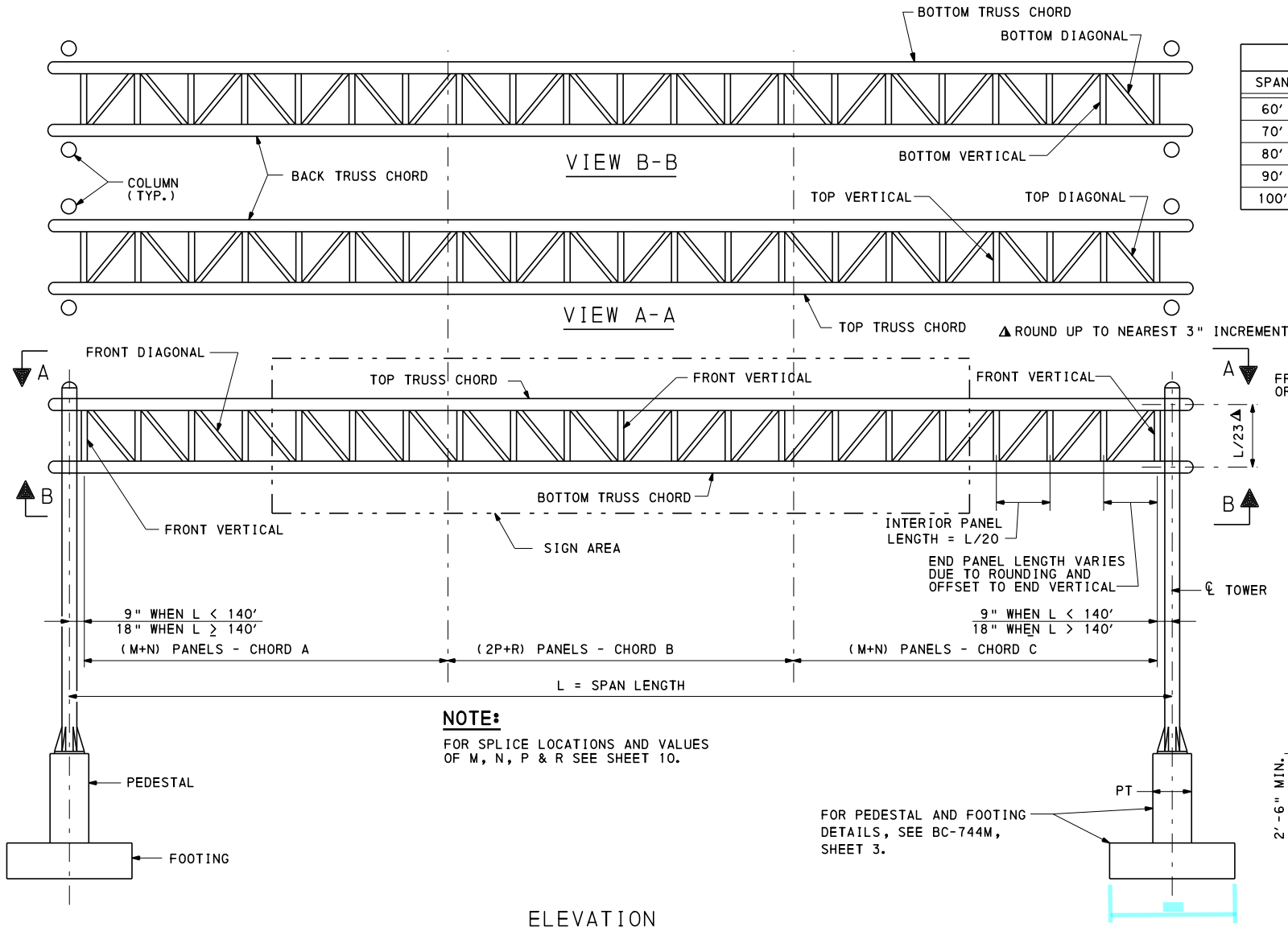
PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

FOR CONTINUATION OF CHART, SEE SHEETS 10 AND 11.

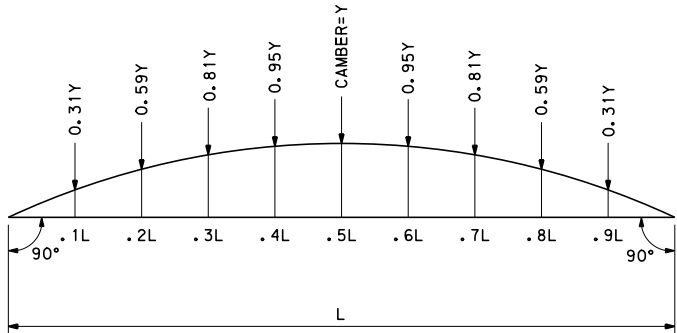
* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - TRUSS VERTICALS AND TRUSS DIAGONALS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



CAMBER TABLE			
SPAN	CAMBER (IN.)	SPAN	CAMBER (IN.)
60'	1.66	120'	3.67
70'	1.94	140'	4.53
80'	2.41	160'	5.21
90'	2.71	180'	6.13
100'	2.90	200'	7.47



CAMBER DIAGRAM

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 609 INDICATES A FOOTING 6' WIDE x 9' LONG). SEE BC-744M, SHEET 3 FOR FOUNDATION DETAILS.
 - FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
 - FOR STRUCTURAL DETAILS, SEE BC-744M.
 - FOR PEDESTAL DETAILS, SEE BC-744M SHEET 3.
- CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST TRI-CHORD TRUSS
SPANS FROM 60' TO 240'

DESIGN TABLES
LOADING TYPE 1

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHT. 9 OF 13
BD-644M

LOADING TYPE 1 (CONTINUED)

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE X WALL THK.) **			DIAGONALS ▲		VERTICALS ▲		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'	
		A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
OVER 70' TO 80'	150	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	1.5x3.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	613	FP122	613	FP126	615	FP131	715
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	1.5x3.75	2.0x4.75	2.0x4.75	8x.322 *	2.0x3.85	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	615	FP122	717	FP126	717	FP131	819
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.0x3.85	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	3.0x8.625	FP122	717	FP122	819	FP126	821	FP131	921
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	819	FP122	821	FP126	1118	FP131	923
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	3.0x8.625	6.0x15.9	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	4.0x11.5	FP122	821	FP126	821	FP126	1120	FP131	1025
	900	10x.500	10x.365 *	10x.500	2.0x4.75	3.0x8.625	4.0x11.5	6.0x25.0	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP122	821	FP126	923	FP131	1120	FP136	1025
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	3.0x8.625	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375	4.0x11.5	24x.375 *	4.0x11.5	FP122	1118	FP126	1120	FP131	1222	FP136	1324
	1200	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	3.0x8.625	16x.375	3.0x8.625	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP122	1120	FP126	1222	FP131	1027	FP136	1324
	1350	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375 *	3.0x8.625	16x.375	3.0x8.625	20x.375 *	4.0x9.2	24x.375	5.0x12.7	FP126	1120	FP126	1222	FP131	1027	FP136	1324
1480	12x.500	12x.375	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375	3.0x8.625	18x.375 *	3.0x8.625	20x.375	4.0x9.2	24x.375	5.0x12.7	FP126	1120	FP131	1222	FP131	1222	FP136	1324	
OVER 80' TO 90'	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	2.0x4.75	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	613	FP122	615	FP126	615	FP131	715
	300	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	1.5x3.75	3.0x8.625	2.0x4.75	8x.322 *	2.0x3.85	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	615	FP122	717	FP126	717	FP131	819
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	717	FP122	719	FP126	821	FP231	821
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	819	FP122	821	FP126	821	FP231	923
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	4.0x11.5	6.0x15.9	10x.365 *	4.0x9.2	14x.375 *	4.0x9.2	16x.375 *	4.0x9.2	20x.375 *	4.0x11.5	FP122	821	FP126	1118	FP226	1120	FP231	1025
	900	10x.500	10x.365	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	6.0x25.0	12x.375 *	4.0x9.2	14x.375	4.0x9.2	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP222	821	FP126	1120	FP131	1120	FP136	1027
	1050	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	12x.375 *	4.0x9.2	16x.375 *	4.0x9.2	18x.375	4.0x11.5	24x.375 *	4.0x11.5	FP222	1118	FP226	1120	FP131	1222	FP136	1324
	1200	12x.500	12x.375	12x.500	4.0x11.5	3.0x8.625	4.0x11.5	9.0x27.35	12x.375	4.0x9.2	16x.375	4.0x9.2	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP222	1120	FP226	1222	FP231	1222	FP136	1324
	1350	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	14x.375	4.0x11.5	18x.375 *	4.0x11.5	20x.375	5.0x12.7	24x.375	5.0x12.7	FP126	1120	FP131	1222	FP231	1324	FP136	1426
1500	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	14x.375	5.0x12.7	18x.375 *	4.0x11.5	20x.375	5.0x12.7	26x.375 *	5.0x12.7	FP126	1222	FP131	1222	FP231	1027	FP138	1326	
1665	12x.500	12x.500 *	12x.500	4.0x11.5	3.0x8.625	5.0x17.5	9.0x27.35	16x.375 *	5.0x12.7	18x.375	4.0x11.5	20x.375	5.0x12.7	26x.375	5.0x12.7	FP226	1222	FP131	1222	FP231	1324	FP138	1623	
OVER 90' TO 100'	200	6x.432 *	6x.432 *	6x.432 *	2.0x4.75	2.0x4.75	3.0x6.25	2.5x5.0	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x6.25	FP122	614	FP222	616	FP226	718	FP136	718
	350	6x.432 *	6x.432	6x.432 *	2.5x5.0	2.0x4.75	4.0x11.5	3.0x6.25	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x6.25	FP122	717	FP222	718	FP226	820	FP136	820
	500	8x.500	8x.500 *	8x.500	3.0x6.25	2.5x5.0	4.0x11.5	3.0x8.625	10x.365 *	3.0x6.25	12x.375 *	3.0x6.25	16x.375 *	3.0x6.25	24x.375 *	3.0x8.625	FP222	718	FP222	820	FP226	822	FP136	922
	650	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	4.0x9.2	10x.365 *	3.0x6.25	14x.375 *	3.0x6.25	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP222	820	FP226	822	FP231	1119	FP236	924
	800	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	4.0x11.5	12x.375 *	4.0x9.2	14x.375 *	4.0x9.2	18x.375 *	4.0x9.2	24x.375 *	4.0x11.5	FP222	1017	FP226	1119	FP231	1121	FP236	1026
	950	12x.500	12x.375 *	12x.500	4.0x11.5	4.0x11.5	5.0x17.5	4.0x11.5	12x.375 *	4.0x9.2	16x.375 *	4.0x11.5	20x.375 *	4.0x9.2	24x.375 *	4.0x11.5	FP222	1119	FP226	924	FP231	924	FP236	1223
	1100	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	5.0x17.5	14x.375 *	4.0x11.5	16x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x12.7	FP226	1119	FP226	1121	FP231	1026	FP236	1325
	1250	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	5.0x17.5	14x.375 *	4.0x11.5	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.375 *	5.0x12.7	FP226	924	FP231	1223	FP236	1223	FP236	1325
	1400	14x.500	14x.500 *	14x.500	4.0x11.5	4.0x11.5	5.0x17.5	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x12.7	24x.375 *	5.0x12.7	26x.375 *	5.0x12.7	FP226	1121	FP231	1223	FP236	1028	FP138	1427
	1550	14x.500	14x.500 *	14x.500	5.0x12.7	5.0x12.7	6.0x20.4	5.0x17.5	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.500 *	5.0x17.5	FP231	1223	FP231	1223	FP236	1325	FP236	1327
	1700	14x.500	14x.500 *	14x.500	5.0x12.7	5.0x12.7	6.0x25.0	5.0x17.5	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	26x.375 *	5.0x12.7	24x.500 *	5.0x17.5	FP231	1221	FP236	1127	FP138	1325	FP236	1327
	1850	16x.500	16x.500 *	16x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x15.9	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	26x.375 *	5.0x12.7	24x.500 *	5.0x17.5	FP231	1125	FP236	1325	FP138	1325	FP236	1429
	OVER 100' TO 120'	300	8x.500	8x.322 *	8x.500	2.5x5.0	2.0x4.75	4.0x11.5	3.0x6.25	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	24x.375 *	4.0x11.5	FP222	717	FP226	719	FP226	719	FP236
600		10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	4.0x9.2	14x.375 *	3.0x8.625	14x.375 *	4.0x11.5	16x.375 *	4.0x11.5	24x.375 *	4.0x9.2	FP226							

LOADING TYPE 1 (CONTINUED)

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)**			DIAGONALS ▲		VERTICALS ▲		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'	
		A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
OVER 140' TO 160'	300	14x.500	14x.375 *	14x.500	4.0x11.5	4.0x11.5	5.0x12.7	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP326	720	FP331	821	FP331	822	FP436	824
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP326	1018	FP331	1020	FP331	925	FP436	1028
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	FP326	1122	FP331	1122	FP331	1028	FP436	1030
	1200	20x.500	20x.500 *	20x.500	4.0x11.5	6.0x17.5	9.0x35.0	6.0x20.4	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	26x.375 *	6.0x25.0	FP331	1224	FP431	1225	FP436	1225	FP238	1329
	1500	20x.500	20x.500 *	20x.500	5.0x17.5	6.0x25.0	9.0x35.0	6.0x25.0	18x.375	4.0x11.5	20x.375	5.0x17.5	24x.375 *	6.0x25.0	26x.500 *	6.0x25.0	FP331	1224	FP431	1225	FP436	1327	FP238	1431
	1800	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	9.0x35.0	7.5x25.0	20x.375	4.0x11.5	24x.375 *	5.0x17.5	24x.375	6.0x25.0	26x.500 *	6.0x25.0	FP431	1225	FP436	1327	FP436	1329	FP238	1236
	2100	26x.500	26x.500 *	26x.500	6.0x25.0	6.0x25.0	9.0x35.0	7.5x25.0	24x.375 *	4.0x11.5	24x.375	5.0x17.5	26x.375	6.0x25.0	26x.562	9.0x35.0	FP436	1427	FP436	1329	FP338	1431	FP338	1433
	2400	26x.500	26x.500 *	26x.500	6.0x25.0	6.0x25.0	9.0x35.0	7.5x25.0	24x.375 *	4.0x11.5	26x.375	6.0x25.0	24x.500 *	6.0x25.0	24x.969	9.0x35.0	FP436	1427	FP338	1431	FP436	1431	FP238	1535
OVER 160' TO 180'	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP426	822	FP431	1019	FP431	823	FP536	925
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1019	FP431	1021	FP431	925	FP536	1225
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	FP426	1121	FP431	1123	FP431	1225	FP536	1327
	1200	20x.500	20x.500 *	20x.500	4.0x11.5	6.0x25.0	10.0x48.0	6.0x20.4	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	26x.375	6.0x25.0	FP431	1224	FP431	1225	FP536	1327	FP338	1329
	1500	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	6.0x25.0	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	24x.375	6.0x25.0	26x.500 *	6.0x25.0	FP431	1225	FP536	1327	FP536	1329	FP338	1431
	1800	24x.500	24x.500	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	7.5x25.0	24x.375 *	4.0x11.5	24x.375	5.0x17.5	26x.375	6.0x25.0	26x.500	9.0x35.0	FP536	1426	FP536	1327	FP338	1431	FP338	1433
	2100	26x.500	26x.500	26x.500	6.0x25.0	6.0x25.0	10.0x48.0	7.5x25.0	24x.375	4.0x11.5	24x.375	6.0x25.0	24x.500 *	6.0x25.0	26x.562	9.0x35.0	FP536	1427	FP536	1329	FP536	1431	FP338	1535
	2400	26x.562	26x.562	26x.562	6.0x25.0	6.0x25.0	10.0x48.0	9.0x35.0	24x.375	5.0x17.5	26x.375	6.0x25.0	24x.500	9.0x35.0	24x.969	9.0x35.0	FP536	1427	FP338	1431	FP536	1533	FP338	1535
OVER 180' TO 200'	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1019	FP431	1019	FP431	923	FP536	926
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1121	FP431	1123	FP431	926	FP536	1226
	900	16x.500	16x.500	16x.500	4.0x11.5	6.0x25.0	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375	5.0x17.5	20x.375	5.0x17.5	24x.375	6.0x25.0	FP426	1122	FP431	1225	FP431	1226	FP536	1328
	1200	24x.500	24x.500 *	24x.500	6.0x25.0	6.0x25.0	10.0x48.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	24x.375 *	6.0x25.0	24x.500 *	6.0x25.0	FP531	1324	FP536	1226	FP536	1328	FP536	1330
	1500	24x.562	24x.562	24x.562	6.0x25.0	6.0x25.0	10.0x48.0	6.0x25.0	20x.375	5.0x17.5	24x.375 *	5.0x17.5	26x.375 *	6.0x25.0	26x.500 *	6.0x25.0	FP531	1325	FP536	1328	FP338	1328	FP338	1432
	1800	24x.688	24x.688	24x.688	9.0x35.0	9.0x35.0	10.0x48.0	9.0x35.0	24x.375	5.0x17.5	26x.375	6.0x25.0	24x.500	6.0x25.0	26x.562	9.0x35.0	FP536	1427	FP338	1430	FP536	1432	FP338	1434
	2100	24x.688	24x.688	24x.688	9.0x35.0	9.0x35.0	WT10.5x73.5	9.0x35.0	26x.375	5.0x17.5	24x.500 *	6.0x25.0	26x.500 *	9.0x35.0	24x.969	9.0x35.0	FP338	1528	FP536	1431	FP338	1432	FP338	1536
	2400	24x.969	24x.969	24x.969	WT10.5x73.5	10.0x48.0	WT10.5x73.5	9.0x35.0	24x.500 *	5.0x17.5	24x.500	6.0x25.0	26x.562	9.0x35.0	24x.969	9.0x35.0	FP536	1529	FP536	1432	FP338	1534	FP338	1536
OVER 200' TO 220'	300	14x.500	14x.500 *	14x.500	4.0x11.5	6.0x25.0	6.0x25.0	5.0x17.5	14x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	6.0x25.0	24x.375 *	5.0x17.5	FP526	1020	FP531	1122	FP531	925	FP636	1225
	600	18x.500	18x.500 *	18x.500	5.0x17.5	6.0x25.0	9.0x35.0	5.0x17.5	16x.375 *	5.0x17.5	18x.375 *	5.0x17.5	20x.375	6.0x25.0	24x.375 *	6.0x25.0	FP526	1122	FP531	1124	FP531	1224	FP636	1226
	900	20x.500	20x.500 *	20x.500	6.0x25.0	6.0x25.0	9.0x35.0	5.0x17.5	18x.375	5.0x17.5	20x.375	6.0x25.0	24x.375 *	6.0x25.0	26x.375	6.0x25.0	FP531	1224	FP531	1224	FP636	1226	FP438	1329
	1200	26x.500	26x.500	26x.500	6.0x25.0	9.0x35.0	10.0x48.0	6.0x25.0	20x.375	5.0x17.5	24x.375	6.0x25.0	26x.375 *	6.0x25.0	26x.500 *	10.0x48.0	FP531	1325	FP636	1328	FP438	1430	FP438	1431
	1500	26x.562	26x.562	26x.562	6.0x25.0	9.0x35.0	10.0x48.0	6.0x25.0	24x.375	5.0x17.5	24x.375	6.0x25.0	24x.500 *	6.0x25.0	26x.500	10.0x48.0	FP636	1425	FP636	1328	FP636	1330	FP438	1533
	1800	24x.969	24x.969	24x.969	WT10.5x73.5	10.0x48.0	WT10.5x73.5	9.0x35.0	26x.375	5.0x17.5	24x.500 *	6.0x25.0	26x.500 *	9.0x35.0	24x.969	10.0x48.0	FP438	1528	FP636	1430	FP438	1432	FP438	1536
	2100	24x.969	24x.969	24x.969	WT10.5x73.5	10.0x48.0	WT10.5x73.5	9.0x35.0	24x.500 *	6.0x25.0	24x.500	6.0x25.0	26x.562	9.0x35.0	24x.969	10.0x48.0	FP636	1528	FP636	1432	FP438	1534	FP438	1536
	2400	24x.969	24x.969	24x.969	WT10.5x73.5	10.0x48.0	WT10.5x73.5	9.0x35.0	24x.500	6.0x25.0	26x.500	9.0x35.0	24x.969	9.0x35.0	24x.969	10.0x48.0	FP636	1727	FP438	1432	FP438	1534	FP438	1637
OVER 220' TO 240'	300	18x.500	18x.500 *	18x.500	5.0x17.5	6.0x25.0	9.0x35.0	5.0x17.5	16x.375 *	5.0x17.5	18x.375 *	5.0x17.5	20x.375 *	6.0x25.0	24x.375 *	6.0x25.0	FP526	1121	FP531	1123	FP531	926	FP636	1225
	600	26x.500	26x.500 *	26x.500	6.0x25.0	9.0x35.0	10.0x48.0	6.0x25.0	20x.375 *	5.0x17.5	20x.375	6.0x25.0	24x.375 *	6.0x25.0	24x.500 *	10.0x48.0	FP531	1223	FP531	1225	FP636	1227	FP636	1329
	900	24x.688	24x.688	24x.688	10.0x48.0	10.0x48.0	10.0x48.0	6.0x25.0	24x.375 *	5.0x17.5	24x.375	6.0x25.0	26x.375 *	6.0x25.0	26x.500 *	10.0x48.0	FP636	1425	FP636	1328	FP438	1329	FP438	1433
	1200	24x.969	24x.969	24x.969	WT10.5x73.5	10.0x48.0	WT10.5x73.5	9.0x35.0	24x.375	5.0x17.5	26x.375	6.0x25.0	24x.500	9.0x35.0	26x.562	10.0x48.0	FP636	1426	FP438	1329	FP636	1431	FP438	1433
	1500	24x.969	24x.969	24x.969	WT10.5x73.5	10.0x48.0	WT10.5x73.5	9.0x35.0	26x.375	6.0x25.0	24x.500 *	6.0x25.0	26x.500 *	9.0x35.0	24x.969									

LOADING TYPE 2																									
DESIGN SPAN	SIGN AREA (SQ.FT.)	TRUSS MEMBERS							TOWER MEMBERS								FOUNDATION								
		CHORDS (PIPE NOMINAL SIZE x WALL THK.) **			DIAGONALS ▲		VERTICALS ▲		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'		
		A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	COLUMN **	BRACING▲	COLUMN **	BRACING▲	COLUMN **	BRACING▲	COLUMN **	BRACING▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	
TO 60'	125	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	2.0x3.85	1.5x2.85	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	614	FP122	614	FP126	614	FP131	716	
	250	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x2.85	3.0x8.625	2.0x4.75	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	614	FP122	716	FP126	718	FP131	818	
	375	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	2.0x4.75	3.0x8.625	3.0x8.625	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.0x4.75	FP122	718	FP122	718	FP126	820	FP131	820	
	500	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	4.0x11.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	718	FP122	820	FP126	820	FP131	1219	
	625	8x.500	8x.322 *	8x.500	2.0x4.75	2.0x4.75	3.0x8.625	6.0x20.4	10x.365 *	2.0x4.75	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	820	FP126	820	FP126	1119	FP131	922	
	750	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x20.4	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	1119	FP136	924	
	875	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	4.0x11.5	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	1117	FP126	1119	FP131	924	FP136	1026	
	930	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	4.0x11.5	9.0x35.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	820	FP126	1119	FP131	922	FP136	1026	
OVER 60' TO 70'	175	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	2.0x3.85	1.5x3.75	8x.322 *	1.5x3.75	12x.375 *	1.5x3.75	16x.375 *	2.0x3.85	20x.375 *	2.0x3.85	FP116	615	FP122	615	FP126	717	FP131	717	
	300	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	2.0x4.75	3.0x8.625	4.0x11.5	8x.322 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.0x4.75	FP116	717	FP122	717	FP126	719	FP131	819	
	425	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	2.0x4.75	3.0x8.625	5.0x17.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	821	FP131	923	
	550	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x17.5	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	821	FP131	923	
	675	8x.500	8x.322 *	8x.500	2.0x4.75	2.0x4.75	3.0x8.625	6.0x20.4	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	821	FP126	821	FP126	1120	FP131	1025	
	800	8x.500	8x.500 *	8x.500	3.0x8.625	2.0x4.75	3.0x8.625	6.0x20.4	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	923	FP131	1120	FP136	925	
	925	10x.500	10x.365 *	10x.500	3.0x8.625	2.0x4.75	4.0x11.5	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP122	821	FP126	1120	FP131	1222	FP136	1027	
	1050	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x35.0	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP126	1118	FP126	1120	FP131	1025	FP136	1324	
OVER 70' TO 80'	1090	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x35.0	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	24x.375 *	3.0x8.625	FP126	1118	FP126	1120	FP131	1025	FP136	1324	
	150	5x.375 *	5x.375 *	5x.375 *	1.5x3.75	1.5x2.85	1.5x3.75	2.0x3.85	8x.322 *	1.5x3.75	12x.375 *	2.0x3.85	16x.375 *	2.0x3.85	20x.375 *	2.0x4.75	FP116	615	FP122	615	FP126	717	FP131	717	
	300	5x.375 *	5x.375 *	5x.375 *	2.0x3.85	1.5x3.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x3.85	12x.375 *	2.0x3.85	16x.375 *	2.0x4.75	20x.375 *	2.5x5.0	FP122	717	FP122	719	FP126	719	FP131	821	
	450	8x.500	8x.322 *	8x.500	2.0x3.85	2.0x4.75	3.0x8.625	5.0x12.7	10x.365 *	2.5x5.0	12x.375 *	2.0x4.75	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	719	FP122	821	FP126	821	FP131	923	
	600	8x.500	8x.500 *	8x.500	2.0x3.85	2.0x4.75	5.0x17.5	6.0x20.4	10x.365 *	3.0x8.625	14x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	3.0x8.625	FP122	821	FP126	821	FP126	1120	FP131	1025	
	750	10x.500	10x.365 *	10x.500	2.0x3.85	3.0x8.625	5.0x17.5	6.0x20.4	12x.375 *	3.0x8.625	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	24x.375 *	4.0x11.5	FP122	821	FP126	823	FP131	1120	FP136	1027	
	900	10x.500	10x.365 *	10x.500	2.0x4.75	3.0x8.625	5.0x17.5	6.0x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	18x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP122	821	FP126	925	FP131	925	FP136	1027	
	1050	10x.500	10x.500 *	10x.500	3.0x8.625	3.0x8.625	5.0x17.5	7.5x25.0	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	20x.375 *	4.0x11.5	24x.375 *	4.0x11.5	FP122	923	FP126	1120	FP131	1025	FP136	1324	
OVER 80' TO 90'	1200	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP126	1120	FP131	1222	FP131	1027	FP136	1324	
	1240	12x.500	12x.375 *	12x.500	3.0x8.625	3.0x8.625	4.0x11.5	9.0x27.35	14x.375 *	3.0x8.625	18x.375 *	3.0x8.625	20x.375 *	4.0x9.2	24x.375 *	5.0x12.7	FP126	1120	FP131	1222	FP131	1027	FP136	1324	
	150	5x.375 *	5x.375 *	5x.375 *	1.5x2.85	1.5x3.75	3.0x8.625	2.0x3.85	8x.322 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.0x3.85	20x.375 *	2.5x5.0	FP116	615	FP122	615	FP126	717	FP131	717	
	300	6x.432 *	6x.432 *	6x.432 *	2.0x3.85	1.5x3.75	4.0x11.5	5.0x12.7	10x.365 *	2.0x4.75	12x.375 *	2.0x4.75	16x.375 *	2.5x5.0	20x.375 *	2.5x5.0	FP122	717	FP122	719					

LOADING TYPE 2 (CONTINUED)

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS							TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)*			DIAGONALS ▲		VERTICALS ▲		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'	
		A	B	C	FRONT	TOP & BOTTOM	FRONT	TOP & BOTTOM	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
OVER 100' TO 120'	300	8x.500	8x.322 *	8x.500	2.5x5.0	2.0x4.75	4.0x11.5	3.0x6.25	10x.365 *	3.0x8.625	12x.375 *	3.0x8.625	16x.375 *	3.0x8.625	24x.375 *	4.0x11.5	FP222	719	FP222	719	FP226	721	FP236	821
	600	10x.500	10x.365 *	10x.500	3.0x6.25	3.0x6.25	4.0x11.5	5.0x17.5	14x.375 *	3.0x8.625	14x.375 *	4.0x11.5	16x.375 *	4.0x11.5	24x.375 *	4.0x9.2	FP226	823	FP226	823	FP226	825	FP236	1027
	900	12x.500	12x.375 *	12x.500	4.0x11.5	4.0x11.5	5.0x17.5	6.0x17.5	14x.375 *	4.0x9.2	16x.375	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x12.7	FP226	925	FP226	927	FP231	1027	FP236	1029
	1200	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	6.0x20.4	16x.375 *	5.0x12.7	18x.375	5.0x12.7	24x.375 *	5.0x12.7	26x.375 *	5.0x12.7	FP226	1122	FP231	1224	FP236	1029	FP138	1428
	1500	16x.500	16x.500 *	16x.500	5.0x12.7	5.0x17.5	6.0x25.0	6.0x20.4	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x12.7	24x.500 *	5.0x17.5	FP231	1224	FP231	1027	FP236	1131	FP236	1430
	1800	18x.500	18x.500 *	18x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x20.4	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.500	6.0x20.4	FP236	1324	FP236	1326	FP236	1428	FP236	1430
	1865	18x.500	18x.500 *	18x.500	6.0x15.9	5.0x17.5	6.0x25.0	6.0x20.4	24x.375 *	6.0x20.4	24x.375 *	6.0x20.4	24x.375	6.0x20.4	24x.562	6.0x20.4	FP236	1324	FP236	1326	FP236	1428	FP138	1430
OVER 120' TO 140'	300	8x.500	8x.322 *	8x.500	2.5x5.0	3.0x8.625	4.0x11.5	3.0x8.625	10x.365 *	3.0x8.625	16x.375 *	4.0x9.2	18x.375 *	4.0x9.2	24x.375 *	4.0x9.2	FP222	720	FP326	720	FP231	722	FP336	924
	600	10x.500	10x.365 *	10x.500	3.0x8.625	3.0x8.625	4.0x11.5	5.0x12.7	12x.375 *	4.0x11.5	18x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x17.5	FP226	824	FP231	1121	FP331	926	FP336	1028
	900	12x.500	12x.500 *	12x.500	4.0x9.2	4.0x9.2	5.0x17.5	6.0x20.4	16x.375 *	5.0x12.7	20x.375 *	5.0x12.7	20x.375 *	5.0x12.7	24x.375 *	5.0x17.5	FP326	1121	FP331	926	FP331	1028	FP336	1030
	1200	14x.500	14x.500 *	14x.500	5.0x12.7	4.0x11.5	5.0x17.5	6.0x25.0	16x.375 *	5.0x12.7	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	26x.375	6.0x15.9	FP326	1123	FP331	1325	FP336	1030	FP238	1132
	1500	16x.500	16x.500 *	16x.500	5.0x12.7	5.0x17.5	6.0x25.0	6.0x25.0	18x.375 *	5.0x17.5	24x.375 *	6.0x17.5	24x.375 *	6.0x20.4	24x.500 *	6.0x20.4	FP331	1225	FP336	1130	FP336	1132	FP436	1431
	1800	18x.500	18x.500 *	18x.500	5.0x17.5	5.0x17.5	6.0x25.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	6.0x17.5	24x.375	6.0x20.4	24x.562	6.0x20.4	FP331	1325	FP336	1327	FP336	1429	FP238	1431
	2100	18x.500	18x.500 *	18x.500	6.0x15.9	5.0x17.5	6.0x25.0	6.0x25.0	24x.375 *	6.0x15.9	24x.375 *	6.0x17.5	26x.375	6.0x20.4	24x.688	6.0x20.4	FP336	1425	FP336	1327	FP238	1429	FP436	1431
OVER 140' TO 160'	2175	18x.500	18x.500 *	18x.500	6.0x15.9	6.0x15.9	6.0x25.0	6.0x25.0	24x.375 *	6.0x17.5	24x.375 *	6.0x25.0	26x.375	6.0x25.0	24x.688	6.0x25.0	FP336	1425	FP336	1429	FP238	1429	FP436	1533
	300	14x.500	14x.375 *	14x.500	4.0x11.5	4.0x11.5	5.0x12.7	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP326	721	FP331	823	FP331	824	FP436	926
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x12.7	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP326	1020	FP331	927	FP331	926	FP436	1030
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375	5.0x17.5	24x.375	6.0x25.0	FP326	1122	FP331	929	FP331	1030	FP436	1032
	1200	20x.500	20x.500 *	20x.500	5.0x17.5	6.0x17.5	9.0x35.0	6.0x25.0	18x.375 *	4.0x11.5	20x.375	5.0x17.5	24x.375 *	5.0x17.5	24x.500 *	6.0x25.0	FP331	1226	FP431	1225	FP436	1329	FP436	1134
	1500	20x.500	20x.500 *	20x.500	5.0x17.5	6.0x25.0	9.0x35.0	6.0x25.0	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	26x.375 *	6.0x25.0	26x.500 *	6.0x25.0	FP431	1225	FP436	1327	FP238	1329	FP238	1431
	1800	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	9.0x35.0	7.5x25.0	24x.375 *	5.0x17.5	26x.375 *	5.0x17.5	24x.500 *	6.0x25.0	26x.562	6.0x25.0	FP436	1326	FP238	1329	FP436	1431	FP238	1433
OVER 160' TO 180'	2100	26x.500	26x.500 *	26x.500	6.0x25.0	6.0x25.0	9.0x35.0	7.5x25.0	24x.375 *	5.0x17.5	26x.375 *	5.0x17.5	24x.500 *	6.0x25.0	24x.969	9.0x35.0	FP436	1327	FP338	1329	FP436	1431	FP238	1535
	2400	26x.500	26x.500 *	26x.500	6.0x25.0	6.0x25.0	9.0x35.0	7.5x25.0	24x.375	5.0x17.5	26x.375	6.0x25.0	24x.500	6.0x25.0	24x.969	9.0x35.0	FP436	1428	FP338	1431	FP436	1431	FP238	1535
	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP426	822	FP431	1019	FP431	824	FP536	926
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	5.0x17.5	5.0x17.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP426	1021	FP431	1123	FP431	928	FP536	1030
	900	16x.500	16x.500 *	16x.500	4.0x11.5	5.0x17.5	6.0x25.0	6.0x20.4	16x.375	4.0x11.5	18x.375	5.0x17.5	20x.375	5.0x17.5	24x.375	6.0x25.0	FP426	1123	FP431	1125	FP431	1030	FP536	1329
	1200	20x.500	20x.500 *	20x.500	4.0x11.5	6.0x25.0	10.0x48.0	6.0x20.4	20x.375	4.0x11.5	24x.375 *	5.0x17.5	24x.375 *	6.0x25.0	24x.500 *	6.0x25.0	FP431	1225	FP536	1327	FP536	1329	FP536	1431
	1500	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	6.0x25.0	24x.375 *	4.0x11.5	24x.375 *	5.0x17.5	26x.375 *	6.0x25.0	26x.500 *	6.0x25.0	FP536	1326	FP536	1329	FP338	1134	FP338	1433
OVER 180' TO 200'	1800	24x.500	24x.500 *	24x.500	5.0x17.5	6.0x25.0	10.0x48.0	7.5x25.0	26x.375 *	4.0x11.5	26x.375 *	6.0x25.0	24x.500 *	6.0x25.0	26x.562	9.0x35.0	FP338	1427	FP338	1329	FP536	1431	FP338	1535
	2100	26x.500	26x.500 *	26x.500	6.0x25.0	6.0x25.0	10.0x48.0	7.5x25.0	26x.375 *	5.0x17.5	26x.375	6.0x25.0	24x.500	9.0x35.0	26x.562	9.0x35.0	FP338	1528	FP338	1431	FP536	1433	FP338	1535
	2400	26x.562	26x.562	26x.562	6.0x25.0	6.0x25.0	10.0x48.0	9.0x35.0	26x.375 *	5.0x17.5	24x.500 *	6.0x25.0	24x.500	9.0x35.0	24x.969	9.0x35.0	FP338	1528	FP536	1431	FP536	1433	FP338	1535
	300	14x.500	14x.375 *	14x.500	4.0x11.5	5.0x12.7	5.0x17.5	4.0x11.5	14x.375 *	4.0x11.5	18x.375 *	4.0x11.5	20x.375 *	4.0x11.5	24x.375 *	5.0x17.5	FP426	822	FP431	1121	FP431	825	FP536	927
	600	14x.500	14x.500 *	14x.500	4.0x11.5	5.0x17.5	6.0x25.0	5.0x17.5	16x.375 *	4.0x11.5	18x.375 *	5.0x17.5	20x.375 *	5.0x17.5	24x.375 *	5.0x17.5	FP426	1123	FP431	928	FP431	1029	FP536	1226
	900	16x.500	16x.500 *	16x.500	6.0x25.0	6.0x25.0	6.0x25.0	6.0x25.0	18x.375	4.0x11.5	20x.375 *	5.0x17.5	24x.375 *	6.0x25.0	26x.375	6.0x25.0	FP431	1225	FP431	1226	FP536	1328	FP338	1330
	1200	24x.500	24x.500 *	24x.500	6.0x25.0	6.0x25.0	10.0x48.0	6.0x25.0	20x.375	5.0x17.5	24x.375</													

CHANGE 1

CHANGE 2

CHANGE 3

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.

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 MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY II. THE DESIGNER MUST CHECK THE ADEQUACY OF THE MEMBER SIZES INDICATED WHEN THE FATIGUE CATEGORY IS SPECIFIED TO BE I FOR THE PROJECT.
- THE SPAN RANGE INCLUDED IN THIS STANDARD ARE AS FOLLOWS:

BD-645M	FOUR-POST FOUR-CHORD TRUSS, SPANS FROM 100' TO 200'.
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- 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.

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 AND 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. PROVIDE BOLT HOLES 1/16" LARGER THAN BOLT DIAMETER.
13. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
14. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
15. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
16. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN CRITERIA FOR PENNDOT SIGN STRUCTURES

- DEAD LOADS

SIGN PANELS	TC-8701E OR TC-8701S
LIGHT FIXTURES	BC-745M, SHT. 10
SIGN SUPPORT BEAM	BC-745M, SHT. 8
COLUMNS, CHORDS	CALCULATED INTERNALLY WITHIN PROGRAM
CATWALK	BC-745M, SHT. 8 & 9
- DYNAMIC\VARIABLE MESSAGE SIGN (DMS\VMS) STRUCTURES

4-POST 4-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS ARE RECOMMENDED TO CARRY DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS). THE CHIEF BRIDGE ENGINEER MUST REVIEW AND APPROVE ALL STRUCTURES DESIGNED TO CARRY A DYNAMIC\VARIABLE MESSAGE SIGN (DMS\VMS).

- EXTERNAL LOADS

ICE LOAD	3.7
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR
CATWALK	1994 SIGN SPEC. COMMENTARY 1.2.2
- GROUP LOADS

	AASHTO SIGN SPECS. 3.4
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- STEEL CRITERIA

SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11
ALLOWABLE STRESSES FOR SIGN SUPPORTS	5.12
ALLOWABLE STRESSES FOR BASE PLATES	5.8
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12
FATIGUE REQUIREMENTS (FATIGUE CATEGORY II)	SECTION 11
ALLOWABLE DEFLECTION	10.4
PERMANENT CAMBER	10.5
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5
- BOLT CRITERIA

ALLOWABLE BOLT STRESSES	TABLE 10.32.3B
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1
BOLT PRYING ACTION	10.32.3.3.2
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3
BOLT DESIGN CRITERIA	AASHTO SIGN SPECS. 5.16
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO SIGN SPECS. 5.17
- CONCRETE CRITERIA

ALLOWABLE BEARING STRESS	8.15.2.1.3
REINFORCEMENT TENSILE STRESS	8.15.2.2
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1
SHEAR STRESS IN FOOTINGS	8.15.5.6.2
ALLOWABLE SHEAR STRESS	8.15.5.6.4
SLENDERNESS OF COLUMNS	8.16.5.2
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1
SPACING LIMITS FOR REINFORCEMENT	8.21
MINIMUM CONCRETE COVER	DM-4 D8.22.1*
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2
FOOTING STABILITY REQUIREMENTS	DM-4 D5.5.5
TORSION	ACI SECTION A.7.3*
COLUMN DESIGN (PEDESTALS)	8.15.4
- SPREAD FOOTINGS

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MINIMUM AREA IN BEARING	95%
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
- DRILLED SHAFTS (CAISSONS) DM-4 SEC. D4.6, PENNDOT COM624P COMPUTER PROGRAM

MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT
ANGLE OF INTERNAL FRICTION	25°
COHESION	0 KIPS PER SQUARE FOOT
- SEISMIC DESIGN CRITERIA

STRUCTURES ARE DESIGNED FOR A SEISMIC ACCELERATION COEFFICIENT = 0.15

CONSTRUCTION GENERAL NOTES

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, ANSI/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE ANSI/AWS D1.1 FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS D1.5.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

COLUMNS, PIPE CHORDS & PIPE BRACING:	SEE PUBLICATION 408, SECTION 948.2.
ANGLES, SHAPES, AND PLATES:	AASHTO M270, GRADE 36 ASTM A709, GRADE 36
- 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 MEMBER FOR STRENGTH AND FATIGUE. PRESS-BREAK MEMBERS ARE PERMITTED AS AN ALTERNATE ONLY FOR COLUMNS. PRESS-BREAK MEMBERS ARE NOT PERMITTED FOR CHORDS.
- PROVIDE BOLTS CONFORMING TO THE FOLLOWING:

ANCHOR BOLTS:	ASTM, F1554 GRADE 55 PER PUBLICATION 408 SECTION 1105.02(c) 3.
BOLTS:	ASTM A-325 H.S. BOLTS EXCEPT AS NOTED
- DESIGN SPECIFICATIONS:

AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 2001 WITH CURRENT INTERIMS (UNLESS NOTED OTHERWISE); AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996 WITH INTERIMS THROUGH AND INCLUDING 2000; PENNDOT DESIGN MANUAL - PART 4, AUGUST 1993 EDITION (INCLUDING AUGUST 1995 REVISIONS)
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

NOTES TO DESIGNER

- PLACE THE FOLLOWING NOTE ON CONTRACT DRAWINGS - "PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH SPECIFICATIONS, PUBLICATION 408 (INDICATE CHANGE NUMBER), ANSI/AASHTO/AWS D1.5 BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS. USE ANSI/AWS D1.1 FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS D1.5".
- 4-POST 4-CHORD STRUCTURE TYPES AS PRESENTED IN THESE STANDARDS ARE RECOMMENDED TO CARRY DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS). OVERHEAD SIGN STRUCTURES INTENDED TO CARRY DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS) MUST BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF PENNSYLVANIA AND SUBMITTED TO THE CHIEF BRIDGE ENGINEER FOR REVIEW AND APPROVAL. THESE STANDARDS MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF OVERHEAD SIGN STRUCTURES CARRYING DYNAMIC\VARIABLE MESSAGE SIGNS (DMS\VMS).

* LEGEND:

- AASHTO SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS"
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES"
- 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 318-99).
- CVN: CHARPY V-NOTCH.

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/MERCURY VAPOR LAMPS
TC-8716	ERECTION DETAILS/EXTRUDED ALUMINUM CHANNEL SIGNS FLAT SHEET ALUMINUM WITH STIFFENERS/OVERHEAD STRUCTURES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-745M	OVERHEAD SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES

4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

NOTES AND DESIGN CRITERIA

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHT. 1 OF 7

BD-645M

HOW TO USE THE DESIGN TABLES
SETTING SUBSTRUCTURE ELEVATIONS

- SET THE TOP OF THE PEDESTAL OR CAISSON ELEVATION SO THAT THE BOTTOM OF BASE PLATE ELEVATION IS 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").

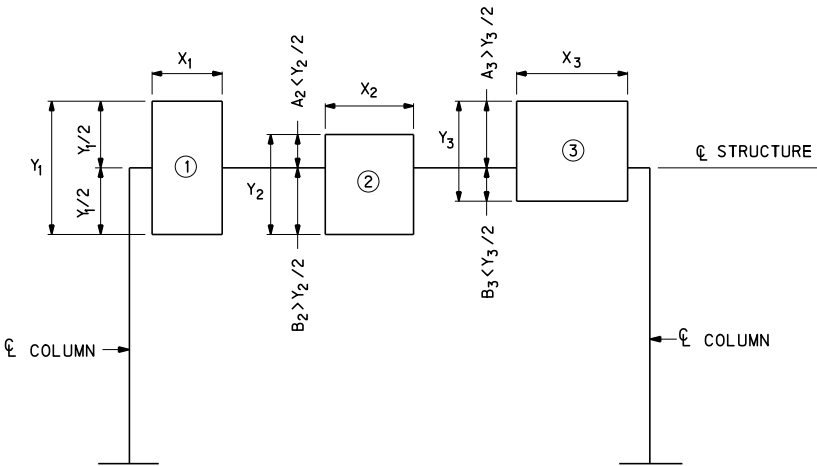
- THE DESIGN SIGN AREA WILL BE ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SIGN AREA SHOWN IN THE DESIGN TABLES. CLEARLY SHOW THE DESIGN AREA USED ON THE DESIGN PLANS FOR FUTURE REFERENCE.

- 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 = (X₁) x (Y₁)
AREA OF SIGN NO. 2 = (X₂) x (B₂) x 2
AREA OF SIGN NO. 3 = (X₃) x (A₃) x 2



A = DISTANCE FROM CL STRUCTURE TO TOP OF SIGN
B = DISTANCE FROM CL STRUCTURE TO BOTTOM OF SIGN

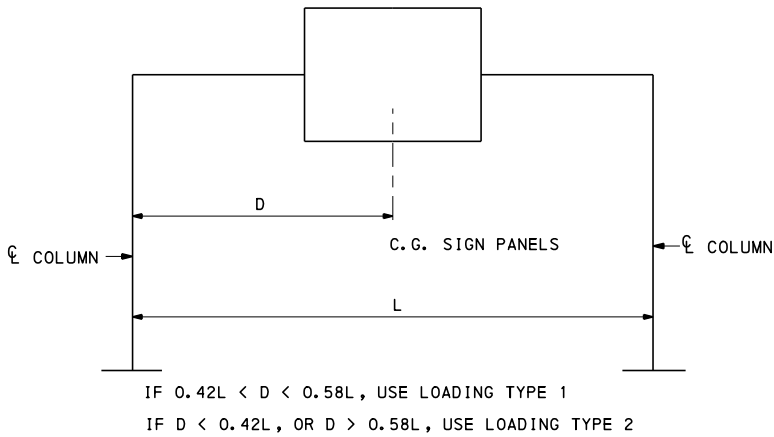
DESIGN AREA OF SIGN NO.1 = X₁Y₁
DESIGN AREA OF SIGN NO.2 = (X₂B₂) x2
DESIGN AREA OF SIGN NO.3 = (X₃A₃) x2

- 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 ULTIMATE SIGN AREA 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.

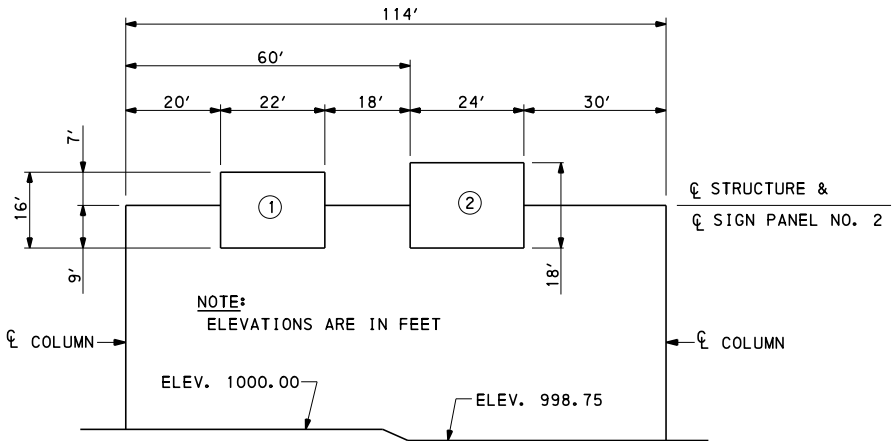
- DESIGNS FOR TWO TYPES OF LOADING CONDITIONS ARE PRESENTED IN THE DESIGN TABLES. TYPE 1 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE TOTAL DESIGN SIGN AREA LIES BETWEEN 0.42 X SPAN LENGTH AND 0.58 X SPAN LENGTH. TYPE 2 LOADING IS TO BE USED WHEN THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA LIES BETWEEN THE BEGINNING OF THE SPAN AND 0.42 X SPAN LENGTH OR 0.58 X SPAN LENGTH AND END OF SPAN. DETERMINE THE CENTER OF GRAVITY OF THE DESIGN SIGN AREA AND USE THE APPROPRIATE LOADING CONDITION FOR SELECTING THE MEMBER SIZES. WHEN DETERMINING THE CENTER OF GRAVITY OF DESIGN SIGN AREA, USE THE INDIVIDUAL SIGN AREAS AS CALCULATED IN ACCORDANCE WITH THE PROCEDURE FOR CENTERED AND OFF-CENTER SIGNS.



LOADING TYPE DIAGRAM

- THE DESIGN SPAN LENGTH SHALL BE THE ACTUAL SPAN LENGTH ROUNDED UP TO THE NEXT HIGHEST INCREMENT OF SPAN LENGTH SHOWN IN THE DESIGN TABLES.
- 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.

EXAMPLE TO SHOW PROCEDURE FOR SELECTING
SIGN AREA, SPAN LENGTH, & POST HEIGHT



Δ ELEV. = 1000.00 - 998.75 = 1.25 < 2'-6" }
Y₁ = 16' } Y₁ < Y₂ } USE CASE B
Y₂ = 18' }

- SET BOTTOM OF EACH SIGN PANEL AT SAME ELEVATION

ELEV. 1000.00 + 17'-6" + 1'-8" = 1019.17
[1'-8" = BOTTOM OF LUMINAIRE SUPPORT TO BOTTOM OF SIGN PANEL]

- SET CL STRUCTURE AT CL OF SIGN PANEL NO. 2

ELEV. 1019.17 + 18' /2 = 1028.17

- ACTUAL SPAN LENGTH = 114' → USE: 120'

- DESIGN COLUMN HEIGHT (H):
H = 1028.17 - 998.750 = 29.42' → USE H = OVER 24' TO 33'

- CL SIGN TO BOTTOM OF CATWALK IS 9'-0" + 1'-8 7/8" = 10'-8 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:

A₁ = 22' x 9' x 2 = 396.0 SF
A₂ = 24' x 18' = 432.0 SF
828.0 SF

→ USE 830.0 SF

- LOCATE C.G. OF SIGN AREA (FROM LEFT)

(X = [396.0 SF x (20' + 22' /2)] + [432.0 SF x (60' + 24' /2)]) / 828 SF

X = 52.40' 52.4' /114' = 0.46; 0.42 < 0.46 < 0.58

- VERIFY LOADING TYPE BASED ON ACTUAL SIGN AREA AND C.G.

- IF LOADING TYPES DIFFER USE THE LARGEST MEMBER SIZES FROM EACH LOADING TYPE.

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OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

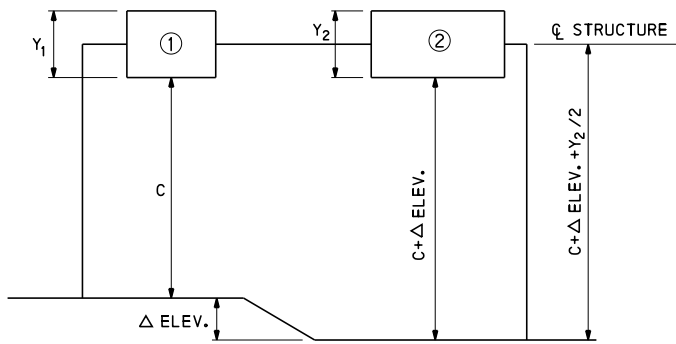
DESIGN INSTRUCTIONS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 2 OF 7

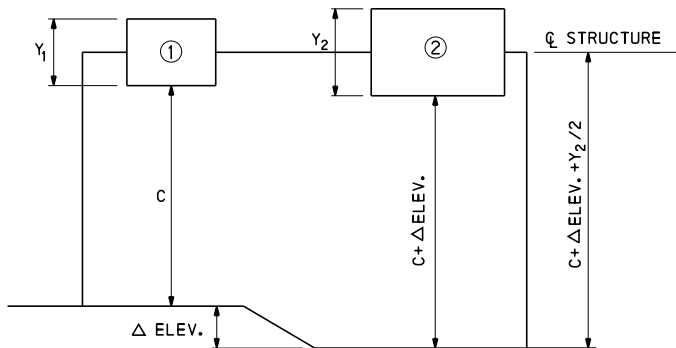
BD-645M



CASE A

$Y_1 = Y_2$
 $\Delta \text{ELEV.} < 2' - 6''$

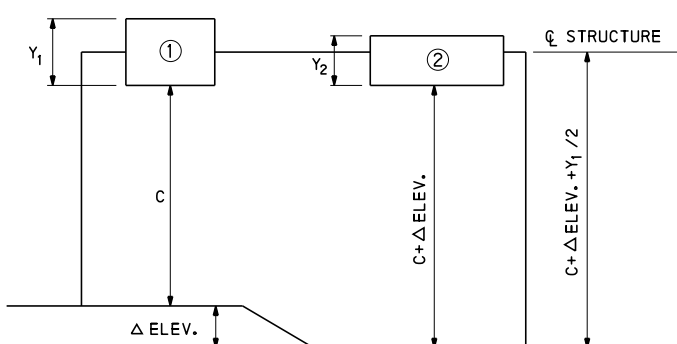
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ϕ OF STRUCTURE AT ϕ OF SIGN PANELS UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.



CASE B

$Y_1 < Y_2$
 $\Delta \text{ELEV.} < 2' - 6''$

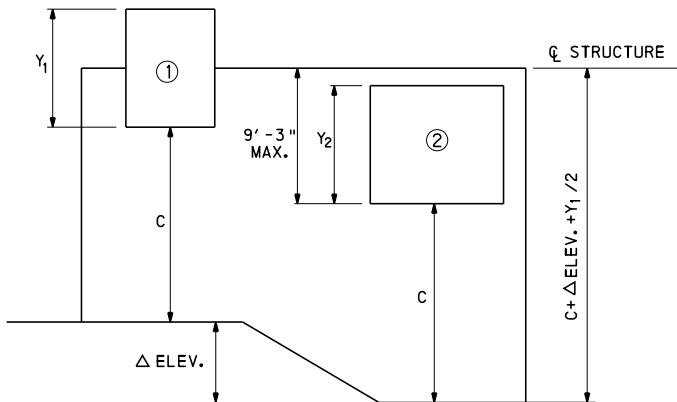
SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ϕ OF STRUCTURE AT ϕ OF SIGN PANEL NO. 2 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF
 Y_1 AND Y_2 WHERE $Y_1 < Y_2$.



CASE C

$Y_1 > Y_2$
 $\Delta \text{ELEV.} < 2' - 6''$

SET BOTTOMS OF SIGN PANELS AT SAME ELEVATION.
SET ϕ OF STRUCTURE AT ϕ OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.
THIS CASE IS APPLICABLE FOR ALL COMBINATIONS OF
 Y_1 AND Y_2 WHERE $Y_1 > Y_2$.

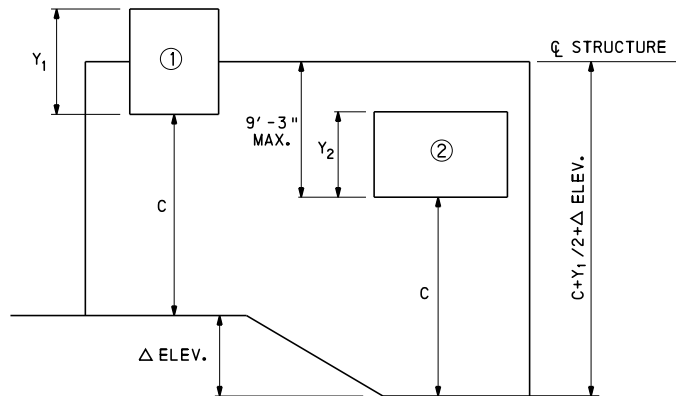


CASE D

$Y_1 = Y_2$
 $\Delta \text{ELEV.} > 2' - 6''$

SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL
CLEARANCE.
SET ϕ OF STRUCTURE AT ϕ OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.
THIS CASE IS APPLICABLE FOR THE FOLLOWING COMBINATIONS OF
 $\Delta \text{ELEV.}$ AND $Y_{1,2}$:

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

$Y_1 \geq Y_2$
 $\Delta \text{ELEV.} > 2' - 6''$

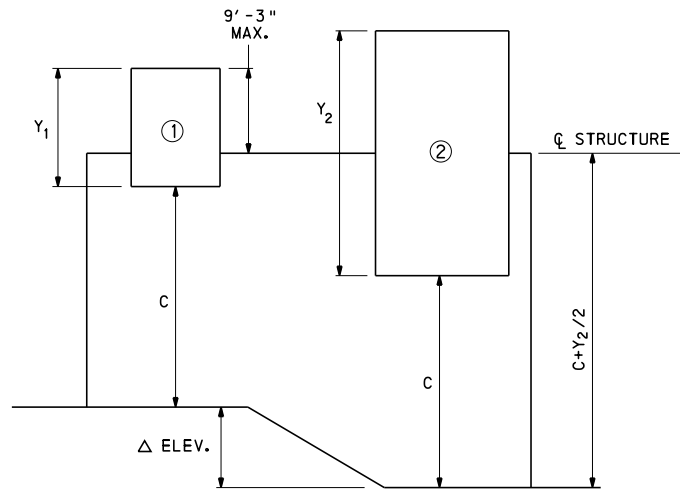
SET BOTTOM OF EACH SIGN PANEL TO SAME VERTICAL
CLEARANCE.
SET ϕ OF STRUCTURE AT ϕ OF SIGN PANEL NO. 1 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ STRUCTURE TO OBTAIN ADEQUATE
CLEARANCE.
THIS CASE IS APPLICABLE FOR THE FOLLOWING
COMBINATIONS OF $\Delta \text{ELEV.}$ AND Y_2 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_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 ϕ OF STRUCTURE AT ϕ OF SIGN PANEL NO. 2 UNLESS
STRUCTURE DEPTH GOVERNS VERTICAL CLEARANCE. IN
THIS CASE, RESET ϕ 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 ϕ 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

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OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

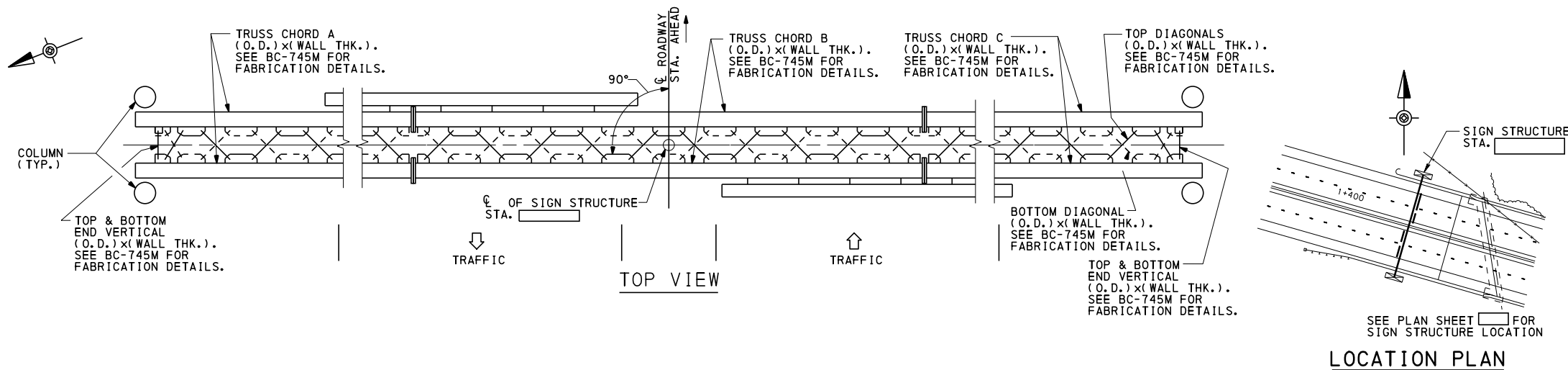
INSTRUCTIONS FOR USE OF DESIGN TABLES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

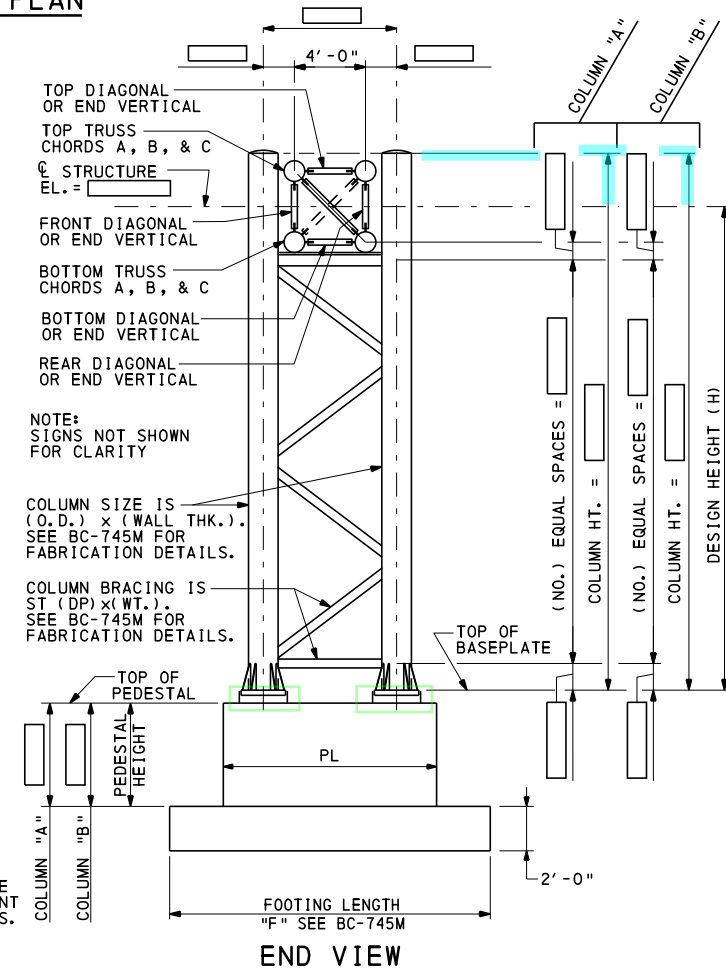
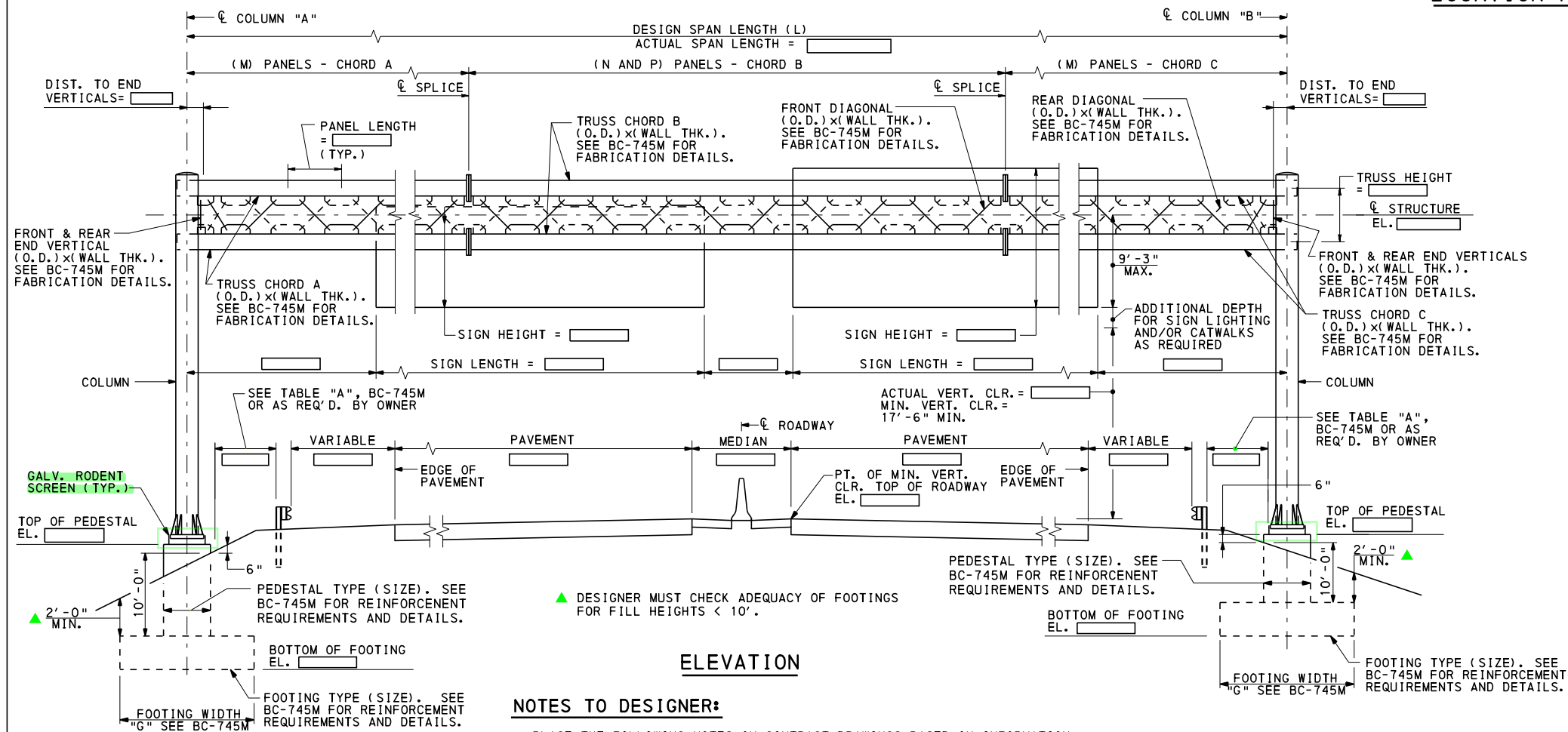
SHT. 3 OF 7

BD-645M



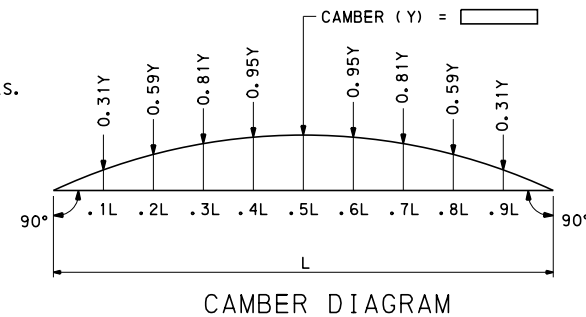
DESIGN CRITERIA	
SIGN AREA (A) =	
SPAN LENGTH (L) =	
STRUCTURE HEIGHT (H) =	
LOADING TYPE =	(1 OR 2)
FATIGUE CATEGORY =	

NOTE: DESIGN FOR (ULTIMATE OR ACTUAL) 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 (SIZE). 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.
- 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.



NOTE: PRIOR TO SHIPMENT OF TRUSS STRUCTURE TO THE SITE, SHOP ASSEMBLE TRUSSES IN AN UPRIGHT POSITION AND CHECK TRUSS CAMBER.

TABLE OF ESTIMATED QUANTITIES			
ITEM NO.	ITEM	UNIT	QUANTITY
*	STEEL SIGN STRUCTURE	LBS	
0000-0000	STRUCTURE MOUNTED SIGNS	SF	
0000-0000	CLASS 3 EXCAVATION	CF	
0000-0000	CLASS A CEMENT CONCRETE	CF	
0000-0000	REINFORCEMENT BARS	LBS	

* ITEMS SHOWN FOR INFORMATION ONLY, INCLUDED IN LUMP SUM ITEM NO. [0000] - [0000].

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OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'

SAMPLE CONTRACT DRAWING

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHT. 4 OF 7

BD-645M

LOADING TYPE 1

DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS**								TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)			DIAGONALS		END VERTICALS		TRUSS CROSS 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'	
		A	B	C	FRONT & REAR	TOP & BOTTOM	FRONT & REAR	TOP & BOTTOM		COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
TO 100'	200	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2x3.85	12x.375*	2x4.75	16x.375*	3x6.25	24x.375*	3x6.25	FP12	716	FP12	718	FP16	819	FP24	820
	350	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2x4.75	12x.375*	2.5x5.0	16x.375*	3x6.25	24x.375*	3x8.625	FP12	718	FP12	718	FP16	819	FP24	922
	500	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	4x9.2	FP12	718	FP12	720	FP16	921	FP24	924
	650	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	3x6.25	12x.375*	3x6.25	16x.375*	4x9.2	24x.375*	4x9.2	FP12	820	FP12	822	FP16	923	FP24	924
	800	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	822	FP16	923	FP16	923	FP24	1026
	950	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	12x.375	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	4x11.5	FP12	822	FP16	923	FP20	1025	FP24	1223
	1100	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	14x.375*	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	5x17.5	FP16	923	FP16	923	FP20	1025	FP24	1325
	1250	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	3x8.625	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	5x17.5	FP16	923	FP20	1025	FP20	1324	FP24	1325
	1400	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375*	5x17.5	24x.500	5x17.5	FP16	1025	FP20	1025	FP20	1324	FP24	1325
	1550	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375*	5x17.5	24x.500	5x17.5	FP16	1025	FP20	1025	FP20	1324	FP24	1325
	1700	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x9.2	20x.375*	5x17.5	24x.375*	5x17.5	24x.500	5x17.5	FP20	1025	FP20	1222	FP24	1325	FP24	1427
	1850	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	20x.375*	4x9.2	20x.375*	5x17.5	24x.375*	5x17.5	24x.500	6x17.5	FP20	1125	FP20	1324	FP24	1325	FP24	1429

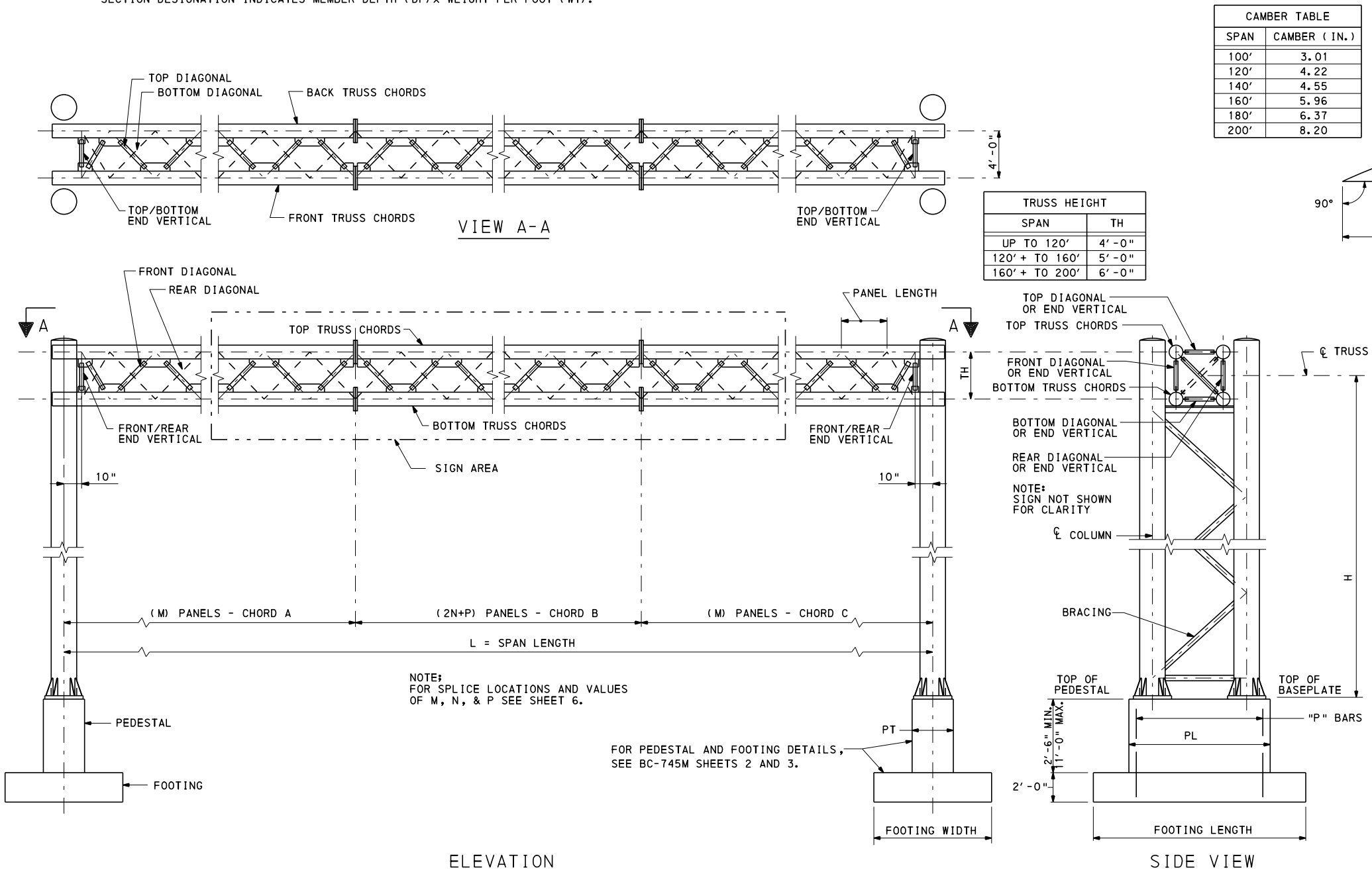
PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

FOR CONTINUATION OF CHART, SEE SHEET 6.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 3/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - COLUMN BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).



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 716 INDICATES A FOOTING 7' WIDE x 16' LONG). SEE BC-745M, SHEET 2 AND 3 FOR FOUNDATION DETAILS.
- FOOTING DESIGN BASED ON 10 FOOT FILL HEIGHT. DESIGNER MUST CHECK ADEQUACY FOR FILL HEIGHTS < 10'.
- FOR STRUCTURAL DETAILS, SEE BC-745M.
- FOR PEDESTAL DETAILS, SEE BC-745M SHEET 2.
- **CVN REQUIRED FOR COLUMN AND CHORD WALL THICKNESSES EXCEEDING 1/2" (0.500").**

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

OVERHEAD SIGN STRUCTURES
4 POST 4 CHORD TRUSS
SPANS FROM 100' TO 200'
DESIGN TABLES
LOADING TYPE 1

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHT. 5 OF 7
BD-645M

LOADING TYPE 1 (CONTINUED)																									
DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS **								TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)			DIAGONALS		END VERTICALS		TRUSS CROSS 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'	
		A	B	C	FRONT & REAR	TOP & BOTTOM	FRONT & REAR	TOP & BOTTOM		COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
OVER 100' TO 120'	300	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	3x8.625	FP12	717	FP12	718	FP16	819	FP24	922
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	820	FP12	822	FP16	923	FP24	924
	900	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x8.625	16x.375*	4x9.2	18x.375*	4x11.5	24x.375*	4x11.5	FP12	822	FP16	923	FP20	1025	FP24	1026
	1200	8x.500*	8x.500*	8x.500*	3x.216	3x.216	3x.216	3x.216	3x.216	14x.375	4x9.2	16x.375*	5x17.5	18x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1222	FP24	1325
	1500	8x.500*	8x.500*	8x.500*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375	4x9.2	18x.375*	5x17.5	24x.375*	6x17.5	24x.500*	6x17.5	FP16	1025	FP20	1222	FP24	1325	FP24	1427
	1800	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.500*	6x17.5	FP20	1025	FP20	1324	FP24	1427	FP26	1528
	2100	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	FP20	1324	FP20	1324	FP24	1427	FP26	1528
	2220	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	20x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.688	6x17.5	FP20	1324	FP20	1324	FP24	1427	FP26	1530
OVER 120' TO 140'	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	3x8.625	FP12	717	FP12	820	FP16	921	FP24	922
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	4x9.2	16x.375*	4x9.2	24x.375*	4x9.2	FP12	819	FP16	921	FP16	923	FP24	924
	900	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	4x11.5	FP16	921	FP16	923	FP20	1025	FP24	1223
	1200	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	5x17.5	18x.375*	5x17.5	20x.375	5x17.5	24x.500*	5x17.5	FP16	923	FP20	1222	FP20	1324	FP24	1325
	1500	12x.375	12x.375	12x.375	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	18x.375*	6x17.5	18x.375*	6x17.5	24x.375	6x17.5	24x.500*	6x17.5	FP20	1323	FP20	1324	FP24	1426	FP26	1429
	1800	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	24x.688	6x17.5	FP20	1324	FP24	1324	FP24	1427	FP24	1528
	2100	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500*	6x17.5	24x.688	6x20.4	FP20	1324	FP24	1427	FP24	1429	FP24	1530
	2400	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	26x.375*	6x17.5	24x.688	6x20.4	FP20	1324	FP24	1427	FP26	1528	FP24	1531
OVER 140' TO 160'	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	2.5x5.0	14x.375*	3x8.625	16x.375*	3x8.625	24x.375*	4x9.2	FP12	818	FP16	819	FP16	921	FP24	922
	600	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x6.25	16x.375*	4x9.2	18x.375*	4x9.2	24x.375*	4x9.2	FP16	921	FP16	921	FP20	923	FP24	1026
	900	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	4x11.5	16x.375*	4x11.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	1024	FP16	1025	FP20	1025	FP24	1325
	1200	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	5x17.5	18x.375*	5x17.5	24x.375*	5x17.5	24x.500*	5x17.5	FP16	1024	FP20	1222	FP24	1325	FP24	1427
	1500	12x.500	12x.500	12x.500	4x.237	4x.237	4x.237	4x.237	4x.237	18x.375*	6x17.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.500*	6x17.5	FP20	1125	FP20	1324	FP24	1325	FP26	1429
	1800	12x.562	12x.562	12x.562	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	24x.688*	6x17.5	FP20	1324	FP24	1325	FP24	1427	FP24	1429
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	24x.375*	6x17.5	26x.375*	6x17.5	24x.688*	6x20.4	FP24	1325	FP24	1427	FP26	1429	FP26	1530
	2400	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	26x.375	6x17.5	24x.500*	6x20.4	24x.969*	6x20.4	FP24	1426	FP26	1528	FP26	1530	FP26	1630
OVER 160' TO 180'	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x8.625	14x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP16	818	FP16	819	FP16	921	FP24	924
	600	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	4x9.2	16x.375*	4x9.2	18x.375	4x9.2	24x.375*	4x11.5	FP16	922	FP16	923	FP20	923	FP24	1026
	900	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x11.5	16x.375*	4x11.5	18x.375	5x17.5	24x.375*	5x17.5	FP16	1024	FP16	1025	FP20	1222	FP24	1325
	1200	12x.500	12x.500	12x.500	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	20x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	26x.375*	5x17.5	FP20	1222	FP20	1222	FP24	1325	FP26	1426
	1500	12x.688	12x.688	12x.688	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	5x17.5	24x.375*	6x17.5	24x.375*	6x17.5	24x.688*	6x17.5	FP20	1323	FP24	1325	FP24	1325	FP24	1427
	1800	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	5x17.5	24x.375*	6x17.5	26x.375*	6x17.5	24x.688	6x17.5	FP24	1324	FP24	1325	FP26	1426	FP24	1429
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	26x.375*	6x17.5	24x.500*	6x20.4	24x.969*	6x20.4	FP24	1325	FP26	1426	FP24	1429	FP26	1530
	2400	12x.844	12x.844	12x.844	4x.337	4x.337	4x.337	4x.337	4x.337	24x.375	6x17.5	26x.375*	6x17.5	24x.688*	6x20.4	24x.969	6x20.4	FP24	1426	FP26	1528	FP24	1530	FP24	1533
OVER 180' TO 200'	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	16x.375*	3x8.625	16x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP16	1016	FP16	1016	FP16	1117	FP24	1117
	600	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x9.2	16x.375*	4x9.2	20x.375*	4x9.2	24x.375*	4x11.5	FP16	1117	FP16	1117	FP20	1118	FP24	1221
	900	12x.562	12x.562	12x.562	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	4x9.2	18x.375	4x9.2	20x.375*	4x11.5	24x.500*	5x17.5	FP16	1117	FP20	1220	FP20	1120	FP24	1221
	1200	12x.688	12x.688	12x.688	4x.237	4x.237	4x.237	4x.237	4x.237	18x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	24x.500*	5x17.5	FP20	1219	FP20	1221	FP24	1221	FP26	1324
	1500	12x.844	12x.844	12x.844	5x.258	5x.258	5x.258	5x.258	5x.258	18x.375*	5x17.5	24x.375*	5x17.5	24x.375*	5x17.5	24x.688*	6x17.5	FP20	1219	FP24	1425	FP24	1221	FP24	1325
	1800	12x.844	12x.844	12x.844	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	5x17.5	26x.375*	5x17.5	26x.500*	6x17.5	24x.969*	6x17.5	FP24	1323	FP26	1324	FP26	1324	FP26	1426

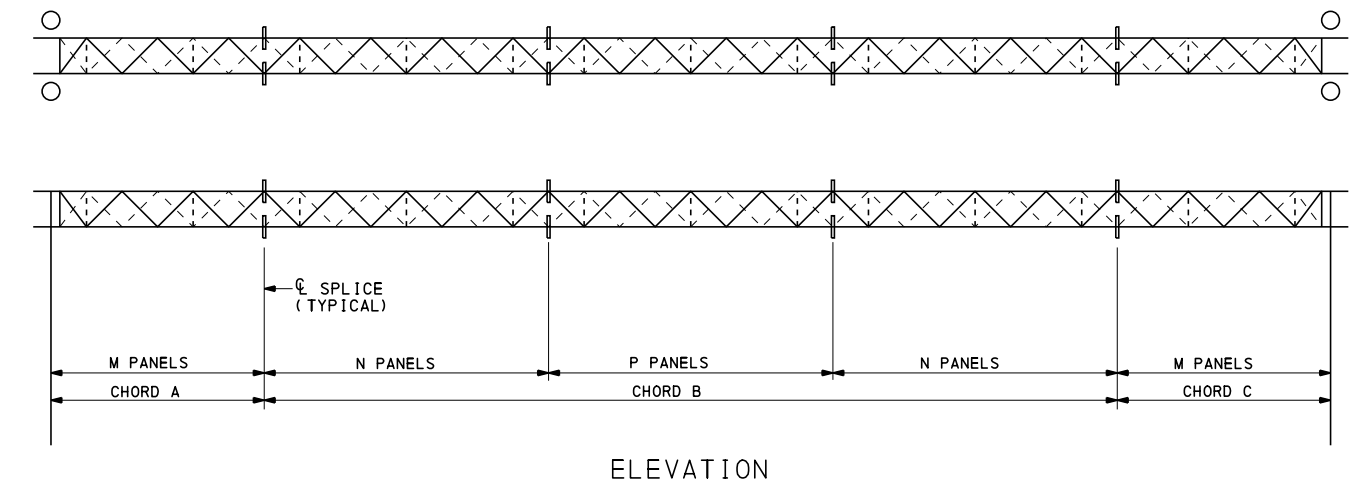
PED. TYPE - INDICATES FOUNDATION PEDESTAL TYPE.

* - MEMBER SIZE SHOWN WAS SELECTED BASED ON AVAILABILITY OF STD., XS, OR XXS PIPE. IF AVAILABLE, THE SAME NOMINAL DIAMETER PIPE WITH THE NEXT THINNER WALL THICKNESS, AS PER ASTM A53-90b, MAY BE USED, EXCEPT PROVIDE MINIMUM WALL THICKNESS OF 5/16" FOR COLUMNS AND CHORDS.

** - SEE GENERAL NOTE 11 ON SHEET 1.

▲ - COLUMN BRACING MEMBERS ARE ST SHAPES, UNLESS NOTED OTHERWISE. SECTION DESIGNATION INDICATES MEMBER DEPTH (DP) x WEIGHT PER FOOT (WT).

NOTE:
FOR DESIGN TABLE NOTES, SEE SHEET 5.



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

LOADING TYPE 2																									
DESIGN SPAN	SIGN AREA (SQ. FT.)	TRUSS MEMBERS **								TOWER MEMBERS								FOUNDATION							
		CHORDS (PIPE NOMINAL SIZE x WALL THK.)			DIAGONALS		END VERTICALS		TRUSS CROSS 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'	
		A	B	C	FRONT & REAR	TOP & BOTTOM	FRONT & REAR	TOP & BOTTOM		COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	COLUMN **	BRACING ▲	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.	PED. TYPE	FTG.
TO 100'	200	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2x3.85	12x.375*	2x4.75	16x.375*	3x6.25	24x.375*	3x6.25	FP12	717	FP12	718	FP16	819	FP24	820
	350	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	2.5x5.0	12x.375*	3x6.25	16x.375*	3x8.625	24x.375*	4x9.2	FP12	718	FP12	720	FP16	821	FP24	822
	500	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	3x6.25	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	720	FP12	822	FP16	923	FP24	924
	650	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	3x8.625	18x.375*	4x9.2	24x.375*	4x11.5	FP12	822	FP16	923	FP20	923	FP24	1026
	800	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	12x.375*	3x8.625	16x.375*	4x9.2	18x.375*	4x11.5	24x.375*	5x17.5	FP12	822	FP16	923	FP20	1025	FP24	1028
	950	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	12x.375*	3x8.625	16x.375*	4x11.5	18x.375*	5x17.5	24x.375*	5x17.5	FP12	923	FP16	1025	FP20	1027	FP24	1028
	1100	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	14x.375*	3x8.625	16x.375*	5x17.5	18x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1027	FP24	1130
	1250	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	3x8.625	16x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP20	1027	FP20	1027	FP24	1325
	1400	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375*	5x17.5	24x.500*	5x17.5	FP16	1025	FP20	1027	FP20	1324	FP24	1427
	1550	8x.322*	8x.322*	8x.322*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	24x.375*	5x17.5	24x.500*	5x17.5	FP16	1025	FP20	1222	FP24	1325	FP24	1427
OVER 100' TO 120'	300	6x.432*	6x.432*	6x.432*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	10x.365*	3x6.25	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	718	FP12	720	FP16	819	FP24	822
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x8.625	14x.375*	4x9.2	18x.375*	4x11.5	24x.375*	4x11.5	FP12	820	FP16	923	FP20	923	FP24	1026
	900	8x.322*	8x.322*	8x.322*	3x.216	3x.216	3x.216	3x.216	3x.216	14x.375*	4x9.2	16x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1027	FP24	1028
	1200	8x.500*	8x.500*	8x.500*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x9.2	18x.375*	5x17.5	20x.375	6x17.5	24x.500*	6x17.5	FP16	1025	FP20	1027	FP20	1324	FP24	1427
	1500	8x.500*	8x.500*	8x.500*	3x.300	3x.300	3x.300	3x.300	3x.300	16x.375*	4x11.5	18x.375*	6x17.5	24x.375	6x17.5	24x.500	6x17.5	FP16	1025	FP20	1027	FP24	1130	FP24	1429
	1800	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375*	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.688	6x17.5	FP20	1127	FP20	1324	FP24	1427	FP26	1429
	1865	8x.500	8x.500	8x.500	3x.300	3x.300	3x.300	3x.300	3x.300	18x.375	4x11.5	20x.375*	6x17.5	24x.375*	6x17.5	24x.688	6x17.5	FP20	1324	FP20	1324	FP24	1427	FP26	1429
OVER 120' TO 140'	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	2.5x5.0	12x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	718	FP12	720	FP16	821	FP24	924
	600	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x8.625	14x.375*	4x11.5	18x.375*	4x11.5	24x.375*	4x11.5	FP12	821	FP16	923	FP20	923	FP24	926
	900	10x.365*	10x.365*	10x.365*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	5x17.5	16x.375*	5x17.5	20x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	1025	FP20	1027	FP24	1130
	1200	12x.375*	12x.375*	12x.375*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375*	6x17.5	18x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	FP16	1025	FP20	1027	FP24	1130	FP24	1429
	1500	12x.375*	12x.375*	12x.375*	4x.237	4x.237	4x.237	4x.237	4x.237	18x.375*	6x17.5	20x.375*	6x17.5	24x.375*	6x17.5	26x.500	6x17.5	FP20	1323	FP20	1129	FP24	1427	FP26	1530
	1800	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	24x.688	6x20.4	FP20	1324	FP24	1325	FP24	1429	FP24	1531
	2100	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x17.5	24x.688	6x20.4	FP20	1324	FP24	1427	FP24	1429	FP24	1531
	2175	12x.500*	12x.500*	12x.500*	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375*	6x17.5	24x.375*	6x17.5	24x.500	6x20.4	24x.688	6x20.4	FP20	1324	FP24	1427	FP26	1429	FP24	1531
	300	8x.322*	8x.322*	8x.322*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	12x.375*	3x6.25	14x.375*	3x8.625	16x.375*	4x9.2	24x.375*	4x9.2	FP12	819	FP16	819	FP16	821	FP24	924
OVER 140' TO 160'	600	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	3x8.625	16x.375*	4x11.5	18x.375*	4x11.5	24x.375*	5x17.5	FP16	821	FP16	923	FP20	1025	FP24	1028
	900	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	5x17.5	18x.375*	5x17.5	20x.375*	6x17.5	24x.375*	6x17.5	FP16	1024	FP20	1027	FP20	1027	FP24	1130
	1200	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	18x.375*	6x17.5	20x.375*	6x17.5	24x.375	6x17.5	24x.500	6x17.5	FP20	1025	FP20	1027	FP24	1130	FP24	1429
	1500	12x.500*	12x.500*	12x.500*	4x.237	4x.237	4x.237	4x.237	4x.237	20x.375*	6x17.5	24x.375*	6x17.5	24x.375*	6x17.5	24x.688	6x17.5	FP20	1324	FP24	1130	FP24	1429	FP26	1530
	1800	12x.562	12x.562	12x.562	5x.258	5x.258	5x.258	5x.258	5x.258	20x.375	6x17.5	24x.375*	6x17.5	24x.500	6x20.4	24x.688	6x20.4	FP20	1324	FP24	1427	FP24	1429	FP24	1531
	2100	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	24x.375	6x17.5	26x.375*	6x20.4	24x.688	6x20.4	FP24	1325	FP24	1427	FP26	1429	FP26	1533
	2400	12x.688	12x.688	12x.688	5x.258	5x.258	5x.258	5x.258	5x.258	24x.375*	6x17.5	26x.375	6x17.5	26x.500	6x20.4	24x.969	6x20.4	FP24	1427	FP26	1528	FP26	1530	FP26	1630
	300	10x.365*	10x.365*	10x.365*	2.5x.203	2.5x.203	2.5x.203	2.5x.203	2.5x.203	14x.375*	4x9.2	14x.375*	4x9.2	16x.375*	4x9.2	24x.375*	4x9.2	FP16	819	FP16	819	FP16	923	FP24	924
OVER 160' TO 180'	600	12x.375*	12x.375*	12x.375*	3x.216	3x.216	3x.216	3x.216	3x.216	16x.375*	4x11.5	16x.375*	4x11.5	18x.375*	5x17.5	24x.375*	5x17.5	FP16	923	FP16	923	FP20	925	FP24	1028
	900	12x.500*	12x.500*	12x.500*	3.5x.226	3.5x.226	3.5x.226	3.5x.226	3.5x.226	16x.375	5x17.5	18x.375	5x17.5	24x.375*	6x17.5	24x.500	6x17.5	FP16	1025	FP20	1027	FP24	1028	FP24	1427
	12><																								

- CHANGE 1
- CHANGE 2
- CHANGE 3

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. PIPE DIAMETERS SHOWN IN THE DESIGN TABLES ARE OUTSIDE DIAMETERS.
10. PROVIDE BOLT HOLES 1/16" LARGER THAN BOLT DIAMETER.
11. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
12. PROVIDE DOUBLE NUTS AND WASHER FOR EACH ANCHOR BOLT.
13. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN) PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.

DESIGN

1. SPECIFICATIONS: "AASHTO 4TH EDITION STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS" (2001 WITH INTERIMS THROUGH 2003) AND "AASHTO 17TH EDITION STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" (2004).
2. WIND LOADS ARE BASED ON 100 MPH (3 SECOND GUST) BASIC WIND SPEED.
3. CAISSON FOUNDATIONS ARE BASED ON A MAXIMUM 1/2" LATERAL DEFLECTION AT TOP OF CAISSON AND ON THE FOLLOWING SOIL PARAMETERS:

A) LOOSE GRANULAR SOIL WITH 100 PCF UNIT WEIGHT, 28 DEGREE INTERNAL FRICTION ANGLE, 0 PSF COHESION, AND 25 PCI MODULUS OF SUBGRADE REACTION.

B) SOFT COHESIVE SOIL WITH 100 PCF UNIT WEIGHT, 0 DEGREE INTERNAL FRICTION ANGLE, 800 PSF COHESION, 200 PCI MODULUS OF SUBGRADE REACTION, AND 0.02 E50 STRAIN.
4. THE MEMBER SIZES INDICATED IN THE DESIGN TABLES MEET THE FATIGUE REQUIREMENTS FOR FATIGUE CATEGORY J.
5. THE TRAFFIC ENGINEER SETS THE DESIGN SIGN AREA USING ONE OF THE FOLLOWING OPTIONS:

- A. THE ACTUAL SIGN AREA TO BE PLACED ON THE STRUCTURE AT THE TIME OF CONSTRUCTION.
- B. 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").
- C. 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").
6. 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.

MATERIAL

1. PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, ANSI/AWS WELDING CODE D1.5, CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE ANSI/AWS D1.1 FOR WELDING NOT COVERED IN ANSI/AASHTO/AWS D1.5.
2. PROVIDE STRUCTURAL STEEL CONFORMING TO AASHTO M270, GRADE 36 (ASTM A709, GRADE 36) DESIGNATION EXCEPT WHEN NOTED OTHERWISE.
3. PROVIDE WELDED OR SEAMLESS STEEL PIPE CONFORMING TO PUBLICATION 408, SECTION 948.2(a)1.
4. PROVIDE HIGH-STRENGTH STEEL BOLTS CONFORMING TO AASHTO M164 (ASTM A325). MECHANICALLY GALVANIZE ALL BOLTS (EXCEPT ANCHOR BOLTS), NUTS AND WASHERS. EITHER MECHANICALLY GALVANIZE ALL ANCHOR BOLTS OR HOT-DIP GALVANIZE ALL ANCHOR BOLTS IN ACCORDANCE WITH FABRICATION NOTE 6 ON THIS SHEET. PROVIDE U-BOLTS CONFORMING TO ASTM A449. PROVIDE ANCHOR BOLTS CONFORMING TO ASTM F1554, GRADE 55.

FABRICATION

1. 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.
2. 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).
3. 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.
4. 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.
5. 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 ANSI/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".
6. HOT-DIP GALVANIZE ALL COMPONENTS (EXCEPT REINFORCEMENT BARS, ALUMINUM, AND NON-FERROUS INCIDENTALS) AFTER FABRICATION PER ASTM A123 OR ASTM A153, AS APPROPRIATE.

CONSTRUCTION

1. 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.
2. ERECT SIGN STRUCTURE ONLY AFTER CAISSON CONCRETE MEETS 7 DAY STRENGTH REQUIREMENTS.
3. 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.
4. 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".
5. ADEQUATELY SUSPEND FRAME STRUCTURES TO AVOID DISTORTIONS OR CHANGES IN SPAN LENGTH IF ERECTED ONTO FOUNDATIONS AS ONE UNIT.

NOTES TO DESIGNER

- 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.
- DYNAMIC/VARIABLE MESSAGE SIGNS (DMS/VMS) ARE PROHIBITED ON MONOPIPE STRUCTURES.
- USE A MINIMUM OF 2" THICKNESS FOR ALL SPLICE PLATES TO PREVENT DISTORTION DURING WELDING.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

BUREAU OF PROJECT DELIVERY

MONOPIPE SIGN STRUCTURES
FRAME STRUCTURE SPANS UP TO 200'
AND CANTILEVER MONOPIPE STRUCTURE
STRUT LENGTHS UP TO 38'

GENERAL NOTES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

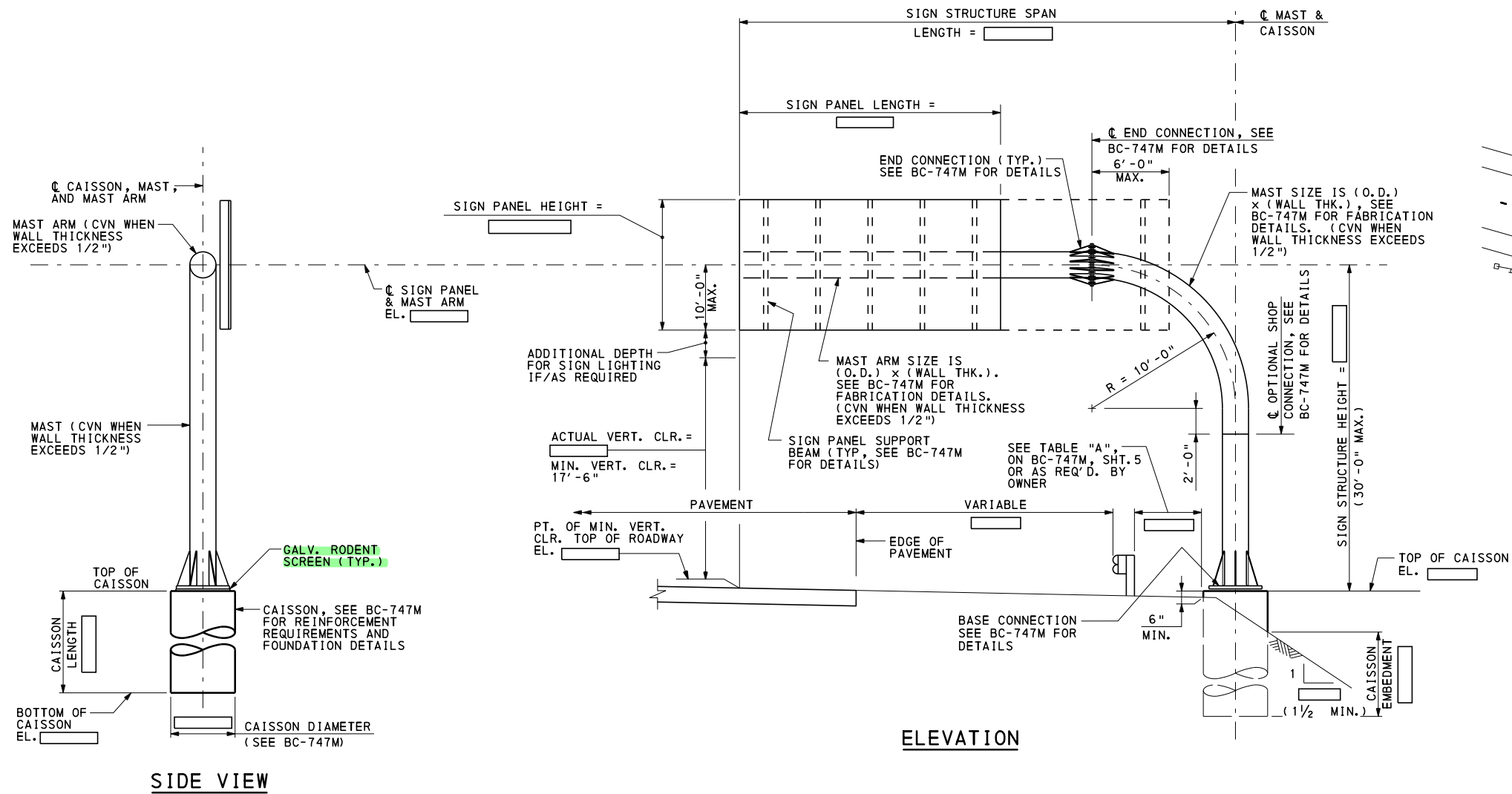
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHEET 1 OF 5

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/MERCURY VAPOR LAMPS
TC-8716	ERECTION DETAILS/EXTRUDED ALUMINUM CHANNEL SIGNS FLAT SHEET ALUMINUM WITH STIFFENERS/OVERHEAD STRUCTURES
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-747M	MONOPIPE SIGN STRUCTURES
RC-11M	CLASSIFICATION OF EARTHWORK FOR STRUCTURES
RC-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

REFERENCE DRAWINGS



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.
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS:

GENERAL NOTES:

1. FOR GENERAL NOTES, SEE BC-747M.
 2. [] DIAMETER CAISSON WITH [] - NO. 8 REINFORCING BARS. SEE BC-747M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
 3. PROVIDE A SPACE OF 2'-0" OR LESS, OR ONE-HALF THE TALLER PANEL HEIGHT OR MORE, BETWEEN ADJACENT SIGN PANELS WHEN PRESENT.
 4. TERMINATE WELDS 1/4" SHORT OF STIFFENER ENDS AND STIFFENER CHAMFER.
 5. 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.
- DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER ON DESIGN PLAN FOR EACH SPECIFIC STRUCTURE SPAN.

DESIGN CRITERIA	
DESIGN SIGN AREA (A) =	[]
DESIGN SPAN =	[]
FATIGUE CATEGORY =	[]

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 PROJECT DELIVERY

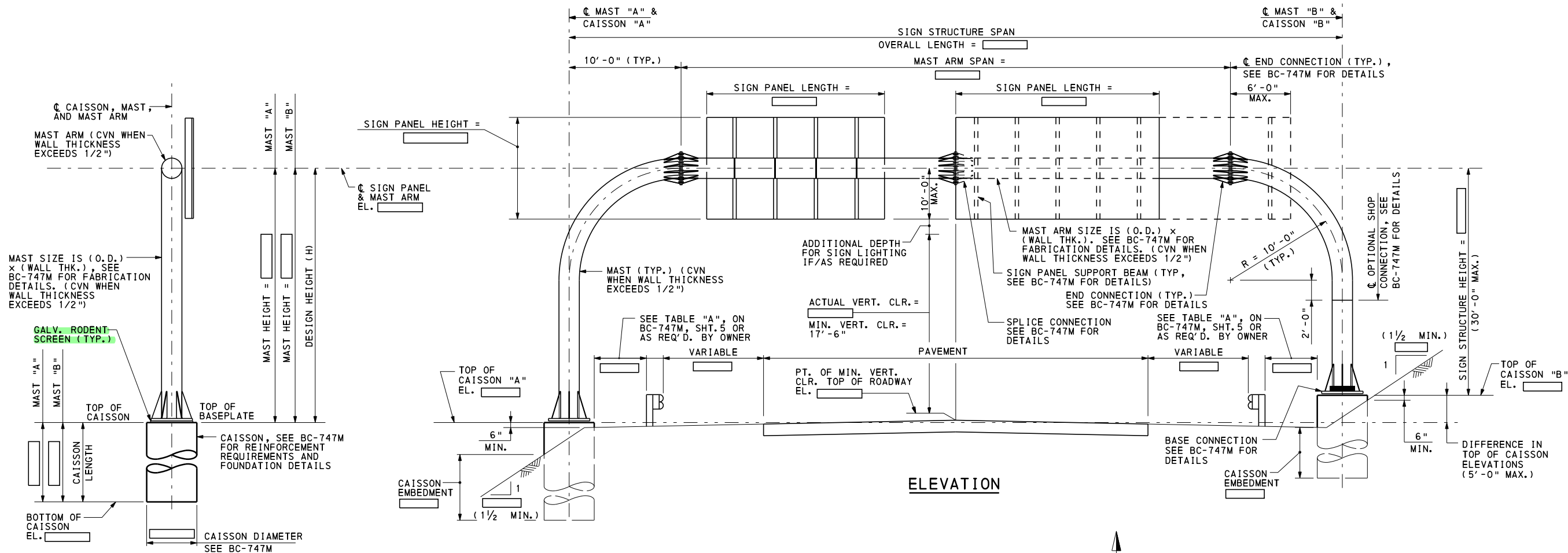
MONOPIPE SIGN STRUCTURES
CANTILEVER MONOPIPE STRUCTURE
STRUT LENGTHS UP TO 38'

CANTILEVER STRUCTURE
SAMPLE CONTRACT DRAWING

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 5
BD-647M

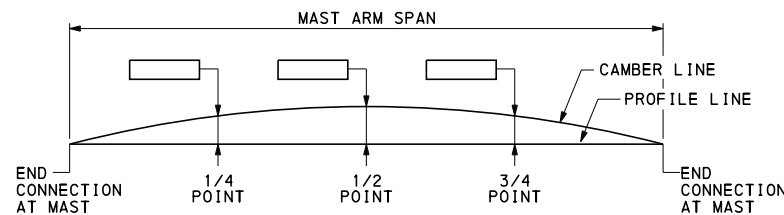


NOTES TO DESIGNER:

- 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.
- PLACE THE FOLLOWING NOTES ON CONTRACT DRAWINGS:

GENERAL NOTES:

- FOR GENERAL NOTES, SEE BC-747M.
 - [] DIAMETER CAISSON WITH [] - NO. 8 REINFORCING BARS. SEE BC-747M FOR ADDITIONAL REINFORCEMENT REQUIREMENTS AND DETAILS.
 - PROVIDE A SPACE OF 2'-0" OR LESS, OR ONE-HALF THE TALLER PANEL HEIGHT OR MORE, BETWEEN ADJACENT SIGN PANELS WHEN PRESENT.**
 - TERMINATE WELDS **1/4"** SHORT OF STIFFENER ENDS AND STIFFENER CHAMFER.
 - 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.
- DESIGNER IS REQUIRED TO PROVIDE MAST ARM CAMBER **ON DESIGN PLAN** FOR EACH SPECIFIC STRUCTURE SPAN.



CAMBER DIAGRAM

CAMBER VALUES REPRESENTS MAXIMUM DEAD LOAD DEFLECTION BETWEEN END CONNECTIONS AND SPAN LENGTH EQUALS DISTANCE BETWEEN MASTS.

DESIGN CRITERIA

DESIGN SIGN AREA (A) = []

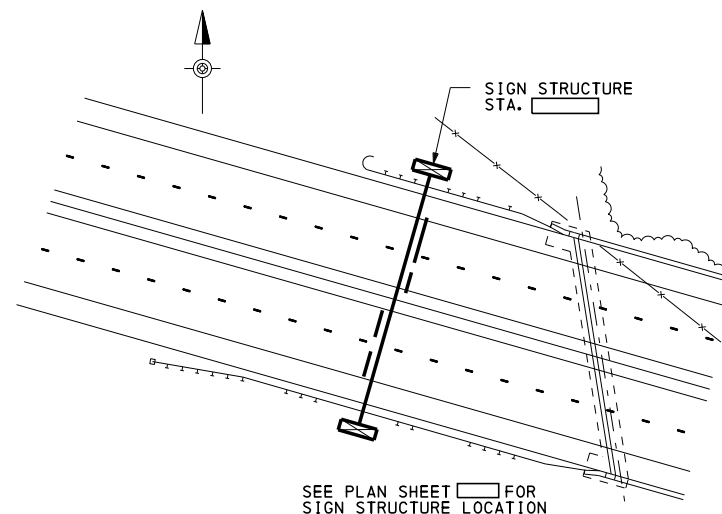
DESIGN SPAN = []

FATIGUE CATEGORY = []

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 **PROJECT DELIVERY**

MONOPIPE SIGN STRUCTURES

FRAME STRUCTURE SPANS UP TO **200'**

FRAME STRUCTURE SAMPLE CONTRACT DRAWING

RECOMMENDED NOV. 21, 2014

Thomas P. Maciara
CHIEF BRIDGE ENGINEER

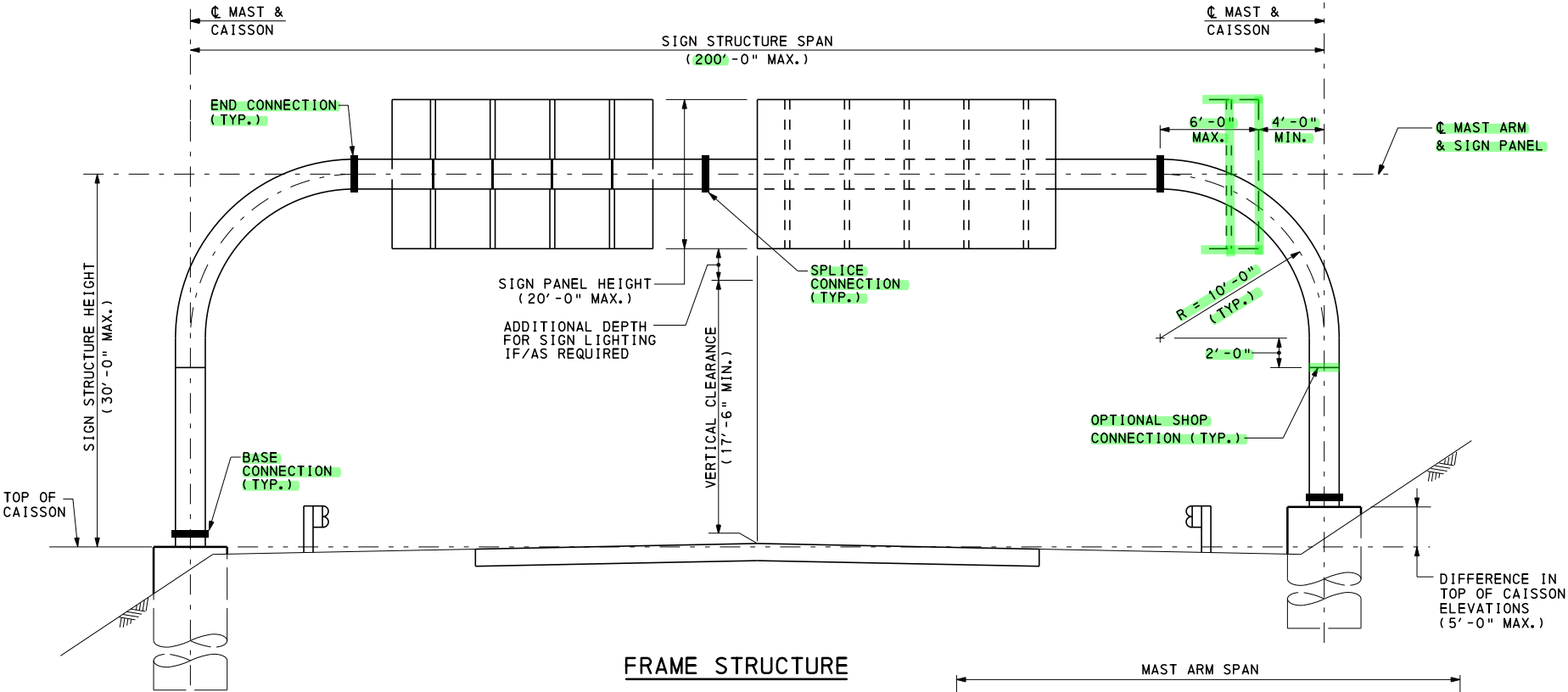
RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR. OF **PROJECT DELIVERY**

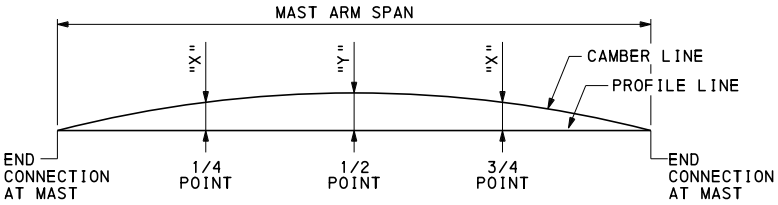
SHEET 3 OF 5

BD-647M

MAST & MAST ARM SELECTION TABLE (FRAME STRUCTURES)									
SPAN (FEET)	PANEL AREA (S.F.)	MAST		MAST ARM					
		DIAMETER (INCHES)	THICKNESS (INCHES)	USING MAXIMUM LENGTH OF MAST ARM SEGMENTS			USING MINIMUM LENGTH OF MAST ARM SEGMENTS		
				DIAMETER (INCHES)	THICKNESS (INCHES)	SEGMENT ARRANGEMENT	DIAMETER (INCHES)	THICKNESS (INCHES)	SEGMENT ARRANGEMENT
60	1,040	24	0.500 (WT. XS)	24	0.375 (SCH. 20)	A	24	0.375 (SCH. 20)	B
	760	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	A	24	0.375 (SCH. 20)	B
	440	20	0.375 (SCH. 20)	20	0.375 (SCH. 20)	A	20	0.375 (SCH. 20)	B
80	1,000	24	0.500 (WT. XS)	24	0.500 (WT. XS)	B	24	0.500 (WT. XS)	C
	880	24	0.500 (WT. XS)	24	0.500 (WT. XS)	B	24	0.500 (WT. XS)	C
	600	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	B	24	0.375 (SCH. 20)	C
	360	20	0.375 (SCH. 20)	20	0.375 (SCH. 20)	B	20	0.375 (SCH. 20)	C
100	1,000	24	0.688 (SCH. 40)	24	0.688 (SCH. 40)	B	24	0.688 (SCH. 40)	C
	740	24	0.500 (WT. XS)	24	0.688 (SCH. 40)	B	24	0.500 (WT. XS)	C
	520	24	0.500 (WT. XS)	24	0.500 (WT. XS)	B	24	0.375 (SCH. 20)	C
	280	20	0.375 (SCH. 20)	20	0.500 (SCH. 30)	B	20	0.375 (SCH. 20)	C
120	1,000	24	0.969 (SCH. 60)	24	0.969 (SCH. 60)	C	24	0.969 (SCH. 60)	D
	800	24	0.688 (SCH. 40)	24	0.688 (SCH. 40)	C	24	0.969 (SCH. 60)	D
	520	24	0.500 (WT. XS)	24	0.500 (WT. XS)	C	24	0.688 (SCH. 40)	D
	360	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	C	24	0.500 (WT. XS)	D
140	1,000	24	1.219 (SCH. 80)	24	1.219 (SCH. 80)	C	24	1.219 (SCH. 80)	D
	840	24	0.969 (SCH. 60)	24	0.969 (SCH. 60)	C	24	1.219 (SCH. 80)	D
	600	24	0.688 (SCH. 40)	24	0.688 (SCH. 40)	C	24	0.969 (SCH. 60)	D
	420	24	0.500 (WT. XS)	24	0.500 (WT. XS)	C	24	0.688 (SCH. 40)	D
	300	24	0.375 (SCH. 20)	24	0.375 (SCH. 20)	C	24	0.500 (WT. XS)	D
	160	24	0.500 (WT. XS)	24	0.500 (WT. XS)	C	24	0.500 (WT. XS)	D
160	1,000	24	1.531 (SCH. 100)	24	1.531 (SCH. 100)	D	24	1.531 (SCH. 100)	E
	720	24	0.969 (SCH. 60)	24	1.219 (SCH. 80)	D	24	1.219 (SCH. 80)	E
	420	24	0.688 (SCH. 40)	24	0.688 (SCH. 40)	D	24	0.688 (SCH. 40)	E
	300	24	0.500 (WT. XS)	24	0.500 (WT. XS)	D	24	0.500 (WT. XS)	E
180	750	24	1.219 (SCH. 80)	24	1.531 (SCH. 100)	D	24	1.531 (SCH. 100)	E
	600	24	0.969 (SCH. 60)	24	1.219 (SCH. 80)	D	24	1.219 (SCH. 80)	E
	450	24	0.688 (SCH. 40)	24	0.969 (SCH. 60)	D	24	0.688 (SCH. 60)	E
200	600	24	1.219 (SCH. 80)	24	1.219 (SCH. 80)	E	24	1.531 (SCH. 100)	F
	450	24	0.969 (SCH. 60)	24	0.969 (SCH. 60)	E	24	0.969 (SCH. 60)	F
	300	24	0.688 (SCH. 40)	24	0.688 (SCH. 40)	E	24	0.688 (SCH. 40)	F



FRAME STRUCTURE



CAMBER DIAGRAM

SPAN* (FEET)	CAMBER	
	X (INCHES)	Y (INCHES)
60	5/8	7/8
80	7/8	1 1/4
100	1 1/2	2 1/8
120	2 1/8	3
140	3 1/2	5
160	5 1/4	7 7/8
180	8	12 1/8
200	11 1/2	17 1/2

* SIGN STRUCTURE SPAN
CAMBER VALUES REPRESENTS MAXIMUM DEAD LOAD DEFLECTION BETWEEN END CONNECTIONS AND SPAN LENGTH EQUALS DISTANCE BETWEEN MASTS.

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
F	0.17 0.17 0.16 0.16 0.17 0.17

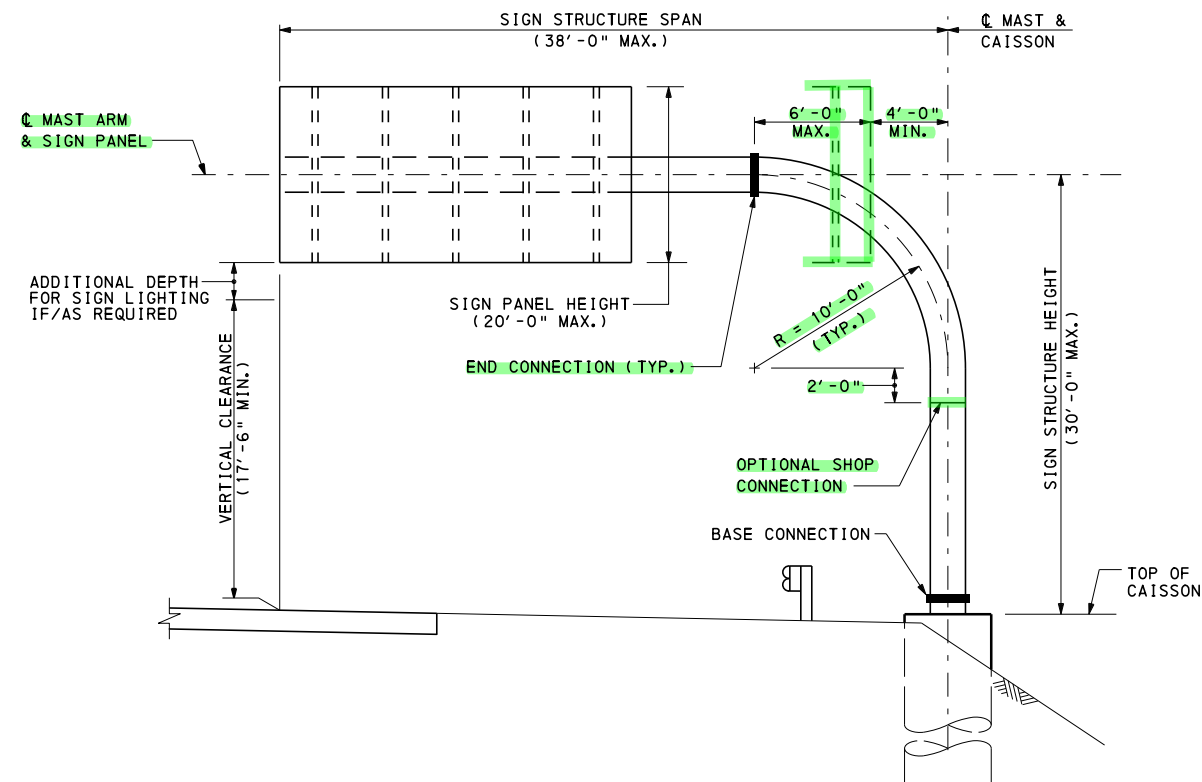
Cantilever Structure information moved to new Sheet 5 of 5 to accommodate new span lengths and sign areas

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

MONOPIPE SIGN STRUCTURES

FRAME STRUCTURE SPANS UP TO 200'

DESIGN TABLES
MAST AND MAST ARM SELECTION



NOTES:

1. FOR GENERAL NOTES, SEE SHEET 1.
2. FABRICATOR OPTION TO ADD OR ELIMINATE SPLICES.

CANTILEVER STRUCTURE

Information previously on Sheet 4 of 4 moved to new sheet to accommodate new span lengths and

MAST & MAST ARM SELECTION TABLE (CANTILEVER STRUCTURES)					
SPAN (FEET)	PANEL AREA (S.F.)	MAST		MAST ARM	
		DIAMETER (INCHES)	THICKNESS (INCHES)	DIAMETER (INCHES)	THICKNESS (INCHES)
38	680	24	1.531 (SCH. 100)	24	0.688 (SCH. 40)
	540	24	1.531 (SCH. 100)	24	0.688 (SCH. 40)
	400	24	1.219 (SCH. 80)	24	0.688 (SCH. 40)
	250	24	0.688 (SCH. 40)	24	0.500 (WT. XS)
27	460	24	0.688 (SCH. 40)	24	0.375 (SCH. 20)
	350	24	0.562 (SCH. 30)	24	0.375 (SCH. 20)
	250	24	0.500 (WT. XS)	24	0.375 (SCH. 20)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

MONOPIPE SIGN STRUCTURES
CANTILEVER MONOPIPE STRUCTURE
STRUT LENGTHS UP TO 38'

DESIGN TABLES
MAST AND MAST ARM SELECTION

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 5 OF 5 BD-647M
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CHANGE 2
CHANGE 3

INFORMATIONAL NOTES:

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS.
- ALL DMS SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-741M SHEET 2.
- PROVIDE CRASHWORTHY BARRIER IN ACCORDANCE WITH PENNDOT PUB 13M (DM-2). CHAPTER 12 GUIDE RAIL, MEDIAN BARRIER AND ROADSIDE SAFETY DEVICES. USE OF GUIDE RAIL AND/OR CONCRETE BARRIER SHALL MEET APPLICABLE PENNDOT WARRANTS FOR INSTALLATION.
- FOR DETAILS NOT SHOWN SEE BC-741M.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS.
2. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
3. USE CLASS A CEMENT CONCRETE $f'c = 3000$ PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
4. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
5. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
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 PENNDOT PUB 408 UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. ALL BOLT HOLES SHALL BE DRILLED.
12. PROVIDE BOLT HOLES $\frac{1}{16}$ " LARGER THAN BOLT DIAMETER.
13. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
14. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
15. PROVIDE A CERTIFICATION LETTER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA, CERTIFYING THAT THE INTERNAL STRUCTURE OF THE DMS AND THE CONNECTION TO THE SIGN STRUCTURE MEET THE REQUIREMENT OF THE AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS AS AMENDED BY PENNDOT." THE CERTIFICATION LETTER SHALL BE PREPARED BY THE DMS MANUFACTURER'S PROFESSIONAL ENGINEER AND SUBMITTED BY THE CONTRACTOR.
16. ONE TEST BORING SHALL BE PROVIDED AT EACH DMS FOUNDATION LOCATION.

CONSTRUCTION GENERAL NOTES:

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNDOT PUB 408, (LET DATE EDITION), AASHTO/AWS D1.5M/D1.5:2002-BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1/D1.1M:2008 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5M/D1.5:2002
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

PIPE COLUMNS & PIPE CHORDS,
PIPE BRACING, ANGLES, SHAPES,
AND PLATES, ANCHOR BOLTS, BOLTS: PER PENNDOT PUB 408 SECTION 1230.2(K).

U-BOLT INSTALLATION: PER FHWA PUB GUIDELINES FOR THE INSTALLATION, INSPECTION, MAINTAINENACE, AND REPAIR OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS (2005).
- DESIGN SPECIFICATIONS:

AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006 (UNLESS NOTED OTHERWISE); AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION; PENNDOT DESIGN MANUAL - PART 4, MAY 2012 EDITION.
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

DESIGN CRITERIA FOR PENNDOT DMS STRUCTURES

LOADING	AASHTO 2001 SIGN SPECS. (U.N.O.)	
DEAD LOAD	3.5	
LIVE LOAD (CATWALKS)	3.6	
ICE LOAD	3.7	
WIND LOAD	APPENDIX C, SECTION C.3, EQ. C-1, WITH 80 MPH WIND AND 30% GUST FACTOR	
DMS SIZE AND DEAD LOAD PER SUPPLIER		
WIND DRAG COEFFICIENT $C_d = 1.7$ FOR DMS (STRENGTH DESIGN AND FATIGUE DESIGN)		
GROUP LOADS	AASHTO 2001 SIGN SPECS. 3.4	
STEEL CRITERIA	AASHTO 2001 SIGN SPECS. (U.N.O.)	
STRENGTH CRITERIA		
SECTION PROPERTIES FOR TUBULAR SHAPES	APPENDIX B, TABLE B-1	
MAXIMUM STRESSES IN TUBULAR SHAPES	APPENDIX B, TABLE B-2	
ALLOWABLE STRESSES FOR TUBULAR SHAPES	5.6 (TABLE 5-3) & 5.11	
ALLOWABLE STRESSES FOR DMS SUPPORTS	5.12	
ALLOWABLE STRESSES FOR BASE PLATES	5.8	
ALLOWABLE STRESSES FOR COMBINED STEEL STRESS	5.12	
ALLOWABLE STRESSES FOR STRUCTURAL STEEL	SECTION 5	
FATIGUE CRITERIA		
FATIGUE REQUIREMENTS (FATIGUE CATEGORY I)	SECTION 11	
FATIGUE IMPORTANCE FACTOR ($I_F = 1$)	11.6	
GALLOPING	11.7.1	
NATURAL WIND GUST	11.7.3	
TRUCK-INDUCED GUST	11.7.4	
SERVICEABILITY CRITERIA		
ALLOWABLE DEFLECTION	10.4	
BOLT CRITERIA	AASHTO HIGHWAY BRIDGES (U.N.O.)	
ALLOWABLE BOLT STRESSES	TABLE 10.32.3B	
SLIP-CRITICAL BOLT ALLOWABLE	10.32.3.2.1	
BOLT PRYING ACTION	10.32.3.3.2	
COMBINED BOLT SHEAR AND TENSION	10.32.3.3.3	
BOLT DESIGN CRITERIA	AASHTO 2001 SIGN SPECS. 5.16	
ALLOWABLE ANCHOR BOLT STRESSES	AASHTO 2001 SIGN SPECS. 5.17	
CONCRETE CRITERIA	AASHTO HIGHWAY BRIDGES (U.N.O.)	
ALLOWABLE BEARING STRESS	8.15.2.1.3	
REINFORCEMENT TENSILE STRESS	8.15.2.2	
SHEAR CAPACITY OF FOOTINGS	8.15.5.6.1	
SHEAR STRESS IN FOOTINGS	8.15.5.6.2	
ALLOWABLE SHEAR STRESS	8.15.5.6.4	
SLENDERNESS OF COLUMNS	8.16.5.2	
MINIMUM REINF. OF FLEXURAL MEMBERS	8.17.1	
SPACING LIMITS FOR REINFORCEMENT	8.21	
MINIMUM CONCRETE COVER	DM4 D8.22.1*	
PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS	FIG. 4.4.7.1.1.1C	
DISTRIBUTION OF REINFORCEMENT	4.4.11.2.2	
FOOTING STABILITY REQUIREMENTS	DM4 D5.5.5	
TORSION	ACI SECTION A.7.3*	
COLUMN DESIGN (PEDESTALS)	8.15.4	
SPREAD FOOTINGS:	DM4 SEC.10.6	
MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT (FOR FOOTINGS FOLLOWING THE DESIGN TABLES IN THIS STANDARD)	
MINIMUM AREA IN BEARING	95%	
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT	
DRILLED SHAFTS (CAISSONS):	DM4 SEC.D10.8.3.8, PENNDOT COM	
MAXIMUM DESIGN PRESSURE	1.5 TONS PER SQUARE FOOT	
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"	
MODULUS OF SUBGRADE REACTION	10.0 POUNDS PER CUBIC INCH	
UNIT WEIGHT OF SOIL	100 POUNDS PER CUBIC FOOT	
ANGLE OF INTERNAL FRICTION	25°	
COHESION	0 KIPS PER SQUARE FOOT	

*LEGEND

- AASHTO 2001 SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, INCLUDING INTERIMS THRU 2006
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION
- DM4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES, MAY 2012 EDITION
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - METRIC BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318M-99).
- CVN: CHARPY V-NOTCH.
- DMS: DYNAMIC MESSAGE SIGN

ITS-1201	ITS DEVICES - GENERAL
ITS-1230	GENERAL NOTES FOR CANTILEVER STRUCTURES
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-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-55M	TYPE 2 WEAK POST MEDIAN BARRIER
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
DESIGN CRITERIA AND
GENERAL NOTES

RECOMMENDED NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

SHEET 1 OF 6

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
 - DMS HEIGHT AND LENGTH
 - DMS AREA
 - DESIGN HEIGHT
 - DESIGN ECCENTRICITY
 - DESIGN WEIGHT OF DMS
 - 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 DMS 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 DMS CENTER-MOUNT STRUCTURE STANDARDS, BD-641M OR ITS STANDARDS.
8. IDENTIFY THE PRESENCE OF GUIDERAIL, BARRIER OR PLACEMENT OUTSIDE THE CLEAR ZONE.
9. THE DESIGNER MUST DETAIL THE LEAST DISTANCE FROM EDGE OF PEDESTAL TO REAR OF GUIDERAIL 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 DMS CENTER-MOUNT STRUCTURE STANDARDS OR BC-741M A SPECIAL SUBMISSION REQUESTING APPROVAL MUST BE MADE TO THE CHIEF BRIDGE ENGINEER.
11. SUPPORT SIGN STRUCTURES INTENDED TO CARRY DMS NOT COVERED IN THESE STANDARDS 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, THE BD-641M AND BD-645M STANDARDS MAY BE USED FOR PRELIMINARY MEMBER SIZES ONLY; DESIGN COMPUTATION MUST BE SUBMITTED FOR ALL COMPONENTS OF SUPPORT STRUCTURES CARRYING NON-STANDARD DMS.
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 DMS. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH DMS. 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.

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
 - DMS 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
- DMS HEIGHT AND LENGTH
- DMS AREA
- DESIGN HEIGHT
- DESIGN ECCENTRICITY
- DESIGN WEIGHT OF DMS
- 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 DMS SUPPORT STRUCTURES ARE PROHIBITED.
5. TELESOPING (SLIP-FIT) FIELD SPLICES FOR DMS SUPPORT STRUCTURES ARE PROHIBITED.
6. INDICATE THE SUPPLIER FOR CATWALK GRATING ON THE SHOP DRAWINGS.
7. PROVIDE HAND HOLE, WEATHERPROOF 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.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
NOTES TO DESIGNER
AND FABRICATOR

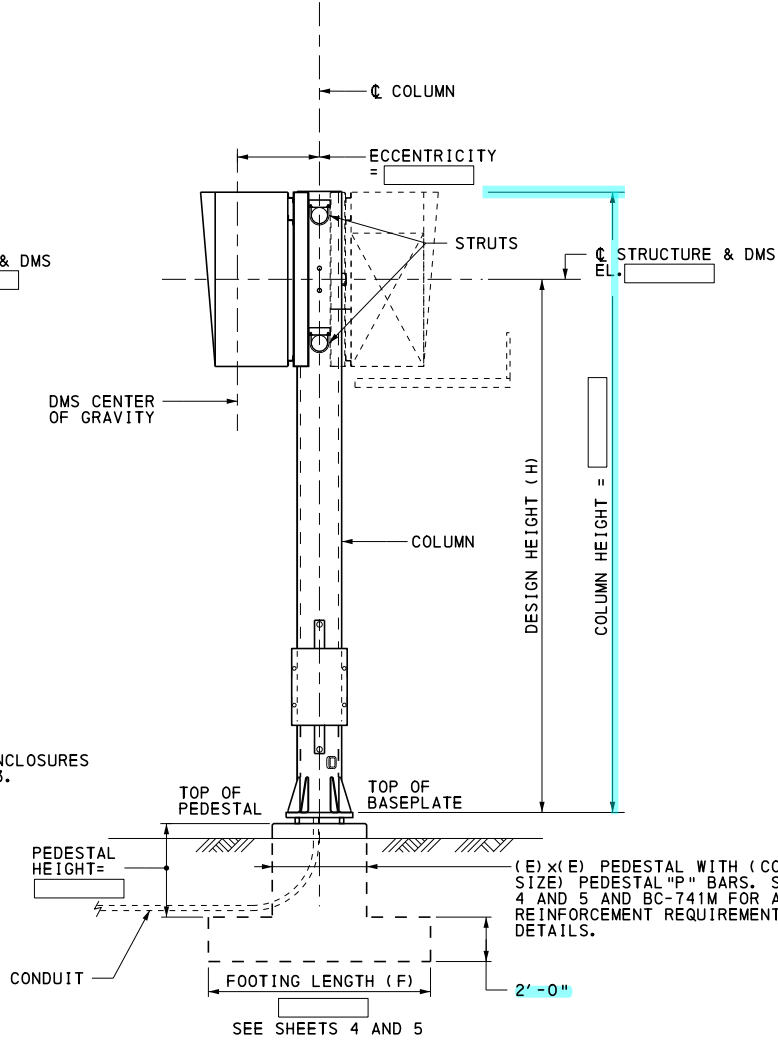
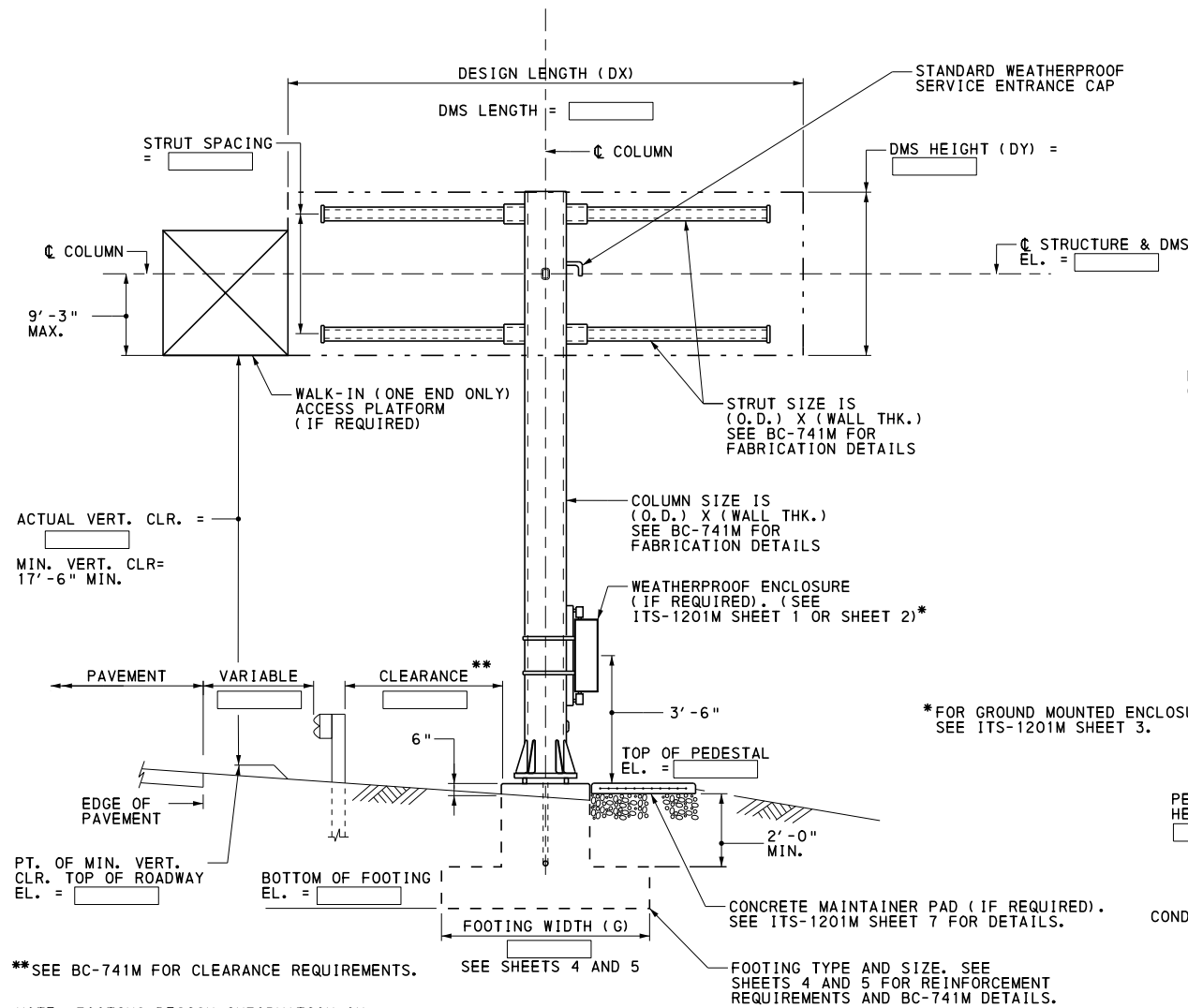
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CHIEF BRIDGE ENGINEER

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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.
 - (E)x(E) PEDESTAL WITH (COUNT) - (BAR SIZE) PEDESTAL "P" BARS. 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, WEATHERPROOF 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, WEATHERPROOF 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 DMS. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH DMS. 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 BAR NUMBER AND SIZE, AND ROCK SOCKET REQUIREMENTS AS REQUIRED.
- PROVIDE GENERAL NOTES FROM SHEET 1 ON THE CONTRACT DRAWINGS.
- PROVIDE DMS CONNECTION DETAILS ON THE CONTRACT DRAWINGS IN ACCORDANCE WITH SHEET 6.



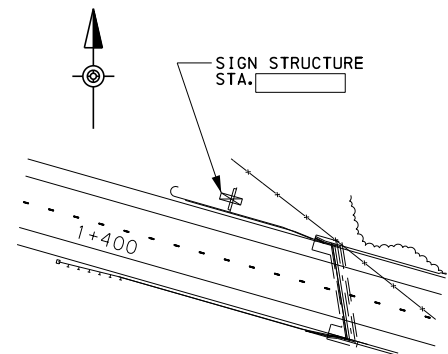
CENTER-MOUNT DMS SUPPORT STRUCTURE

WITH WALK-IN ACCESS PLATFORM OR CATWALK

DESIGN CRITERIA	
DESIGN DMS AREA (A) =	
DESIGN DMS LENGTH (DX) =	
DESIGN DMS HEIGHT (DY) =	
DESIGN HEIGHT (H) =	
DMS ECCENTRICITY =	
DESIGN WEIGHT OF DMS (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]



SEE PLAN SHEET [] FOR SIGN STRUCTURE LOCATION

LOCATION PLAN

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
SAMPLE CONTRACT PLAN FOR
CENTER MOUNT STRUCTURES

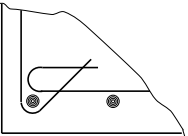
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

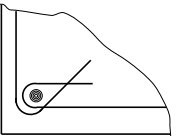
SHEET 3 OF 6
BD-649M

TABLE 1: SINGLE SIGN FRONT DMS PANEL WITH FRONT ACCESS CATWALK

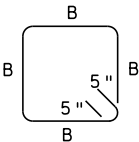
TABLE 1: SINGLE SIGN FRONT DMS PANEL WITH FRONT ACCESS CATWALK										PEDESTAL REINFORCEMENT				FOOTING REINFORCEMENT													
DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	*4 BARS TYPE 'M'	*4 BARS TYPE 'N'	G WIDTH	F LENGTH	*L" BARS					*T" BARS								
										LENGTH				B		L ₁ BARS		L ₂ BARS		LENGTH	T ₁ BARS		T ₂ BARS		LENGTH		
										No.	SIZE			No.	SIZE	No.	SIZE	No.	SIZE		No.	SIZE	No.	SIZE			
16	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	9	6	9	5	11'-6"	9	4	9	5	7'-6"		
	200	25	8	2	2300	2.46	10" x 0.365"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"		
	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	14	6	14	5	14'-6"	11	4	11	5	8'-6"		
20	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"		
	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	7	6	7	5	11'-6"	9	4	9	5	7'-6"		
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	11	6	11	5	13'-6"	10	4	10	5	7'-6"		
	200	25	8	2	2300	2.38	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	14	6	12	5	14'-6"	11	4	11	5	8'-6"		
24	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	15	6	15	5	14'-6"	12	4	12	5	8'-6"		
	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	16	7	16	6	16'-6"	12	5	12	5	9'-6"		
	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"		
	150	20	7.5	1.17	1800	1.88	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"		
28	200	25	8	2	2300	2.38	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"		
	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	17	6	17	5	14'-6"	13	4	13	5	8'-6"		
	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	17	7	15	6	16'-6"	12	5	12	5	9'-6"		
	50	10	5	2	550	2.21	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100	17.5	5.71	2	1030	2.29	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"		
32	150	20	7.5	1.17	1800	1.88	6" x 0.280"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	13'-0"	10	6	10	5	12'-6"	10	4	10	5	8'-6"		
	200	25	8	2	2300	2.38	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	12	7	12	6	14'-6"	12	4	12	5	8'-6"		
	250	31.25	8	2	2105	2.46	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	17	7	17	6	16'-6"	12	5	12	5	9'-6"		
	300	40	7.5	1.17	2660	2.05	10" x 0.365"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	10'-0"	17'-0"	18	7	18	6	16'-6"	13	5	13	5	9'-6"		



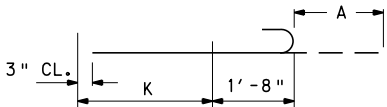
DETAIL A



DETAIL B

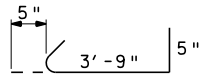


BAR TYPES
"M" & "N"



A= 1'-7"
LENGTH = K + 3'-0"
16 REQUIRED PER PEDESTAL

BAR TYPE "P"



LENGTH = 4'-7"

BAR TYPE "X"

TABLE 2: DOUBLE SIGN FRONT AND BACK DMS PANELS WITH FRONT ACCESS CATWALK

										PEDESTAL REINFORCEMENT				FOOTING REINFORCEMENT													
DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	*4 BARS	TYPE 'M'	*4 BARS	TYPE 'N'	G WIDTH	F LENGTH	*L" BARS					*T" BARS						
										LENGTH	B	LENGTH	B			L ₁ BARS		L ₂ BARS		LENGTH	T ₁ BARS		T ₂ BARS		LENGTH		
																No.	SIZE	No.	SIZE		No.	SIZE	No.	SIZE			
16	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	8'-0"	6	5	6	5	7'-6"	6	4	6	5	6'-6"		
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"		
	200 •	25	8	2	4600	0	10" x 0.365"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	11	6	11	5	13'-6"	10	4	10	5	7'-6"		
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	14	6	14	5	14'-6"	11	4	11	5	8'-6"		
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"		
20	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	11	6	11	5	13'-6"	10	4	10	5	7'-6"		
	200 •	25	8	2	4600	0	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	13'-0"	10	6	10	5	12'-6"	10	4	10	5	8'-6"		
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"		
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	16	6	16	5	14'-6"	13	4	13	5	8'-6"		
24	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	7	6	7	5	11'-6"	9	4	9	5	7'-6"		
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"		
	200 •	25	8	2	4600	0	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	14	6	14	5	14'-6"	11	4	11	5	8'-6"		
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"		
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	17	7	17	6	16'-6"	12	5	12	5	9'-6"		
28	50 •	10	5	2	1100	0	4"x 0.237"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	7'-0"	10'-0"	6	5	6	5	9'-6"	8	4	8	5	6'-6"		
	100 •	17.5	5.71	2	2060	0	6" x 0.280"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	12'-0"	8	6	8	5	11'-6"	9	4	9	5	7'-6"		
	150 •	20	7.5	1.17	3600	0	6" x 0.280"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	13'-0"	10	6	10	5	12'-6"	10	4	10	5	8'-6"		
	200 •	25	8	2	4600	0	8" x 0.322"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"		
	250	31.25	8	2	4210	0	10" x 0.365"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	16	7	16	6	16'-6"	12	5	12	5	9'-6"		
	300	40	7.5	1.17	5320	0	10" x 0.365"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	10'-0"	17'-0"	18	7	18	6	16'-6"	13	5	13	5	9'-6"		

TABLE 3: SINGLE SIGN DMS PANEL WITH WALK-IN ACCESS PLATFORM

TABLE 3. SINGLE SIGN DIMS PANEL WITH WALK-IN ACCESS PLATFORM										PEDESTAL REINFORCEMENT				FOOTING REINFORCEMENT													
DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	*4 BARS TYPE 'M'		*4 BARS TYPE 'N'		G WIDTH	F LENGTH	*L' BARS						*T' BARS					
										LENGTH	B	LENGTH	B			L ₁ BARS		L ₂ BARS		LENGTH	T ₁ BARS		T ₂ BARS		LENGTH		
																No.	SIZE	No.	SIZE		No.	SIZE	No.	SIZE		No.	SIZE
16	200	25	8	4	3530	3.54	12" x 0.375"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	13	6	13	5	13'-6"	10	4	10	5	7'-6"		
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	15	6	15	5	14'-6"	12	4	12	5	8'-6"		
	300	37.5	8	4	4750	3.79	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	16	7	16	6	16'-6"	12	5	12	5	9'-6"		
20	200	25	8	4	3530	3.54	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	15	6	15	5	14'-6"	11	4	11	5	8'-6"		
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	17	6	17	5	14'-6"	11	5	11	5	8'-6"		
	300	37.5	8	4	4750	3.79	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	18	7	18	6	16'-6"	13	5	13	5	9'-6"		
24	200	25	8	4	3530	3.54	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	16	6	16	5	14'-6"	12	4	12	5	8'-6"		
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	17	7	17	6	16'-6"	12	5	12	5	9'-6"		
	300	37.5	8	4	4750	3.79	18" x 0.375"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	13'-0"	16'-0"	14	8	14	6	15'-6"	16	6	16	5	12'-6"		
28	200	25	8	4	3530	3.54	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	12	8	12	7	16'-6"	12	5	12	5	9'-6"		
	250	31.25	8	4	4080	3.63	14" x 0.375"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	10'-0"	17'-0"	14	8	14	7	16'-6"	13	5	13	5	9'-6"		
	300	37.5	8	4	4750	3.79	18" x 0.375"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	10'-0"	18'-0"	17	8	17	7	17'-6"	15	5	15	5	9'-6"		

TABLE 4: DOUBLE SIGN DMS PANELS WITH WALK-IN ACCESS PLATFORMS

TABLE 4: DOUBLE SIGN DMS PANELS WITH WALK-IN ACCESS PLATFORMS										PEDESTAL REINFORCEMENT				FOOTING REINFORCEMENT													
DESIGN HEIGHT ft	SIGN AREA sf	MAX DMS LENGTH (DX) ft	MAX DMS HEIGHT (DY) ft	MAX DMS THICKNESS ft	MAXIMUM DMS WEIGHT (W) lbs	MAXIMUM ECCENTRICITY ft	STRUT SIZE	COLUMN SIZE	PEDESTAL SIZE E	*4 BARS	TYPE 'M'	*4 BARS	TYPE 'N'	G WIDTH	F LENGTH	*L' BARS						*T' BARS					
										LENGTH	B	LENGTH	B			L ₁ BARS		L ₂ BARS		LENGTH	T ₁ BARS		T ₂ BARS		LENGTH		
																No.	SIZE	No.	SIZE		No.	SIZE	No.	SIZE			
16	200	25	8	4	7060	0	12" x 0.375"	20" x 0.375"	3'-9"	13'-10"	3'-3"	10'-4"	2'-4 1/2"	8'-0"	14'-0"	12	6	12	5	13'-6"	10	4	10	5	7'-6"		
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	11	7	11	6	14'-6"	12	4	12	5	8'-6"		
	300	37.5	8	4	9500	0	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	12	7	12	6	14'-6"	11	5	11	5	8'-6"		
20	200	25	8	4	7060	0	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	11	7	11	6	14'-6"	11	4	11	5	8'-6"		
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	12	7	12	6	14'-6"	11	5	11	5	8'-6"		
	300	37.5	8	4	9500	0	18" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	13	8	13	7	16'-6"	13	5	13	5	9'-6"		
24	200	25	8	4	7060	0	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	11	7	11	6	14'-6"	12	4	12	5	8'-6"		
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	10'-0"	17'-0"	13	8	13	7	16'-6"	12	5	12	5	9'-6"		
	300	37.5	8	4	9500	0	18" x 0.375"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	10'-0"	17'-0"	14	8	14	7	16'-6"	13	5	13	5	9'-6"		
28	200	25	8	4	7060	0	12" x 0.375"	24" x 0.500"	4'-3"	15'-10"	3'-9"	11'-9"	2'-8 3/4"	9'-0"	15'-0"	12	7	12	6	14'-6"	11	5	11	5	8'-6"		
	250	31.25	8	4	8160	0	14" x 0.375"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	10'-0"	17'-0"	13	8	13	7	16'-6"	13	5	13	5	9'-6"		
	300	37.5	8	4	9500	0	18" x 0.375"	24" x 0.938"	4'-3"	15'-10"	3'-9"	-	-	13'-0"	16'-0"	15	8	15	7	15'-6"	17	6	17	5	12'-6"		

NOTES:

- FOR GENERAL NOTES SEE SHEET 1.
- THE SIGN AREA REPRESENTS THE AREA FOR ONE DMS.
- 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.
- ALL DESIGN WAS PERFORMED UTILIZING PENNDOT'S SIGN PROGRAM VERSION 1.4. THE FOLLOWING ASSUMPTIONS WERE MADE TO COMPLETE THE DESIGN:
 - SEE NOTES ON SHEET 4.

A. GENERAL

- 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).
- AN ADDITIONAL 75 LBS/FT WAS ADDED TO ALL DESIGNS USED TO ACCOUNT FOR CATWALK/WALK-IN ACCESS PLATFORM AND RAILING LOADS.
- DOUBLE SIGN PANELS ASSUMED SAME SIZE DMS ON FRONT AND BACK WITH ZERO ECCENTRICITY.
- THE DEAD LOAD DUE TO THE DMS AND CATWALK/WALK-IN ACCESS PLATFORM WAS DOUBLED TO ACCOUNT FOR FRONT AND BACK DMS.

B. CATWALKS

- CATWALKS ASSUMED TO BE THE LENGTH OF THE DMS MINUS 1'-0" FROM EACH END OF THE SIGN.

C. WALK-IN ACCESS PLATFORMS

- WALK-IN ACCESS PLATFORMS ARE ASSUMED TO BE 4' WIDE (IN ELEVATION VIEW, AND A MAXIMUM PLATFORM LENGTH EQUAL TO THE TOTAL DEPTH OF THE SIGN (4' SINGLE, 8' DOUBLE).
- THE STRUT LENGTHS WERE MODELED ASYMMETRICALLY TO ACCOUNT FOR THE PLATFORM BEING PLACED ON ONE SIDE OF THE SIGN ENCLOSURE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
DESIGN TABLES
WALK-IN ACCESS

RECOMMENDED NOV. 21, 2014

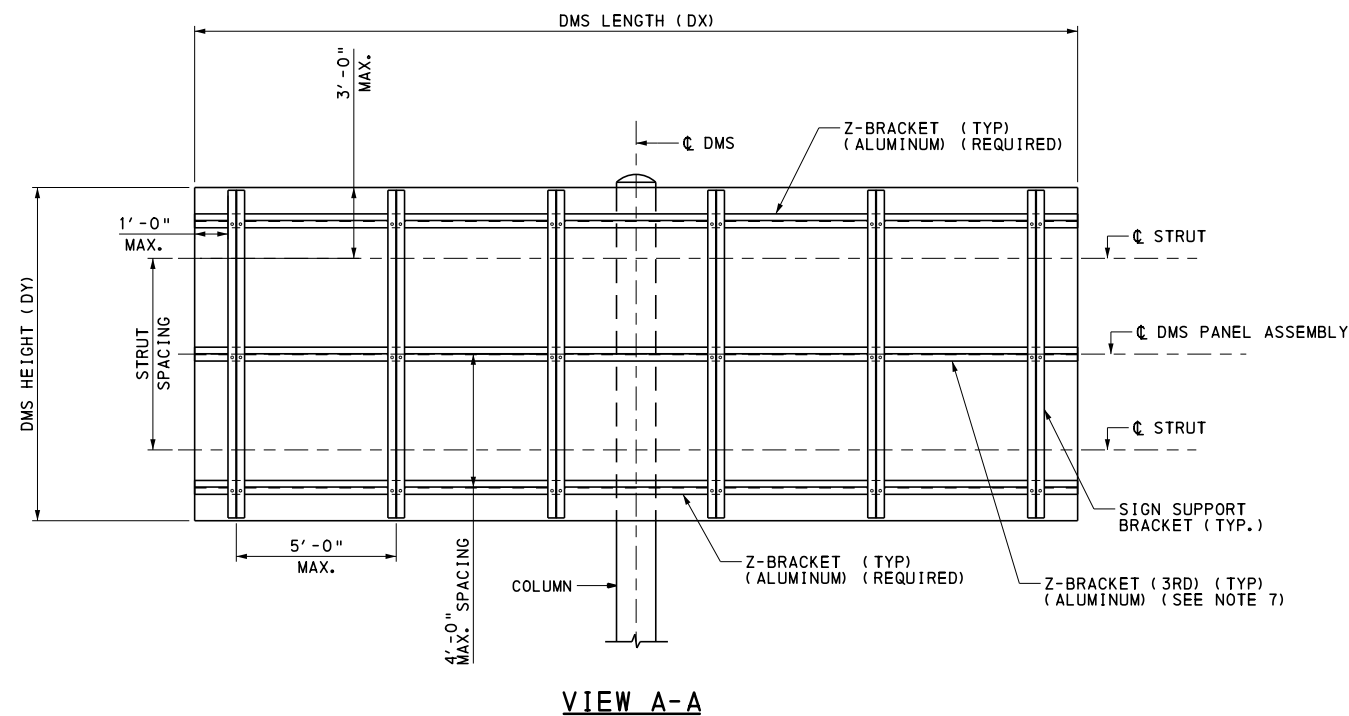
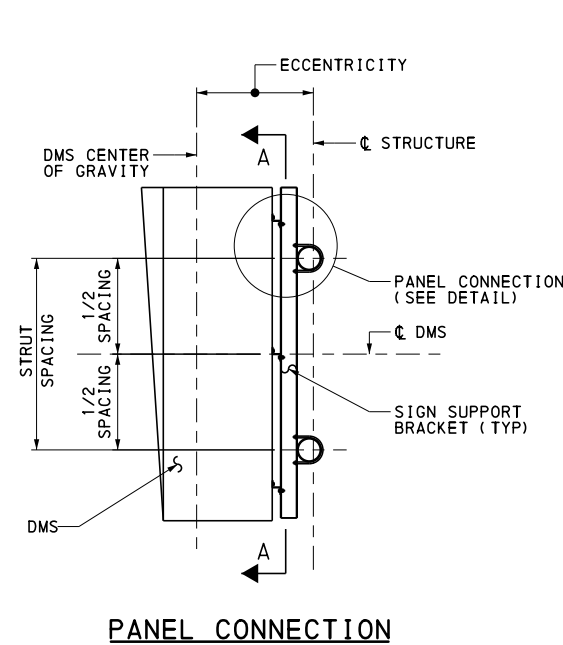
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

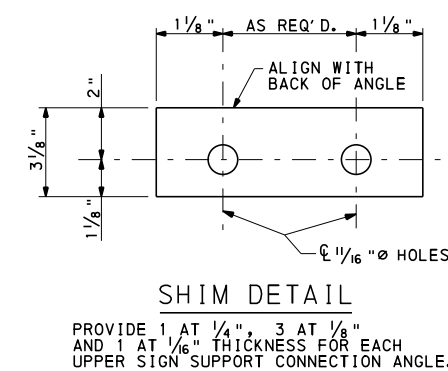
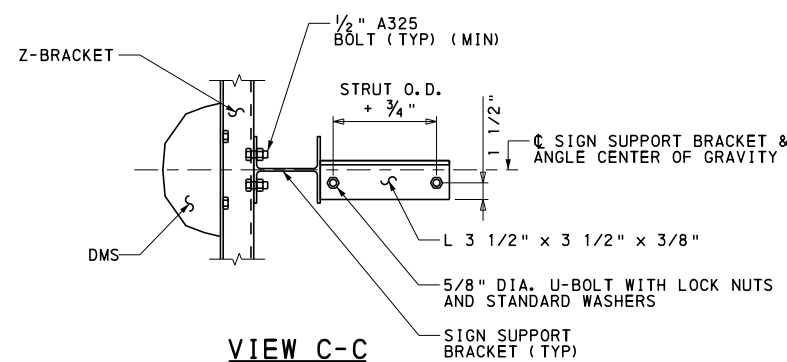
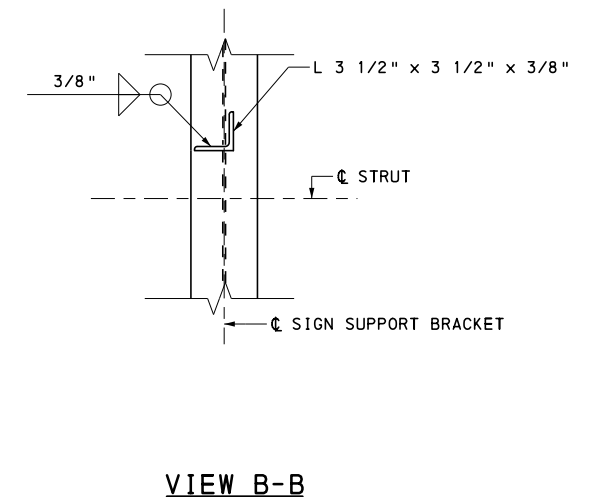
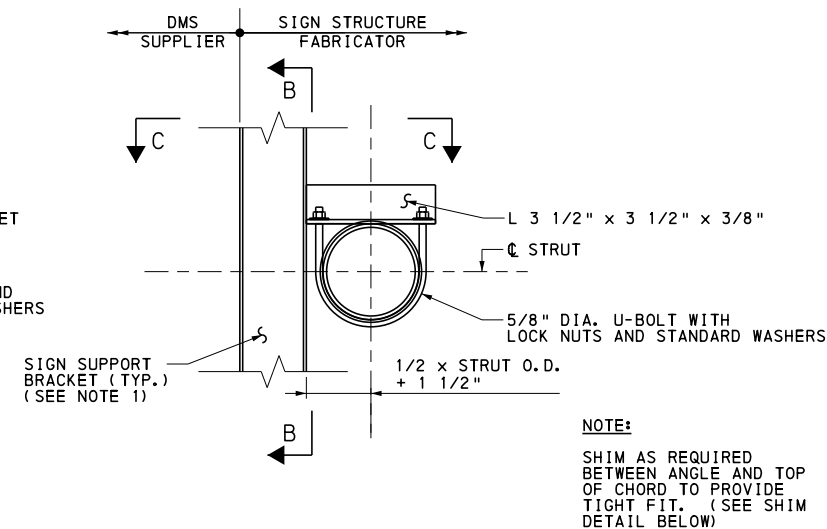
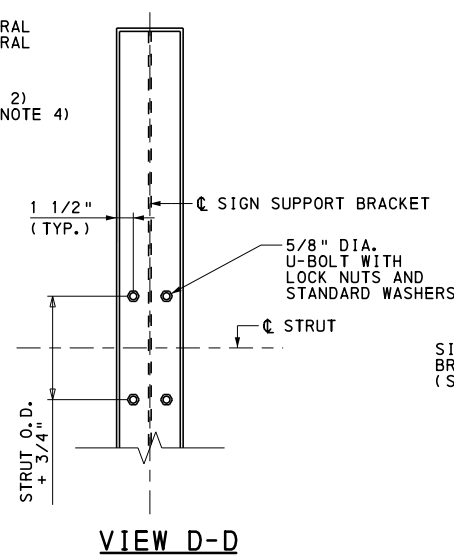
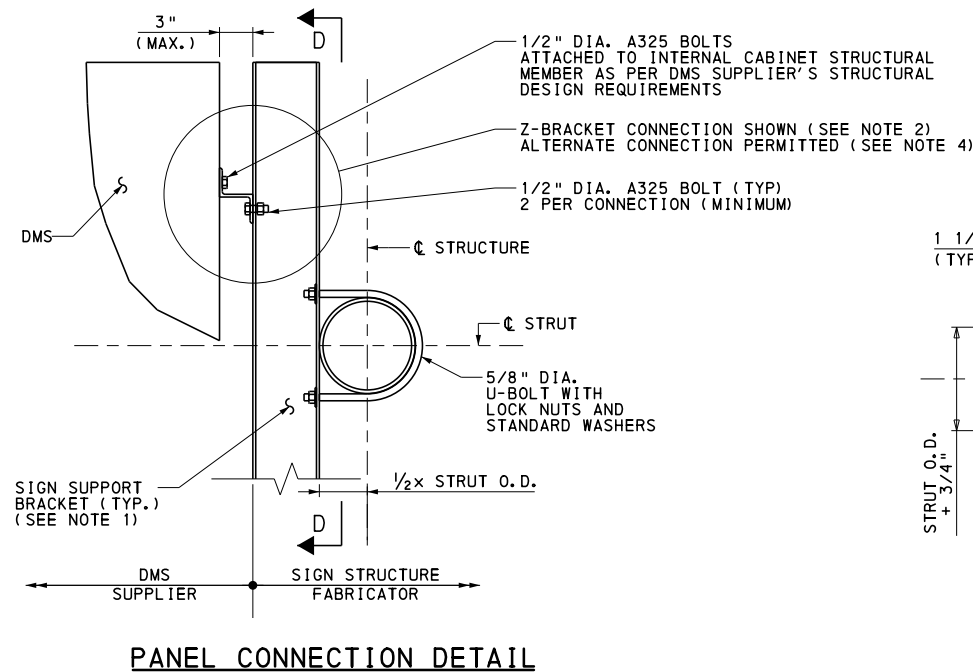
Brian D. Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

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 CHIEF 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 DMS ASSUMPTIONS:
 MAXIMUM DEAD LOAD 6000 LBS
 MAXIMUM ECCENTRICITY 5'-0"
 MAXIMUM LENGTH (DX) 30'-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 DMS 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 DMS 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 STANDARDS (SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006) AND SUBMITTED BY THE FABRICATOR.



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

**STANDARD
DYNAMIC MESSAGE SIGNS
CENTER-MOUNT SIGN STRUCTURES
DMS ATTACHMENT DETAILS**

RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 6 OF 6 BD-649M
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CHANGE 2
CHANGE 3

INFORMATIONAL NOTES:

- READ THESE NOTES BEFORE USING THESE STANDARDS.
- USE THESE STANDARDS AS A BASIS FOR THE PREPARATION OF STRUCTURE LAYOUTS AND CONTRACT DRAWINGS.
- ALL DMS SUPPORTS LOCATED WITHIN THE CLEAR ZONE MUST BE SHIELDED WITH A CRASHWORTHY BARRIER, SEE TABLE A, BC-745M SHEET 2.
- PROVIDE CRASHWORTHY BARRIER IN ACCORDANCE WITH PENNDOT PUB 13M (DM-2). CHAPTER 12 GUIDE RAIL, MEDIAN BARRIER AND ROADSIDE SAFETY DEVICES. USE OF GUIDE RAIL AND/OR CONCRETE BARRIER SHALL MEET APPLICABLE PENNDOT WARRANTS FOR INSTALLATION.
- FOR DETAILS NOT SHOWN SEE BC-745M, ADJUST DIMENSIONS TO ACCOMMODATE THE ACTUAL DMS DIMENSIONS. ALL DETAILING AND COMPONENT SIZING TAKEN FROM BC-745M MUST BE VALIDATED BY INDEPENDENT COMPUTATIONS FOLLOWING THE DESIGN CRITERIA.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN U.S. CUSTOMARY UNITS.
2. PROVIDE 3-INCH CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
3. USE CLASS A CEMENT CONCRETE f'c = 3000 PSI IN PEDESTALS, FOOTINGS AND CAISSONS.
4. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 FOR CONCRETE REINFORCEMENT. DO NOT WELD REINFORCING STEEL BARS.
5. RAKE-FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.
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 PENNDOT PUB 408 UNLESS STAINLESS STEEL OR OTHERWISE INDICATED.
11. ALL BOLT HOLES SHALL BE DRILLED.
12. PROVIDE BOLT HOLES 1/16" LARGER THAN BOLT DIAMETER.
13. PROVIDE ANCHOR BOLT HOLES 1/4" LARGER THAN BOLT DIAMETER.
14. PROVIDE A MINIMUM ANCHOR BOLT EMBEDMENT LENGTH OF 20 ANCHOR BOLT DIAMETERS.
15. STEEL MEMBER COMPONENTS REQUIRING CHARPY V-NOTCH TESTING ARE DESIGNATED ON THE PLANS BY (CVN), PROVIDE STEEL CONFORMING TO THE CVN REQUIREMENTS FOR ZONE 2, NON FRACTURE CRITICAL AS GIVEN IN THE AASHTO MATERIAL SPECIFICATIONS.
16. PIPE DIAMETERS SHOWN UP TO AND INCLUDING 12 INCHES ARE NOMINAL DIAMETERS. PIPE DIAMETERS SHOWN FROM 14 INCHES AND UP ARE ACTUAL DIAMETERS.
17. PROVIDE A CERTIFICATION LETTER, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA, CERTIFYING THAT THE INTERNAL STRUCTURE OF THE DMS AND THE CONNECTION TO THE SIGN STRUCTURE MEET THE REQUIREMENT OF THE AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS AS AMENDED BY PENNDOT." THE CERTIFICATION LETTER SHALL BE PREPARED BY THE DMS MANUFACTURER'S PROFESSIONAL ENGINEER AND SUBMITTED BY THE CONTRACTOR.
18. ONE TEST BORING SHALL BE PROVIDED AT EACH DMS FOUNDATION LOCATION.

CONSTRUCTION GENERAL NOTES:

- MATERIALS AND WORKMANSHIP:

PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH THE CURRENT VERSIONS OF THE PENNDOT PUB 408, (LET DATE EDITION), AASHTO/AWS D1.5M/D1.5+2002-BRIDGE WELDING CODE AND CONTRACT SPECIAL PROVISIONS, AND AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS". USE AASHTO/AWS D1.1/D1.1M+2008 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5M/D1.5+2002.
- PROVIDE STRUCTURAL STEEL CONFORMING TO THE FOLLOWING:

PIPE COLUMNS & PIPE CHORDS,
PIPE BRACING, ANGLES, SHAPES,
AND PLATES, ANCHOR BOLTS, BOLTS: PER PENNDOT PUB 408 SECTION 1230.2(K).

U-BOLT INSTALLATION: PER FHWA PUB GUIDELINES FOR THE INSTALLATION, INSPECTION, MAINTAINENACE, AND REPAIR OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES, AND TRAFFIC SIGNALS (2005).
- DESIGN SPECIFICATIONS:

AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006 (UNLESS NOTED OTHERWISE); AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION; PENNDOT DESIGN MANUAL - PART 4, MAY 2012 EDITION.
- ALL FILLET WELDS SHOWN ARE MINIMUM SIZE UNLESS NOTED OTHERWISE.

DESIGN CRITERIA FOR PENNDOT DMS STRUCTURES

LOADING

DEAD LOAD

LIVE LOAD (CATWALKS)

ICE LOAD

WIND LOAD

DMS SIZE AND DEAD LOAD PER SUPPLIER

WIND DRAG COEFFICIENT $C_d = 1.7$ FOR DMS

(STRENGTH DESIGN AND FATIGUE DESIGN)

3.5

3.6

3.7

APPENDIX C, SECTION C.3,

EQ. C-1, WITH 80 MPH

WIND AND 30% GUST FACTOR

GROUP LOADS

STEEL CRITERIA

AASHTO 2001 SIGN SPECS. 3.4

AASHTO 2001 SIGN SPECS. (U.N.O.)

STRENGTH CRITERIA

SECTION PROPERTIES FOR TUBULAR SHAPES

MAXIMUM STRESSES IN TUBULAR SHAPES

ALLOWABLE STRESSES FOR TUBULAR SHAPES

ALLOWABLE STRESSES FOR DMS SUPPORTS

ALLOWABLE STRESSES FOR BASE PLATES

ALLOWABLE STRESSES FOR COMBINED STEEL STRESS

ALLOWABLE STRESSES FOR STRUCTURAL STEEL

APPENDIX B, TABLE B-1

APPENDIX B, TABLE B-2

5.6 (TABLE 5-3) & 5.11

5.12

5.8

5.12

SECTION 5

FATIGUE CRITERIA

FATIGUE REQUIREMENTS (FATIGUE CATEGORY I)

FATIGUE IMPORTANCE FACTOR ($I_f = 1$)**

GALLOPING

NATURAL WIND GUST

TRUCK-INDUCED GUST

SECTION 11

11.6

11.7.1

11.7.3

11.7.4

DMS SUPPORT STRUCTURE SHALL BE DESIGNED FOR NATURAL WIND GUSTS AND TRUCK-INDUCED GUSTS.

**A FATIGUE IMPORTANCE FACTOR OF 11 MAY BE USED FOR DMS SUPPORT STRUCTURES LOCATED ON MINOR ARTERIALS, COLLECTORS, OR LOCAL ROADS.

SERVICEABILITY CRITERIA

ALLOWABLE DEFLECTION

PERMANENT CAMBER

10.4

10.5

BOLT CRITERIA

ALLOWABLE BOLT STRESSES

SLIP-CRITICAL BOLT ALLOWABLE

BOLT PRYING ACTION

COMBINED BOLT SHEAR AND TENSION

BOLT DESIGN CRITERIA

ALLOWABLE ANCHOR BOLT STRESSES

AASHTO HIGHWAY BRIDGES (U.N.O.)

TABLE 10.32.3B

10.32.3.2.1

10.32.3.3.2

10.32.3.3.3

AASHTO 2001 SIGN SPECS. 5.16

AASHTO 2001 SIGN SPECS. 5.17

CONCRETE CRITERIA

ALLOWABLE BEARING STRESS

REINFORCEMENT TENSILE STRESS

SHEAR CAPACITY OF FOOTINGS

SHEAR STRESS IN FOOTINGS

ALLOWABLE SHEAR STRESS

SLENDERNESS OF COLUMNS

MINIMUM REINF. OF FLEXURAL MEMBERS

SPACING LIMITS FOR REINFORCEMENT

MINIMUM CONCRETE COVER

PRESSURES FOR ECCENTRICALLY LOADED FOOTINGS

DISTRIBUTION OF REINFORCEMENT

FOOTING STABILITY REQUIREMENTS

TORSION

COLUMN DESIGN (PEDESTALS)

AASHTO HIGHWAY BRIDGES (U.N.O.)

8.15.2.1.3

8.15.2.2

8.15.5.6.1

8.15.5.6.2

8.15.5.6.4

8.16.5.2

8.17.1

8.21

DM4 D8.22.1*

FIG. 4.4.7.1.1.1C

4.4.11.2.2

DM4 D5.5.5

ACI SECTION A.7.3*

8.15.4

FOUNDATION NOTES

SPREAD FOOTINGS:	DM4 SEC.10.6
MINIMUM AREA IN BEARING	95%
DRILLED SHAFTS (CAISSONS):	DM4 SEC.10.8, PENNDOT COM624 OR L-PILE
MAXIMUM DESIGN LATERAL DISPLACEMENT	0.5"

*LEGEND

- AASHTO 2001 SIGN SPEC: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 4TH EDITION, INCLUDING INTERIMS THRU 2006
- AASHTO HIGHWAY BRIDGES: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17TH EDITION
- DM4: PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, DESIGN MANUAL PART 4, STRUCTURES, MAY 2012 EDITION
- U.N.O.: UNLESS NOTED OTHERWISE
- ACI: AMERICAN CONCRETE INSTITUTE - METRIC BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE WITH COMMENTARY (ACI 318M-99).
- CVN: CHARPY V-NOTCH.
- DMS: DYNAMIC MESSAGE SIGN

ITS-1201	ITS DEVICES - GENERAL
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-52M	TYPE 2 STRONG POST GUIDE RAIL
RC-53M	TYPE 2 WEAK POST GUIDE RAIL
RC-54M	BARRIER PLACEMENT AT OBSTRUCTIONS
RC-55M	TYPE 2 WEAK POST MEDIAN BARRIER
RC-58M	SINGLE FACE CONCRETE BARRIER PLACEMENT AT MEDIAN PIERS
REFERENCE DRAWINGS	

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD DYNAMIC MESSAGE SIGNS TRUSS SIGN STRUCTURES DESIGN CRITERIA AND GENERAL NOTES		
RECOMMENDED NOV. 21, 2014 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 <i>Brian S. Thompson</i> ACTING DIR. BUR. OF PROJECT DELIVERY	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
 - DMS HEIGHT AND LENGTH
 - DMS AREA
 - DESIGN HEIGHT
 - DESIGN ECCENTRICITY
 - DESIGN WEIGHT OF DMS
 - 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 DMS CABINET IS REQUIRED AND LOCATE
6. IDENTIFY IF A LADDER IS REQUIRED AND LOCATE
7. IDENTIFY THE PRESENCE OF GUIDERAIL, BARRIER OR PLACEMENT OUTSIDE THE CLEAR ZONE
8. THE DESIGNER MUST DETAIL THE LEAST DISTANCE FROM EDGE OF PEDESTAL TO REAR OF GUIDERAIL 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 DMS 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 DMS 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 DMS.
11. ENSURE CATWALK CAN BE ACCESSIBLE FROM SHOULDER WHEN CONDITIONS PERMIT. WALK-IN ACCESS PLATFORMS ARE LOCATED ON ONE END ONLY AT EACH DMS. IDENTIFY CATWALK AND WALK-IN ACCESS PLATFORM LOCATIONS ON CONTRACT DRAWINGS BASED ON SITE SPECIFIC REQUIREMENTS. MAINTAIN MINIMUM VERTICAL CLEARANCE.

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
 - DMS 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
 - DMS HEIGHT AND LENGTH
 - DMS AREA
 - DESIGN HEIGHT
 - DESIGN ECCENTRICITY
 - DESIGN WEIGHT OF DMS
 - SIZE AND TYPE OF PIPE CAPS
 - IDENTIFY ALL WELDS BY SIZE AND TYPE
 - COMPLETED CAMBER DIAGRAM
3. ALUMINUM DMS SUPPORT STRUCTURES ARE PROHIBITED.
4. TELESCOPING (SLIP-FIT) FIELD SPLICES FOR DMS SUPPORT STRUCTURES ARE PROHIBITED.
5. INDICATE THE SUPPLIER FOR CATWALK GRATING ON THE SHOP DRAWINGS.
6. PROVIDE HAND HOLE, WEATHERPROOF 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.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
DYNAMIC MESSAGE SIGNS
TRUSS SIGN STRUCTURES
NOTES TO DESIGNER
AND FABRICATOR

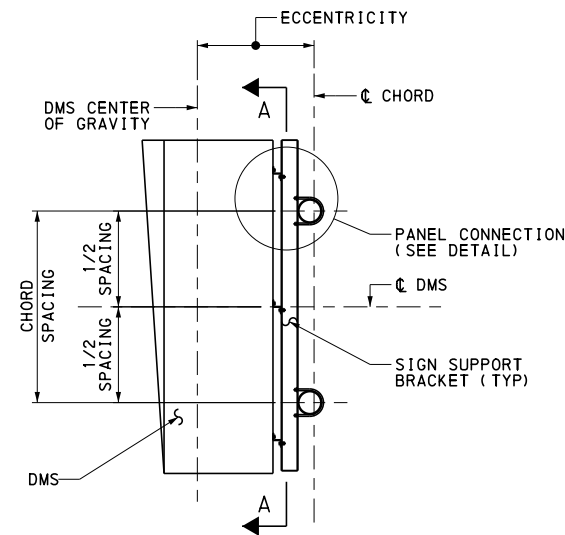
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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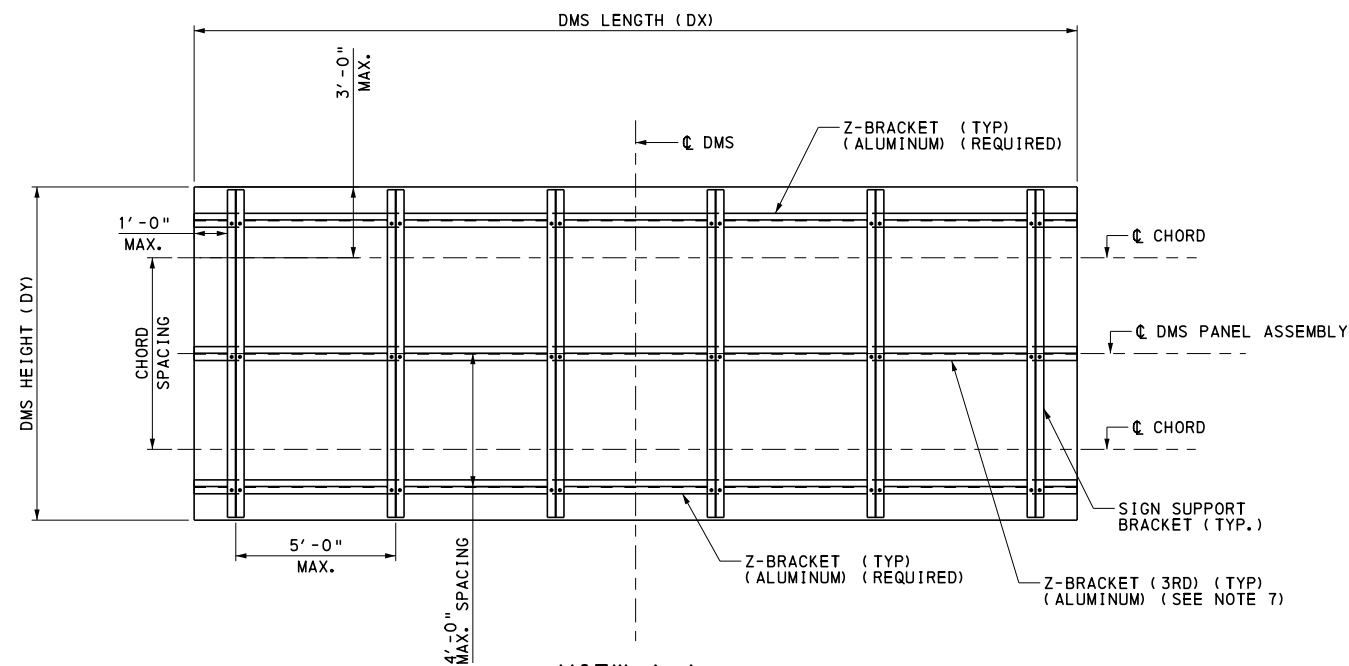
SHEET 2 OF 4
BD-650M

SHEET 3 OF 4

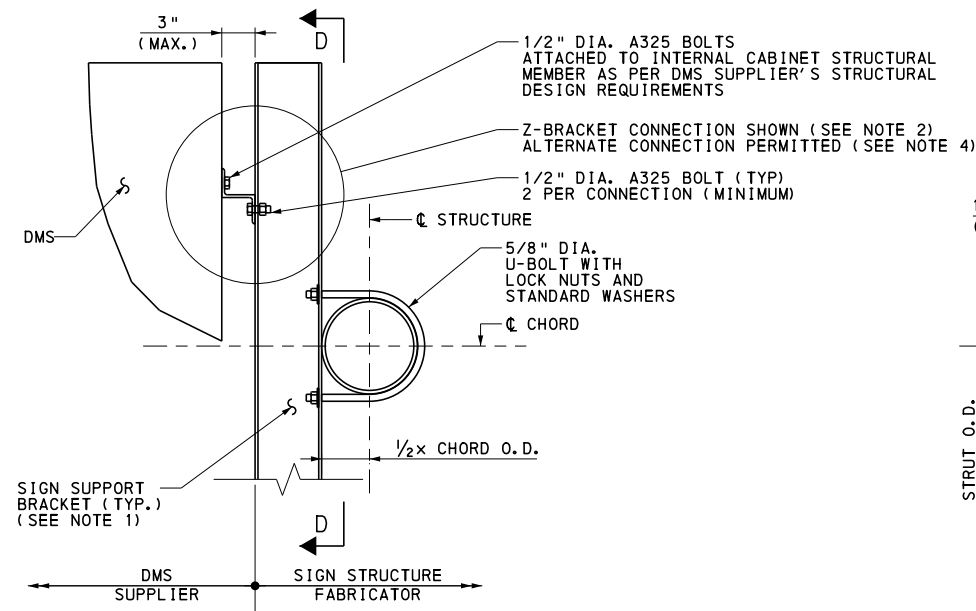
BD-650M



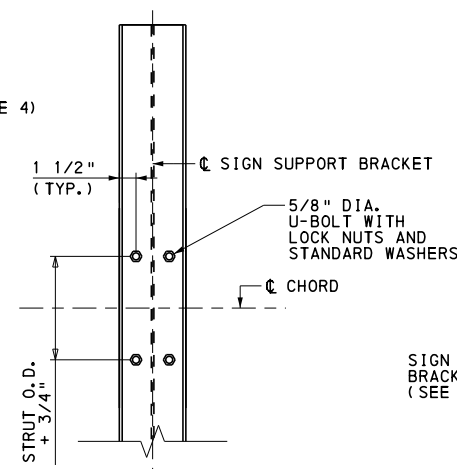
PANEL CONNECTION



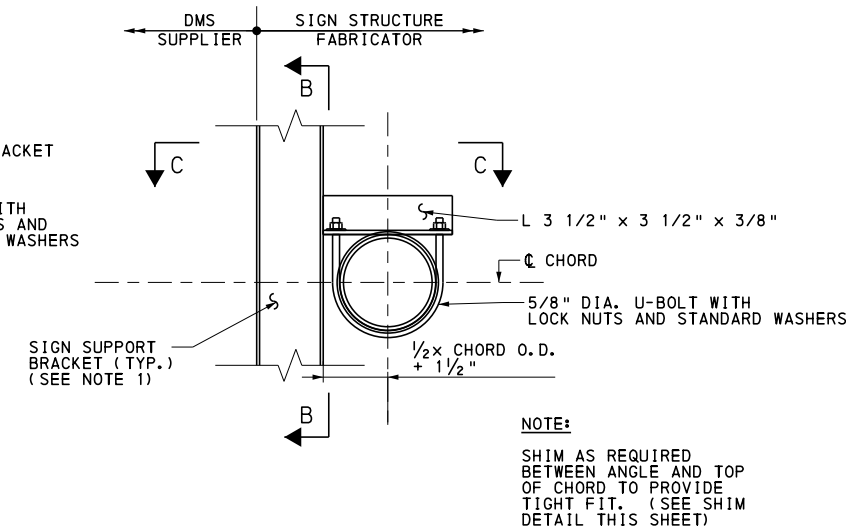
VIEW A-A



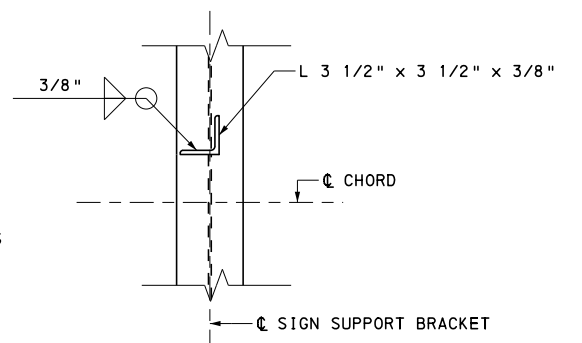
PANEL CONNECTION DETAIL



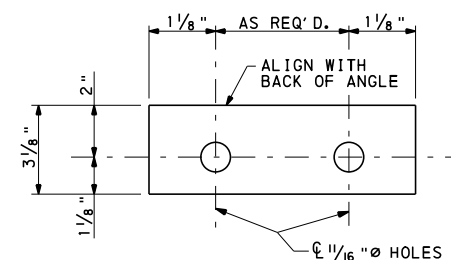
VIEW D-D



ALTERNATE PANEL CONNECTION DETAIL

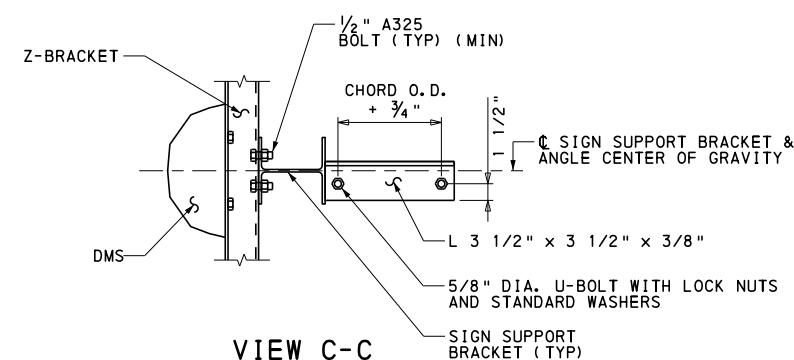


VIEW B-B



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 DESIGNED BASED ON THE FOLLOWING DMS ASSUMPTIONS:
 MAXIMUM DEAD LOAD 6000 LBS
 MAXIMUM ECCENTRICITY 5'-0"
 MAXIMUM LENGTH (DX) 30'-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 DMS 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 DMS 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 STANDARDS (SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS, 4TH EDITION, 2001, INCLUDING INTERIMS THROUGH 2006) AND SUBMITTED BY THE FABRICATOR.

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

**STANDARD
DYNAMIC MESSAGE SIGNS
TRUSS SIGN STRUCTURES
DMS ATTACHMENT DETAILS**

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SHEET 4 OF 4
 BD-650M

CHANGE 2
CHANGE 3

STANDARD BEAM SIZES AND ALLOWABLE SKEW LIMITATIONS																	
SIZE OF BEAM SECTION																	
BEAM DEPTH (IN)	12		17		21 & 24		27 & 30		33		36		39		42		>48
BEAM WIDTH (IN)	36	48	36	48	36	48	36	48	36	48	36	48	36	48	36	48	36
ADJ. BOX (COMP.)	60°	60°	60°	60°	60°	60°	55°	60°	50°	55°	45°	50°	45°	50°	40°	50°	40°
SPREAD BOX			35°	40°	35°	45°	35°	45°	35°	45°	35°	45°	35°	45°	40°	50°	55°
I-BEAMS & PA BULB-TEE BEAMS	FOR ALL SIZES - 30°																

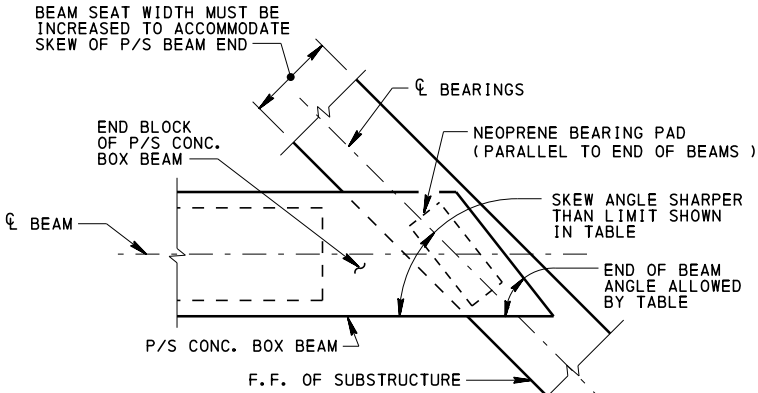
NOTE:
FOR BOX BEAMS WITH SKEW ANGLES SHARPER THAN THOSE LISTED IN THE ABOVE TABLE IT IS PERMITTED TO SKEW THE END OF BEAM AT THE LIMIT SHOWN ABOVE AND PLACE THE BEARING PAD(S) AND BEAM ENDS AT THE REQUIRED SKEW ANGLE. SEE "SHARP SKEW DETAIL" ON THIS SHEET. DESIGNERS ARE TO VERIFY THAT THE COST OF ADDITIONAL 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) 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) PROVIDE AT $\frac{1}{4}$ FOR SPANS 40' AND GREATER
(1) PROVIDE ADDITIONAL INTERNAL DIAPHRAGMS AS NEEDED, WITH MAX. DIAPHRAGM SPACING OF 45'.		
(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.		
(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 REQUIREMENTS FOR SPREAD BOX BEAMS , PA BULB-TEE BEAMS AND I-BEAMS (SIMPLE AND CONTINUOUS SPAN BRIDGES)							
		ABUTMENTS				PIERS	
		FIXED (1) WITHOUT BACKWALL	FIXED WITH BACKWALL	EXPANSION WITHOUT BACKWALL	EXPANSION WITH BACKWALL	FIXED	EXPANSION
DIAPHRAGMS, SHEAR BLOCKS AND CHEEK WALLS	SPREAD BOX BEAM	FULL DEPTH DIAPHRAGMS	ALTERNATING FULL AND PARTIAL DEPTH DIAPHRAGMS	FULL DEPTH DIAPHRAGMS, SHEAR BLKS, & CURTAIN WALLS	PARTIAL DEPTH DIAPHRAGMS, SHEAR BLKS, & CURTAIN WALLS (IF NEEDED)	(2) ALTERNATING FULL AND PARTIAL DEPTH DIAPHRAGMS AND CHEEK WALLS	(2) PARTIAL DEPTH DIAPHRAGMS, SHEAR BLKS, & CURTAIN WALLS
	I-BEAMS & PA BULB-TEE						
DOWELS	(3) SPREAD BOX BEAM	USE 3-1"Ø DOWELS PER DIAPHRAGM	USE 3-1"Ø DOWELS PER DIAPHRAGM	NONE REQUIRED		(4) USE 3-1"Ø DOWELS PER FULL DEPTH DIAPHRAGM	NONE REQUIRED
	I-BEAMS & PA BULB-TEE	(4) USE 3-1"Ø DOWELS PER FULL DEPTH DIAPHRAGM					
SYMBOLS							
(1) DENOTES CONDITIONS THAT PERTAIN TO SIMPLE SPAN BRIDGES.							
(2) FULL DEPTH DIAPHRAGMS ARE TO BE USED FOR CONTINUOUS SPAN BRIDGES.							
(3) THE DOWELS IN THE DIAPHRAGMS MAY BE REPLACED WITH DOWELS IN THE BEAMS. (SEE DOWEL REQUIREMENTS FOR ADJACENT BOX BEAM BRIDGES)							
(4) THE DOWELS SHOWN ARE FOR A MAXIMUM DIAPHRAGM LENGTH OF 10' . FOR EACH 2' OR PART THEREOF, ADD AN ADDITIONAL DOWEL.							
NOTES:							
1. FOR CONTINUOUS SPAN BRIDGES DESIGN THE DOWELS AT THE FIXED ENDS TO RESIST ALL LONGITUDINAL FORCES.							
2. USE GRADE 60 EPOXY COATED STEEL DOWELS.							



PLAN
SHARP SKEW DETAIL
NO SCALE

GENERAL NOTES:
1. REFER TO BD-668M FOR PRECAST CHANNEL BEAM TIE BOLT REQUIREMENTS.

COMMONWEALTH OF PENNSYLVANIA
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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
BC-775M

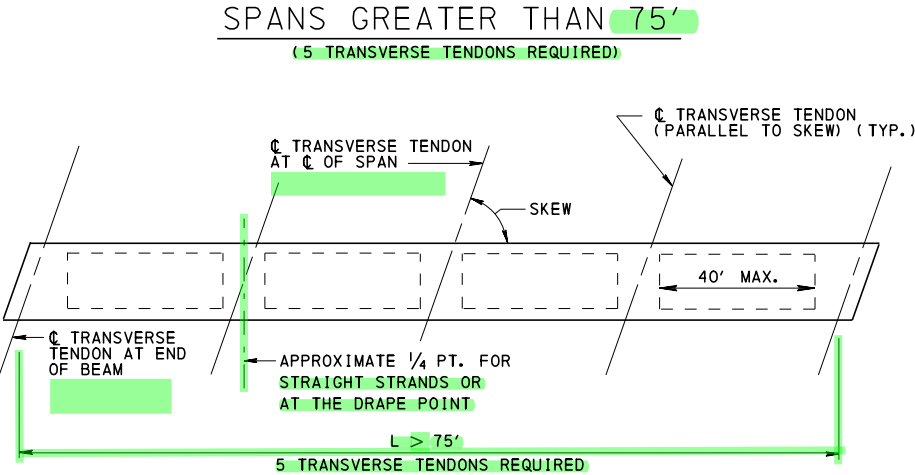
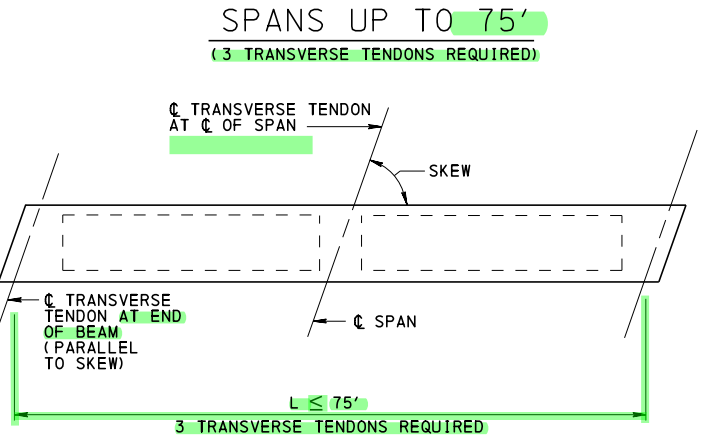
PRECAST CHANNEL BEAM
MISCELLANEOUS PRESTRESS DETAILS
REFERENCE DRAWINGS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
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SHEET 1 OF 2
BD-651M

TENDON AND DIAPHRAGM REQUIREMENTS FOR
ADJACENT BOX BEAM BRIDGES
(SIMPLE AND CONTINUOUS SPAN BRIDGES)



NOTES:

1. DIAPHRAGMS ARE SHOWN PERPENDICULAR, BUT MAY BE CAST ON SKEW. SEE BC-775M FOR DETAIL.
2. DETAILS ALSO APPLY TO PLANK BEAMS.
3. BEAMS WITH DRAPED STRANDS ARE TO HAVE DIAPHRAGMS PLACED AT THE DRAPE POINTS.

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:

1. INVESTIGATE THE ADEQUACY OF DOWELS AND SHEAR BLOCKS WHEN BRIDGE IS SUBJECT TO INUNDATION DURING FLOOD CONDITIONS (100 YEAR MINIMUM).
2. FOR MINIMUM ALLOWABLE SKEW, SEE STANDARD BEAM SIZES AND ALLOWABLE SKEW LIMITATIONS, THIS SHEET.
3. SINGLE SPAN BRIDGES WITH SPANS OF 35' AND LESS, PROVIDE FIXED CONDITION AT BOTH ABUTMENTS.
4. ARRANGE FIXED AND EXPANSION CONDITIONS SO THAT THE BRIDGE IS EXPANDING UPHILL.
5. FOR CONTINUOUS SPANS, PROVIDE DOWELS AT FIXED LOCATIONS. DESIGN DOWELS TO RESIST ALL LONGITUDINAL FORCES.
6. FOR MULTI-SPAN BRIDGES (NON-CONTINUOUS), WITHOUT BACKWALLS, ABUTMENTS ARE TO BE FIXED.
7. THE SHEAR BLOCK AND DOWEL REQUIREMENTS ARE APPLICABLE TO BRIDGES WITH OR WITHOUT BACKWALLS.
8. IF A CHEEKWALL IS TO BE USED AS A SHEAR BLOCK, IT IS TO BE DESIGNED ACCORDINGLY.
9. USE GRADE 60 EPOXY COATED STEEL DOWELS.

SKEW LIMITATIONS 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
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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

PLANK BEAM

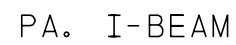
ADJACENT BOX BEAM DATA (COMPOSITE CONSTRUCTION)														
BEAM DEPTH (in.)	BASIC BEAM DATA - 48" BEAMS (COMPOSITE)							BASIC BEAM DATA - 36" BEAMS (COMPOSITE)						
	CONC. (CY/ft.)	AREA (in. ²)	WT/FT. (KIPS)	Y _b (in.)	I (in. ⁴)	S _t (in. ³)	S _b (in. ³)	CONC. (CY/ft.)	AREA (in. ²)	WT/FT. (KIPS)	Y _b (in.)	I (in. ⁴)	S _t (in. ³)	S _b (in. ³)
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. ²)	WT/FT. (KIPS)	Y _b (in.)	I (in. ⁴)	S _t (in. ³)	S _b (in. ³)	CONC. (CY/ft.)	AREA (in. ²)	WT/FT. (KIPS)	Y _b (in.)	I (in. ⁴)	S _t (in. ³)	S _b (in. ³)
12	0.146	568	0.591	5.97	6850	1136	1147	0.109	424	0.441	5.96	5122	848	859

in. = INCHES	Yb = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY
CY = CUBIC YARD	S _t = SECTION MODULUS, TOP BEAM
I = MOMENT OF INERTIA	S _b = SECTION MODULUS, BOTTOM BEAM

SPREAD BOX BEAM

SPREAD BOX BEAM DATA														
BEAM DEPTH (in.)	BASIC BEAM DATA - 48" BEAMS							BASIC BEAM DATA - 36" BEAMS						
	CONC. (CY/ft.)	AREA (in. ²)	WT/FT. (K/IPS)	Y _b (in.)	I (in. ⁴)	S _t (in. ³)	S _b (in. ³)	CONC. (CY/ft.)	AREA (in. ²)	WT/FT. (K/IPS)	Y _b (in.)	I (in. ⁴)	S _t (in. ³)	S _b (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	4262	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

BD-652M



PA. I-BEAMS																		
BEAM DESIGNATION	TOP FLANGE WIDTH (in.) W2	BOTTOM FLANGE WIDTH (in.) W1	DEPTH (in.) D	DEPTH DATA (in.)					FLANGE DATA (in.)		WEB THICKNESS (in.) W3	BASIC BEAM PROPERTIES						
				T2	B3	C	B1	T1	B4	B2		CONC. (CY/ft.)	AREA (in.²)	Yb (in.)	I (in.⁴)	S _t (in.³)	S _b (in.³)	WT/FT. (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	260730	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	0.224	872	29.71	404566	12154	13615	0.907
26/63	26	26	63	9	6	29	10	9	8	8	10	0.269	1046	30.97	470081	14678	15176	1.090

[illegible]

FOR NOTES, SEE SHEET 1.

in. = INCHES	Yb = DISTANCE FROM BOTTOM OF BEAM TO CENTER OF GRAVITY
CY = CUBIC YARD	S† = SECTION MODULUS, TOP BEAM
I = MOMENT OF INERTIA	Sb = SECTION MODULUS, BOTTOM BEAM

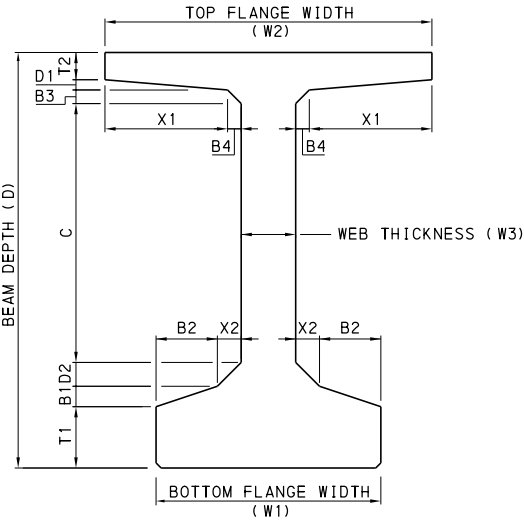
STANDARD PRESTRESSED BEAM SIZES AND SECTION PROPERTIES

RECOMMENDED AUG. 31, 2012
R. Wayne Willey
 ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 2 OF 3

3D-652M

PA BULB-TEE BEAM																						
BEAM DESIGNATION	TOP FLANGE WIDTH (in.) W2	BOTTOM FLANGE WIDTH (in.) W1	DEPTH (in.) D	DEPTH DATA (in.)							FLANGE DATA (in.)				WEB THICKNESS (in.) W3	BASIC BEAM PROPERTIES						
				T2	D1	B3	C	D2	B1	T1	X1	B4	B2	X2		CONC. (CY/ft.)	AREA (in.2)	Yb (in.)	I (in.4)	S _t (in.3)	S _b (in.3)	WT/FT. (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

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

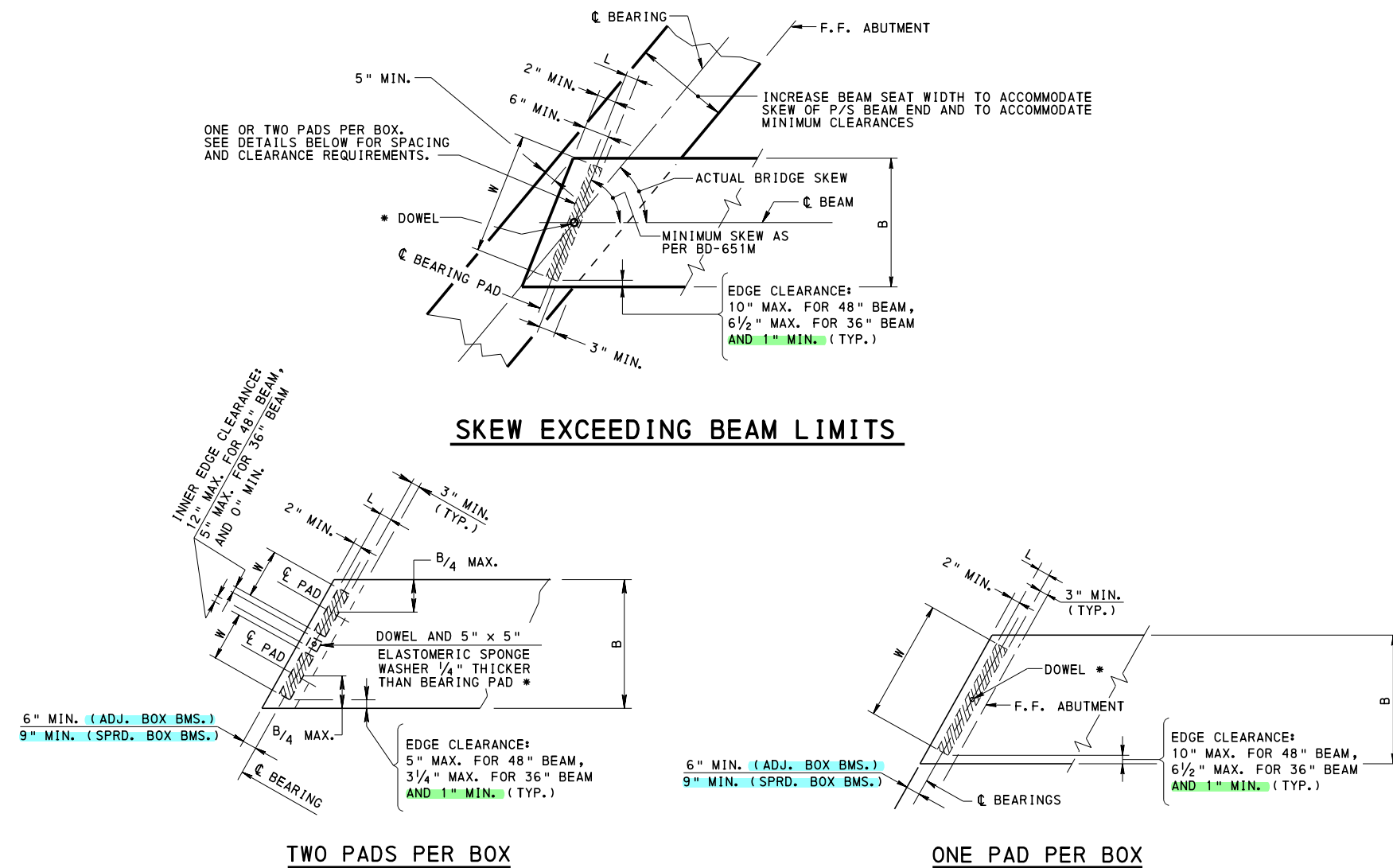
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
PRESTRESSED BEAM SIZES
AND SECTION PROPERTIES

RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

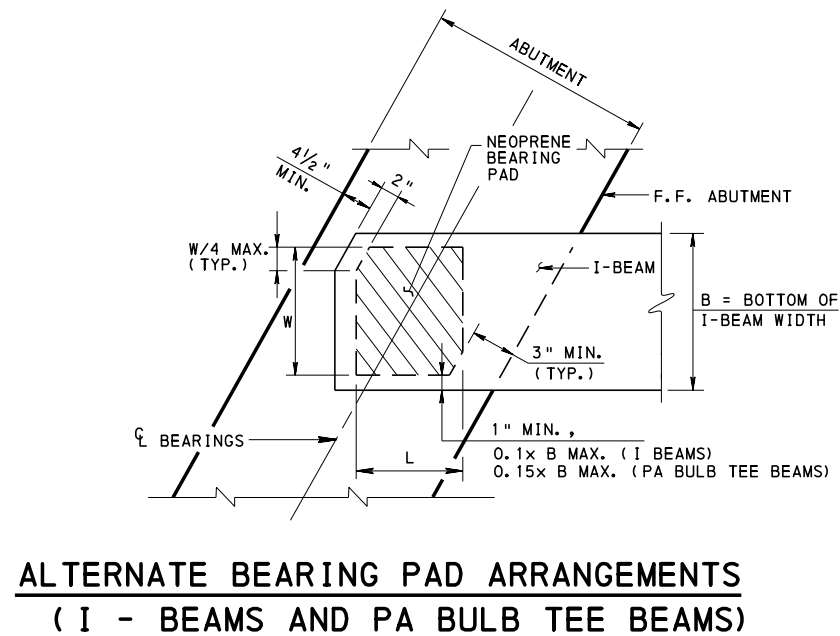
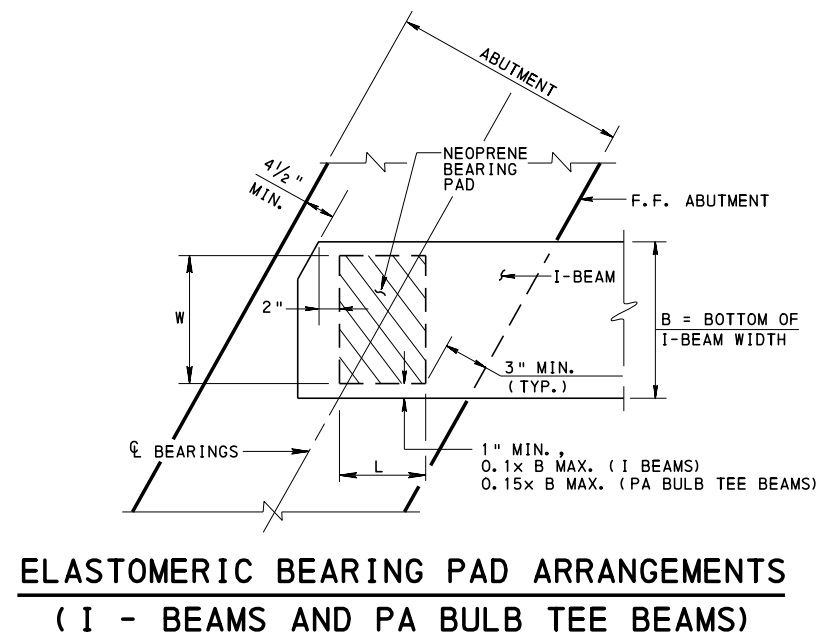
RECOMMENDED AUG. 31, 2012
R. Wayne Willey
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 3 OF 3
BD-652M



* IF REQUIRED BY BD-651M

ELASTOMERIC BEARING PAD ARRANGEMENTS (BOX BEAMS)



NOTE:

- FOR WATERPROOFING AND EXPANSION DETAILS AT BEARING AREA, SEE BC-788M.

LEGEND

- L = BEARING PAD LENGTH
W = BEARING PAD WIDTH
B = BEAM FLANGE WIDTH

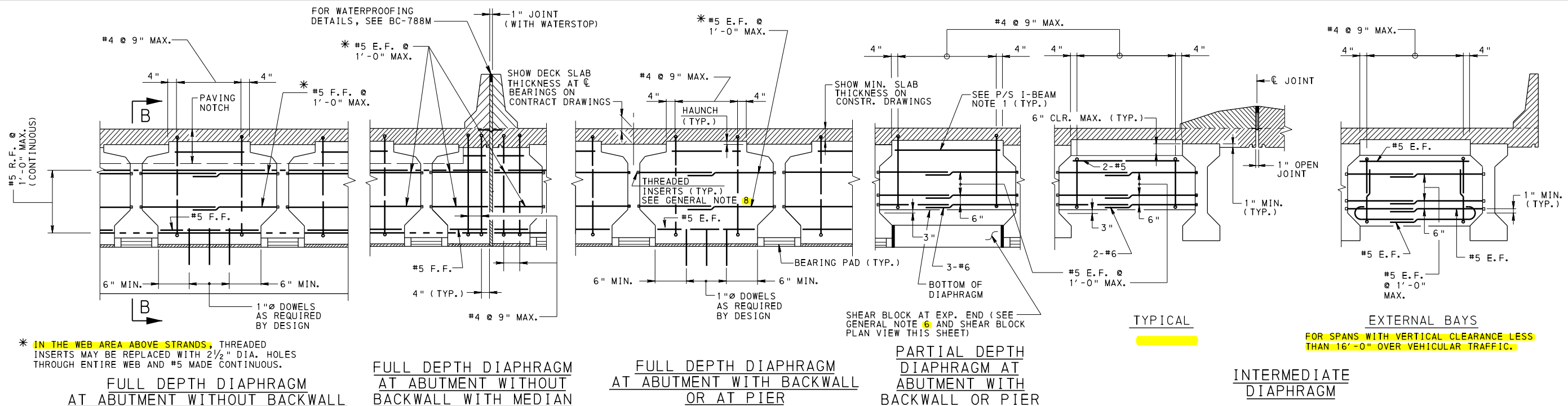
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
TYPICAL FRAMING
PLANS AND DETAILS
BEARING DETAILS FOR
P/S CONCRETE BEAM BRIDGES

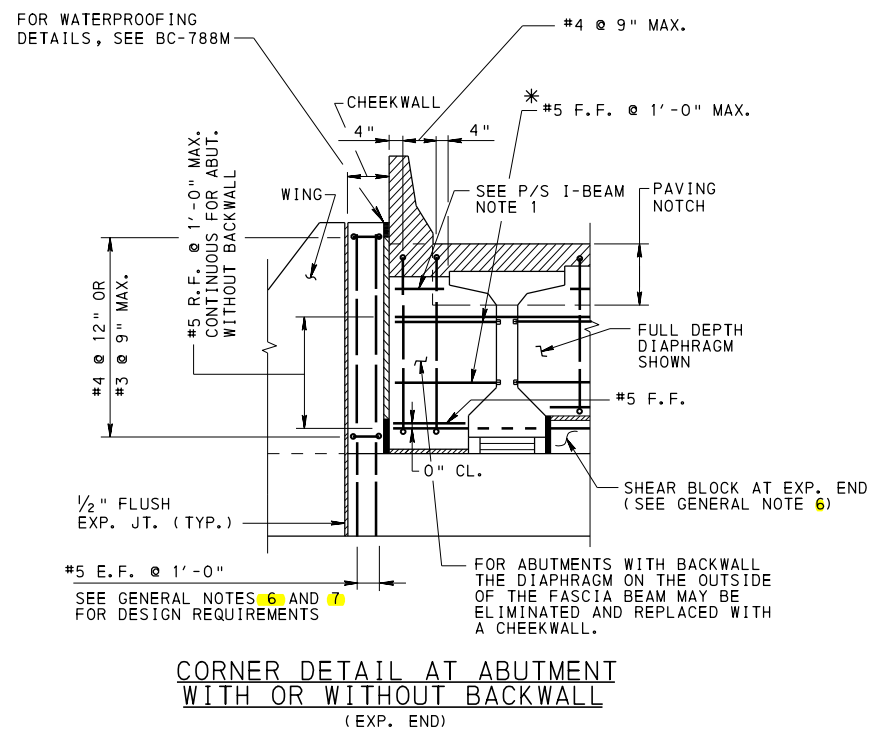
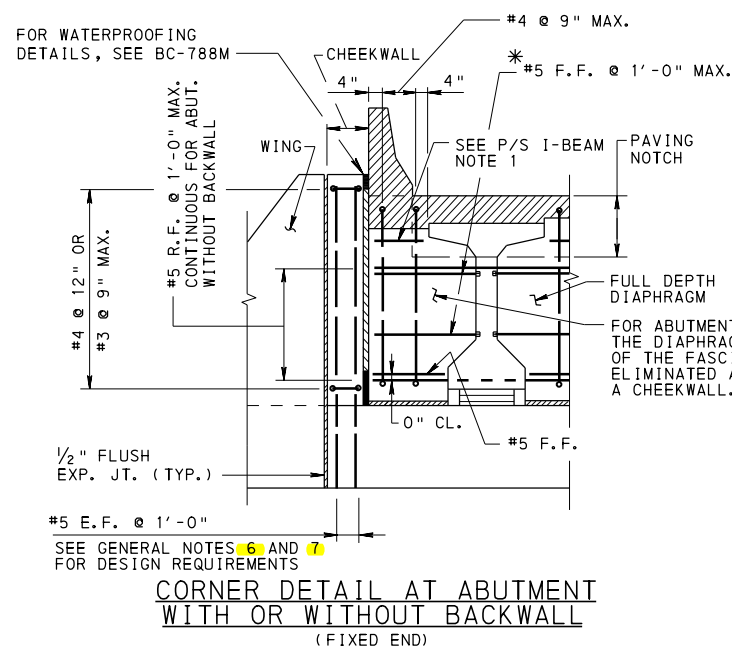
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 2 OF 2
BD-653M



TYPICAL STRUCTURE SECTIONS - I-BEAMS

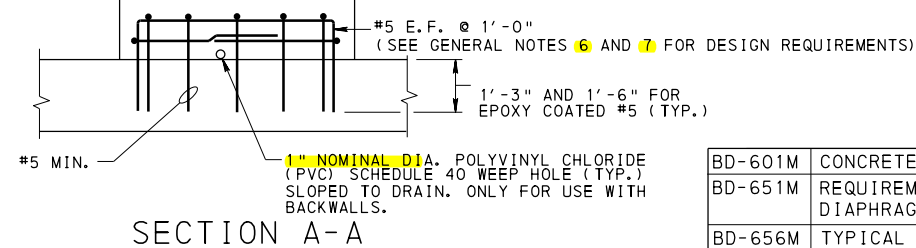
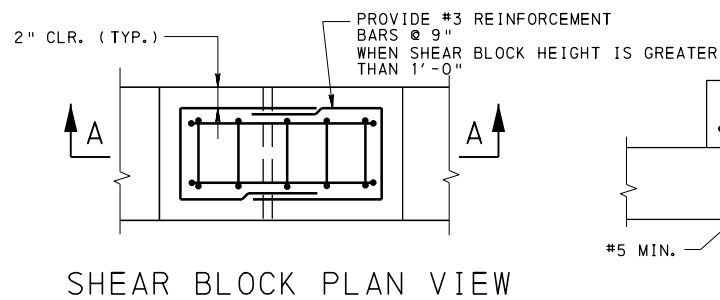


GENERAL NOTES:

- ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706.
- SHOW ALL APPLICABLE DETAILS ON CONSTRUCTION DRAWINGS.
- PROVIDE DRIP NOTCH ON BEAM FOR OVERHANGS LESS THAN 8" (TYP. FOR BOX BEAMS).
- SEE BC-775M FOR DOWEL AND DRIP NOTCH DETAILS.
- SEE BD-667M FOR INSERT LOCATIONS AT END OF GIRDERS ON INTEGRAL ABUTMENTS.
- DESIGN THE CHEEKWALL AND SHEAR BLOCKS TO RESIST THE LATERAL FORCES AT THE EXPANSION END OF THE BRIDGE. REINFORCEMENTS SHOWN ARE MINIMUMS.
- IF THE DESIGN REQUIRES A GREATER SHEAR REINFORCEMENT, #6 REINF. BAR MAY BE USED AND/OR THE SPACING MAY BE REDUCED TO ACCOMMODATE THE LATERAL FORCE.
- USE ONE SIZE SMALLER INSERT FOR DEFORMED BARS. THE MINIMUM LENGTH OF THE INSERT IS 3".
- FOR SECTION B-B, SEE SHEET 2.

P/S I-BEAM NOTES:

- IF THE DISTANCE FROM THE TOP OF WEB TO THE BOTTOM OF DECK SLAB IS >12", PLACE 1 - #5 REINFORCEMENT BAR, EACH FACE 3" FROM BOTTOM OF DECK SLAB.
- FOR ABUTMENT WITHOUT BACKWALL EXTEND DIAPHRAGM TO TOP OF THE **PREFORMED CELLULAR POLYSTYRENE** PLACED ON TOP OF SHEAR BLOCK.



COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

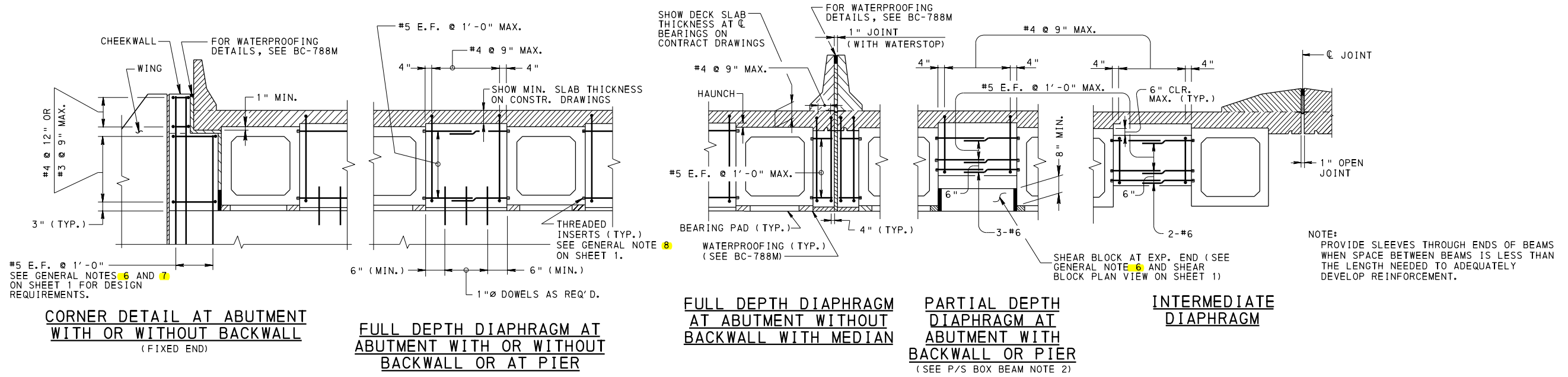
STANDARD TYPICAL SUPERSTRUCTURE SECTIONS I BEAM BRIDGES

BD-601M	CONCRETE DECK SLAB DESIGN
BD-651M	REQUIREMENTS FOR TENDONS, DOWELS, SHEAR BLOCKS, DIAPHRAGMS, SKEW LIMITATIONS AND BACKWALLS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BD-657M	I-BEAM AND BOX BEAM BRIDGES
BD-667M	INTEGRAL ABUTMENTS
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS	

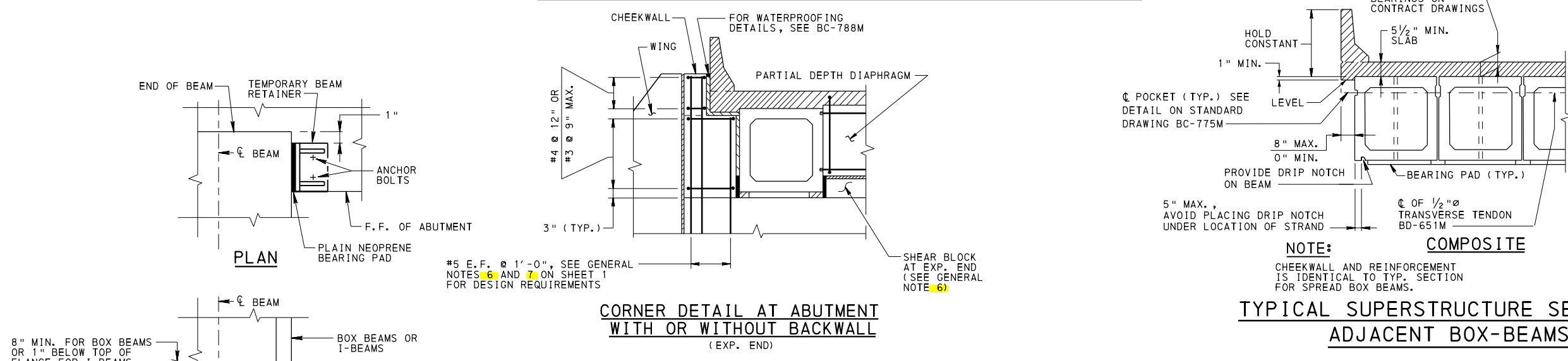
RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. Willey
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHEET 1 OF 2
BD-655M



TYPICAL STRUCTURE SECTIONS - SPREAD BOX BEAMS

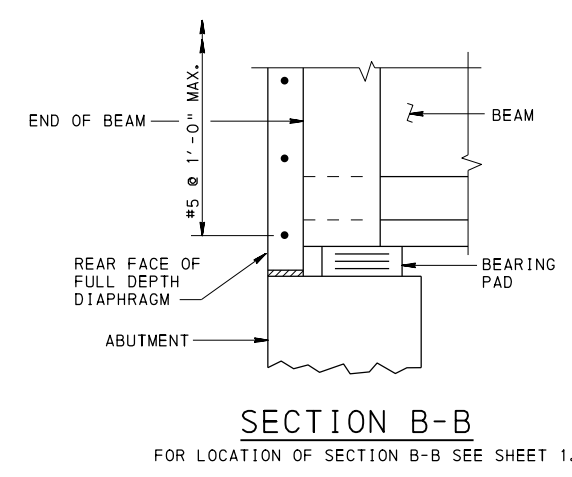


TYPICAL SUPERSTRUCTURE SECTIONS ADJACENT BOX-BEAMS

- 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

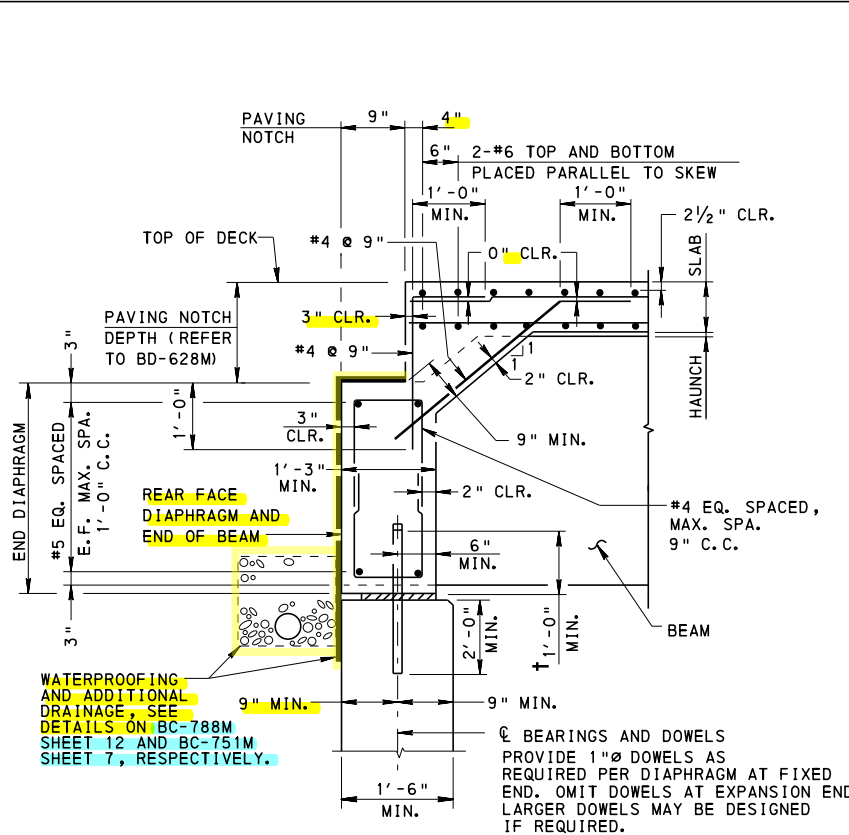
- NOTES:**
- STEEL MEMBERS AND SIZE AND NUMBER OF ANCHOR BOLTS AS REQUIRED BY DESIGN.
 - CONSTRUCT TEMPORARY RETAINER TO PROVIDE FULL BEARING ON SURFACES OF BEAM AND ABUTMENT.



COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD TYPICAL SUPERSTRUCTURE SECTIONS BOX BEAM BRIDGES		
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. H. Willey</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 2 OF 2 BD-655M

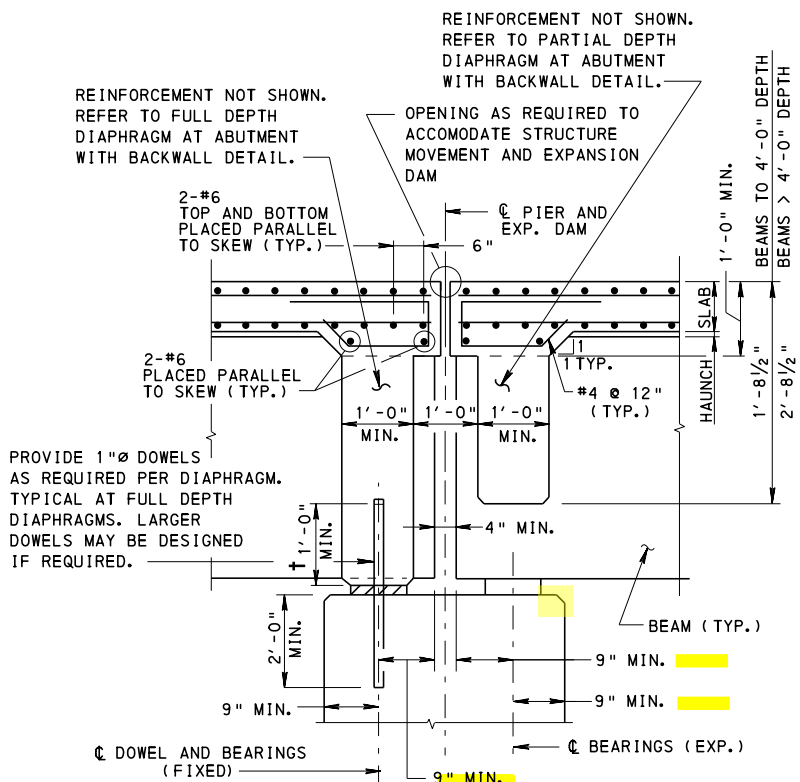
CHANGE 1

CHANGE 3



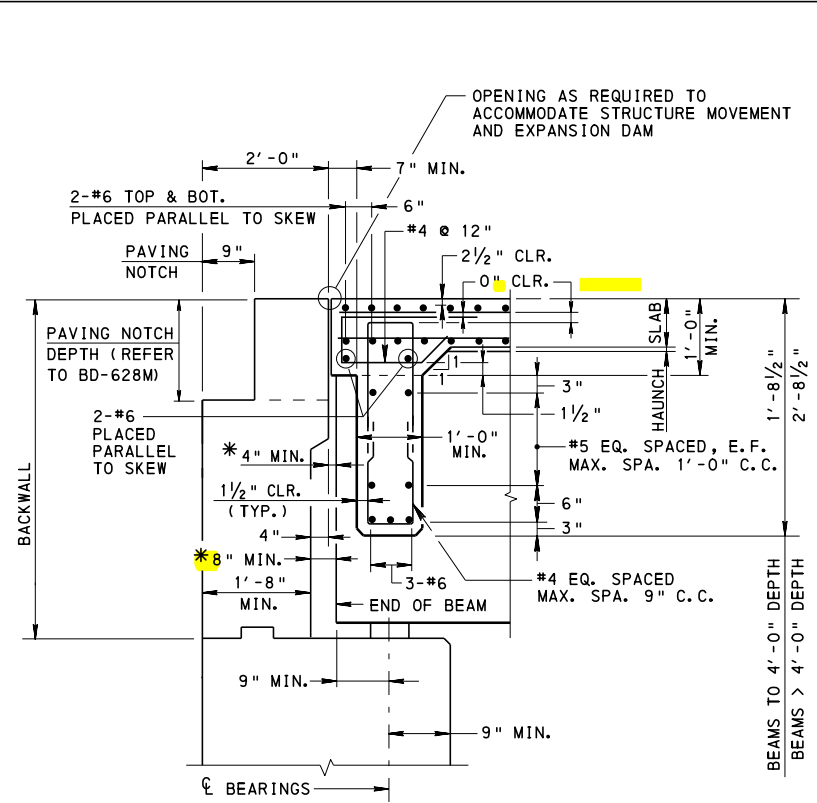
FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL

FOR FULL DEPTH DIAPHRAGM AT ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.



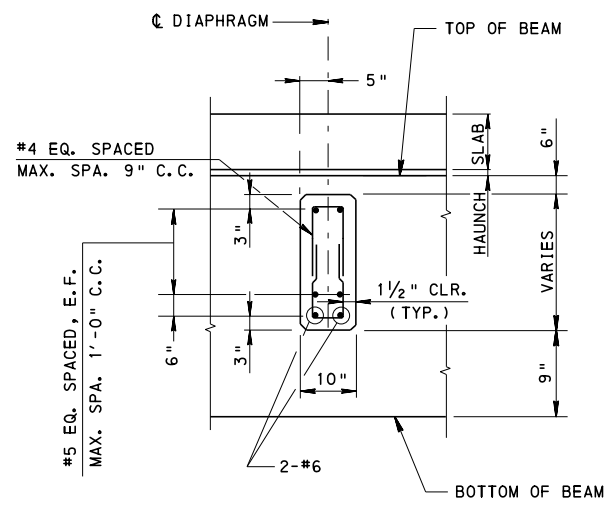
FULL AND PARTIAL DEPTH DIAPHRAGM AT PIER (FIXED AND EXP.)

FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-665M.



PARTIAL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED AND EXP.)

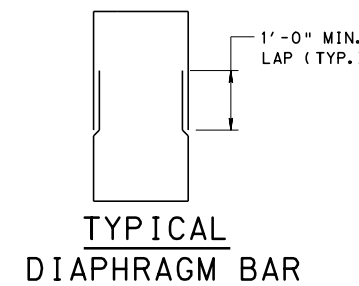
SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.



INTERMEDIATE DIAPHRAGM

LEGEND:

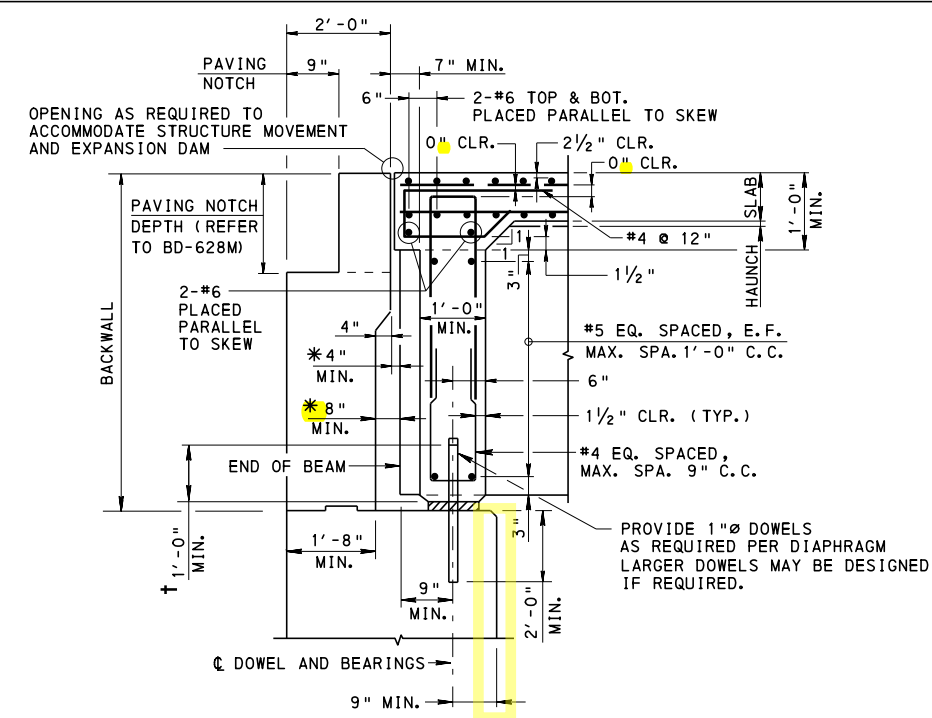
- * DETERMINED BY ANTICIPATED MOVEMENT
- † 6" FOR 17" DEEP BEAM & 10" FOR 21" DEEP BEAM



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-BEAMS
BD-665M	CONTINUITY FOR LIVE LOAD DETAILS, BOX BEAMS
BC-751M	BRIDGE DRAINAGE
BC-762M	TOOTH EXPANSION DAM
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL JOINT
BC-767M	NEOPRENE STRIP SEAL
BC-775M	MISCELLANEOUS PRESTRESS DETAILS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS

REFERENCE DRAWINGS



FULL DEPTH DIAPHRAGM AT ABUTMENT WITH BACKWALL (FIXED)

SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.

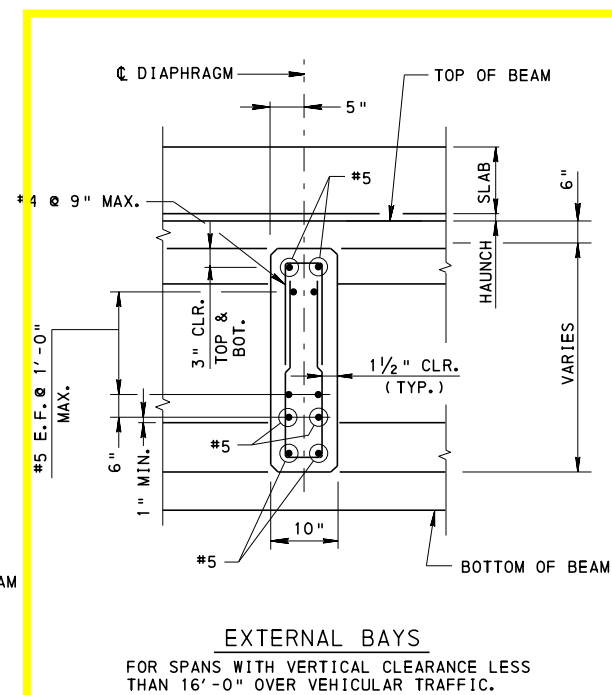
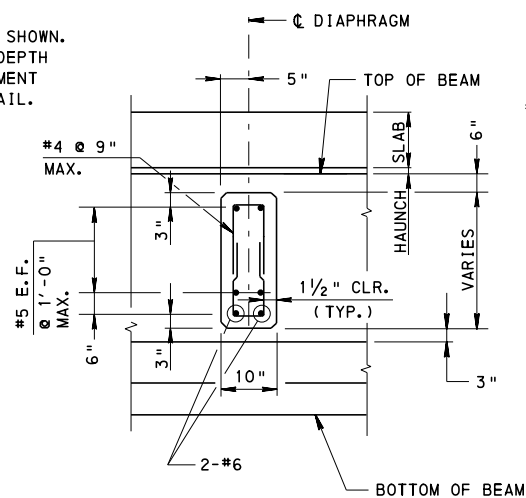
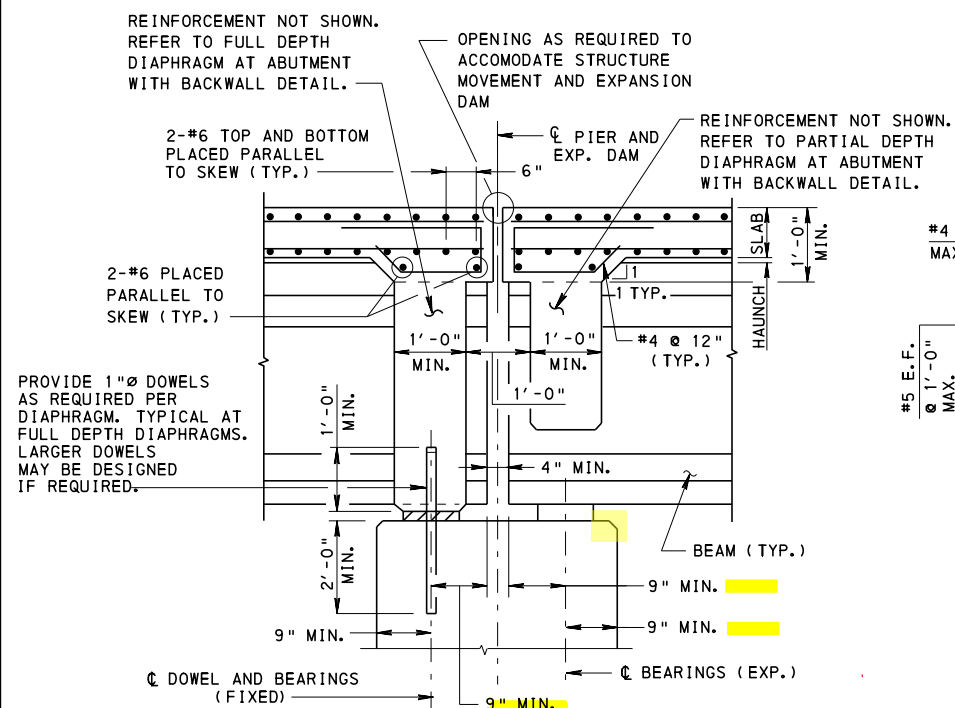
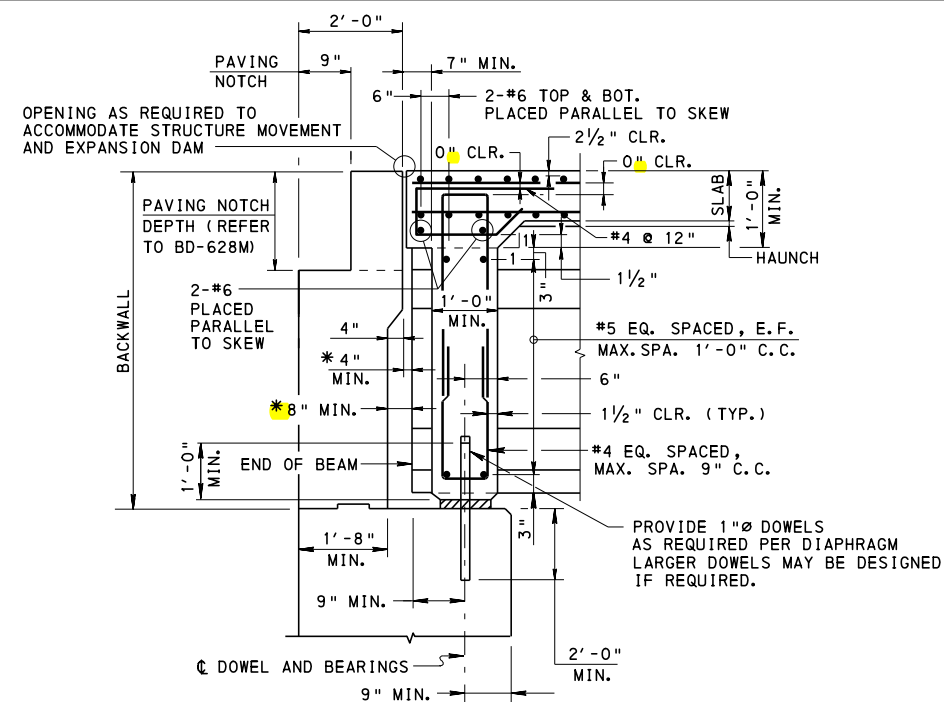
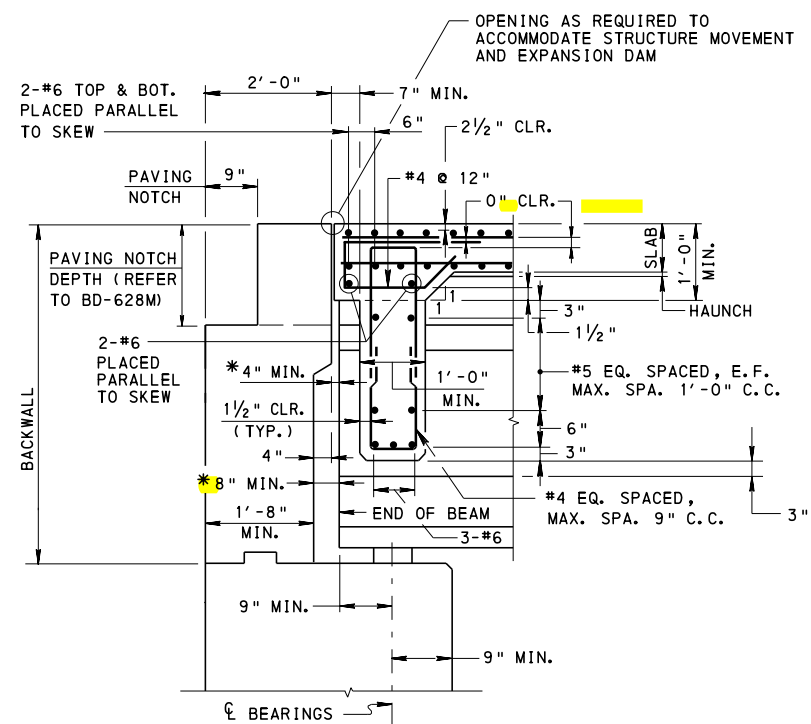
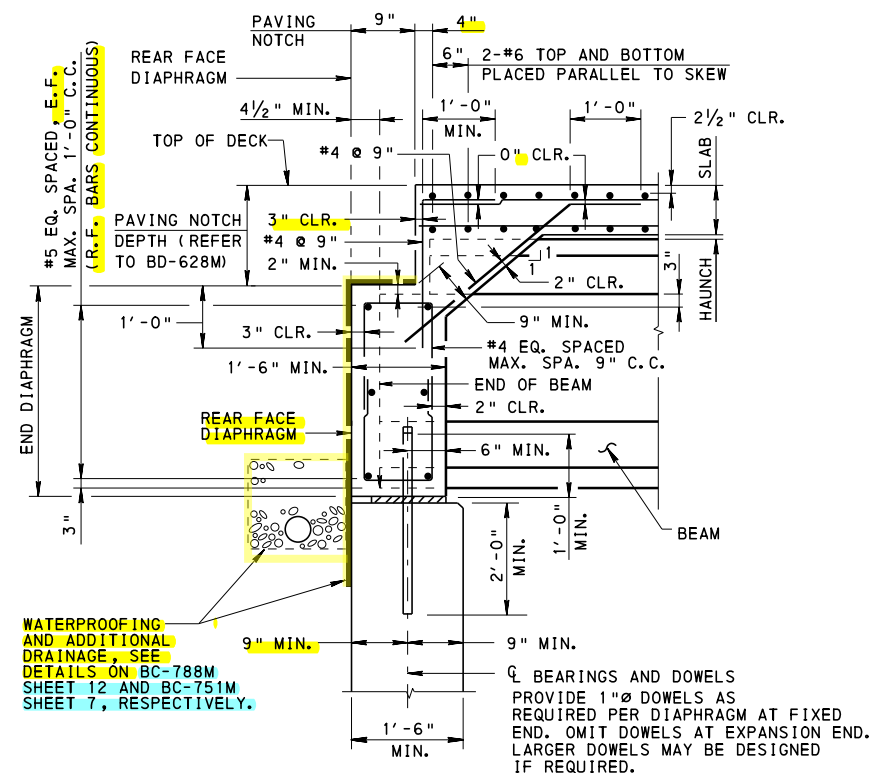
GENERAL NOTES:

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.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY

STANDARD TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES

RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014	SHEET 1 OF 7
Thomas P. Maciore CHIEF BRIDGE ENGINEER	Brian S. Thompson ACTING DIR. BUREAU OF PROJECT DELIVERY	BD-656M



LEGEND:

* DETERMINED BY ANTICIPATED
MOVEMENT

NOTE:

FOR TYPICAL DIAPHRAGM BAR DETAIL, SEE SHEET 1.

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DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES

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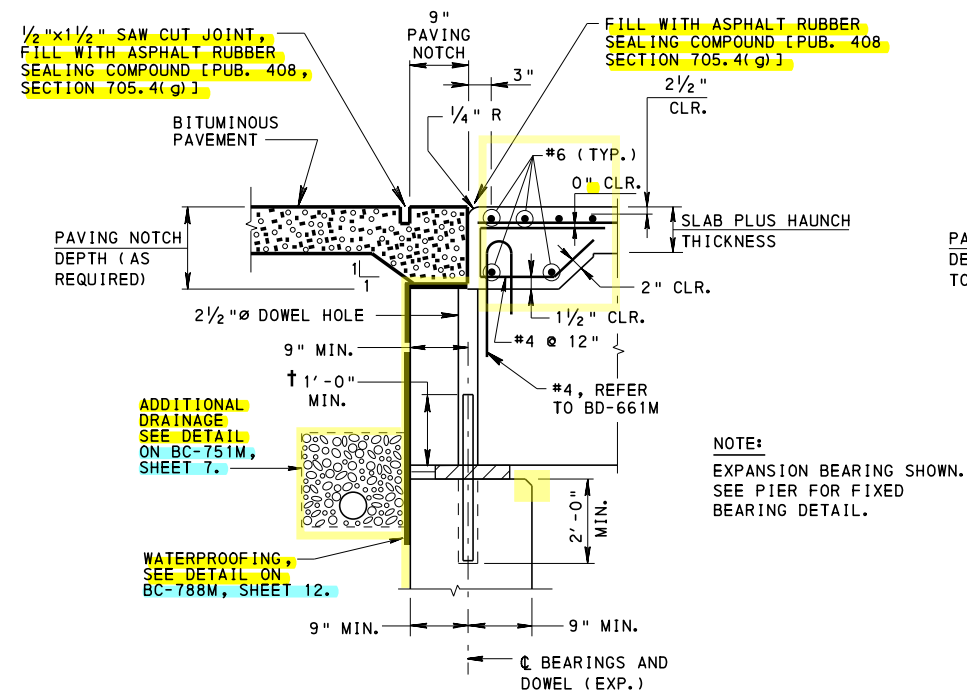
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SHEET 2 OF 7

BD-656M

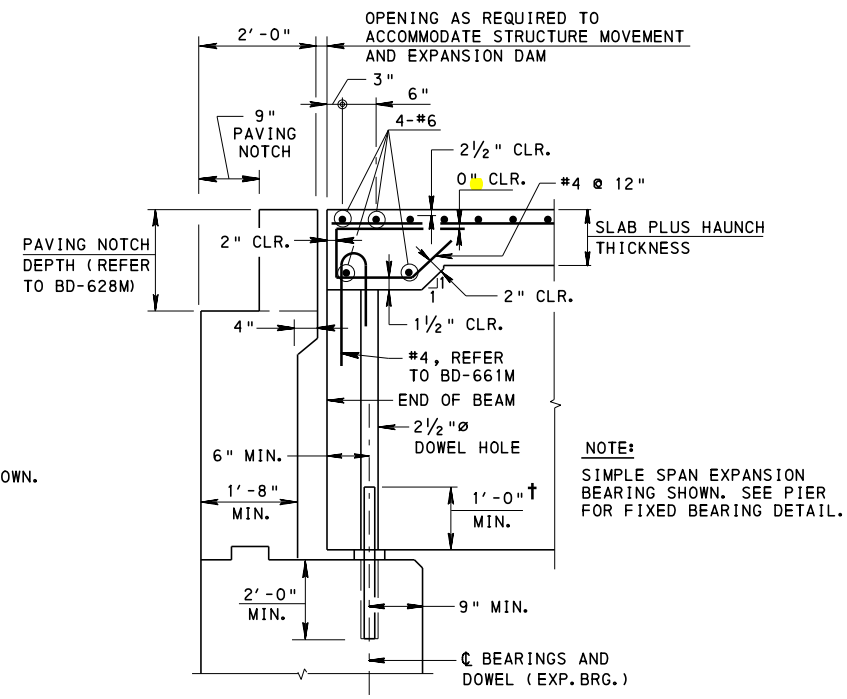
TYPICAL LONGITUDINAL SECTIONS FOR I-BEAMS

SEE SHEET 1 FOR NOTES



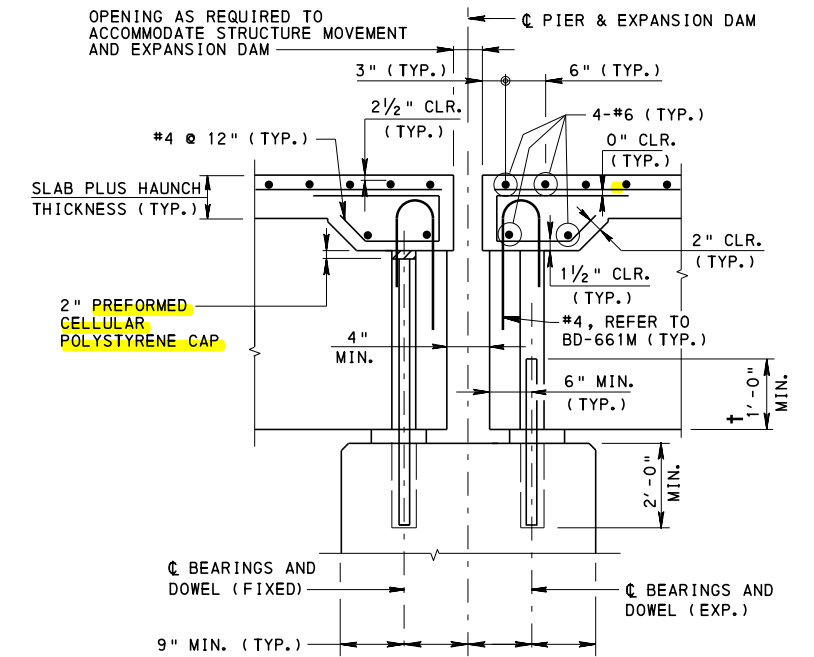
ABUTMENT WITHOUT BACKWALL

FOR ABUTMENT WITHOUT BACKWALL AND WITHOUT PAVING NOTCH, SEE SHEET 4.



ABUTMENT WITH BACKWALL

SECTION SIMILAR FOR ABUTMENT WITHOUT PAVING NOTCH.



PIER

FOR CONTINUITY DIAPHRAGM DETAIL, SEE BD-665M.

TYPICAL LONGITUDINAL SECTIONS FOR ADJACENT BOX BEAMS (COMPOSITE)

ADJACENT BOX BEAM NOTES:

- FOR DOWEL, TENDON AND SHEAR BLOCK REQUIREMENTS, SEE BD-651M.
- DOWEL HOLES IN SUBSTRUCTURE UNITS:
PIER BENTS AND HAMMERHEAD PIERS - 3" Ø PREFORMED HOLES. FILL HOLES WITH NON-SHRINK GROUT AFTER SHEAR KEYS ARE GROUTED.
OTHER SUBSTRUCTURE UNITS - DRILL 2" Ø HOLES AFTER SHEAR KEYS ARE GROUTED. FILL HOLES WITH NON-SHRINK GROUT
- DOWEL HOLES IN BEAMS :
EXP. BRGS. - FILL HOLE WITH AN APPROVED RUBBERIZED JOINT SEALING MATERIAL.
FIXED BRGS. - FILL HOLE WITH NON-SHRINK GROUT (APPLY BOND BREAKER TO PORTION OF DOWEL THAT IS ABOVE THE BRIDGE SEAT.)

LEGEND:

- † 6" FOR 17" DEEP BEAM &
10" FOR 21" DEEP BEAM

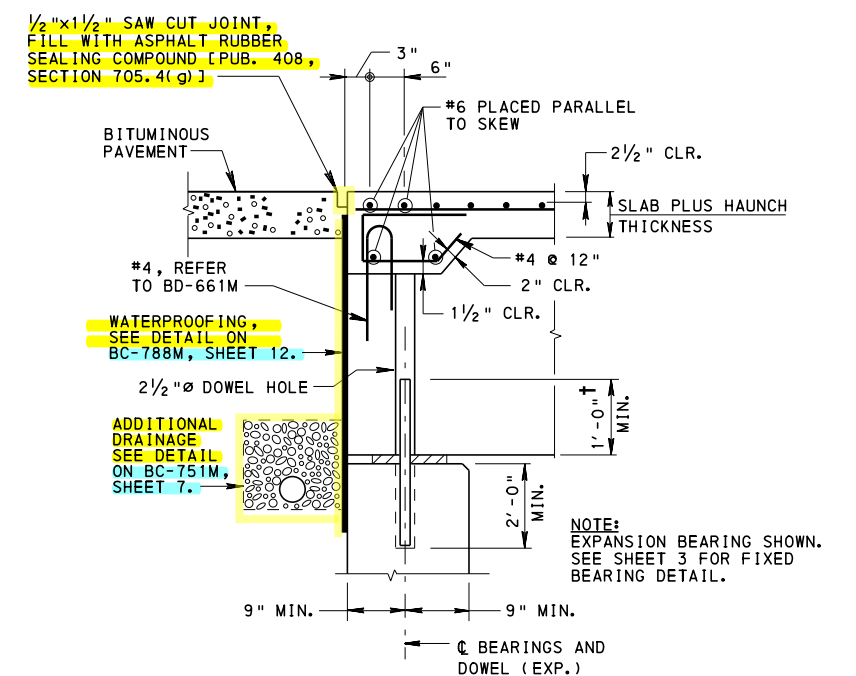
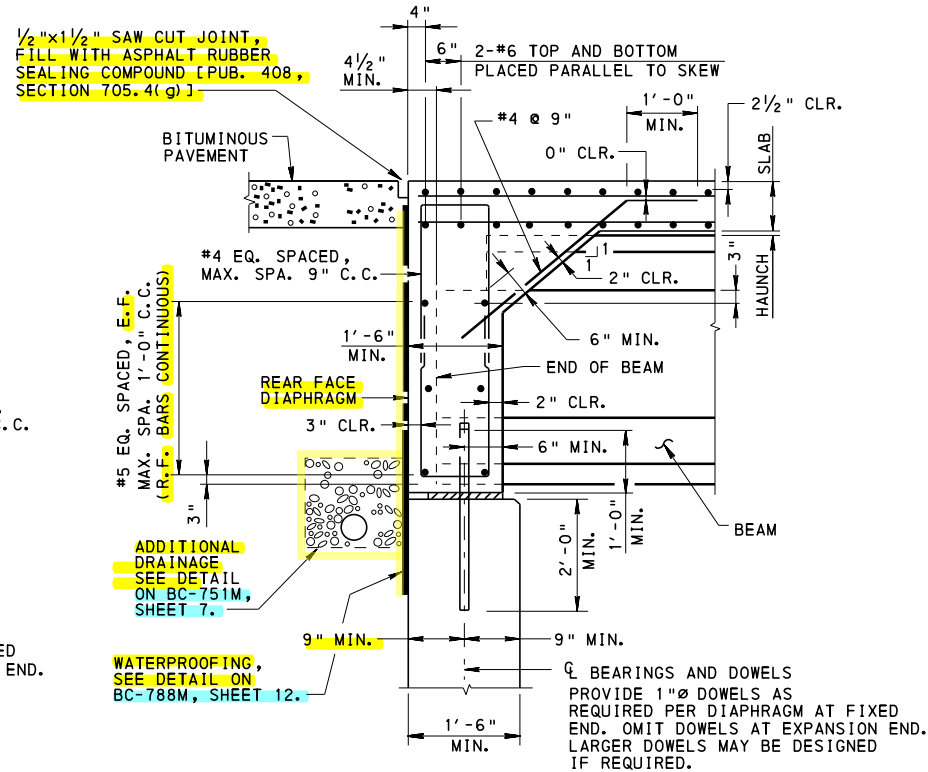
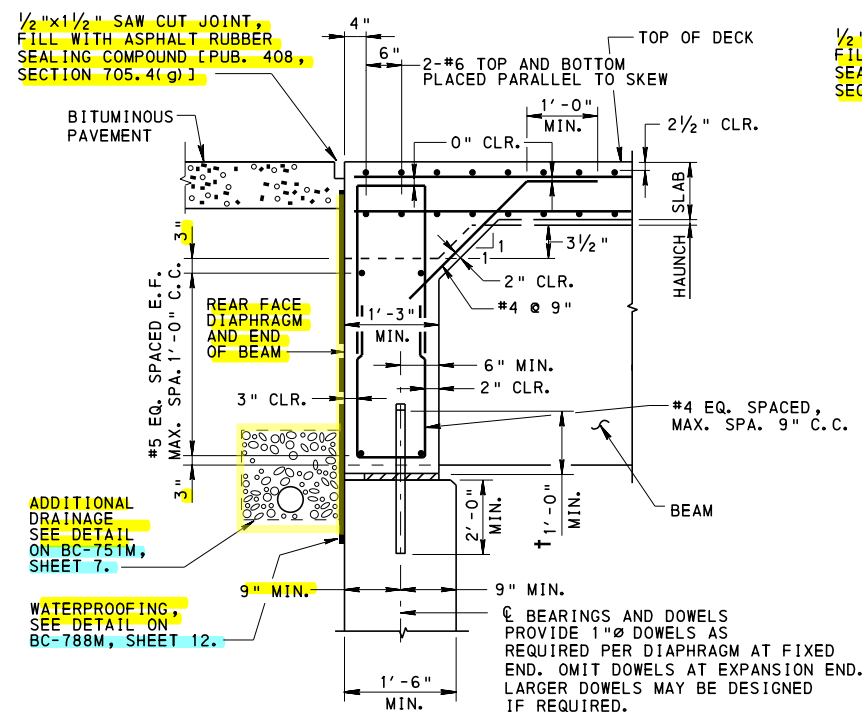
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
TYPICAL LONGITUDINAL SECTIONS
I-BEAM AND BOX BEAM BRIDGES

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Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
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SHEET 3 OF 7
BD-656M



LEGEND:

† 6" FOR 17" DEEP BEAM &
10" FOR 21" DEEP BEAM

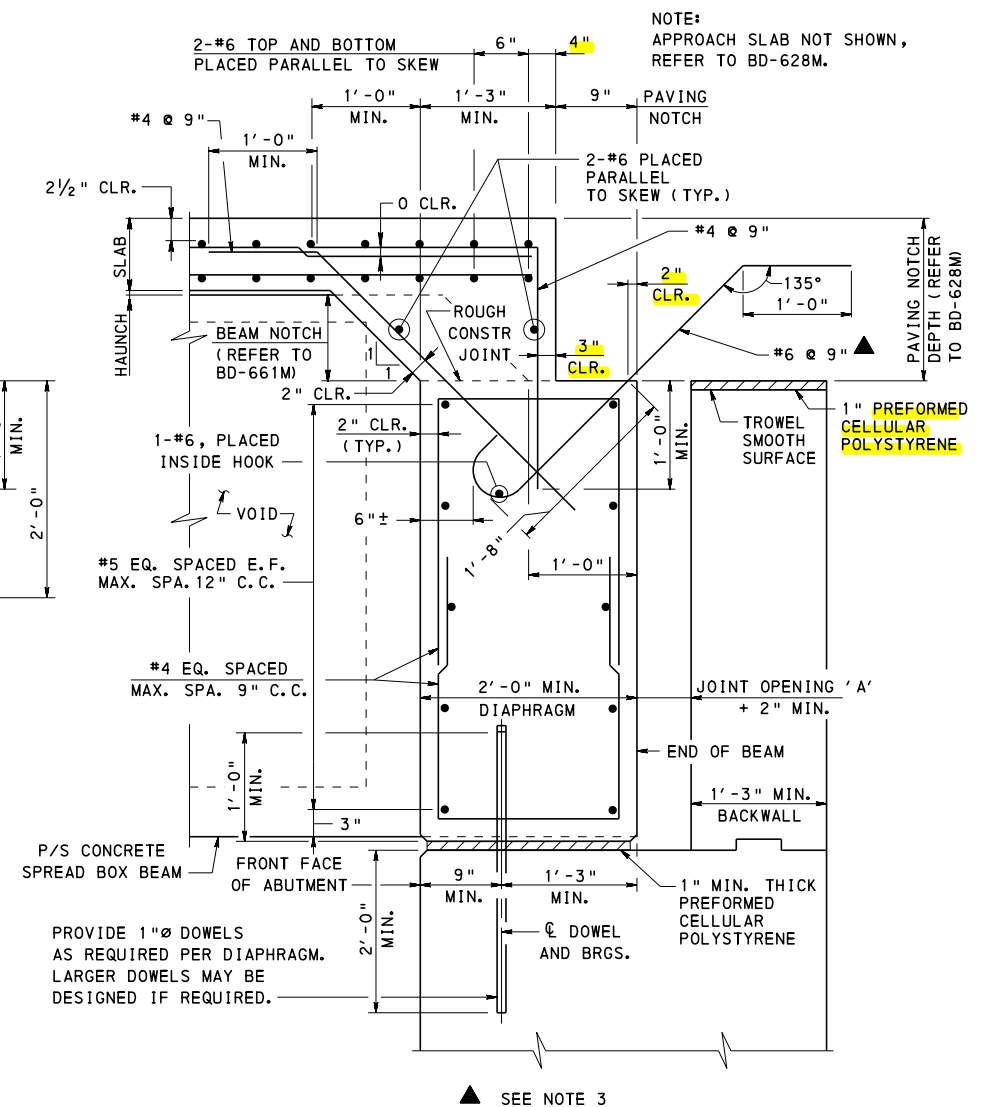
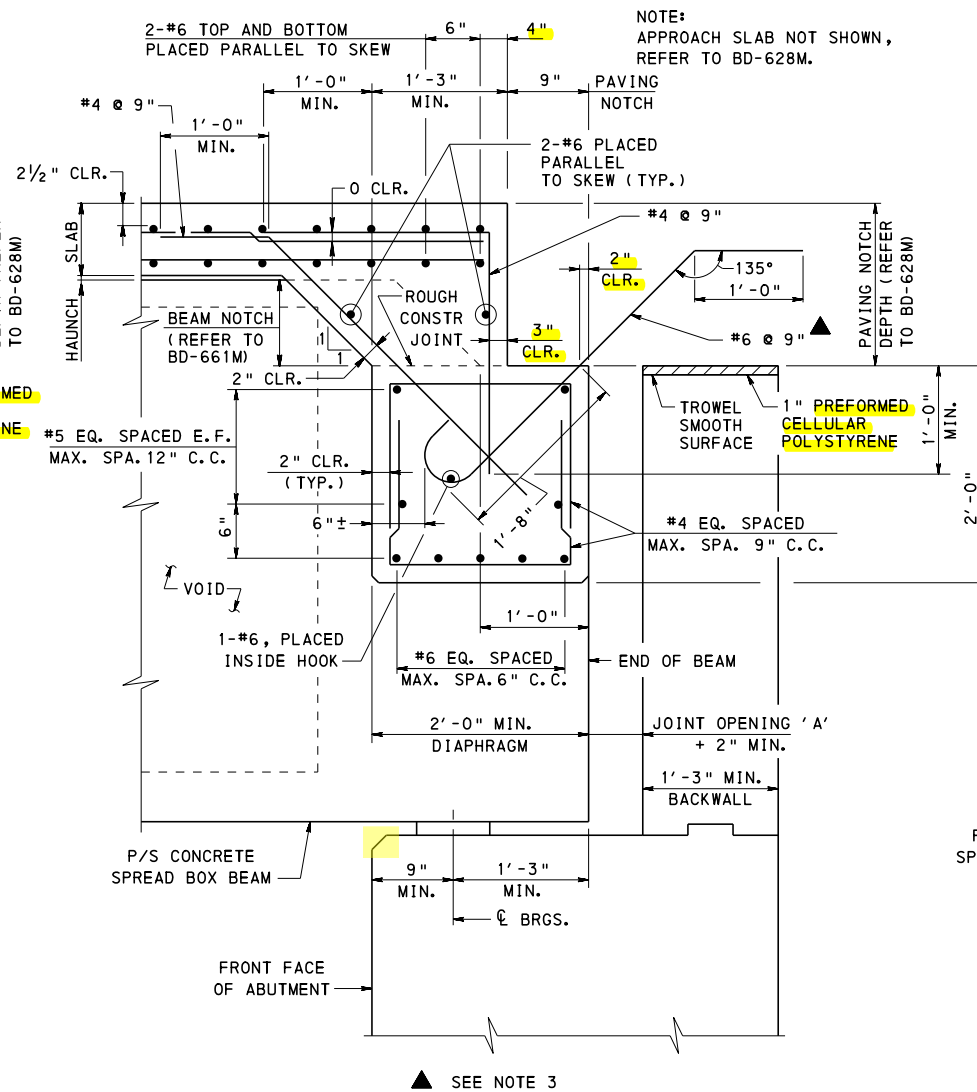
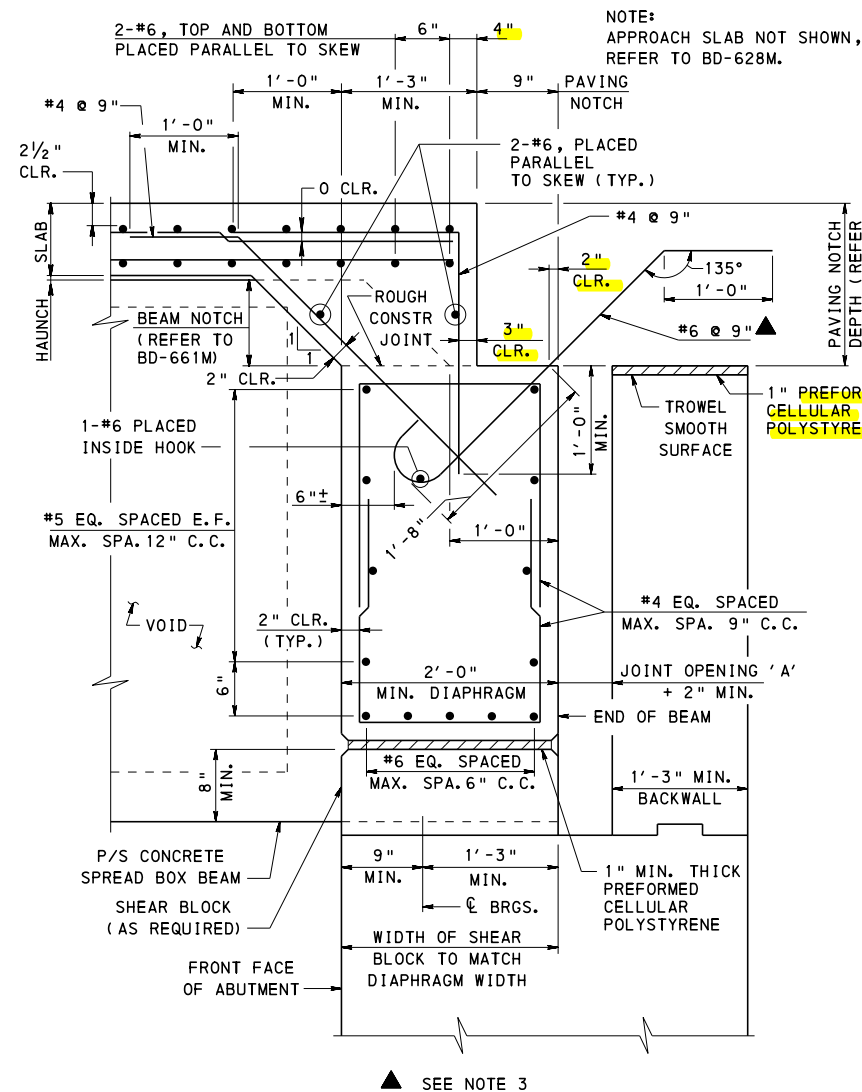
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
TYPICAL LONGITUDINAL SECTIONS
I-BEAM AND BOX BEAM BRIDGES

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SHEET 4 OF 7
BD-656M



TYPICAL LONGITUDINAL SECTIONS FOR SPREAD BOX BEAMS
WITH TYPE 3 APPROACH SLABS
(REFER TO BD-628M FOR BEAM DEPTH LIMITATIONS)

- ## 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, SHT. 24.

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DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

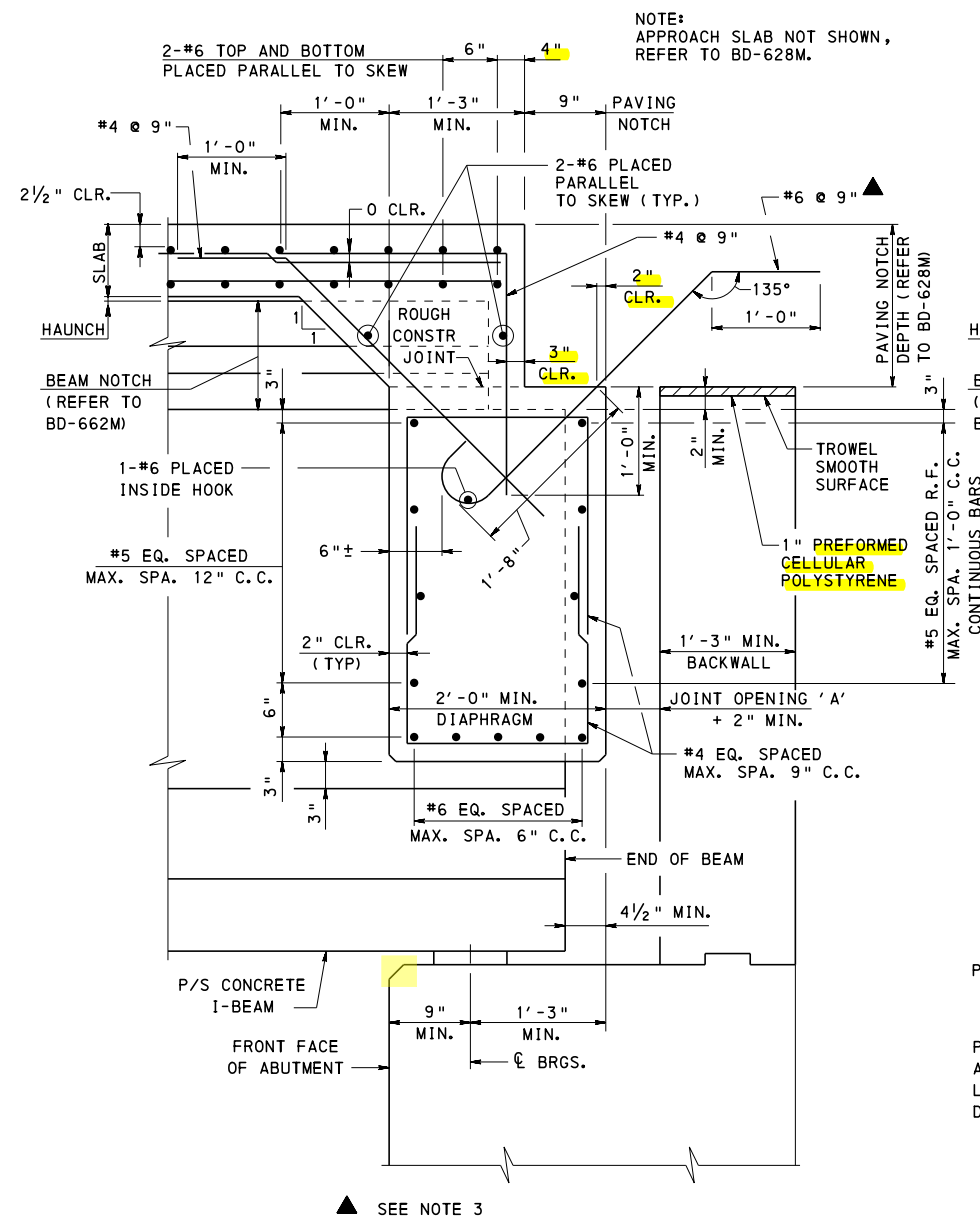
STANDARD TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES

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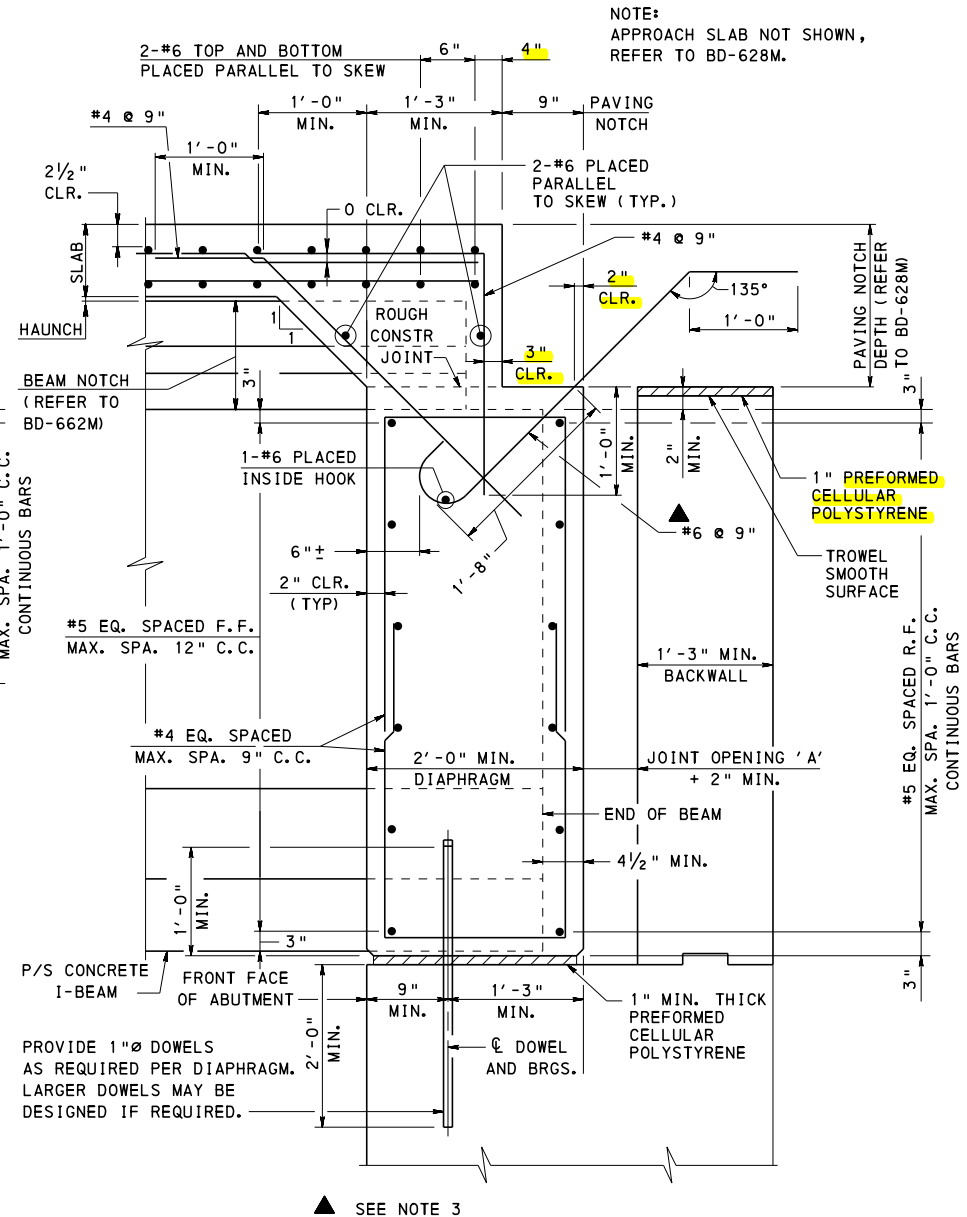
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SHEET 5 OF 7

BD-656M

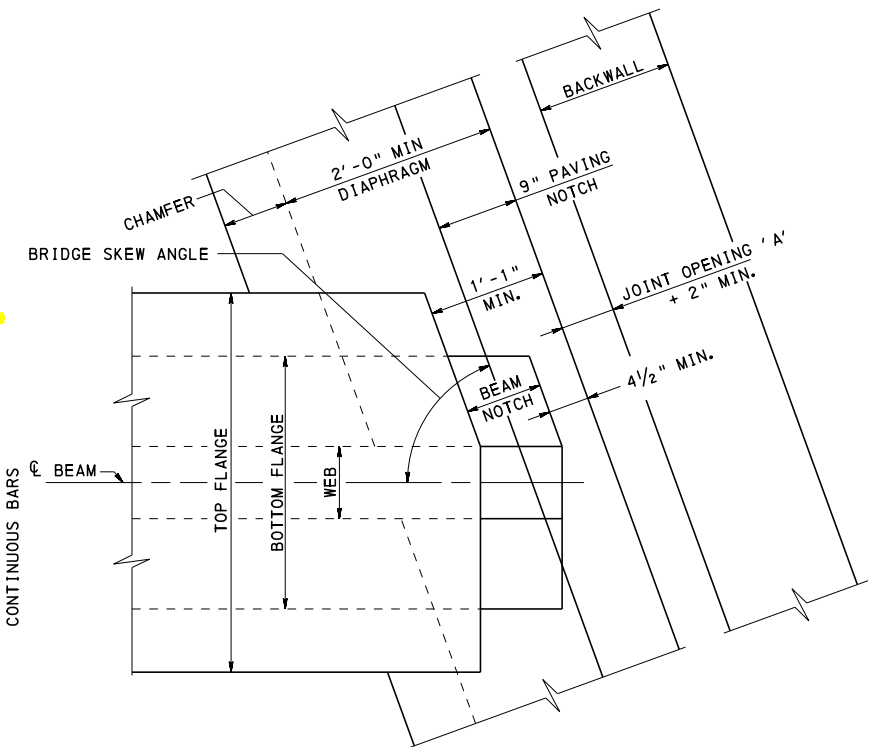


**PARTIAL DEPTH DIAPHRAGM AT ABUTMENT
WITH BACKWALL (FIXED AND EXPANSION)**



**FULL DEPTH DIAPHRAGM AT ABUTMENT
WITH BACKWALL (FIXED)**

**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, SHT.24.

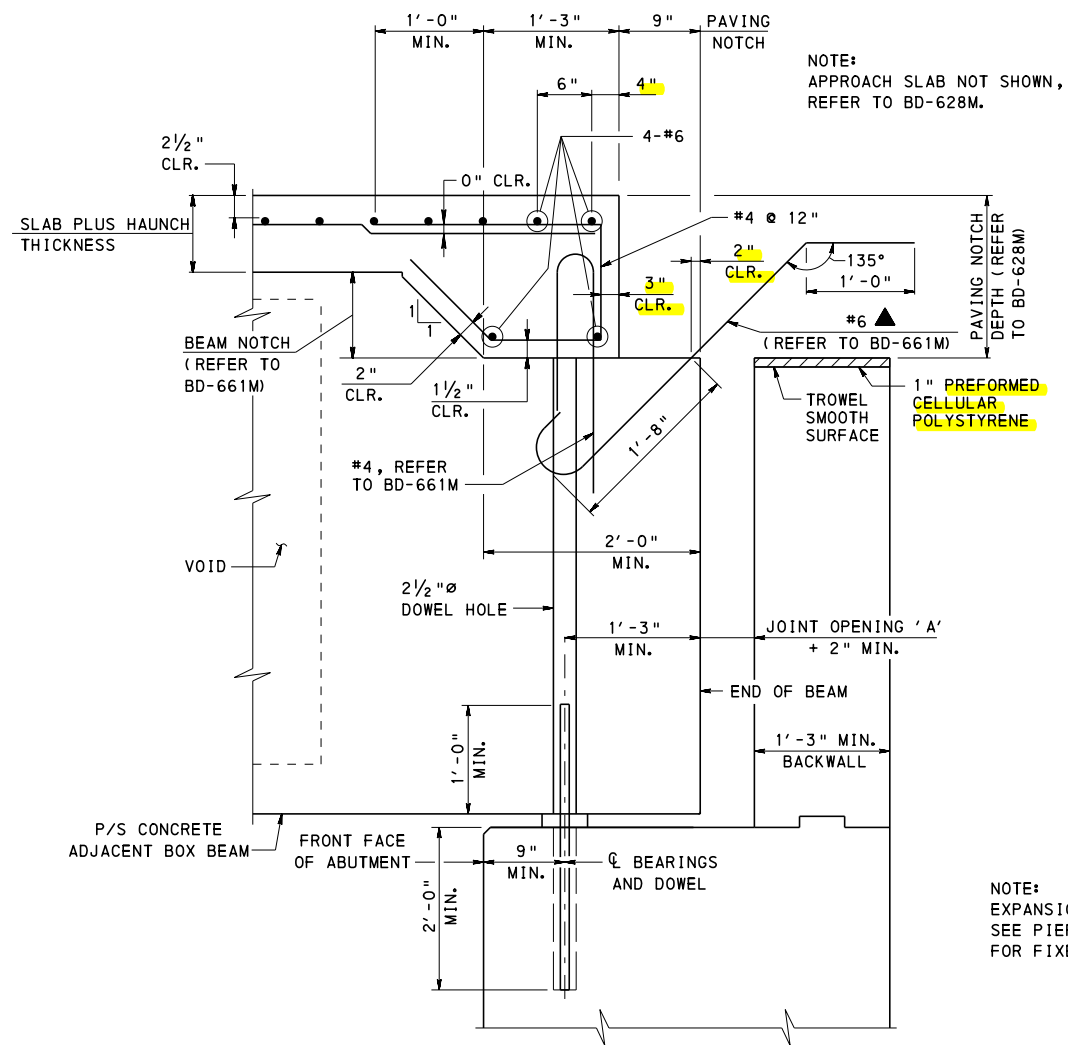
**COMMONWEALTH OF PENNSYLVANIA
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**STANDARD
TYPICAL LONGITUDINAL SECTIONS
I-BEAM AND BOX BEAM BRIDGES**

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SHEET 6 OF 7
BD-656M

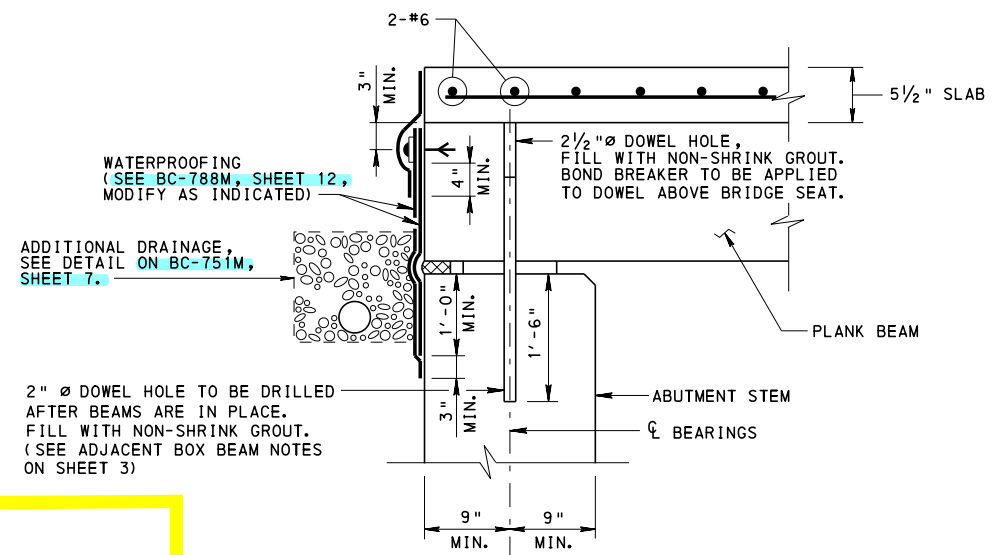


▲ SEE NOTE 3

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.

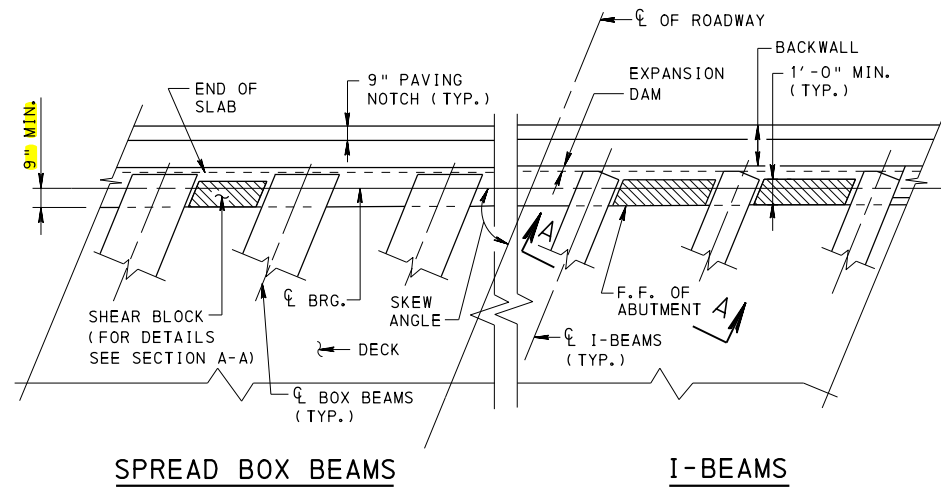
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
TYPICAL LONGITUDINAL SECTIONS
I-BEAM, BOX BEAM AND
PLANK BEAM BRIDGES

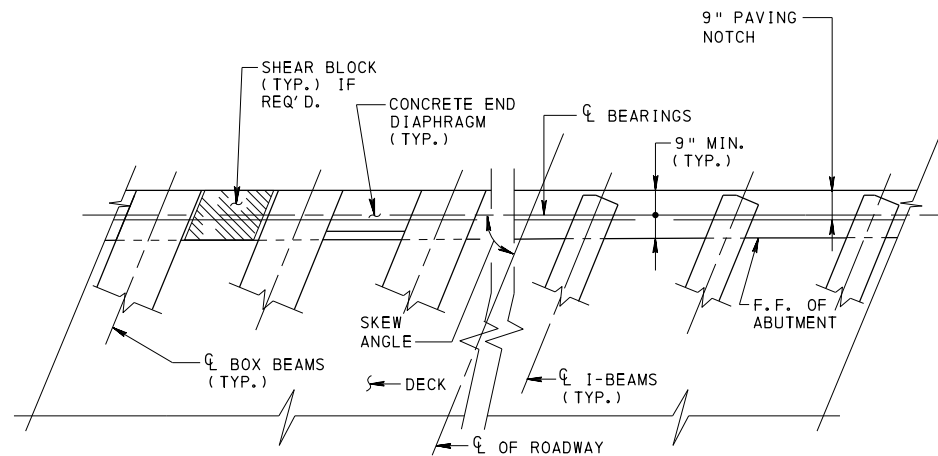
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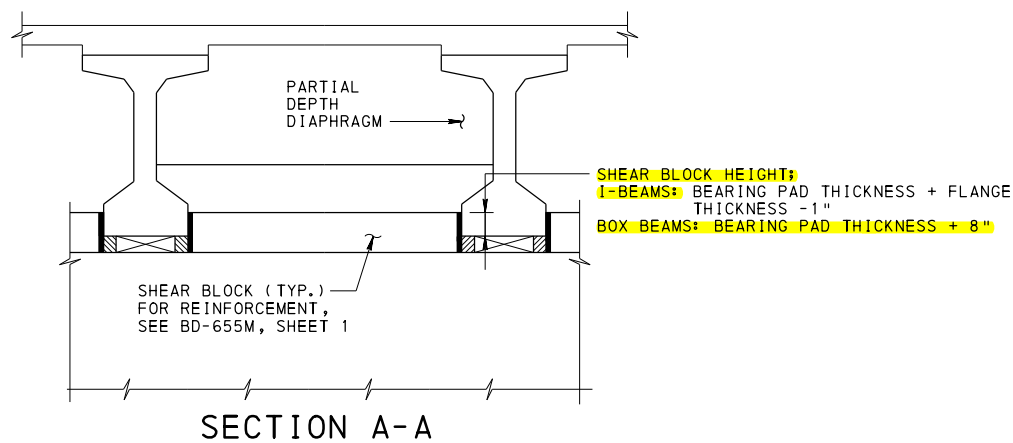
SHEET 7 OF 7
BD-656M



SPREAD BOX BEAMS I-BEAMS
ABUTMENT PLAN - WITH BACKWALL (SKEWED)

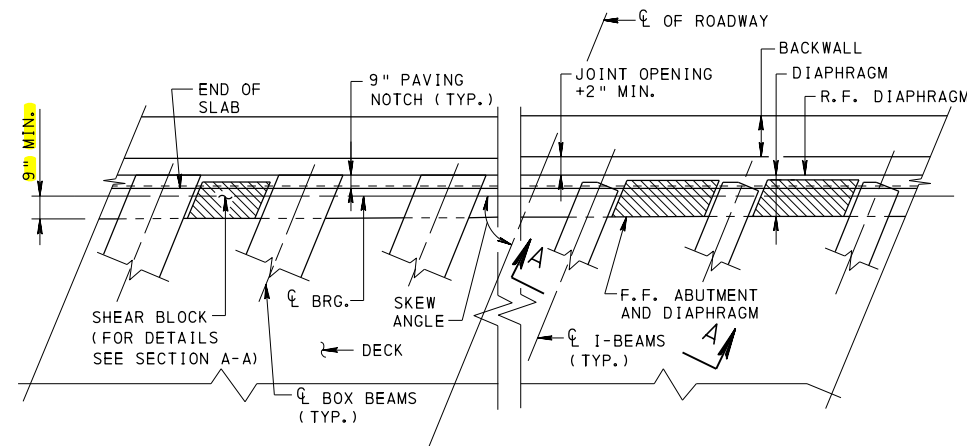


SPREAD BOX BEAMS I-BEAMS
ABUTMENT PLAN - WITHOUT BACKWALL (SKEWED)



SECTION A-A NOTE:
1. SECTION FOR SPREAD BOX AND BULB TEE BEAM IS SIMILAR TO THE SECTION FOR I-BEAM AS SHOWN ABOVE.

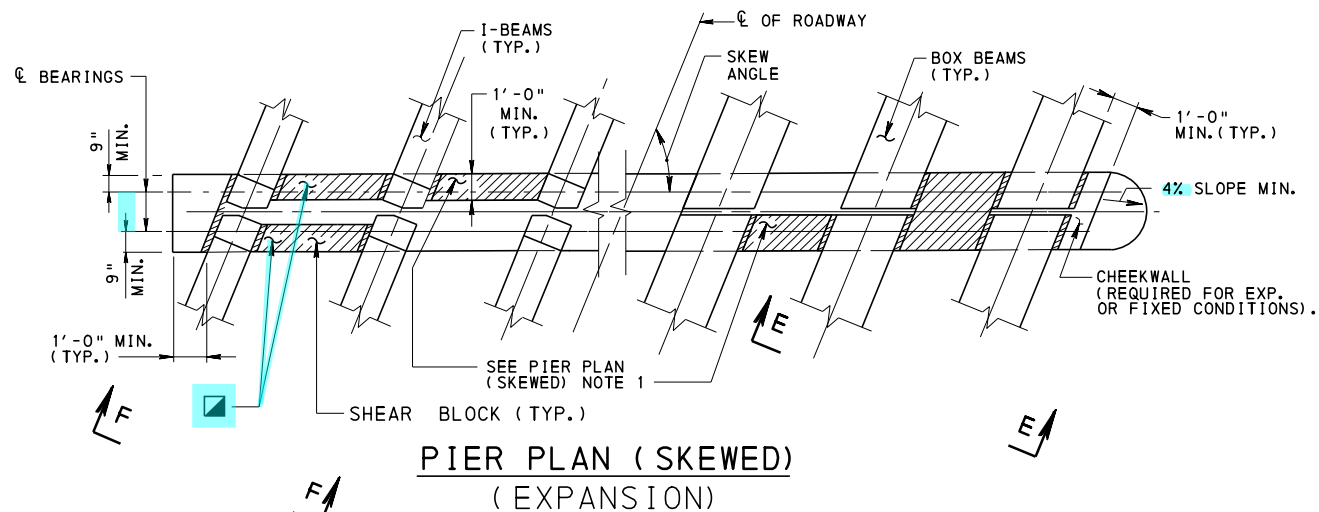
- GENERAL NOTES:
- PAVING NOTCHES MAY BE OMITTED WHEN NO FUTURE CONCRETE APPROACH IS CONTEMPLATED.
 - FOR DOWEL, SHEAR BLOCK AND BACKWALL REQUIREMENTS, SEE BD-651M.
 - EXPANSION CONDITIONS AT ABUTMENTS WITH OR WITHOUT BACKWALL REQUIRE AS A MINIMUM SHEAR BLOCKS BETWEEN THE FASCIA AND FIRST INTERIOR BEAM FOR I-BEAM 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 AND SPREAD BOX BEAM BRIDGES).
 - REFER TO BD-653M AND BD-656M FOR I-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 - I-BEAM BRIDGES
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-23M	BRIDGE APPROACH SLABS
REFERENCE DRAWINGS	

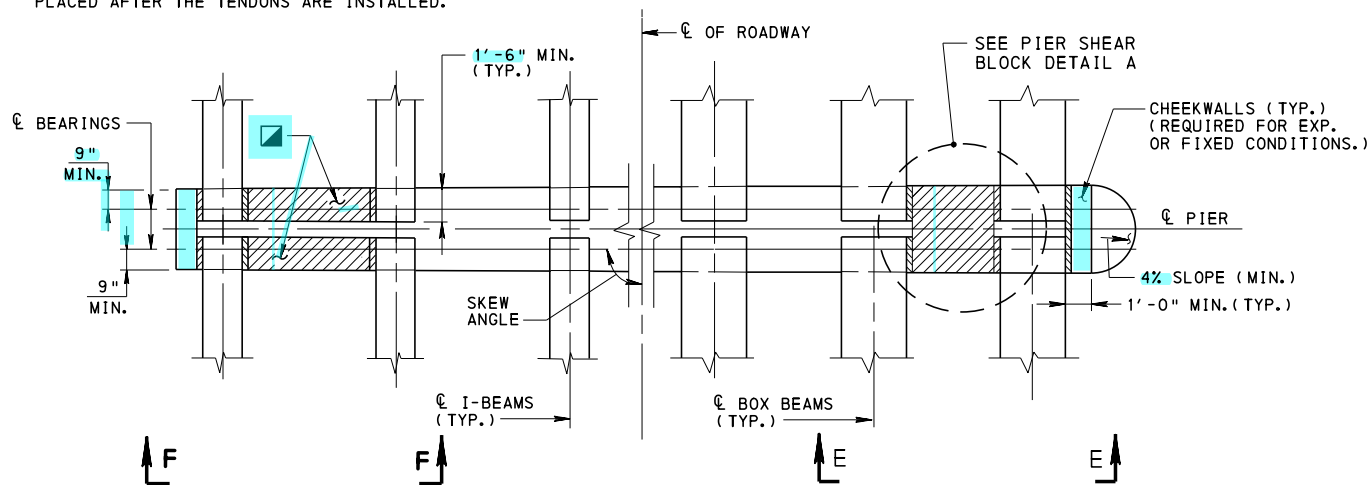
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD I-BEAM AND BOX BEAM BRIDGES WITH BACKWALL AND WITHOUT BACKWALL		
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Wiley</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 1 OF 1 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 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.

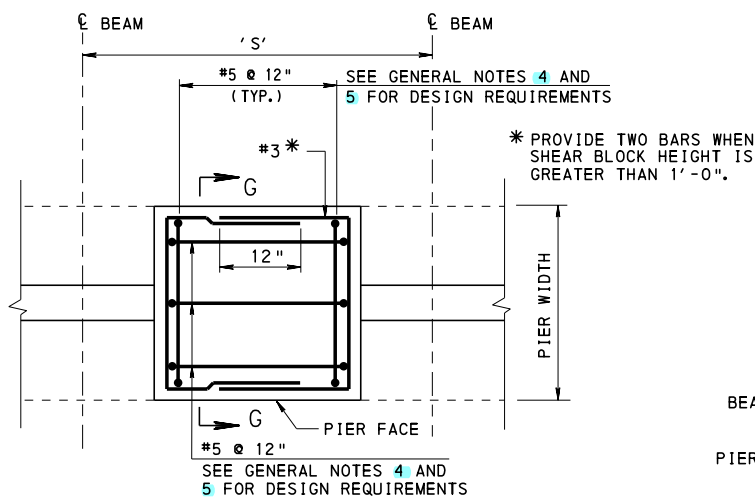
TWO SEPARATE SHEAR BLOCKS SHOWN FOR I-BEAMS. ONE SINGLE SHEAR BLOCK, EXTENDING THE FULL WIDTH OF THE PIER, IS PERMITTED.



PIER PLAN (90°) (EXPANSION)

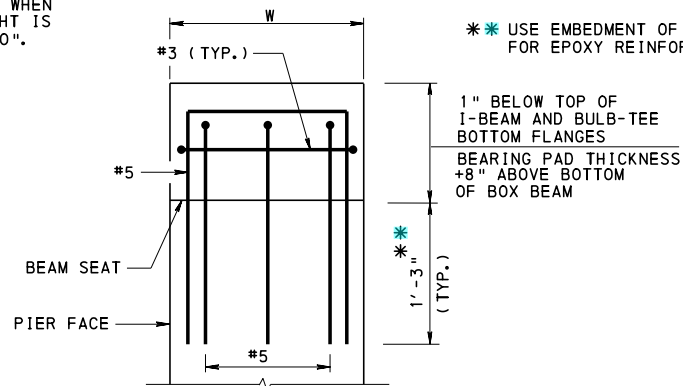
PIER PLAN (90°) NOTE:

- ADJACENT BOX BEAM BRIDGES ARE SIMILAR.



PIER SHEAR BLOCK DETAIL A PLAN VIEW

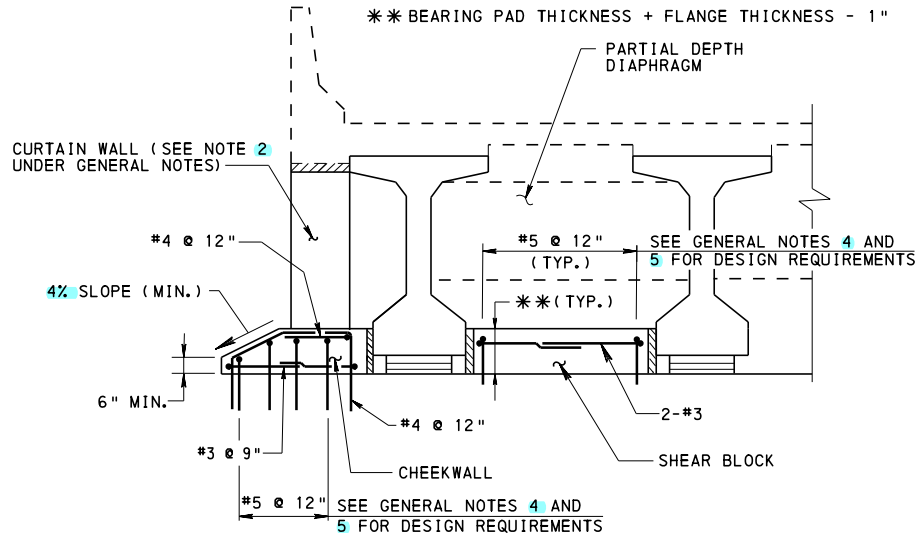
ALL SPANS OF EQUAL 'S' DIMENSION



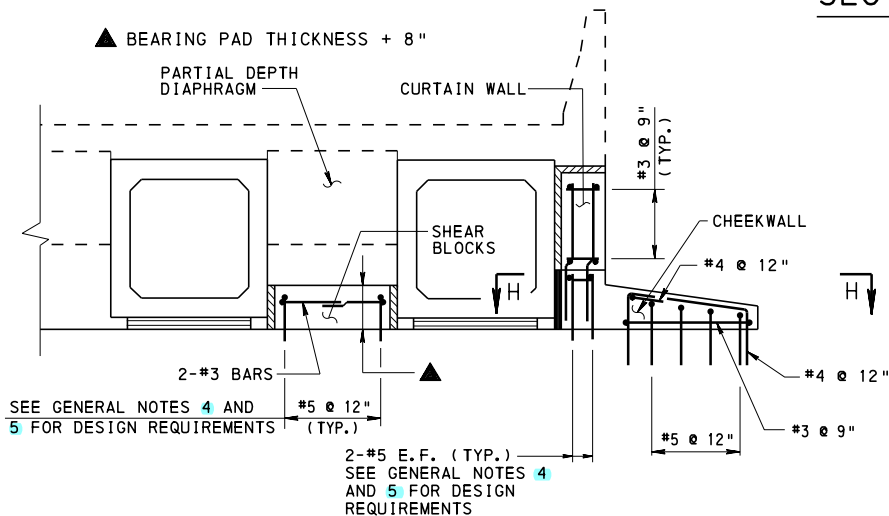
SECTION G-G

USE EMBEDMENT OF 1'-6" FOR EPOXY REINFORCEMENT.

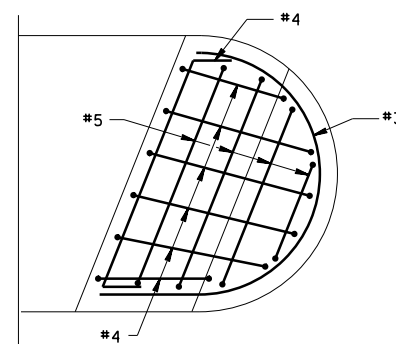
1" BELOW TOP OF I-BEAM AND BULB-TEE BOTTOM FLANGES
BEARING PAD THICKNESS +8" ABOVE BOTTOM OF BOX BEAM



SECTION F-F



SECTION E-E



SECTION H-H

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.

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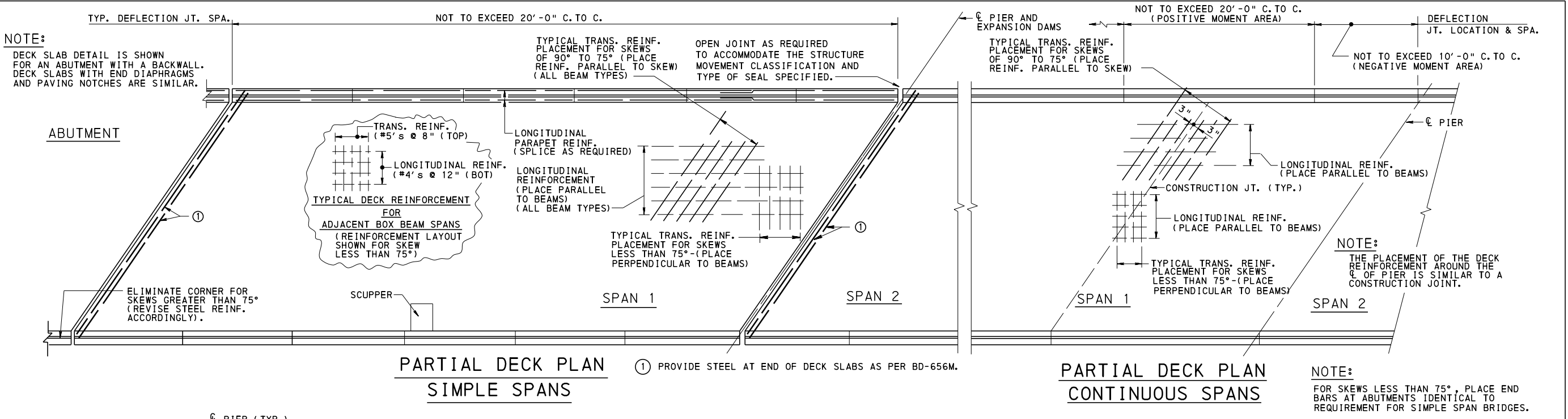
STANDARD
SHEAR BLOCK DETAILS AT PIER
P/S CONCRETE
I-BEAM AND BOX BEAM BRIDGES

BC-788M TYPICAL WATERPROOFING AND EXPANSION DETAILS
REFERENCE DRAWINGS

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CHIEF BRIDGE ENGINEER

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SHEET 1 OF 1
BD-658M

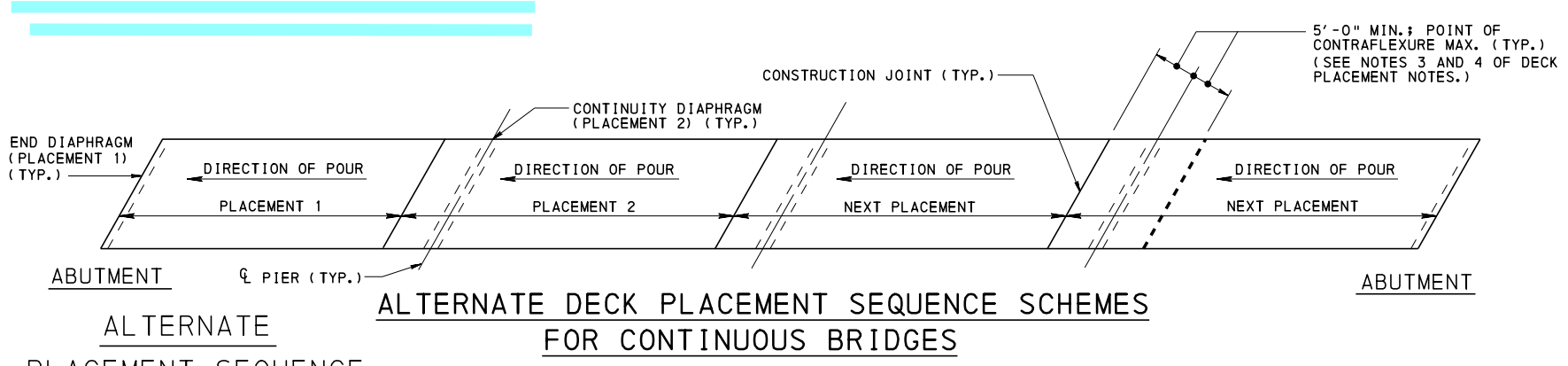


- NOTES:**
- ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706.
 - DESIGN TOP LONGITUDINAL STEEL OVER THE PIERS, IN ACCORDANCE WITH SECTION 5.14.1.2.7 OF THE LRFD SPECIFICATIONS AND THE DESIGN MANUAL PART 4 STRUCTURES.
 - FOR TYPICAL LONGITUDINAL SECTIONS, SEE BD-656M.
 - POURING SEQUENCE IS SHOWN FOR A FOUR SPAN BRIDGE. ALL OTHER SPAN COMBINATIONS ARE SIMILAR.
 - SEE BD-601M FOR PLACEMENT OF TRANSVERSE STEEL REINFORCEMENT OVER FASCIA BEAM, AND ALSO FOR MAXIMUM LENGTH OF DECK REINFORCEMENT.
 - FOR SCUPPER DETAILS AND DECK REINFORCEMENT AT SCUPPER, SEE BC-751M.
 - FOR DEFLECTION JOINT AND CONSTRUCTION JOINT DETAILS, SEE BC-752M.

PLACEMENT SEQUENCE

**DECK PLACEMENT SEQUENCE SCHEMES
FOR CONTINUOUS BRIDGES**

- | STEP NO. | ITEM |
|----------|---|
| 1. | CAST PLACEMENT 1 (INTERMEDIATE DIAPHRAGMS, SHEAR BLOCKS BETWEEN BEAMS AND END DIAPHRAGMS AT ABUTMENTS). |
| 2. | CAST PLACEMENT 2 (POSITIVE MOMENT REGION). |
| 3. | CAST PLACEMENT 3 (CONTINUITY DIAPHRAGMS AT PIERS). |
| 4. | CAST PLACEMENT 4 (NEGATIVE MOMENT REGION) : MINIMUM 2 HOURS AFTER PLACEMENT OF CONTINUITY DIAPHRAGM, WHEN DIAPHRAGM IS OVER 36" IN DEPTH. |



- DECK PLACEMENT NOTES:**
- DESIGNER TO ADD NOTE TO CONSTRUCTION DRAWINGS ALLOWING ALTERNATE DECK PLACEMENT SEQUENCE BY THE CONTRACTOR.
 - IF DETERMINED FEASIBLE BASED ON SPAN LENGTHS, FIRST CONSIDERATION SHOULD BE GIVEN TO A CONTINUOUS POUR OF THE ENTIRE DECK IF CONCRETE CAN BE MAINTAINED IN A PLASTIC STATE THROUGHOUT THE POUR.
 - WHEN CONTINUOUS DECK IS CAST IN PARTIAL WIDTH CONSTRUCTION, 5'-0" MINIMUM DOES NOT APPLY.
 - SHOW POINT OF CONTRAFLEXURE ON EACH SIDE OF THE PIER.

BD-601M	CONCRETE DECK SLAB DESIGN & DETAILS FOR BEAM BRIDGES
BD-656M	TYPICAL LONGITUDINAL SECTIONS I-BEAM AND BOX BEAM BRIDGES
BD-667M	INTEGRAL ABUTMENT DETAILS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-751M	BRIDGE DRAINAGE
BC-752M	CONCRETE DECK SLAB DETAILS
BC-762M	TOOTH EXPANSION DAM FOR PRESTRESSED CONCRETE & STEEL BEAM BRIDGES
BC-767M	NEOPRENE STRIP SEAL DAM FOR PRESTRESSED CONCRETE & STEEL I-BEAM BRIDGES
REFERENCE DRAWINGS	

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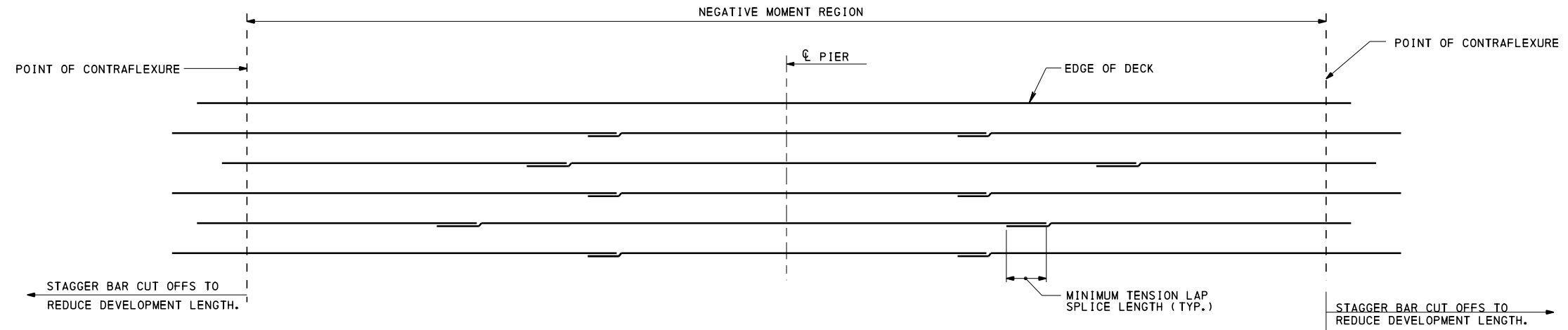
STANDARD
DECK SLAB AND STEEL
REINFORCEMENT PLACEMENT
P/S CONCRETE
I-BEAM AND BOX BEAM BRIDGES

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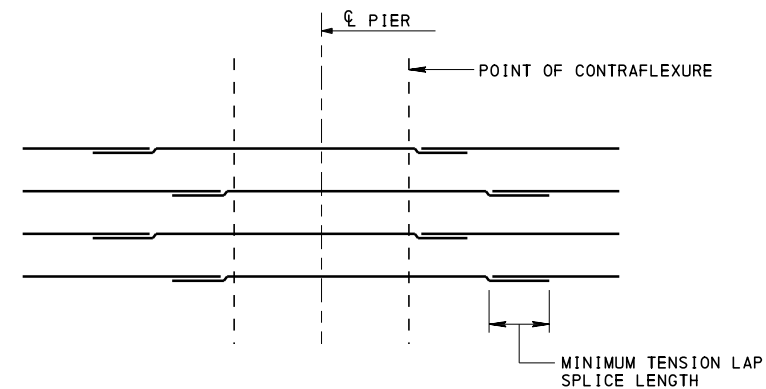
SHEET 1 OF 2
BD-660M

CHANGE 3



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'.

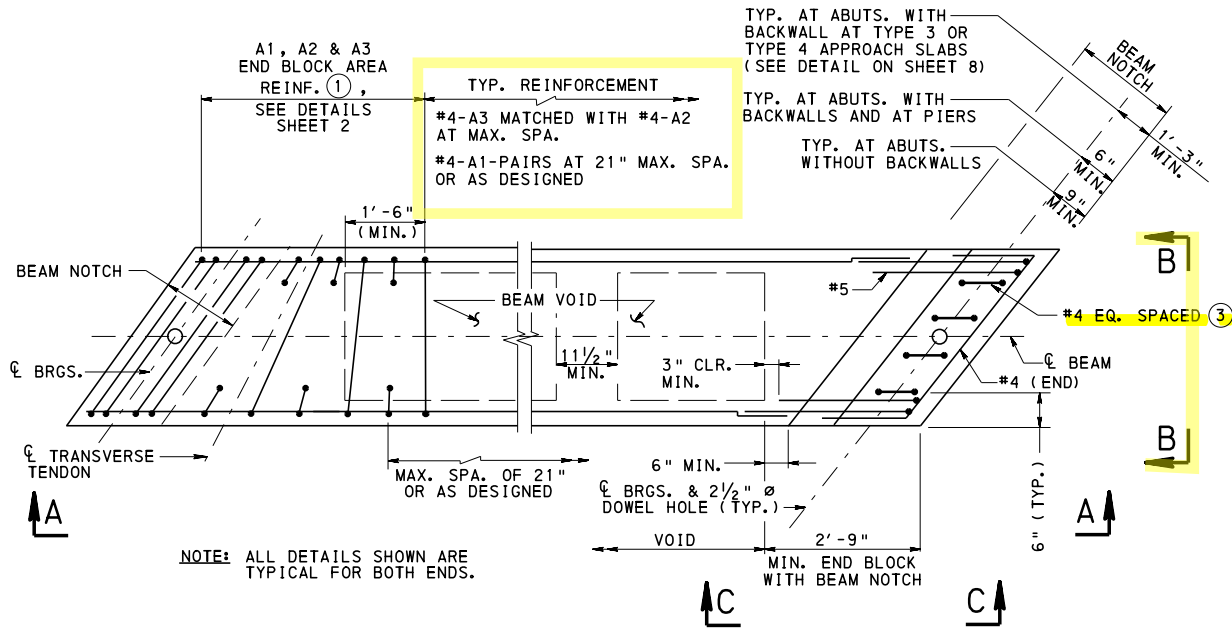
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
DECK SLAB AND STEEL
REINFORCEMENT PLACEMENT
P/S CONCRETE
I-BEAM AND BOX BEAM BRIDGES

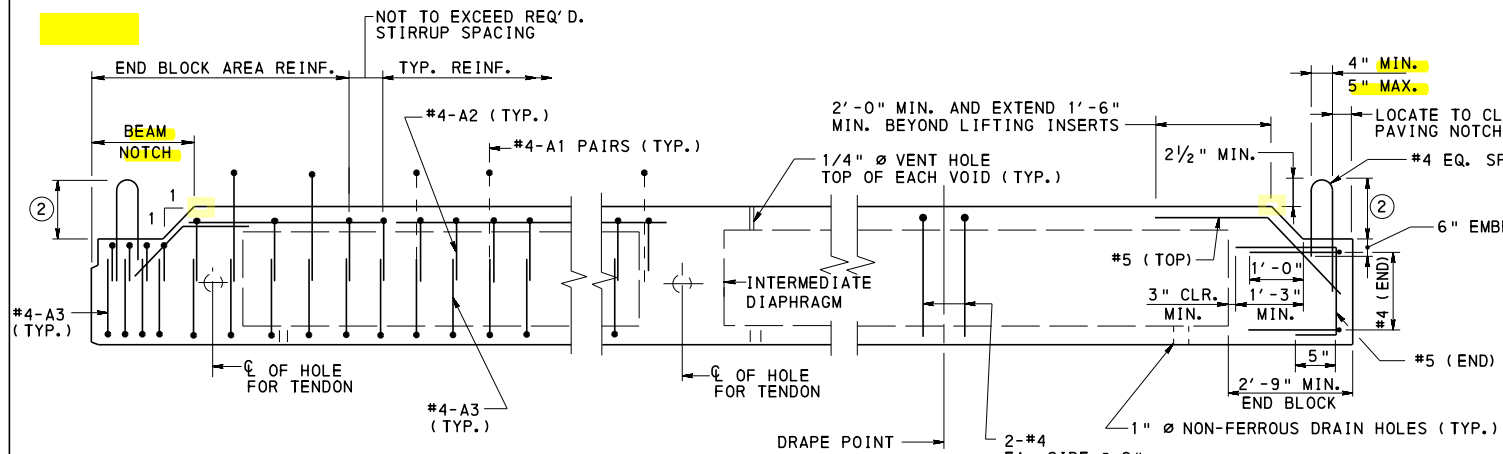
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SHEET 2 OF 2
BD-660M

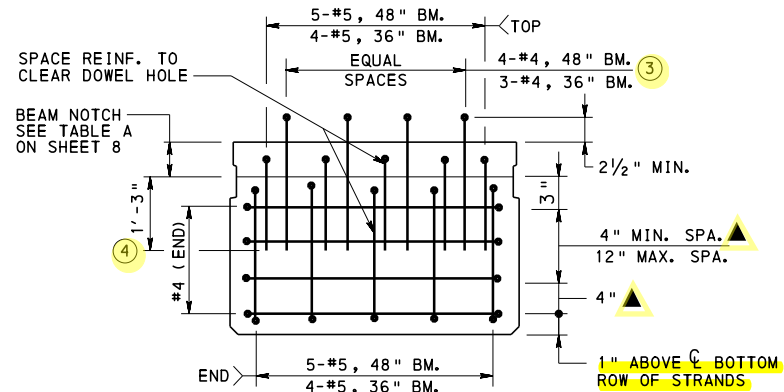


ADJACENT BOX BEAMS
PLAN-TYPICAL BEAM
(COMPOSITE)

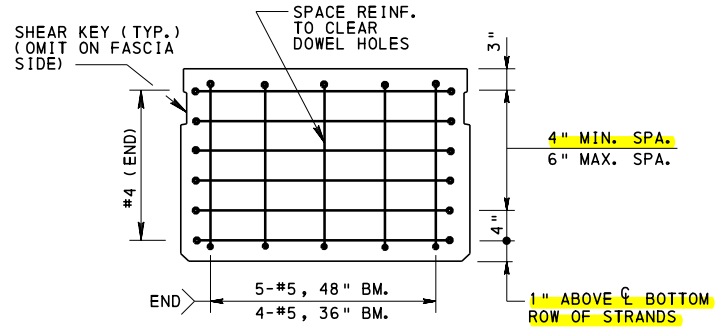


ELEVATION A-A

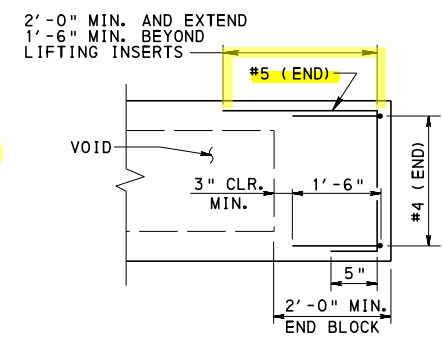
- LEGEND:**
- ① A1 MATCHED WITH A3 IS CONSIDERED A STIRRUP ONLY IN THE END BLOCK AREA. A2 MATCHED WITH A3 IS CONSIDERED A STIRRUP ALONG THE ENTIRE LENGTH OF THE BEAM. A1 IS SPACED AT 21" OR AS DESIGNED INDEPENDENTLY OF A2 AND A3 OUTSIDE THE END BLOCK AREA.
 - ② TO BE DETAILED ON THE SHOP DRAWINGS.
 - 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.



VIEW B-B
WITH BEAM NOTCH
(COMPOSITE)



VIEW B-B
WITHOUT BEAM NOTCH
(COMPOSITE)



VIEW C-C
END ELEVATION
WITHOUT BEAM NOTCH

- GENERAL NOTES:**
- ALL REINFORCEMENT STEEL BARS MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706.
 - 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	

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM

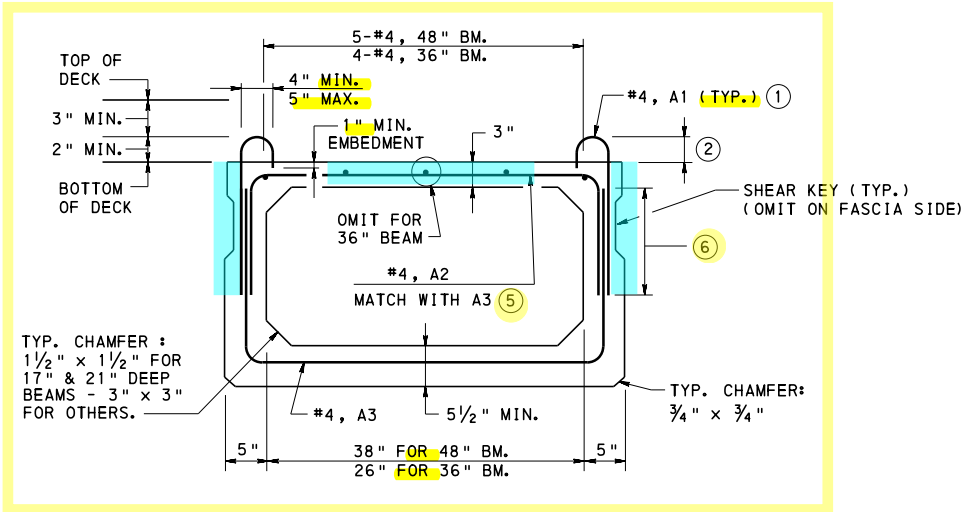
RECOMMENDED NOV. 21, 2014
THOMAS P. MACIORE
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
BRIAN D. THOMPSON
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHEET 1 OF 8
BD-661M

ADJACENT BOX BEAM NOTES:

- FOR ALTERNATE END BLOCK REINFORCEMENT DETAIL, SEE SHEET 6.
- #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.
- OMIT SHEAR KEY ON THE FASCIA SIDE OF BEAMS.
- 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 DM-4 D5.10.10.1, ALTERNATE A1 AND A2 WITH A3 TO THE END OF THE 3" STIRRUP SPACING.



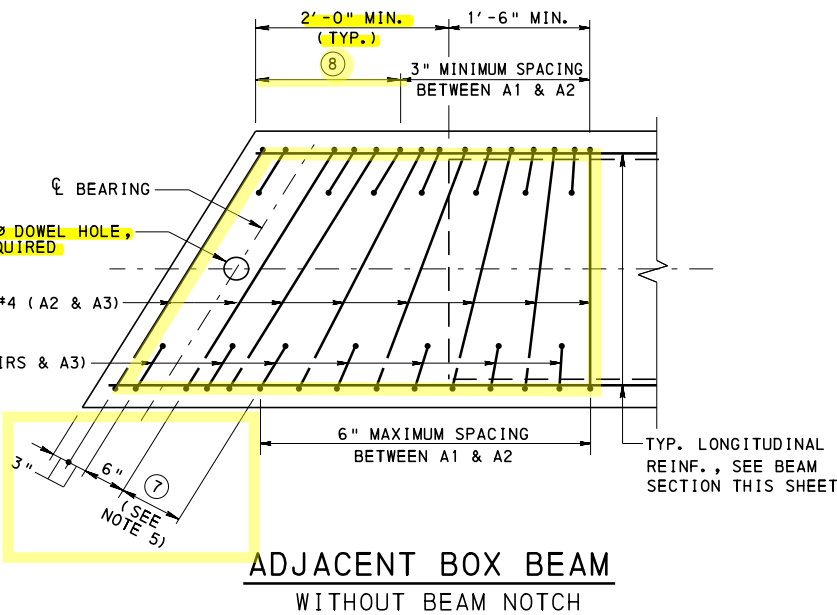
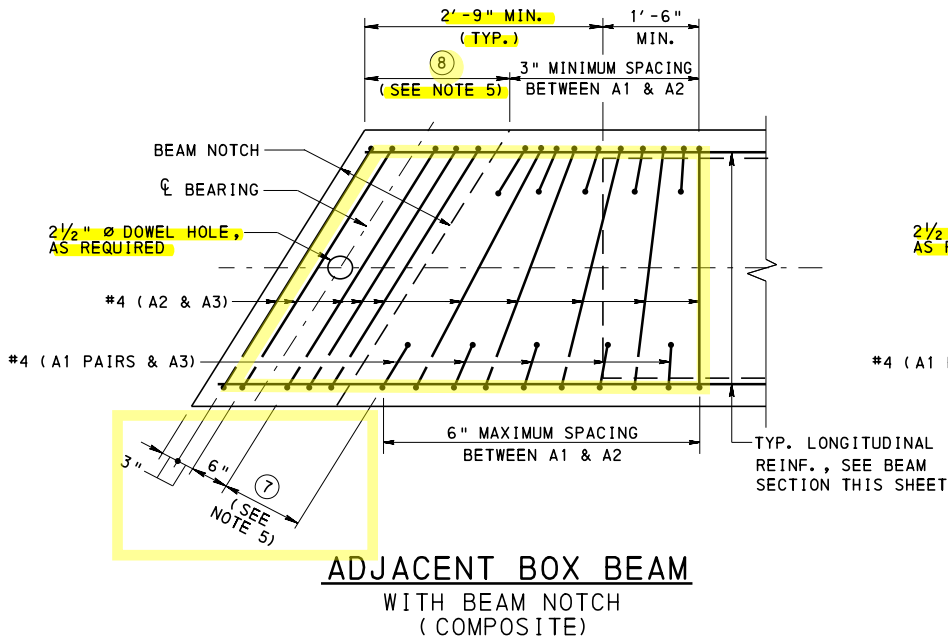
ADJACENT BOX BEAM SECTION

(COMPOSITE)

- FOR ADJACENT BOX BEAMS SUPPORTING BARRIERS, SEE SHEETS 4 AND 5.
- FOR PLANK BEAM DETAIL, SEE SHEET 7.

LEGEND:

- A1 MATCHED WITH A3 IS CONSIDERED A STIRRUP ONLY IN THE END BLOCK AREA OR UP TO WHERE THE BEAM DESIGN REQUIRES 3" SPACING OF STIRRUPS. 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.
- TO BE DETAILED ON THE SHOP DRAWINGS
- DENOTES MAX. SPACING FOR #4, A2
(12" SPA. FOR 17" BMS.)
(15" SPA. FOR 21" BMS.)
(17" SPA. FOR 24" BMS.)
(20" SPA. FOR 27" BMS.)
(21" SPA. FOR OTHERS)
- DENOTES MIN. LAP SPLICE FOR THE VERTICAL LEG OF A1 AND A2 WITH A3. A1 AND A2 WILL TERMINATE 1/4" ABOVE THE TOP OF THE BOTTOM SLAB, OR 21" MULTIPLIED BY 1.2 FOR EPOXY COATED REINFORCEMENT BARS, WHICHEVER IS LESS.
- 3" SPACINGS AS REQUIRED FOR SPLITTING RESISTANCE REINFORCEMENT IN ACCORDANCE WITH DM-4 D5.10.10.1, 6" MAX. SPACING THEREAFTER
- MIN. 3" BEYOND BEAM NOTCH, IF PRESENT, AND EXTENDED AS REQUIRED TO PROVIDE SPLITTING RESISTANCE REINFORCEMENT IN ACCORDANCE WITH DM-4 D5.10.10.1.



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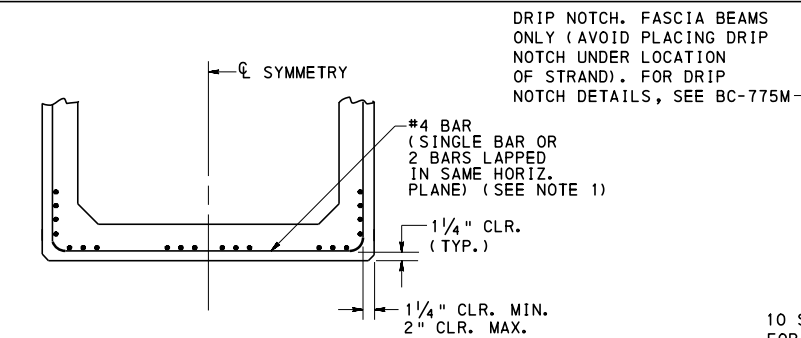
STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

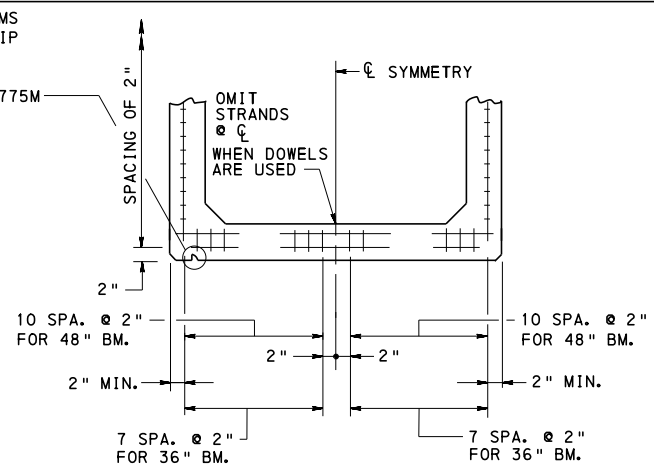
SHEET 2 OF 8
BD-661M

END BLOCK REINFORCEMENT



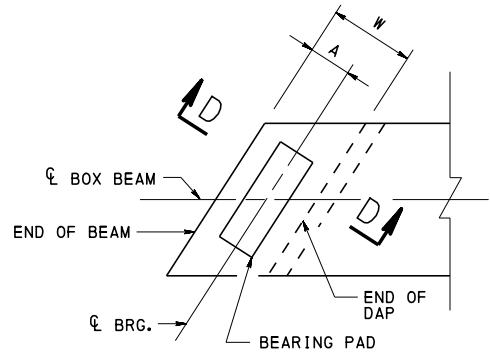
**TYPICAL
STRAND CONFINEMENT
ALL BEAMS**

STRAND CONFINEMENT NOTES:
1. FOR LIMITS OF STRAND CONFINEMENT REINFORCEMENT, REFER TO DESIGN MANUAL, PART 4, D5.10.10.2.

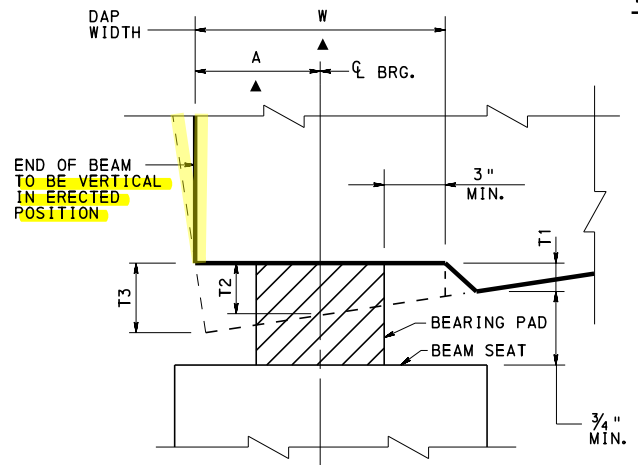


**TYPICAL
STRAND PATTERN
ALL BEAMS**

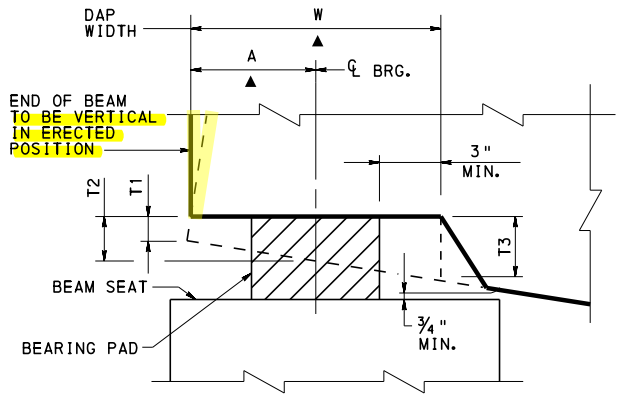
STRAND PATTERN NOTES:
1. DO NOT PLACE MORE THAN ONE COLUMN OF PRESTRESSING STRANDS IN THE WEBS.
2. DO NOT PLACE PRESTRESSING STRANDS AT CORNER LOCATION IN BOTTOM ROW.



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 REQUIRED DAP DEPTH (T3)	DISTANCE TO FIRST ROW OF STRANDS (IN.)	BOTTOM FLANGE THICKNESS (BOX BEAMS) (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

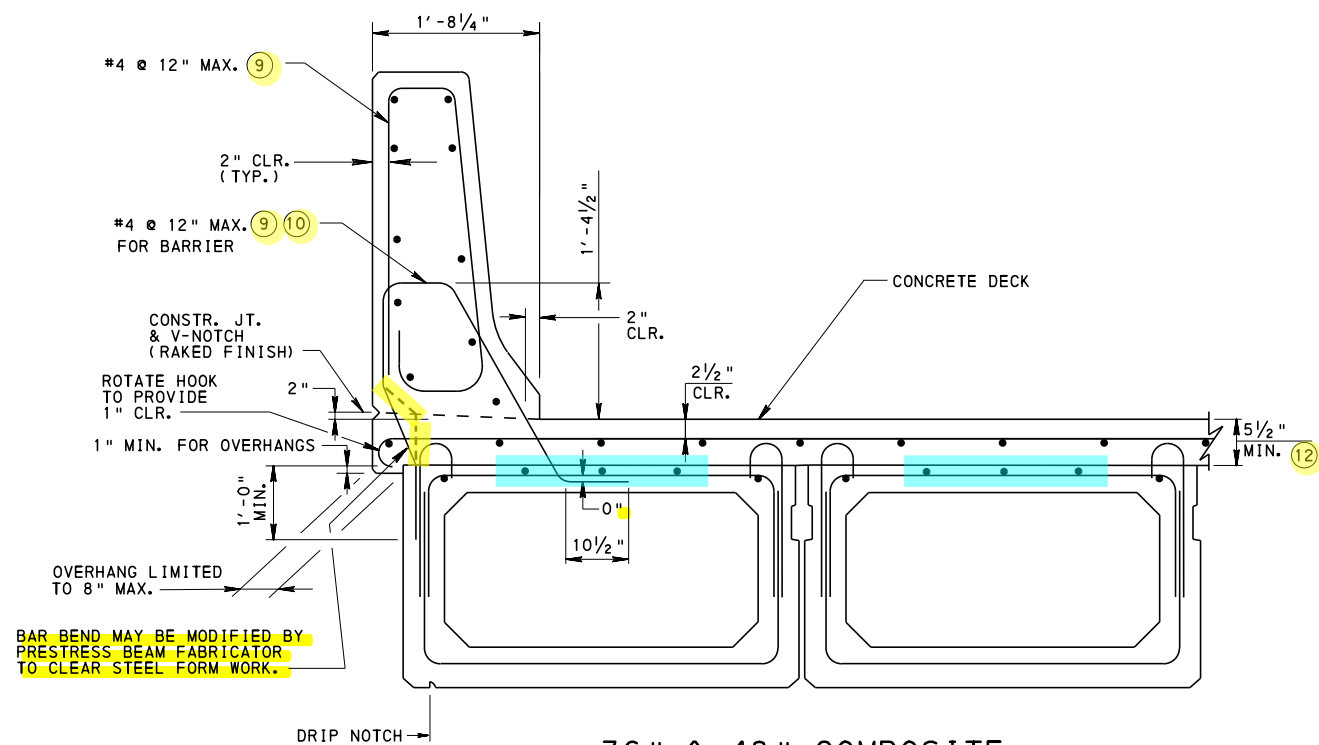
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF **PROJECT DELIVERY**

STANDARD
BOX BEAM REINFORCEMENT DETAILS
STRAND PATTERN AND BEAM DAP

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. BUREAU OF **PROJECT DELIVERY**

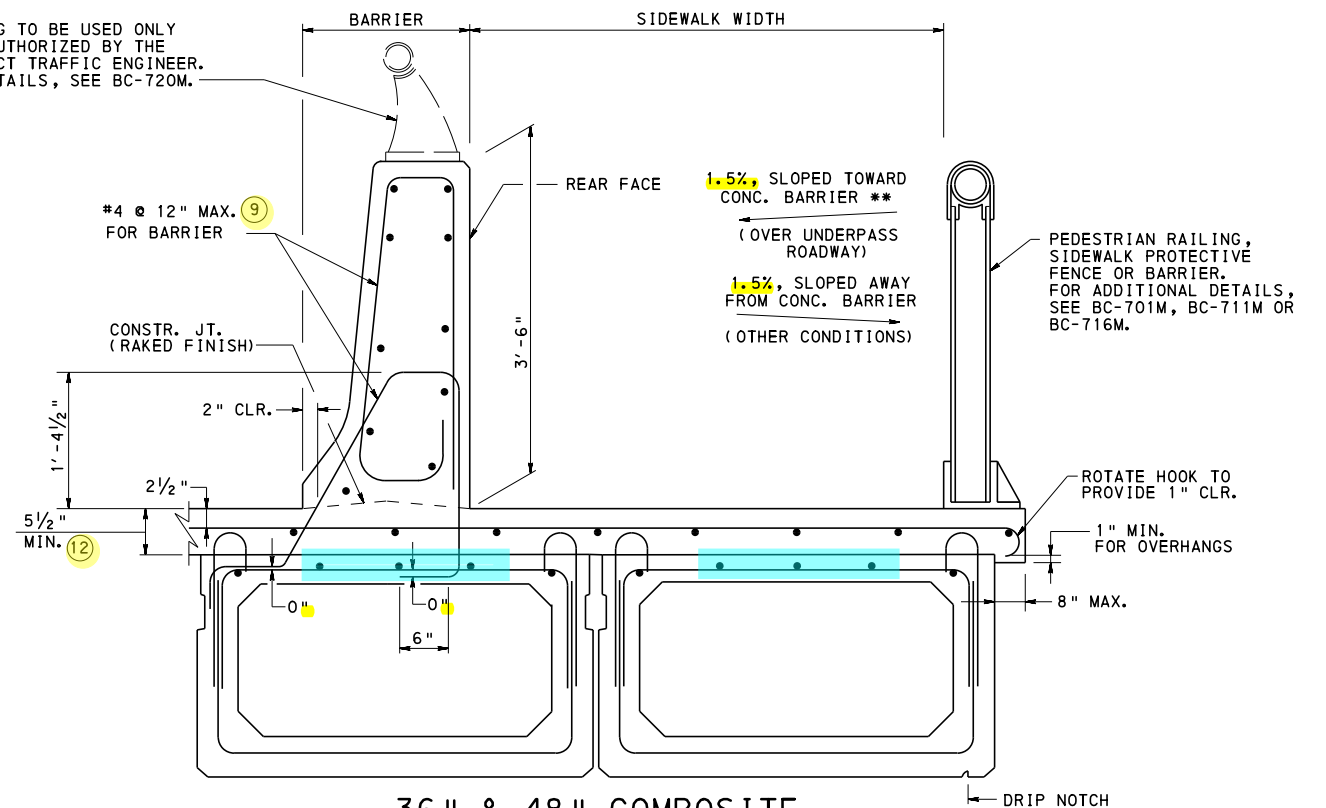
SHEET 3 OF 8
BD-661M



36" & 48" COMPOSITE ADJACENT BOX BEAMS SUPPORTING BARRIER

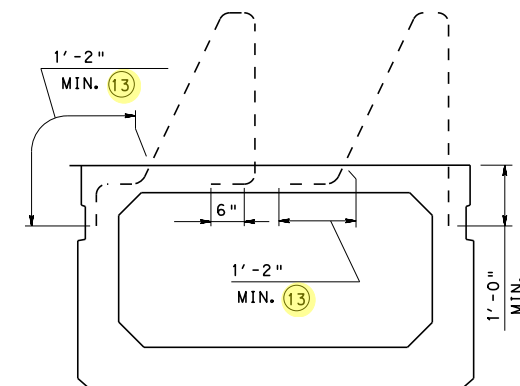
NOTE: TYPICAL BARRIER SHOWN. ALTERNATE BARRIER
AND PLANK BEAM IS SIMILAR.

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

NOTE: TYPICAL BARRIER SHOWN. ALTERNATE BARRIER IS SIMILAR.



REINFORCEMENT DETAIL FOR BARRIERS WITH TYPICAL SIDEWALK

** 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

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS
OF THE BRIDGE BARRIERS NOT SHOWN,
SEE BD-601M.
2. FOR WATERPROOFING DETAIL AT SHEAR
KEY, SEE BC-788M.

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.
- 10 BEND AS REQUIRED TO ACCOMMODATE OVERHANG. SEE BC-736M.
- 11 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.
- 12 INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER
FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD PER DM-4 DC5.14.1.4.8.
- 13 MAINTAIN MIN. EMBEDMENT LENGTH OF 1'-2" FROM TOP OF BEAM TO END OF
REINFORCEMENT (MEASURED ALONG OUTSIDE EDGE OF THE REINFORCEMENT).

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. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE
WITH PUBLICATION 408, SECTION 709.

ADJACENT BOX BEAM SUPPORTING BARRIER/SIDEWALK NOTES:

1. FOR BEAM DIMENSIONS AND BEAM REINFORCEMENT, SEE SHEET 2.
2. REINFORCEMENT BARS PROTRUDING FROM THE BOX BEAM TO THE
BARRIER MUST RESIDE IN ONE BEAM.

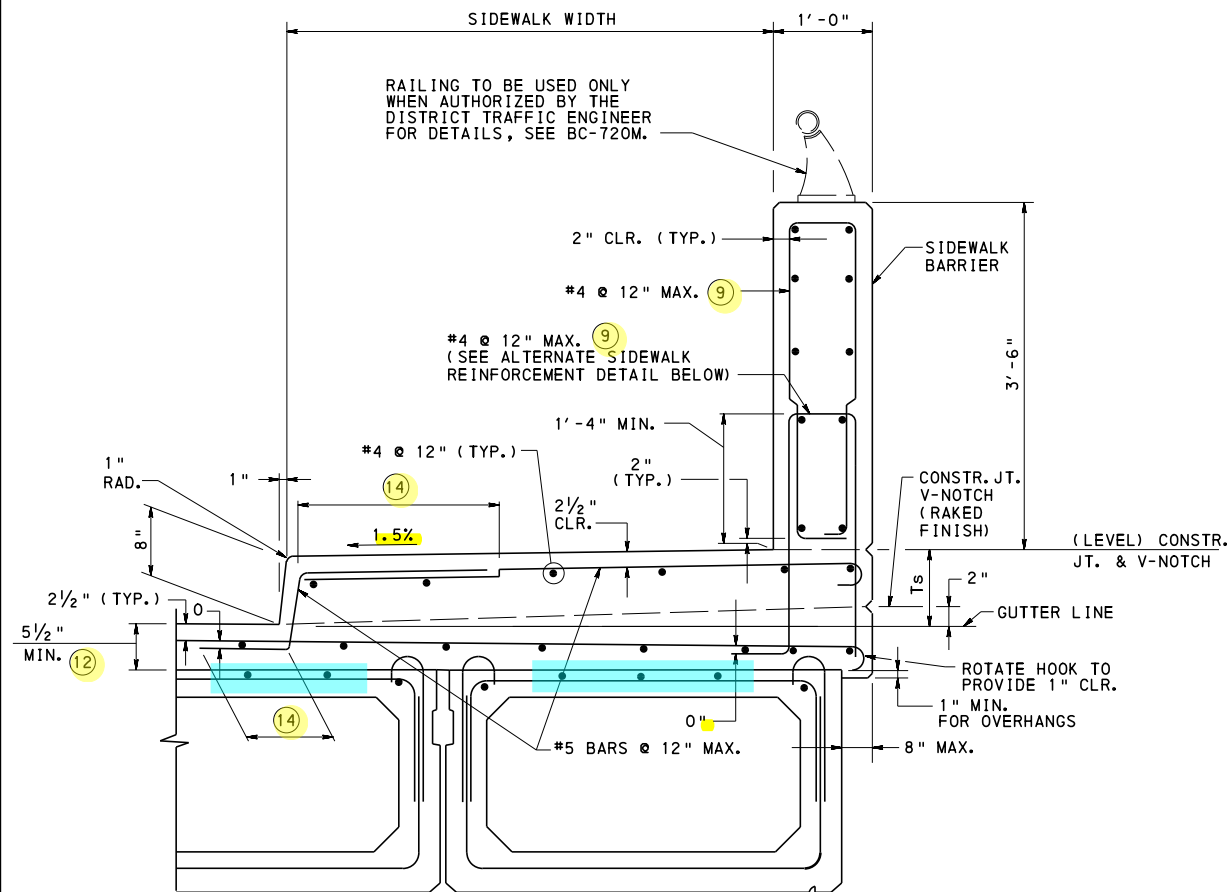
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

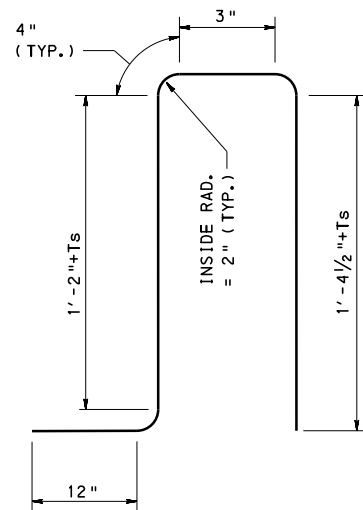
SHEET 4 OF 8
BD-661M



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

**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**

Ts= THICKNESS OF SIDEWALK
SLAB UNDER BARRIER

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. ALL REINFORCEMENT SHOULD BE EPOXY COATED IN ACCORDANCE WITH PUBLICATION 408, SECTION 709.

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.
- (12) INCREASE THICKNESS AS REQUIRED TO PROVIDE MINIMUM REQUIRED COVER FOR BRIDGES MADE CONTINUOUS FOR LIVE LOAD PER DM-4 DC5.14.1.4.8.
- (14) FOR DIMENSION, SEE BD-601M, SHEET 4.

NOTES

1. FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BRIDGE BARRIERS NOT SHOWN, SEE BD-601M.

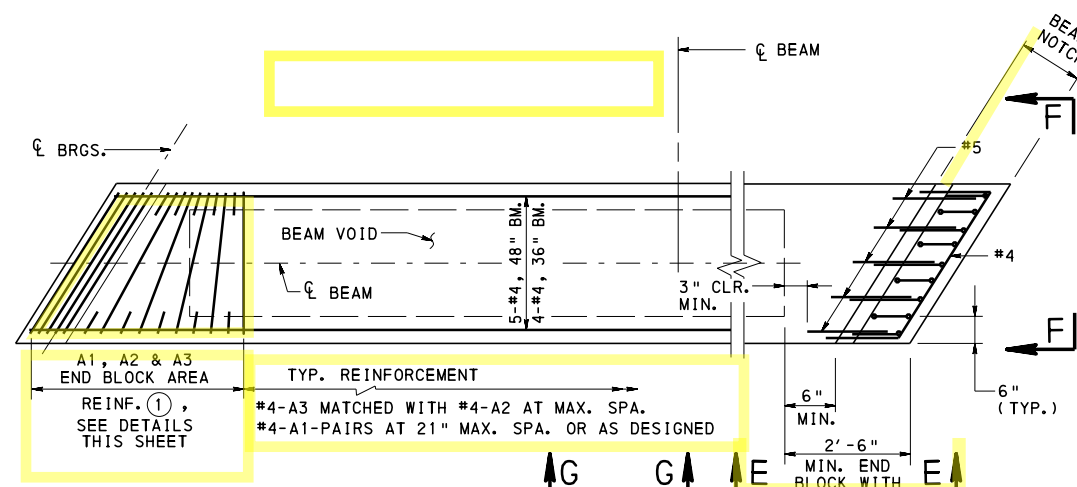
**COMMONWEALTH OF PENNSYLVANIA
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**STANDARD
BOX BEAM REINFORCEMENT DETAILS
ADJACENT BOX BEAM**

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

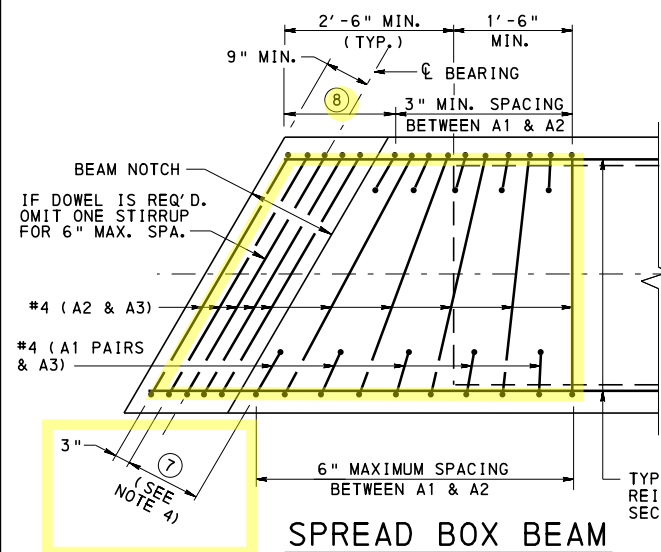
RECOMMENDED NOV. 21, 2014
Brian S. Thompson
ACTING DIR. BUREAU OF PROJECT DELIVERY

SHEET 5 OF 8
BD-661M

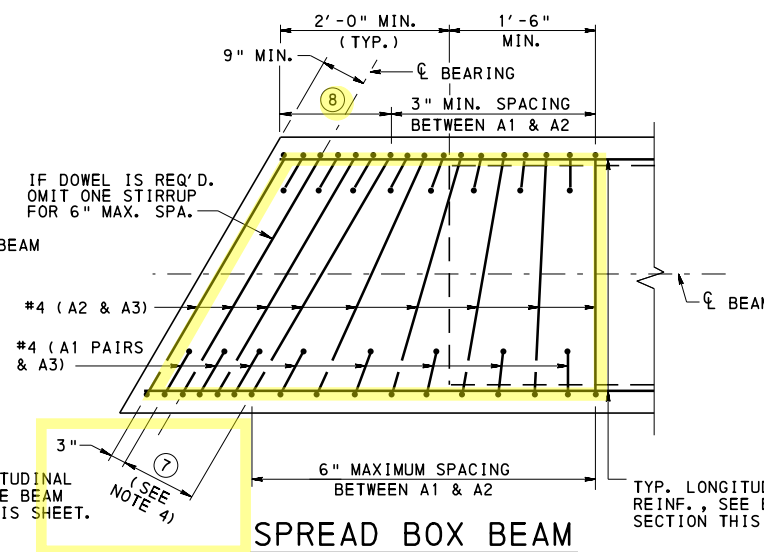


NOTE: ALL DETAILS SHOWN ARE TYPICAL FOR BOTH ENDS.

PLAN - SPREAD BOX BEAM
BEAM REINFORCEMENT

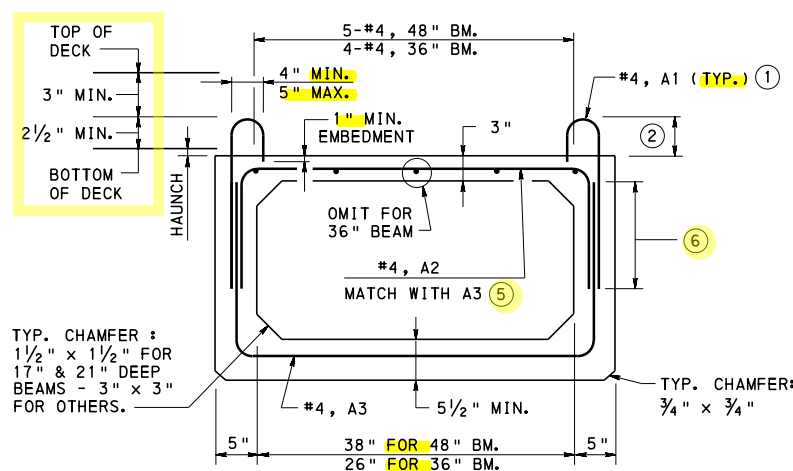


SPREAD BOX BEAM
WITH BEAM NOTCH

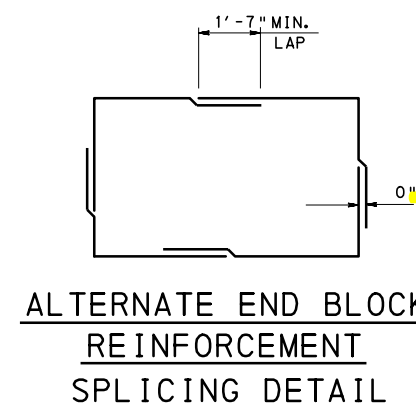


SPREAD BOX BEAM
WITHOUT BEAM NOTCH

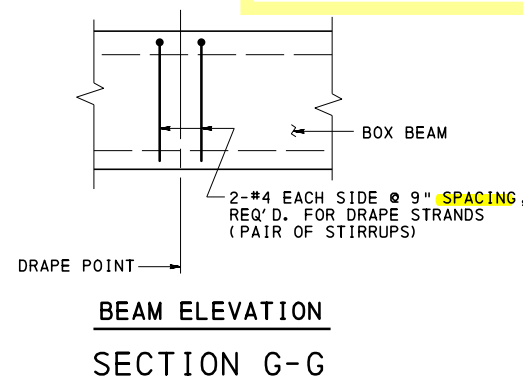
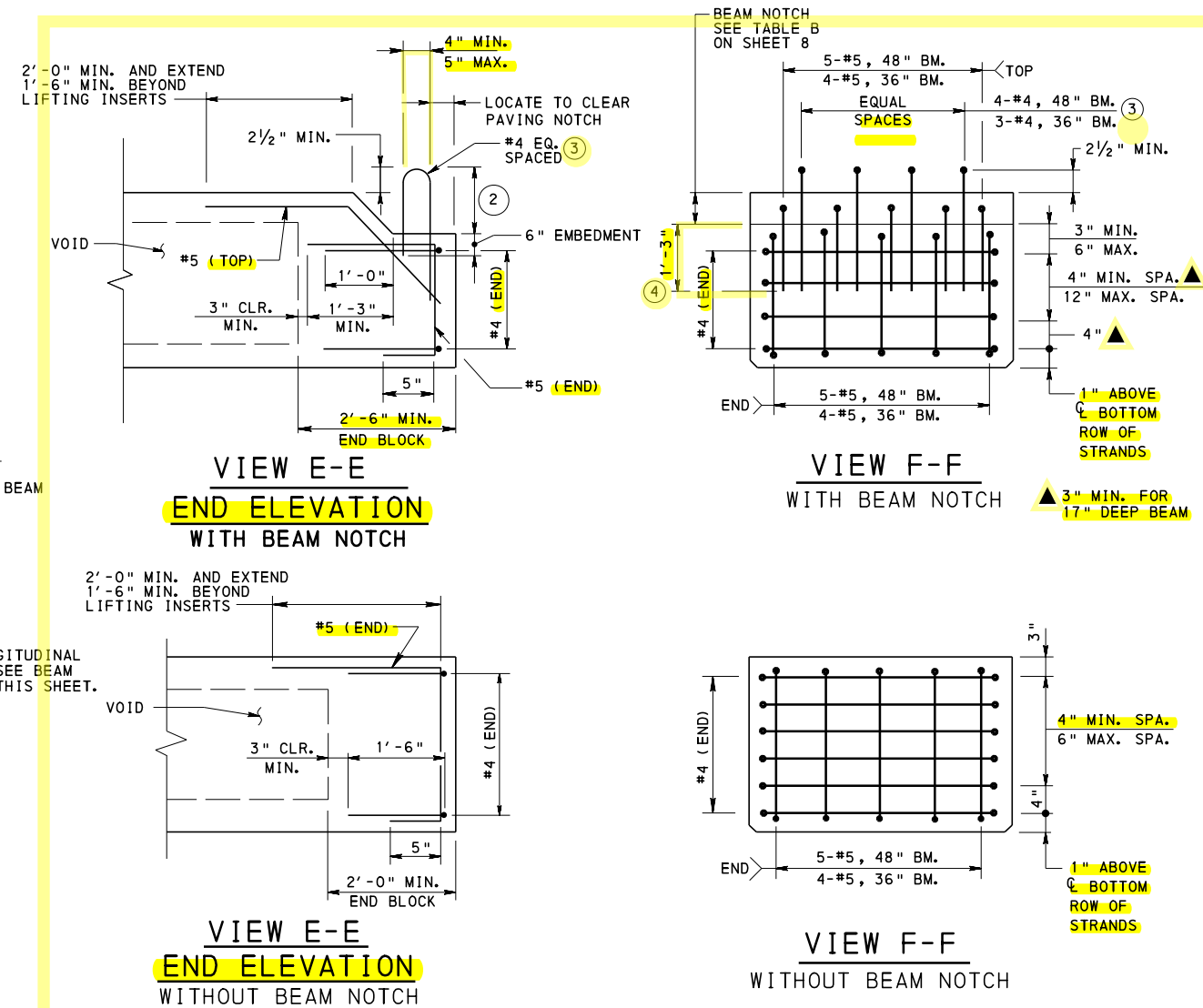
END BLOCK REINFORCEMENT



SPREAD BOX BEAM SECTION



ALTERNATE END BLOCK
REINFORCEMENT
SPLICING DETAIL



BEAM ELEVATION
SECTION G-G

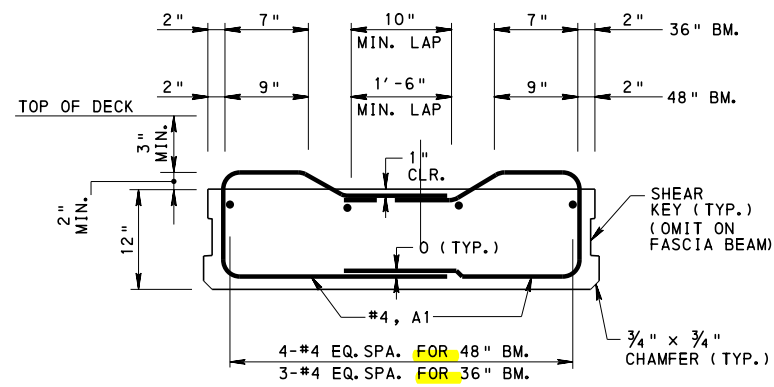
SPREAD BOX BEAM NOTES:

1. SEE THIS SHEET FOR ALTERNATE END BLOCK REINFORCEMENT DETAIL.
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. FOR TYPICAL CORNER BLOCKOUT DETAIL, SEE BC-775M.
4. 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 DM-4 D5.10.10.1, ALTERNATE A1 AND A2 WITH A3 TO THE END OF THE 3" STIRRUP SPACING.
5. FOR LEGEND NOTES (1), (2), (3), (4), (5), (6), (7) AND (8) SEE LEGEND ON SHEETS 1 AND 2.

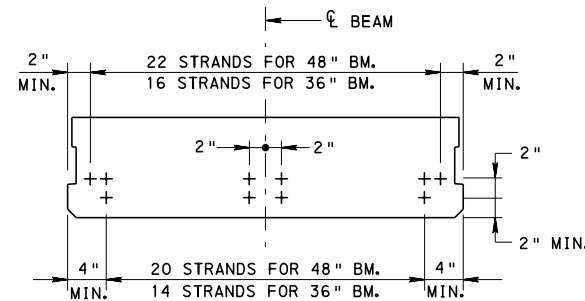
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
BOX BEAM REINFORCEMENT DETAILS
SPREAD BOX BEAM

RECOMMENDED NOV. 21, 2014 Thomas P. Maciore CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 Brenda Thompson ACTING DIR. BUREAU OF PROJECT DELIVERY	SHEET 6 OF 8 BD-661M
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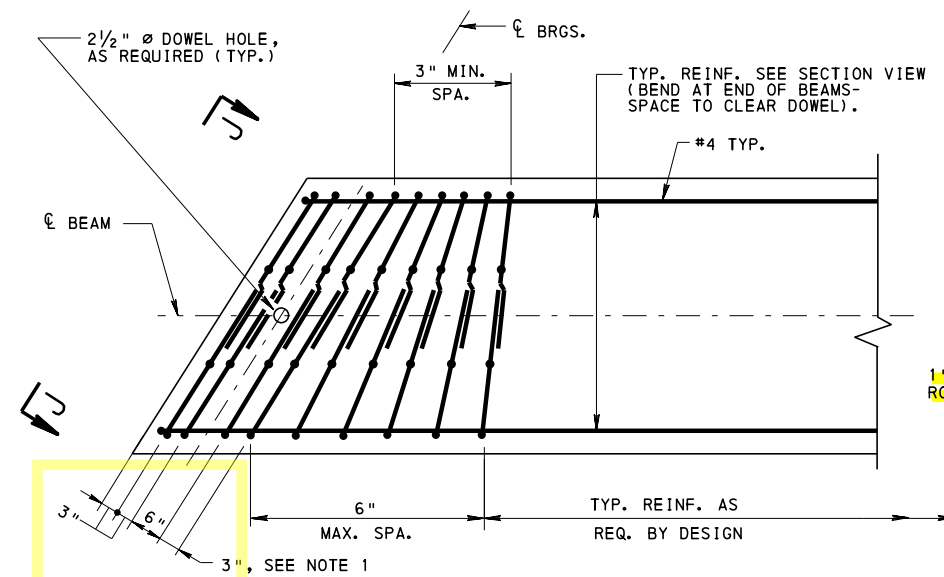
PLANK BEAM
(COMPOSITE)



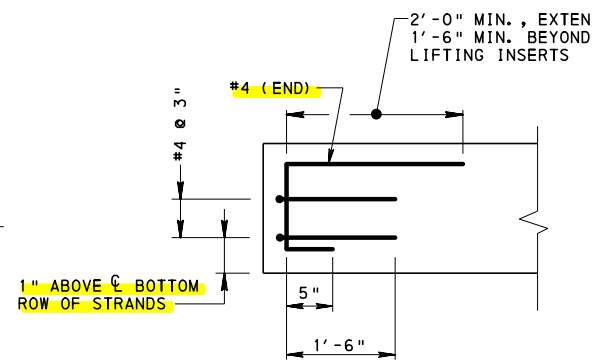
TYPICAL STRAND PATTERN
PLANK BEAM

PLANK BEAM NOTE:

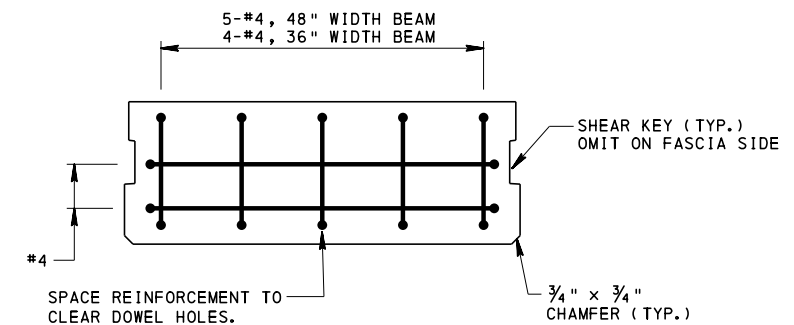
1. IF THE 3" SPACING OF THE STIRRUPS AT THE END OF THE BEAM IS REQUIRED TO GO BEYOND THAT SHOWN TO SATISFY THE SPLITTING RESISTANCE REQUIREMENT IN DM-4 D5.10.10.1, CONTINUE THE 3" STIRRUP SPACING.



PLAN - 12" DEEP PLANK BEAM



VIEW H-H



VIEW J-J

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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STANDARD
BOX BEAM REINFORCEMENT DETAILS
PLANK BEAM

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

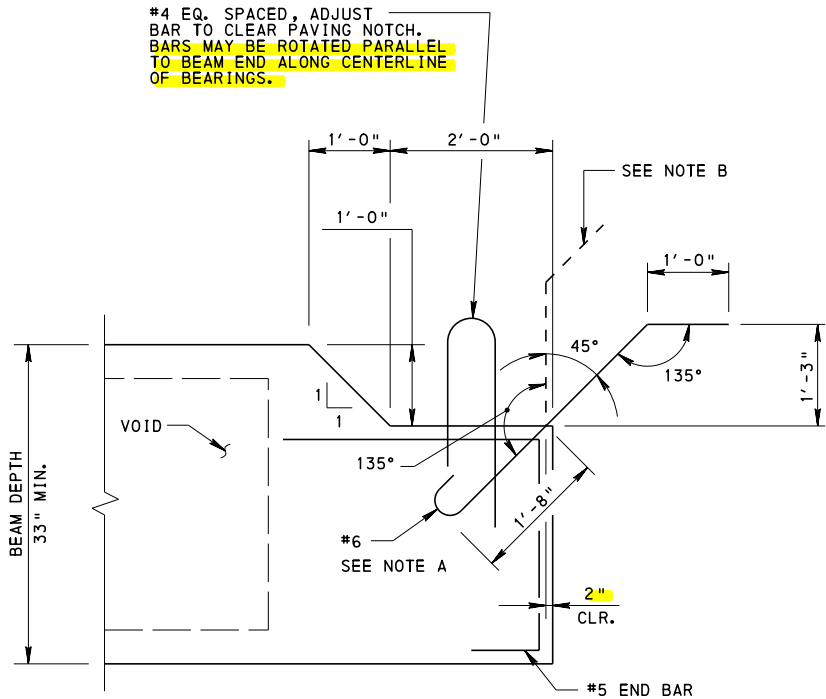
RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 7 OF 8
BD-661M

TABLE A BEAM NOTCH DEPTHS FOR COMPOSITE ADJACENT BOX BEAMS			
APPROACH SLAB TYPE (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 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 BEAM NOTCH DEPTHS FOR SPREAD BOX BEAMS			
APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH	REMARKS
1	YES	3½"	SEE NOTE 2
1	NO	3½" FOR 17" AND 21" BEAM DEPTHS 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 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 29.

COMMONWEALTH OF PENNSYLVANIA
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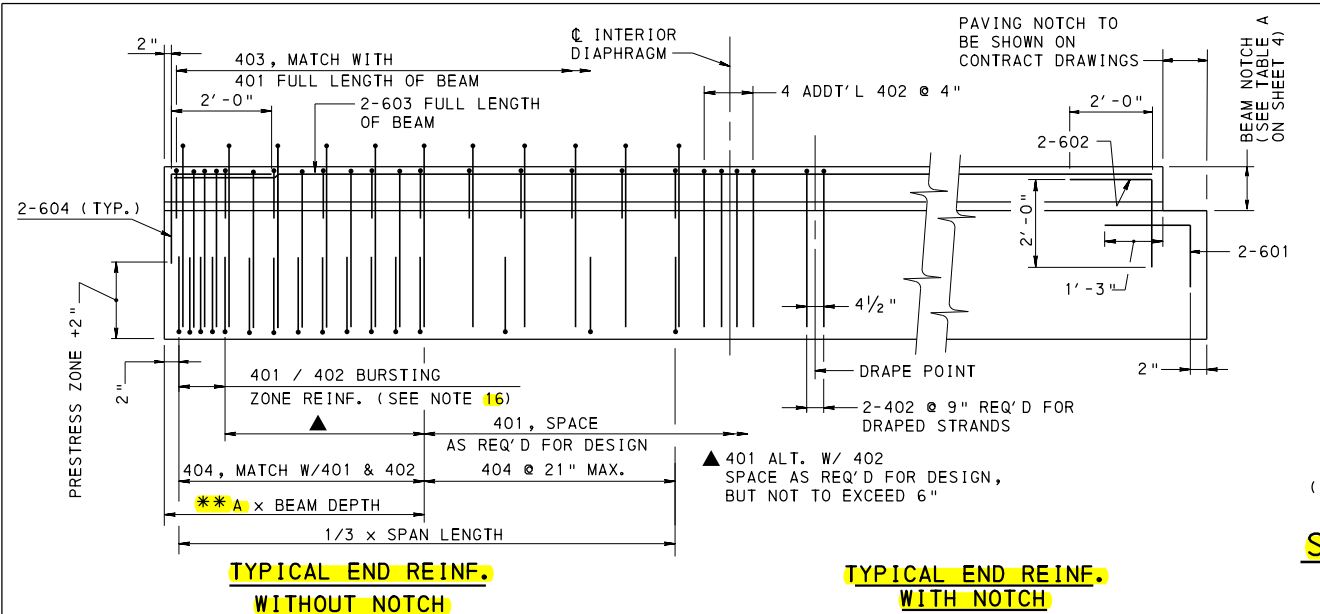
STANDARD
BOX BEAM REINFORCEMENT DETAILS
BEAM NOTCH TABLES

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

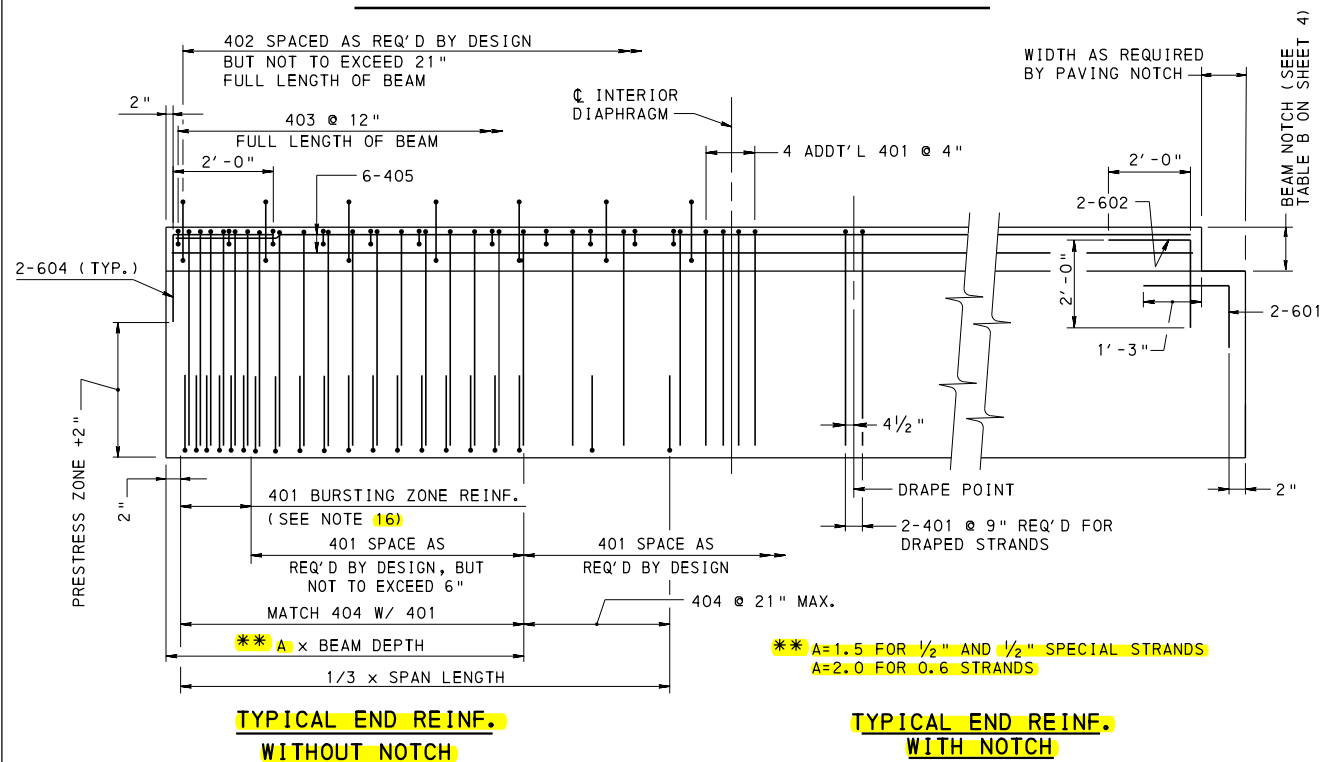
RECOMMENDED NOV. 21, 2014
Brian S. Thompson
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SHEET 8 OF 8

BD-661M



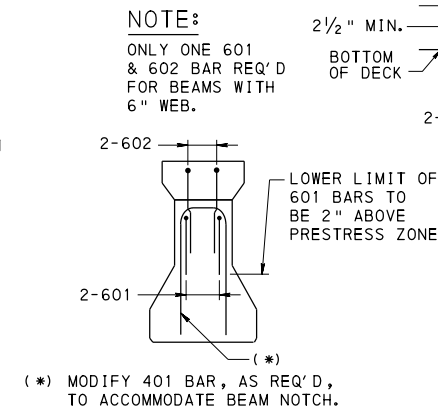
STANDARD PA I-BEAM - ELEVATION



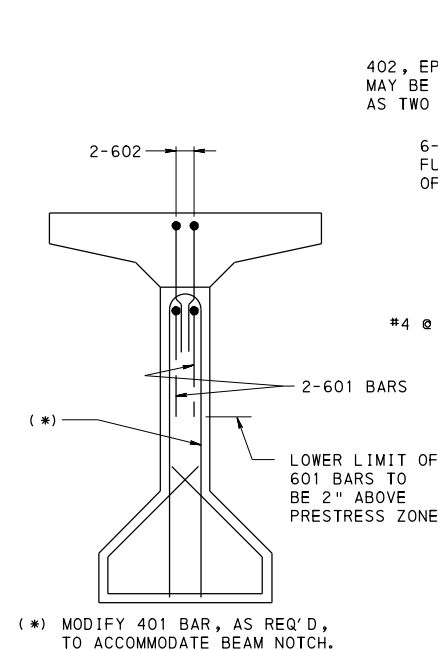
AASHTO I-BEAM - ELEVATION

GENERAL NOTES:

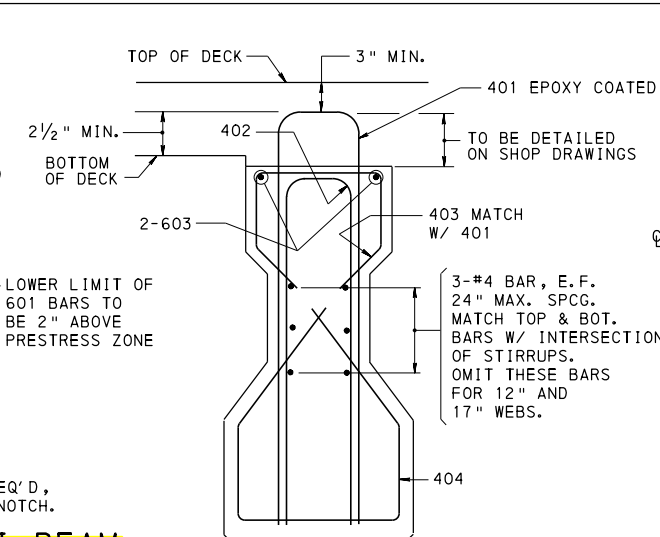
- ALL REINFORCEMENT STEEL BARS MEET THE REQUIREMENTS OF ASTM A 615, A 996 OR A 706.
- DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, D5.4.3.6P.
- EPOXY COAT ALL REBARS FOR A DISTANCE OF 9'-0" FROM BEAM ENDS ADJACENT TO DECK JOINTS.
- EPOXY COAT ALL REINFORCEMENT WHICH PROTRUDES 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, SLOPE AND HAUNCH DEPTH USING THE NET FINAL CAMBER - "C".
- SHOW THE FOLLOWING DATA ON THE SHOP DRAWINGS:
 - THE SIZE AND LOCATION OF THE TEMPORARY STORAGE SUPPORTS.
 - 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.
- FABRICATOR TO CHECK STABILITY FOR HANDLING AND TRANSPORTING OF THE MEMBERS.
- TEMPERATURE REINFORCEMENT IN WEB MAY BE OMITTED, BUT ONLY IN THE AREA WHERE IT INTERFERS WITH DRAPED PRESTRESSING STRANDS.
- MIN. COVER : STIRRUPS - 1" MIN. ALL OTHERS - 1 1/2" MIN.
- PRESTRESS ZONE IS DEFINED AS THE DISTANCE FROM THE BOTTOM OF BEAM TO THE TOP ROW OF STRANDS.
- #5 SIZE BARS MAY BE USED FOR SHEAR STIRRUPS IF THE REQUIRED SPACING FOR #4 BARS IS LESS THAN 3".
- TO SATISFY THE AREA REQUIREMENTS IN AASHTO LRFD ARTICLE 5.10.10.1, USE 3" SPACING FOR 401 AS LONG AS REQUIRED BY DESIGN.
- BEAM FABRICATORS ARE REQUIRED TO SHOW SUPPLEMENTAL WEB REINFORCEMENT ON SHOP DRAWINGS AT THE ENDS OF 96" DEEP I-BEAMS ADJACENT TO CONTINUITY DIAPHRAGMS.
- FOR PA BULB-TEE BEAM DETAILS, SEE SHEET 2.



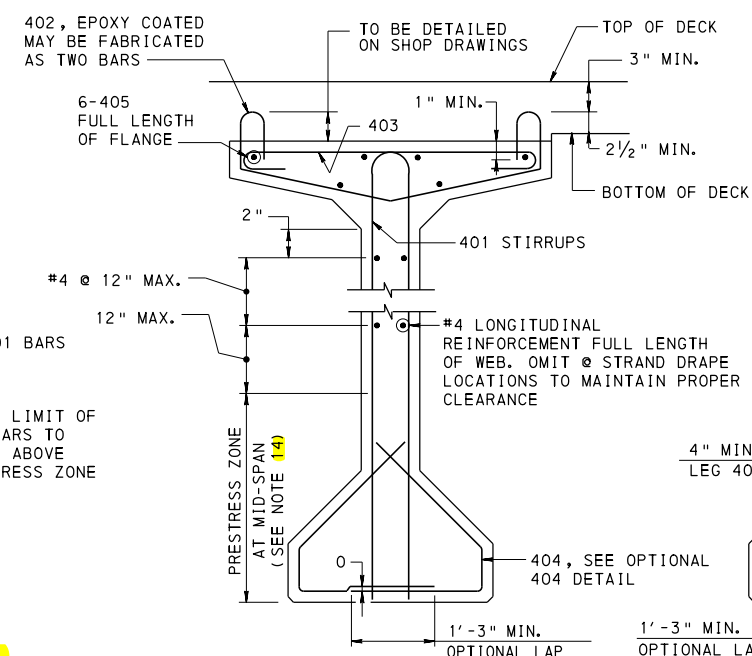
STANDARD PA I-BEAM
ADDITIONAL NOTCH
REINF. END VIEW



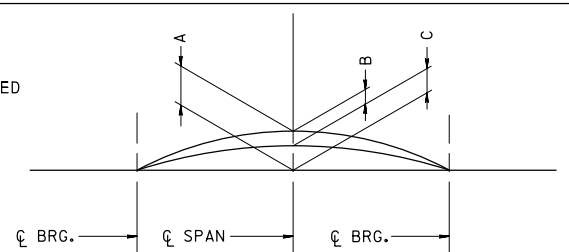
AASHTO I-BEAM
ADDITIONAL NOTCH
REINF. END VIEW



STANDARD PA I-BEAM
TYPICAL SECTION



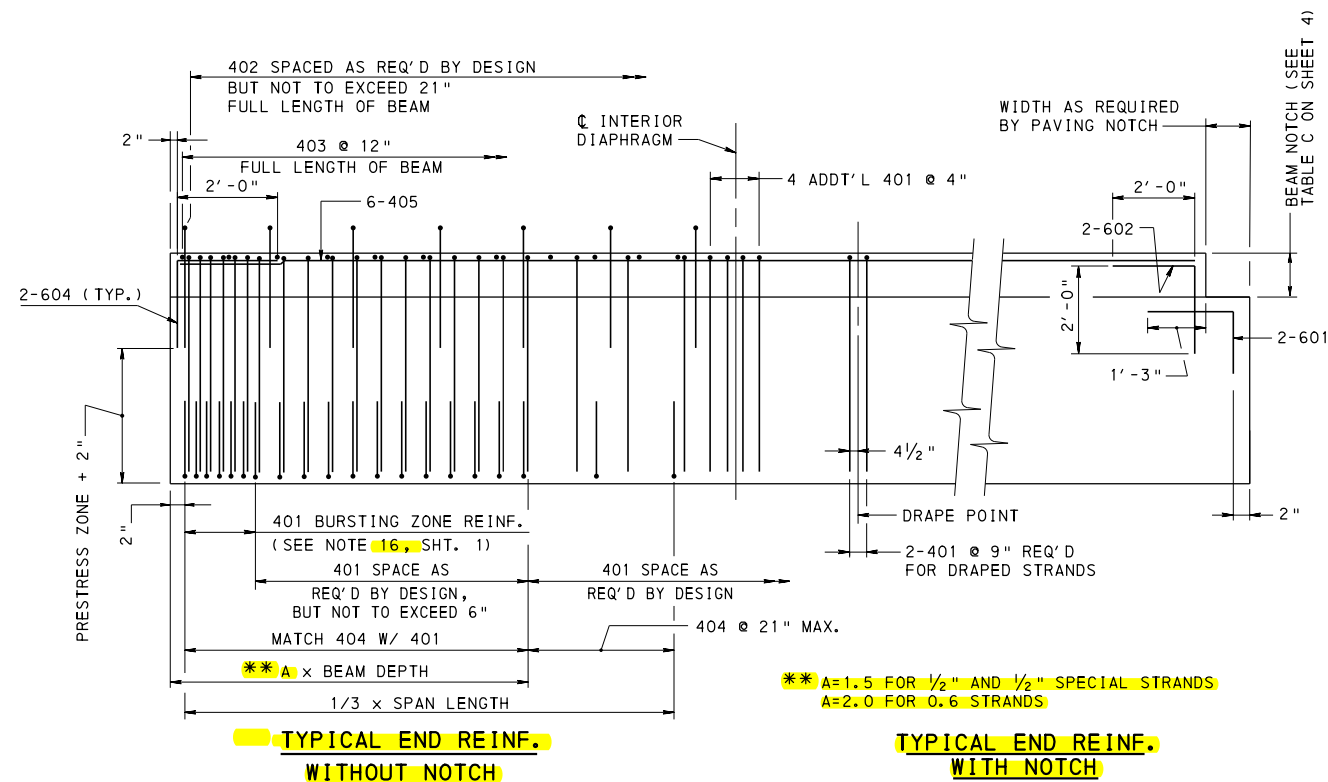
AASHTO I-BEAM
TYPICAL SECTION



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	

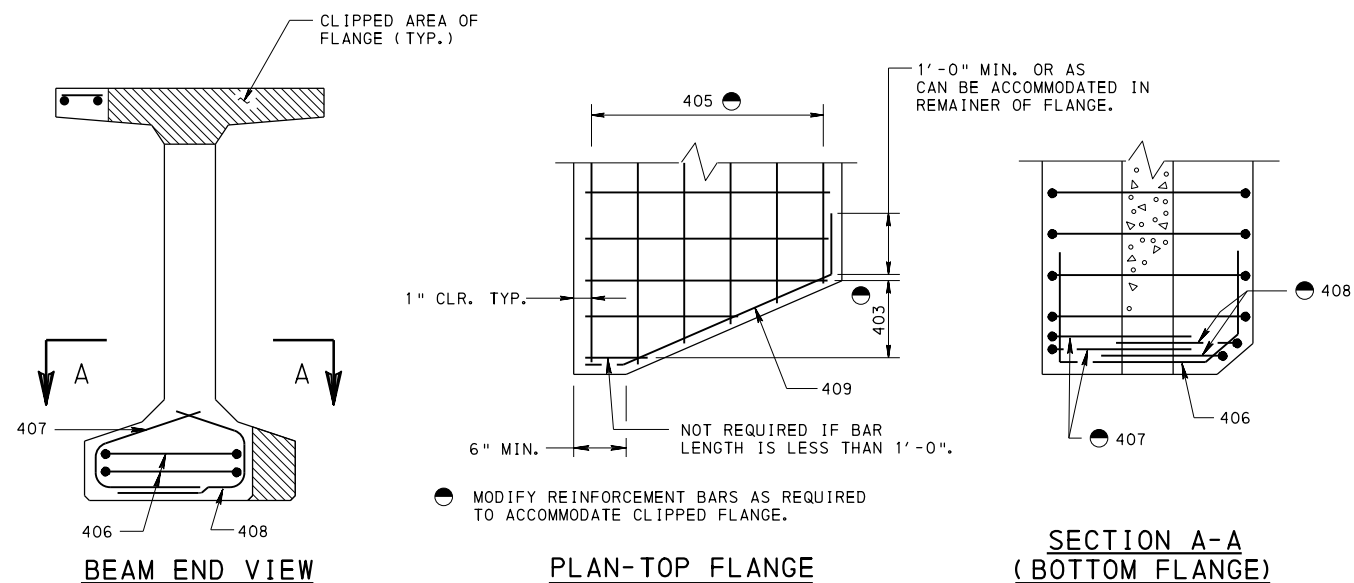
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF PROJECT DELIVERY		
STANDARD I-BEAM & PA BULB-TEE BEAM REINFORCEMENT DETAILS		
RECOMMENDED AUG. 31, 2012 <i>Thomas P. Maciora</i> CHIEF BRIDGE ENGINEER	RECOMMENDED AUG. 31, 2012 <i>R. W. Willey</i> ACTING DIR. OF PROJECT DELIVERY	SHEET 1 OF 4 BD-662M



PA BULB-TEE BEAM - ELEVATION

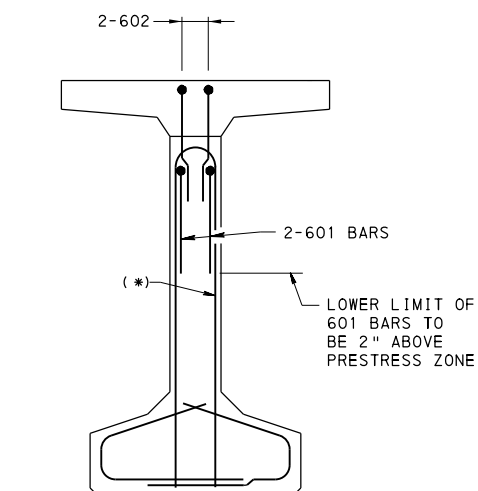
NOTES:

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.



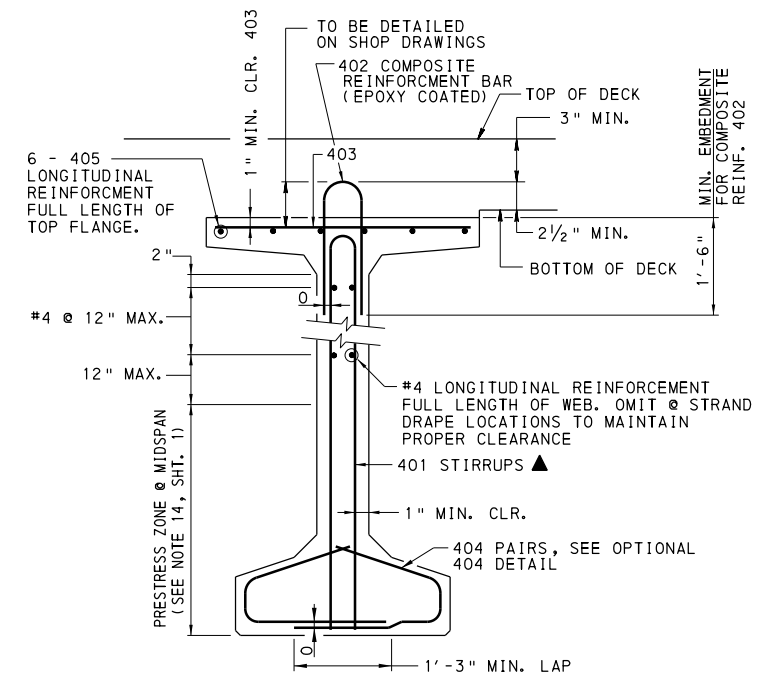
TYPICAL CLIPPED FLANGE REINFORCEMENT DETAILS

BULB TEE SHOWN, SIMILAR FOR AASHTO AND PA I-BEAMS.



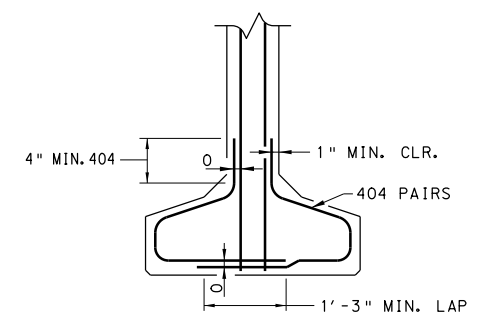
(*) MODIFY 401 BAR, AS REQ'D, TO ACCOMMODATE BEAM NOTCH.

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

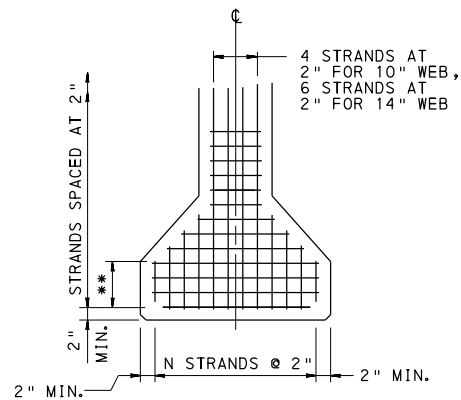
COMMONWEALTH OF PENNSYLVANIA
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STANDARD
I-BEAM & PA BULB-TEE BEAM
REINFORCEMENT DETAILS

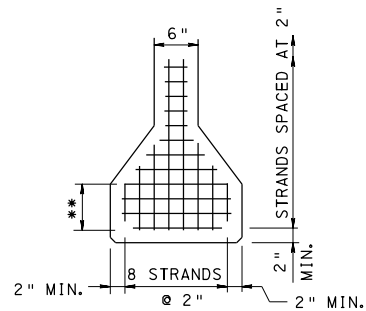
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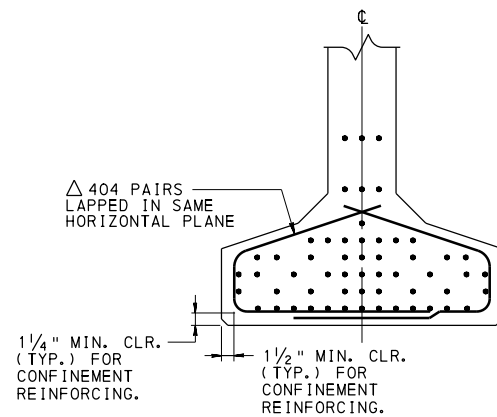
SHEET 2 OF 4
BD-662M



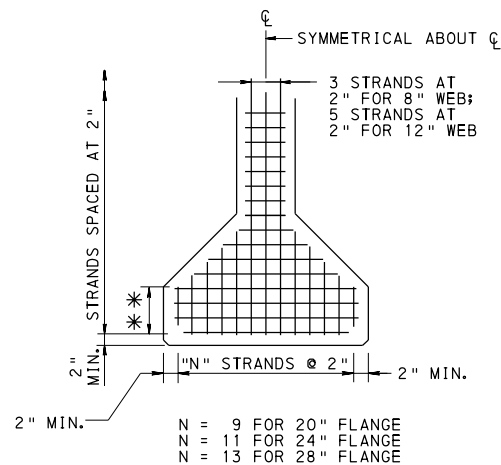
26" BOTTOM FLANGE



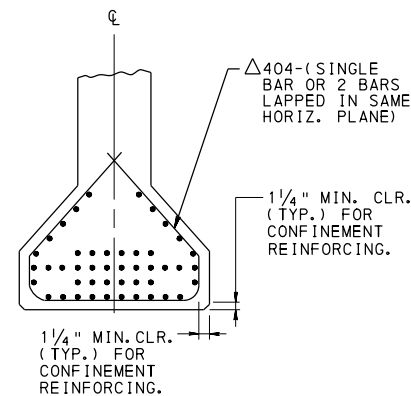
18" BOTTOM FLANGE



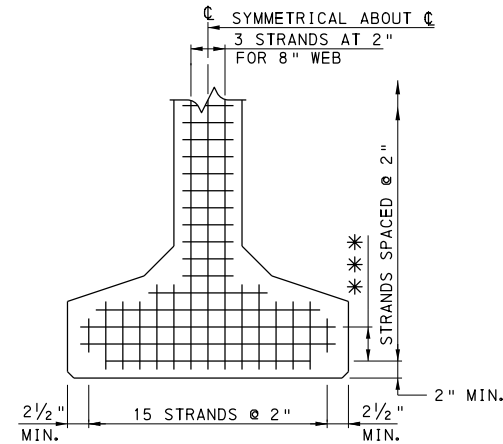
PA BULB-TEE TYP. STRAND CONFINEMENT



20", 24" OR 28" BOTTOM FLANGE



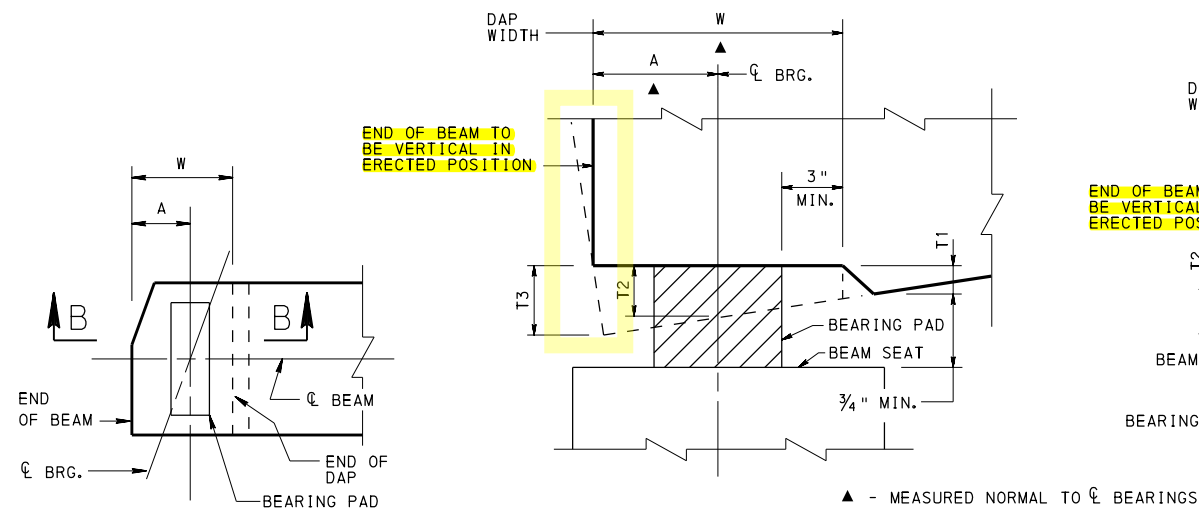
TYP. STRAND CONFINEMENT



33" PA BULB-TEE
BOTTOM FLANGE

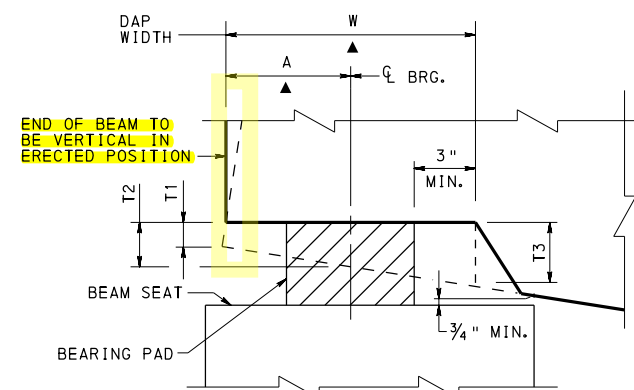
TYPICAL STRAND LOCATIONS

NOTE: DO NOT PLACE PRESTRESSING STRANDS AT CORNER LOCATION IN BOTTOM ROW.



PLAN

SECTION B-B AT
LOW END OF BEAM



SECTION B-B AT
HIGH END OF BEAM

BEAM DAP DETAILS

△ FOR LIMITS OF STRAND CONFINEMENT REINFORCEMENT, REFER TO DESIGN MANUAL PART 4, D5.10.10.2.

*** STRAND LOCATION IS 4 ROWS FOR 9" FLANGE;
3 ROWS FOR 7" AND 8" FLANGES;
2 ROWS FOR 4" AND 6" FLANGES.

*** STRAND LOCATION IS 3 ROWS FOR 9" FLANGE;
2 ROWS FOR 7" FLANGE.

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. 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 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 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 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.

MAXIMUM REQUIRED DAP DEPTH (T3) (IN.)	DISTANCE TO FIRST ROW OF STRANDS (IN.)
1/4 < (T3) ≤ 3/4	2 1/2
3/4 < (T3) ≤ 1 1/4	3
1 1/4 < (T3) ≤ 1 1/2	3 1/4
1 1/2 < (T3) *	2

* USE BEVELED SOLE PLATE, SEE BC-755M.

I-BEAM AND PA BULB-TEE BEAM DAP DESIGN PARAMETERS

COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD
I-BEAM & PA BULB-TEE BEAM
REINFORCEMENT DETAILS

RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. W. Willey
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 3 OF 4
BD-662M

TABLE A BEAM NOTCH DEPTHS FOR PA I-BEAMS			
APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH (SEE NOTE 2)	REMARKS
1	YES	T2 + B3	
1	NO	T2 + B3 IF GREATER THAN 9½"	
		9½" IF T2 + B3 IS LESS THAN 9½" (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" (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" (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" (NOTCH TO EXTEND INTO WEB)	
5	N/A	N/A	
RC-23M	N/A	T2 + B3	SEE NOTE 5
NO APPROACH 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 BEAM NOTCH DEPTHS FOR PA BULB-TEE BEAMS			
APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH (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 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 BEAM NOTCH DEPTHS FOR AASHTO I-BEAMS			
APPROACH SLAB TYPE (SEE NOTE 1)	BACKWALL	BEAM NOTCH DEPTH (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 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.

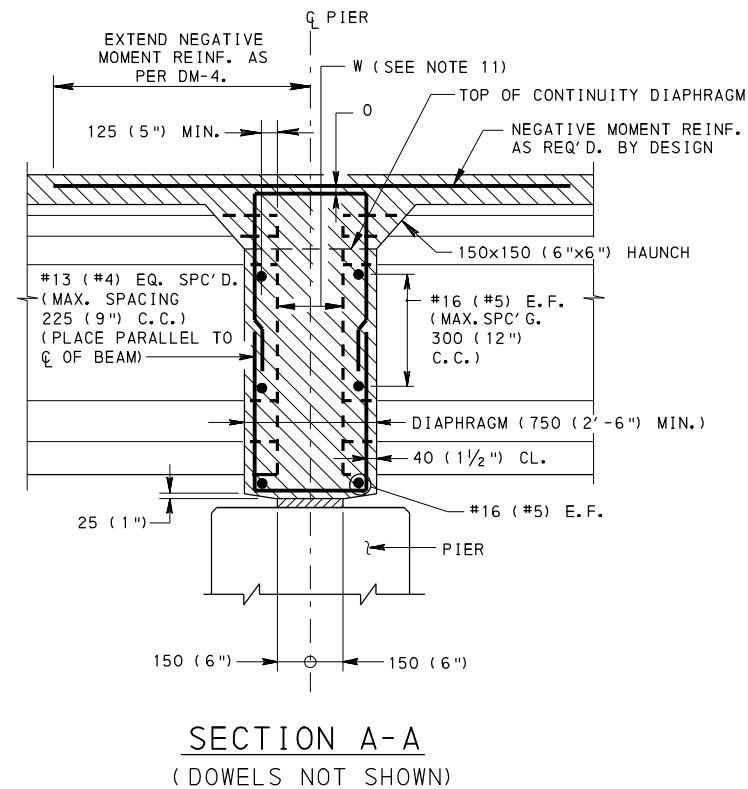
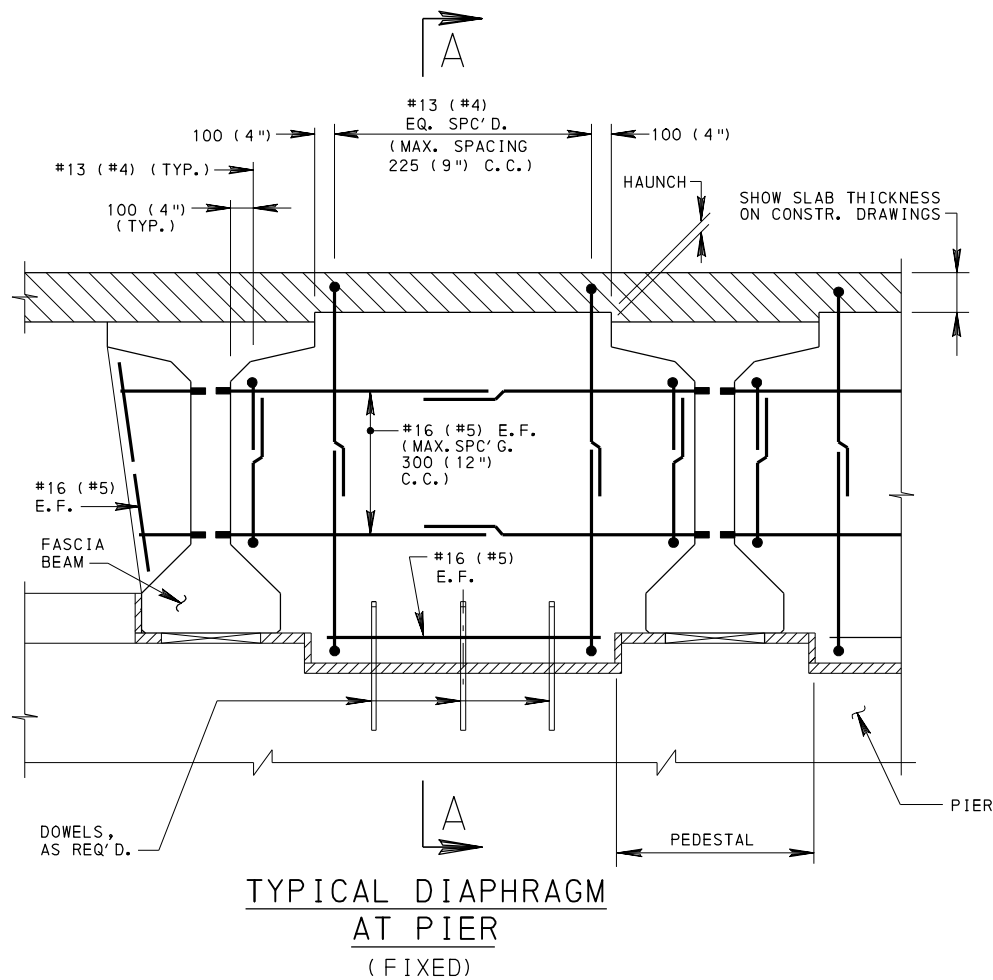
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BUREAU OF PROJECT DELIVERY

STANDARD
I-BEAM & PA BULB-TEE BEAM
REINFORCEMENT DETAILS

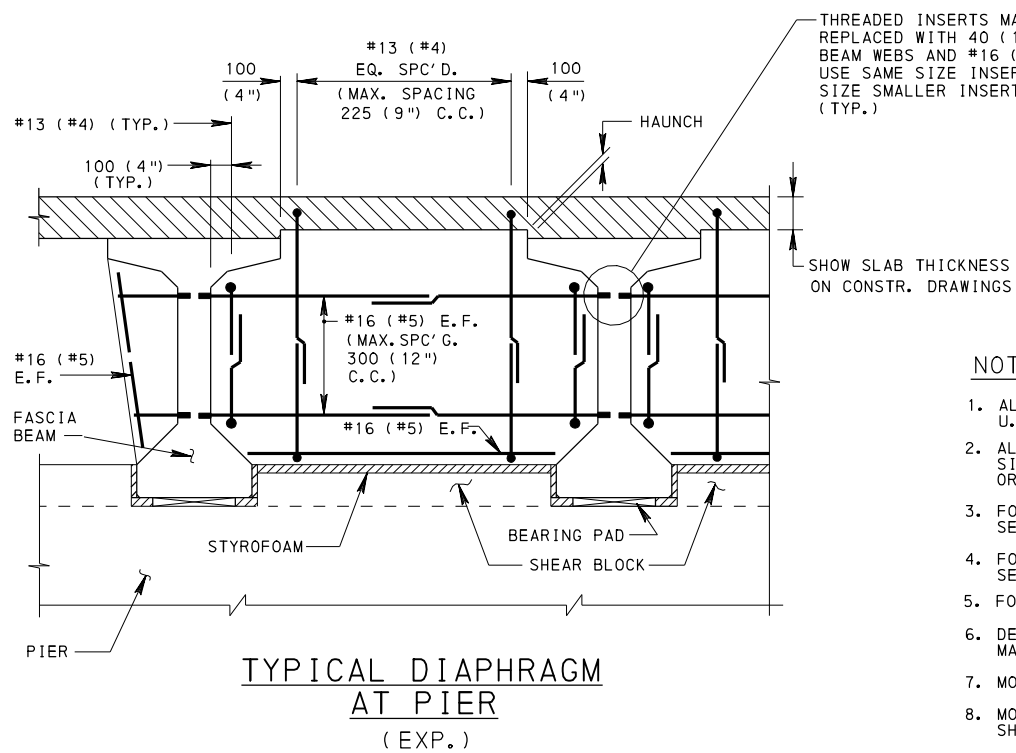
RECOMMENDED AUG. 31, 2012
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CHIEF BRIDGE ENGINEER

RECOMMENDED AUG. 31, 2012
R. Wayne Willey
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 4 OF 4
BD-662M



TYPICAL LONGITUDINAL SECTION
AT PIER
(FIXED CONDITION SHOWN)
(EXPANSION CONDITION SIMILAR)



NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES.
- ALL REINFORCEMENT STEEL BARS SHOWN ARE SOFT CONVERTED METRIC SIZES THAT MEET THE REQUIREMENTS OF ASTM A 615M, A 996M OR A 706M.
- 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:
250 (10") WIDTH FOR #13 (#4) AND #16 (#5)
300 (12") WIDTH FOR #19 (#6) AND #22 (#7)
350 (14") WIDTH FOR #25 (#8)

TWO LAYERS OF POSITIVE MOMENT REINFORCEMENT:
300 (12") WIDTH FOR #13 (#4) AND #16 (#5)
350 (14") WIDTH FOR #19 (#6) AND #22 (#7)
400 (16") WIDTH FOR #25 (#8)

WITHOUT POSITIVE MOMENT REINFORCEMENT

100 (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.

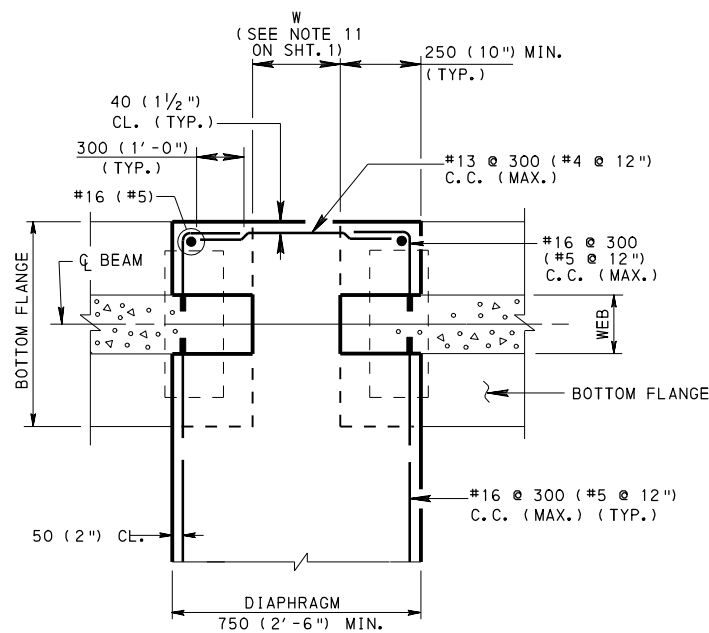
NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN

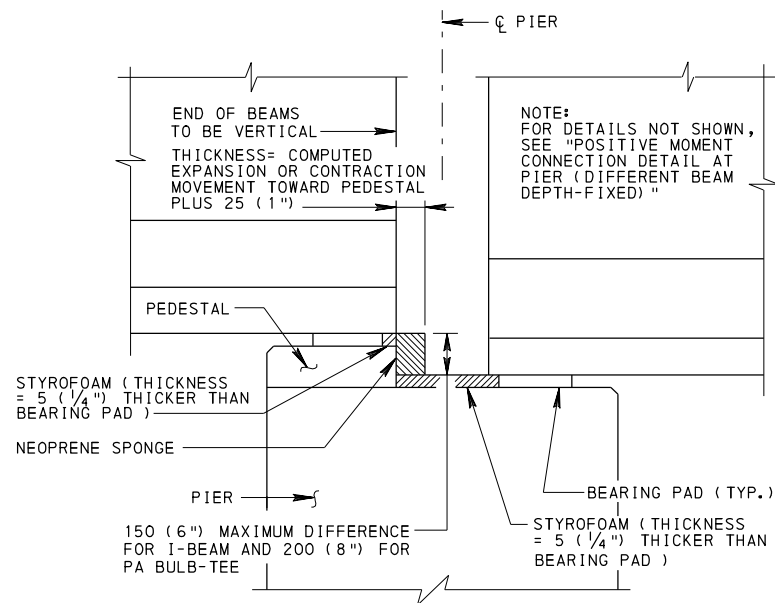
STANDARD CONTINUITY FOR LIVE LOAD DETAILS I-BEAM & PA BULB-TEE BEAM BRIDGES

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	

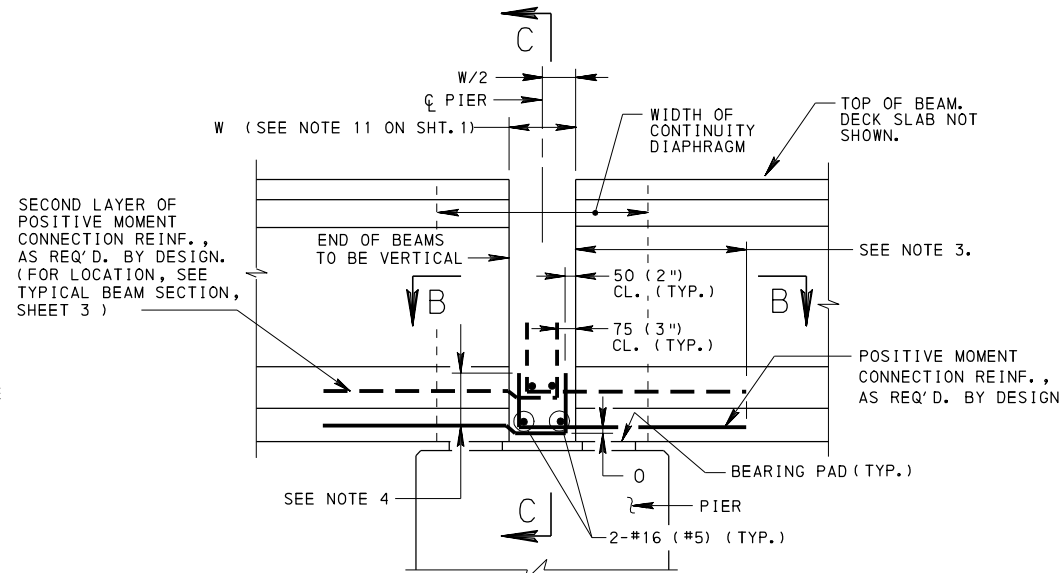
RECOMMENDED SEPT. 20, 2010 <i>Thomas P. Macioro</i> CHIEF BRIDGE ENGINEER	RECOMMENDED SEPT. 20, 2010 <i>Bruce S. Thompson</i> DIRECTOR, BUREAU OF DESIGN	SHEET 1 OF 4 BD-664M
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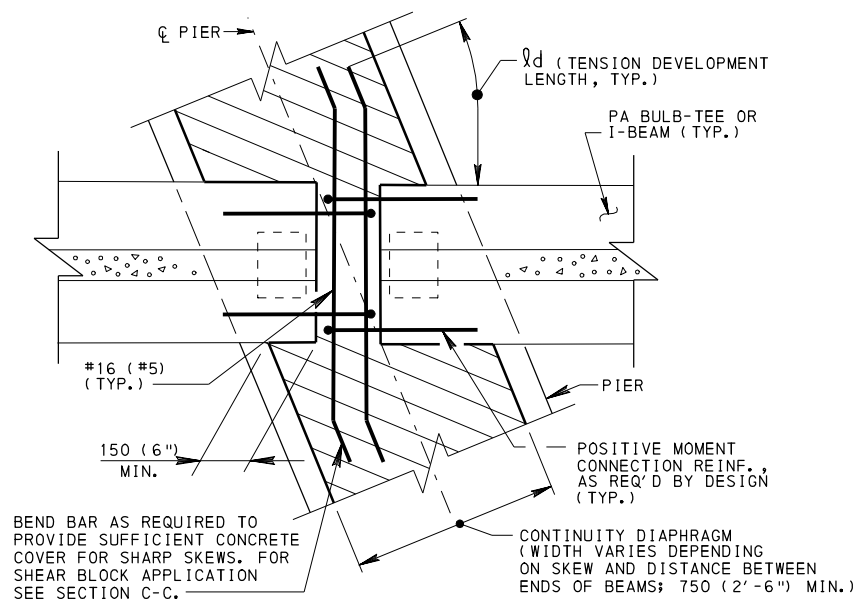
PLAN
TOP FLANGE OF BEAM NOT SHOWN FOR CLARITY
**TYPICAL DIAPHRAGM DETAIL
FASCIA BEAM**
(FASCIA DIAPHRAGM TO BE NORMAL TO
BEAMS FOR SKEWED BRIDGES)



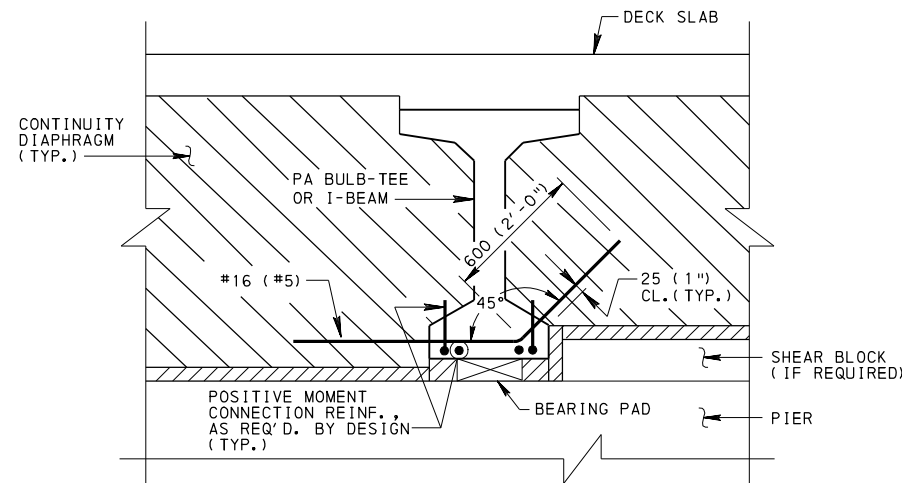
**POSITIVE MOMENT CONNECTION DETAIL
AT PIER**
(DIFFERENT BEAM DEPTH-EXPANSION)



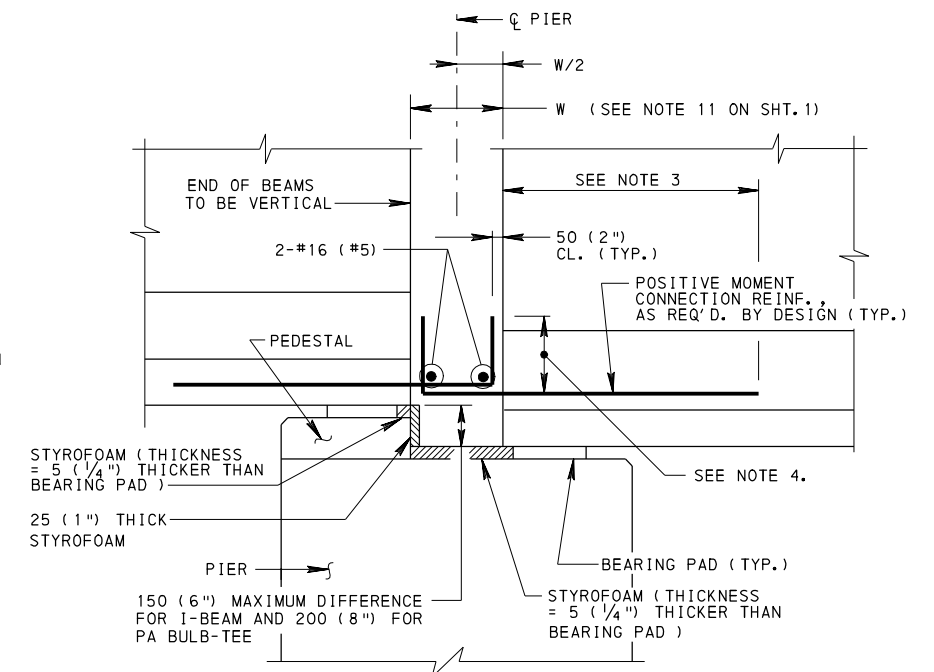
**POSITIVE MOMENT CONNECTION DETAIL
AT PIER**
(SAME BEAM DEPTH)



SECTION B-B
(SKEWED)



SECTION C-C
(SHOWN WITH SHEAR BLOCK)

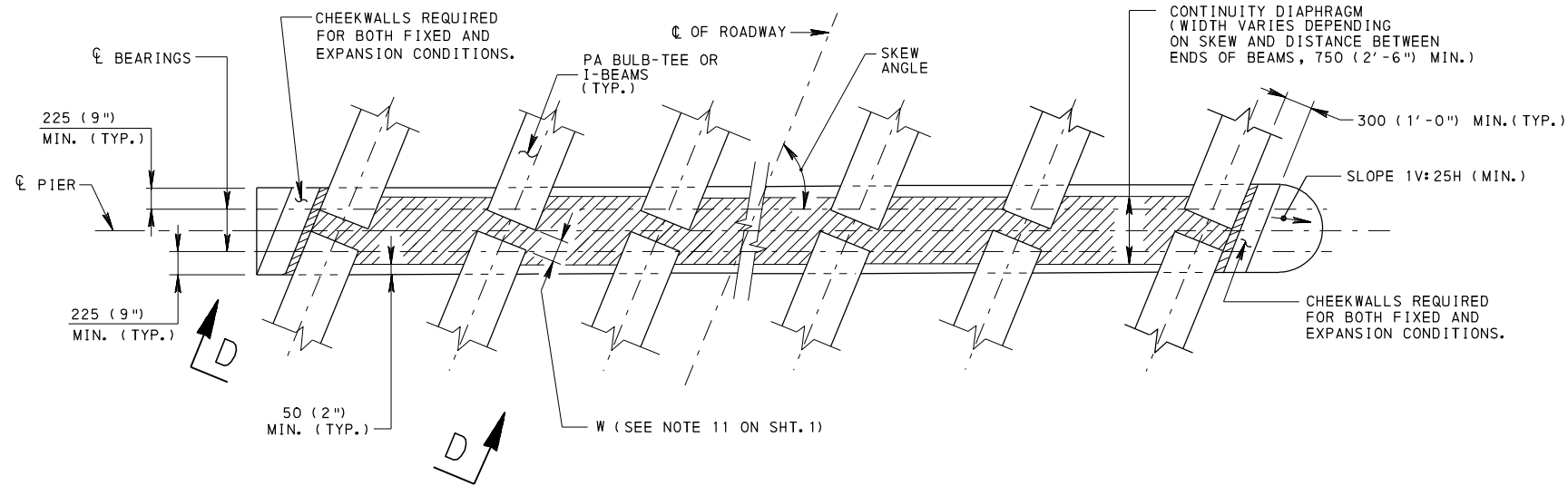


**POSITIVE MOMENT CONNECTION DETAIL
AT PIER**
(DIFFERENT BEAM DEPTH-FIXED)

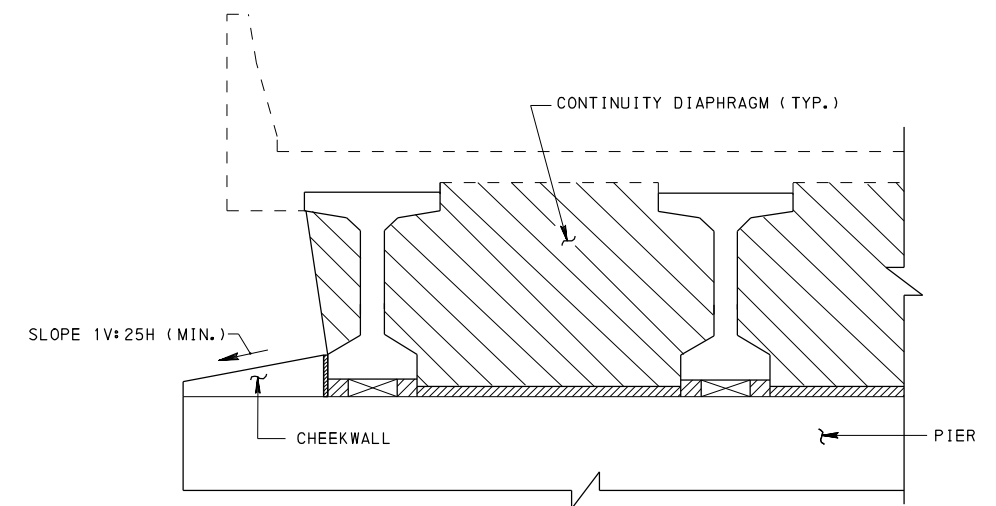
POSITIVE MOMENT CONNECTION NOTES:

1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM.
2. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #25 (#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 225 (9") TO PROVIDE A STAGGERED CUTOFF CONDITION.
4. PROVIDE VERTICAL LEG AS FOLLOWS:
#13 (#4) AND #16 (#5) BAR: 350 (1'-2")
#19 (#6) BAR: 430 (1'-5")
#22 (#7) BAR: 530 (1'-9")
#25 (#8) BAR: 580 (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.

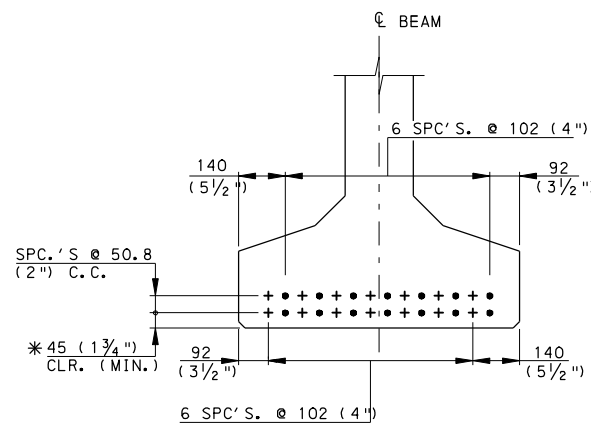
NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
ENGLISH VALUES SHOWN MAY NOT BE MIXED.



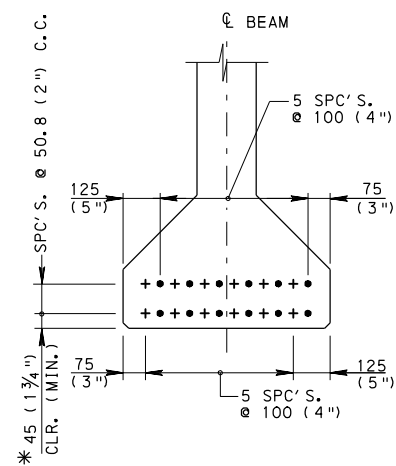
PIER PLAN - (SKEWED)



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 OF 4.

NOTE:

1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

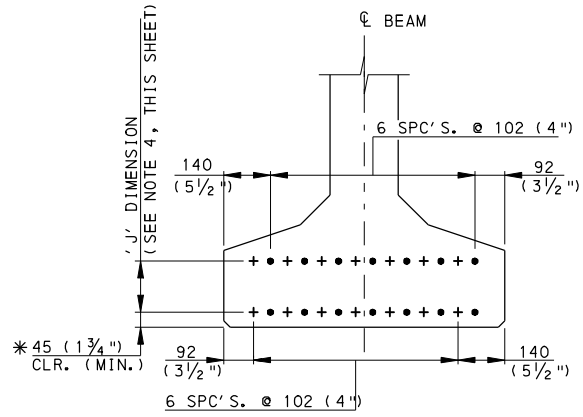
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
I-BEAM & PA BULB-TEE
BEAM BRIDGES

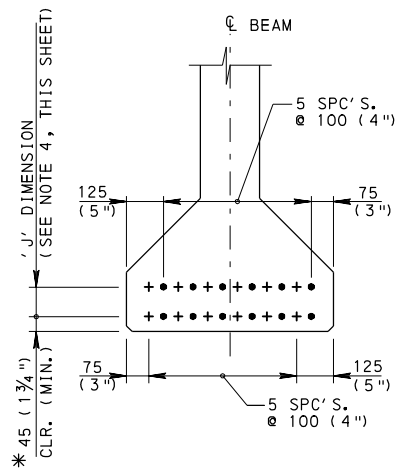
RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thomas
DIRECTOR, BUREAU OF DESIGN

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.

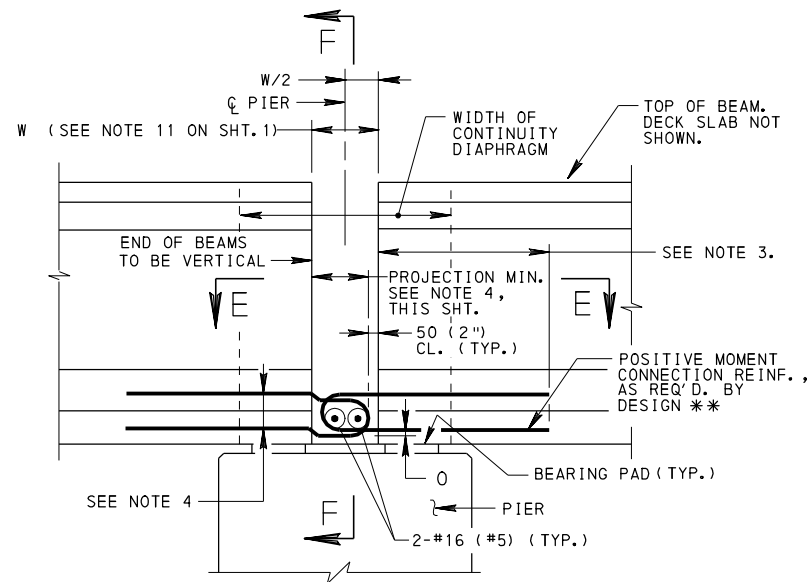
▲ LOCATIONS ARE LIMITED BY BOTTOM FLANGE CONFIGURATION AND 'J' DIMENSION FOR POSITIVE MOMENT REINFORCEMENT (SEE NOTE 4, THIS SHEET)

* ADJUST VERTICAL LOCATION OF POSITIVE MOMENT REINFORCEMENT AS REQUIRED TO ACCOUNT FOR PRESTRESS STRAND DUE TO BEAM DAPS OR BAR SIZE OF POSITIVE REINFORCEMENT.

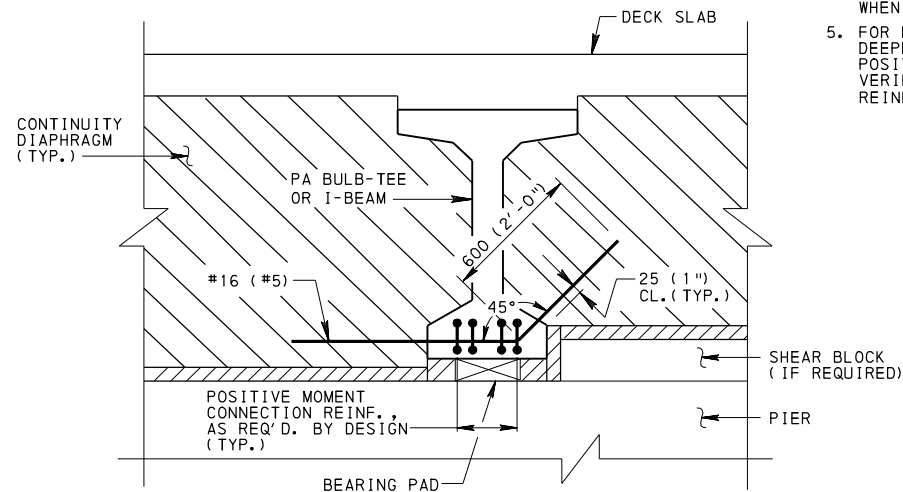
1. BEND EPOXY COATED POSITIVE MOMENT REINFORCEMENT IN THE SHOP PRIOR TO BEAM FABRICATION. BENDING AFTER BEAM FABRICATION WILL BE PERMITTED ONLY IF APPROVED BY THE CHIEF BRIDGE ENGINEER. WHERE POST FABRICATION BENDING IS PERMITTED, A HEAT BENDING PROCEDURE MUST BE USED.
2. PLACE NOTE ON CONSTRUCTION DRAWINGS ALLOWING THE FABRICATOR TO USE ALTERNATE POSITIVE REINFORCEMENT, IF DESIGN IS PROVIDED.

NOTE:

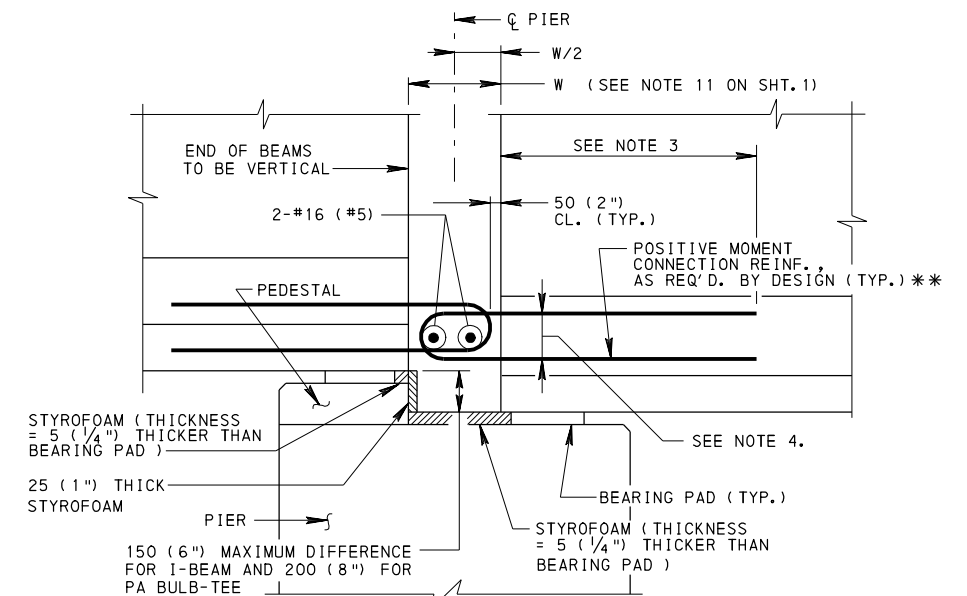
1. FOR TYPICAL LONGITUDINAL SECTIONS AT ABUTMENT, SEE BD-656M.



OPTIONAL POSITIVE MOMENT CONNECTION
DETAIL AT PIER
(SAME BEAM DEPTH)



SECTION F-F
(SHOWN WITH SHEAR BLOCK)



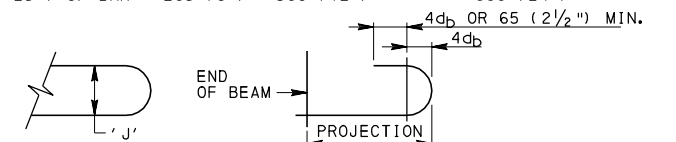
OPTIONAL POSITIVE MOMENT CONNECTION
DETAIL AT PIER
(DIFFERENT BEAM DEPTH-FIXED)

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 #25 (#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 225 (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) (SEE NOTE 3)
#13 (#4) BAR:	100 (4")	200 (8")	320 (12")
#16 (#5) BAR:	125 (5")	200 (8")	410 (15")
#19 (#6) BAR:	150 (6")	250 (10")	490 (18")
#22 (#7) BAR:	180 (7")	250 (10")	560 (21")
#25 (#8) BAR:	205 (8")	300 (12")	660 (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.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

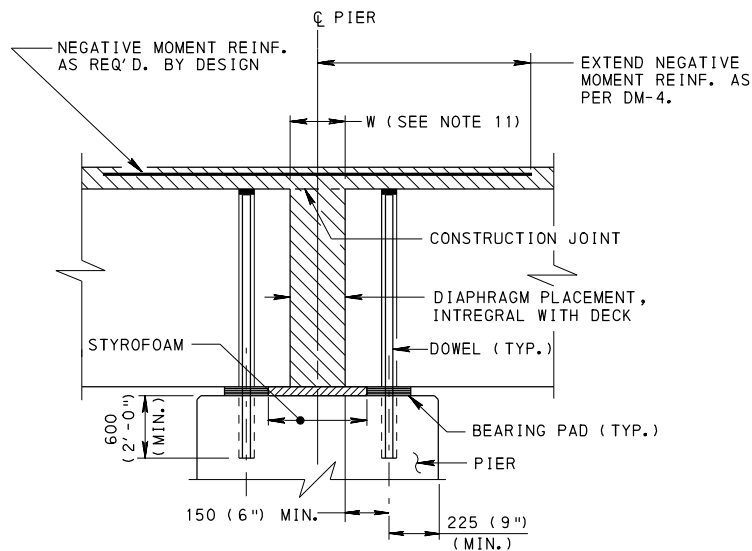
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN

STANDARD CONTINUITY FOR LIVE LOAD DETAILS I-BEAM & PA BULB-TEE BEAM BRIDGES

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

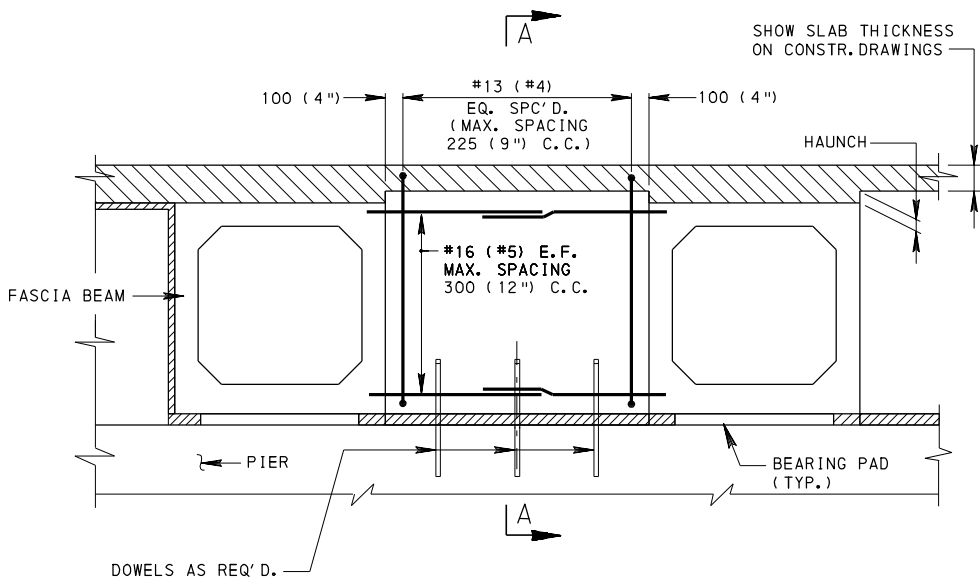
RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 4 OF 4
BD-664M

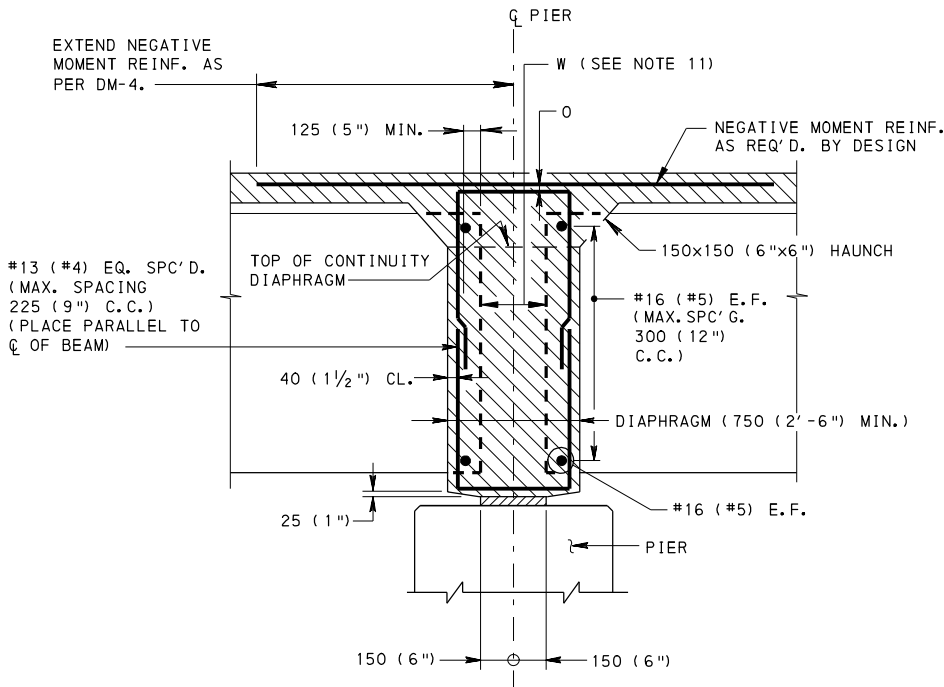


TYPICAL LONGITUDINAL SECTION
ADJACENT BOX BEAMS AT PIER
(FIXED)

NOTE:
DRILL 50 (2") Ø HOLE IN PIER AFTER SHEAR KEY
GROUT REPLACEMENT, PLACE 32 (1¼") Ø DOWEL BARS, AND FILL
HOLE WITH NON-SHRINK GROUT. USE PREFORMED HOLES FOR PIER
BENTS OR HAMMERHEAD PIERS. SEE BC-775M FOR ADDITIONAL DETAILS.

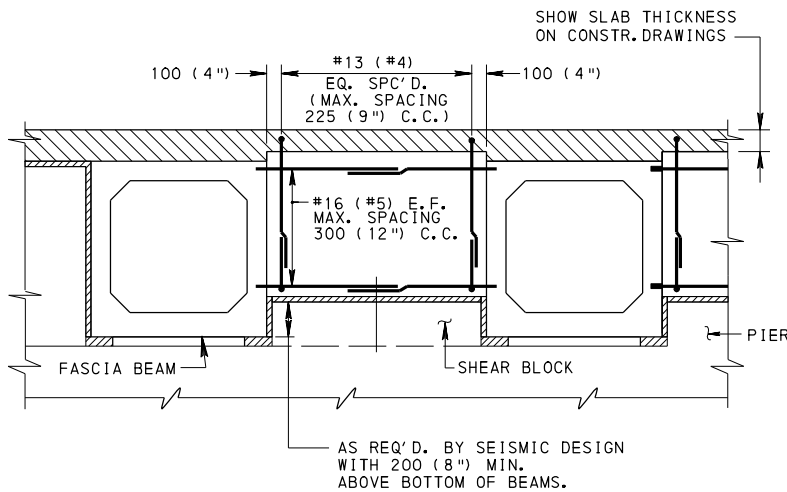


TYPICAL DIAPHRAGM
SPREAD BOX BEAMS AT PIER
(FIXED)



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 DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESES.
2. ALL REINFORCEMENT STEEL BARS SHOWN ARE SOFT CONVERTED METRIC SIZES THAT MEET THE REQUIREMENTS OF ASTM A 615M, A 996M, OR A 706M.
3. FOR LOCATION OF DOWELS, SHEAR BLOCKS OR CURTAIN WALLS, SEE BD-658M.
4. FOR SLAB REINFORCEMENT AND PLACEMENT OF DIAPHRAGM CONCRETE, SEE BD-660M.
5. FOR BEAM REINFORCEMENT, SEE BD-661M.
6. DESIGNER TO SPECIFY STEEL CORROSION PROTECTION AS PER DESIGN MANUAL PART 4, D5.4.3.6P.
7. MODIFY DETAILS AS REQUIRED FOR BRIDGES ON SKEWS.
8. MODIFY DOWELS AS REQUIRED TO RESIST HORIZONTAL FORCES. DOWELS SHOWN ARE THE MINIMUM REQUIRED.
9. FOR DOWEL DETAIL, SEE BC-775M.
10. FOR WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.
11. PROVIDE MINIMUM CLEAR DISTANCE (W) BETWEEN THE ENDS OF BEAMS AS FOLLOWS:

WITH POSITIVE MOMENT REINFORCEMENT

SINGLE LAYER OF POSITIVE MOMENT REINFORCEMENT:
250 (10") WIDTH FOR #13 (#4) AND #16 (#5)
300 (12") WIDTH FOR #19 (#6) AND #22 (#7)
350 (14") WIDTH FOR #25 (#8)

TWO LAYERS OF POSITIVE MOMENT REINFORCEMENT:
300 (12") WIDTH FOR #13 (#4) AND #16 (#5)
350 (14") WIDTH FOR #19 (#6) AND #22 (#7)
400 (16") WIDTH FOR #25 (#8)

WITHOUT POSITIVE MOMENT REINFORCEMENT

100 (4").

12. POSITIVE MOMENT REINFORCEMENT BARS MUST BE THE SAME SIZE WITHIN A BEAM.
13. 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.
14. HORIZONTAL OFFSETS OF OPPOSING GIRDERS ARE NOT PERMITTED.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
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DEPARTMENT OF TRANSPORTATION
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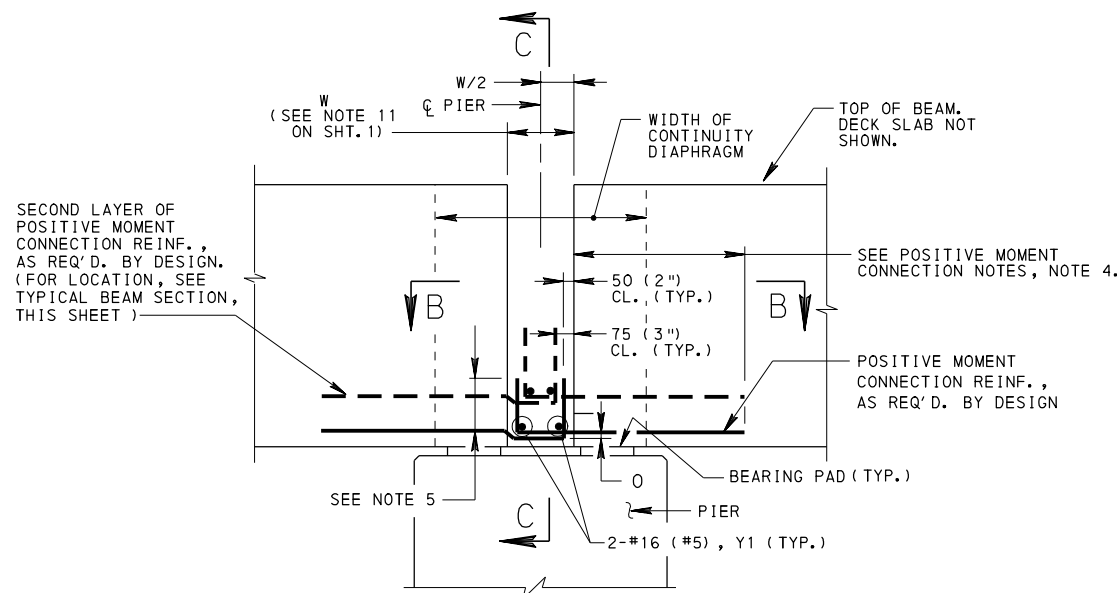
STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
BOX BEAM BRIDGES

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	

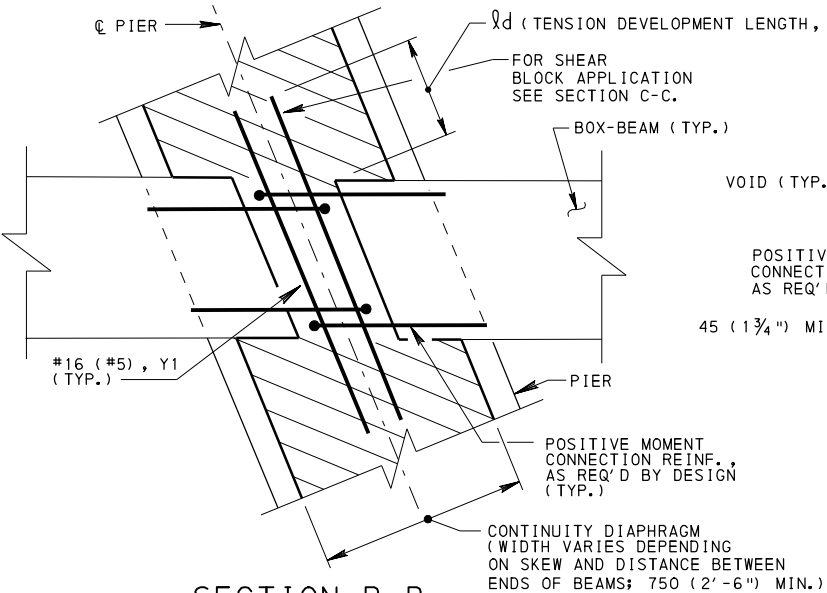
RECOMMENDED SEPT. 20, 2010
Thomas P. Macioro
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
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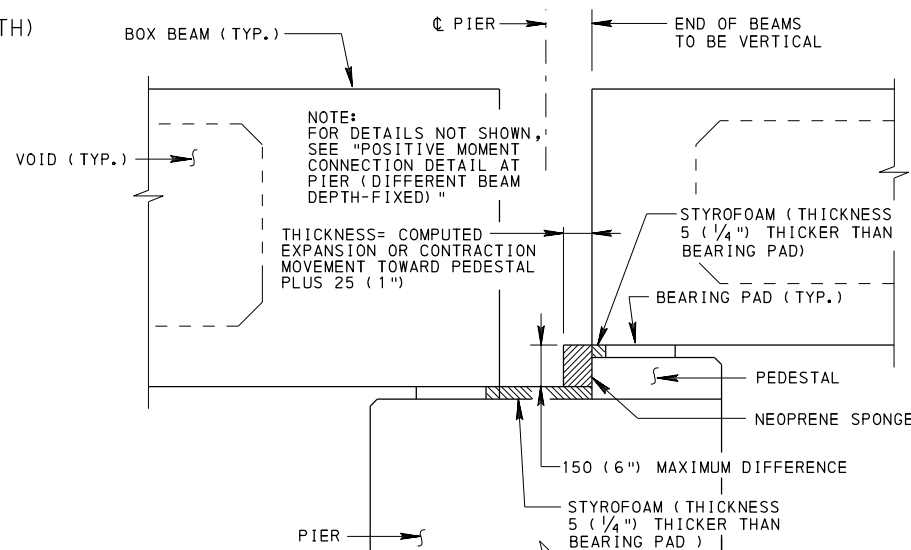
SHEET 1 OF 3
BD-665M



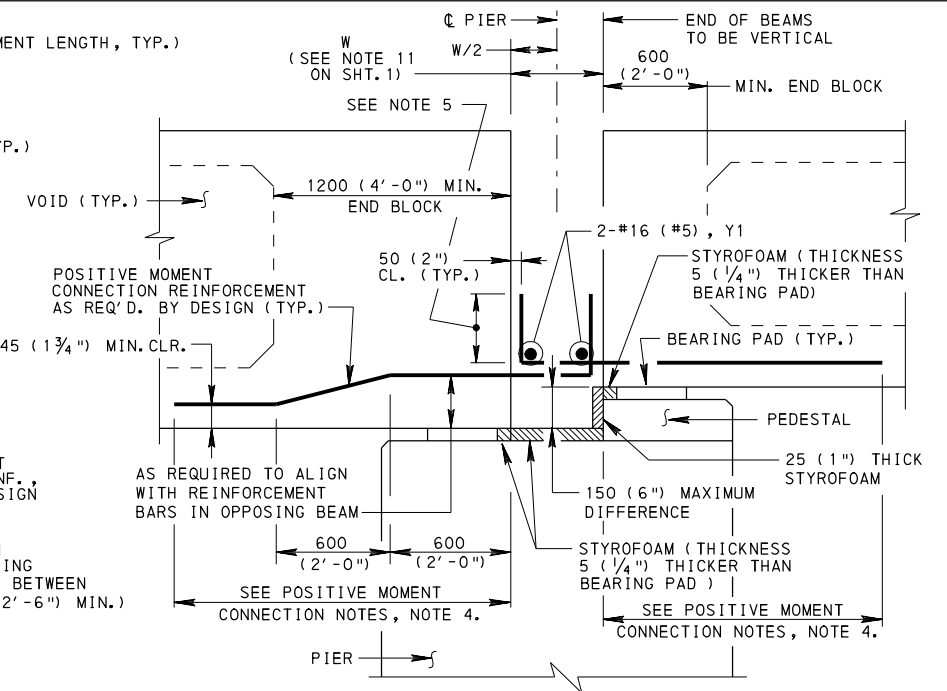
**POSITIVE MOMENT CONNECTION DETAIL
AT PIER
(SAME BEAM DEPTH)**



**SECTION B-B
(SKEWED)**



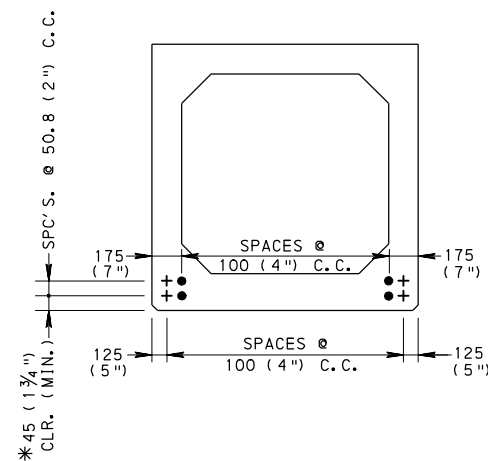
**POSITIVE MOMENT CONNECTION DETAIL
AT PIER
(DIFFERENT BEAM DEPTH-EXPANSION)**



**POSITIVE MOMENT CONNECTION DETAIL
AT PIER
(DIFFERENT BEAM DEPTH-FIXED)**

POSITIVE MOMENT CONNECTION NOTES:

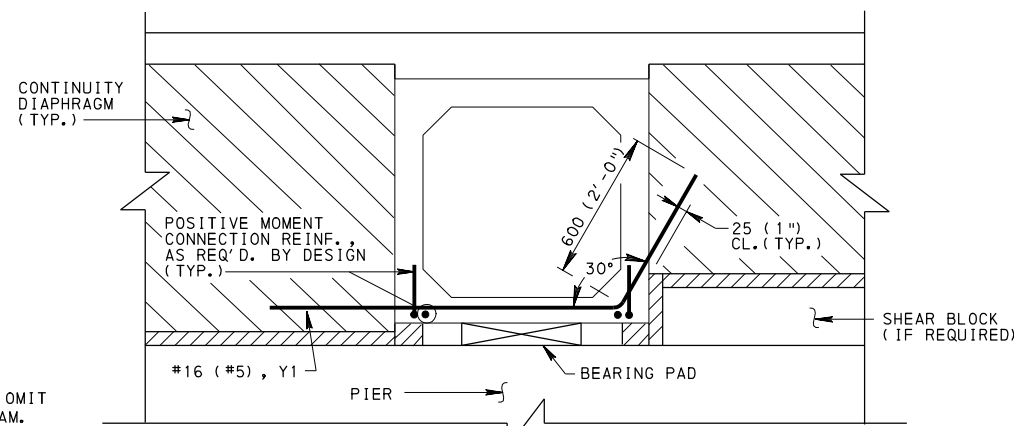
1. PLACE POSITIVE MOMENT REINFORCEMENT SYMMETRICAL ABOUT THE CENTERLINE OF BEAM.
2. FOR BEAMS OF DIFFERENT DEPTHS, POSITIVE MOMENT REINFORCEMENT IN THE DEEPER BEAM SHOULD BE PLACED AT THE SAME VERTICAL LOCATION AS THE POSITIVE MOMENT REINFORCEMENT IN THE SHALLOWER BEAM.
3. MAXIMUM SIZE FOR POSITIVE MOMENT REINFORCEMENT IS #25 (#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 225 (9") TO PROVIDE A STAGGERED CUTOFF CONDITION.
5. PROVIDE VERTICAL LEG AS FOLLOWS:
 #13 (#4) AND #16 (#5) BAR: 350 (1'-2")
 #19 (#6) BAR: 430 (1'-5")
 #22 (#7) BAR: 530 (1'-9")
 #25 (#8) BAR: 580 (1'-11")



**TYPICAL 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.
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 C OF BEAM.

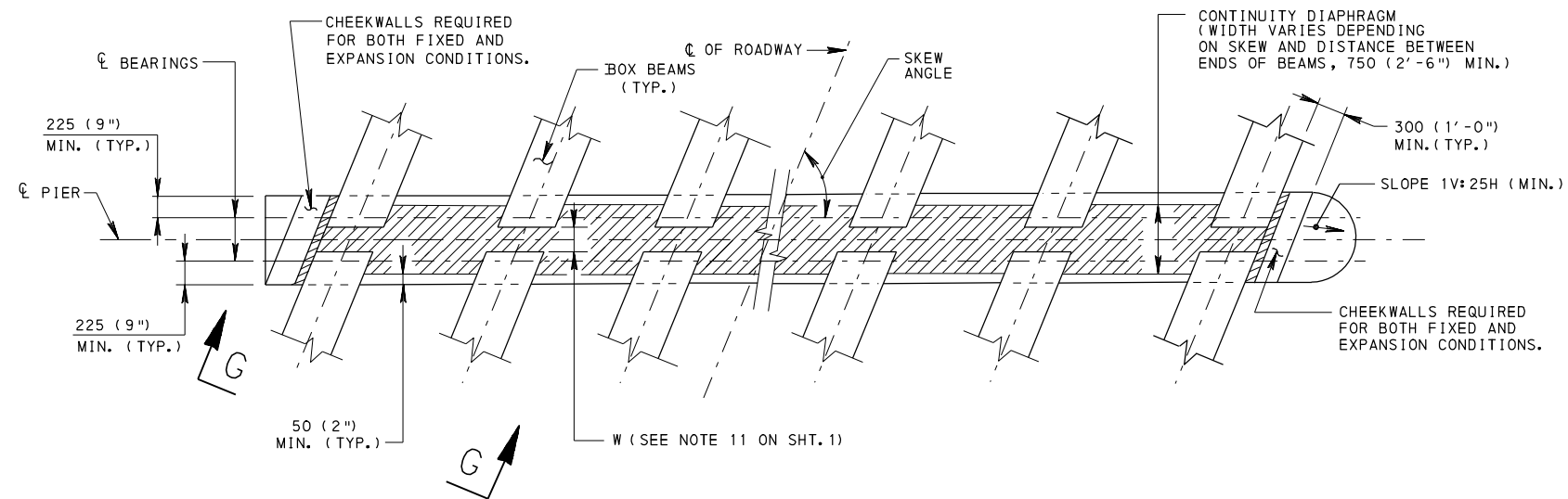


SECTION C-C

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN**

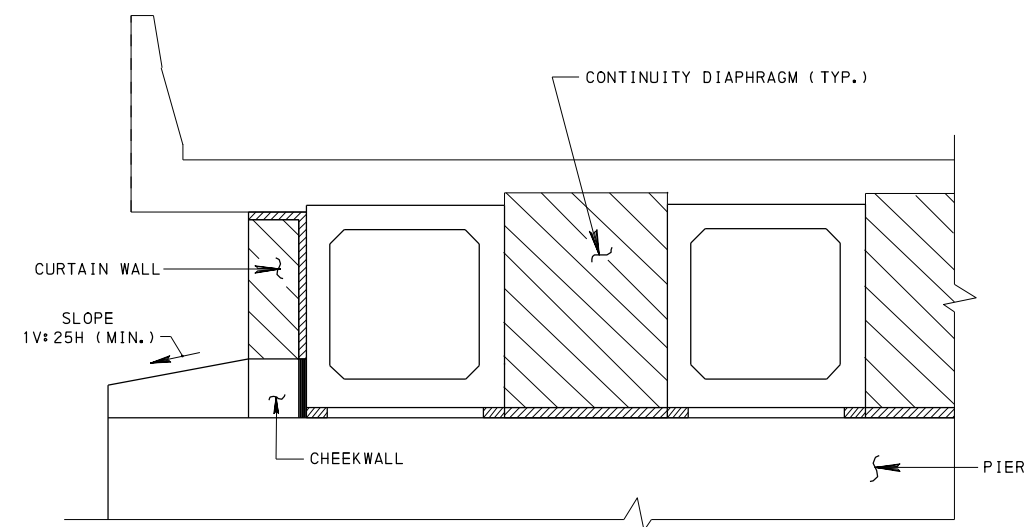
**STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
BOX BEAM BRIDGES**



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.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
CONTINUITY FOR LIVE LOAD DETAILS
BOX BEAM BRIDGES

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thomas
DIRECTOR, BUREAU OF DESIGN

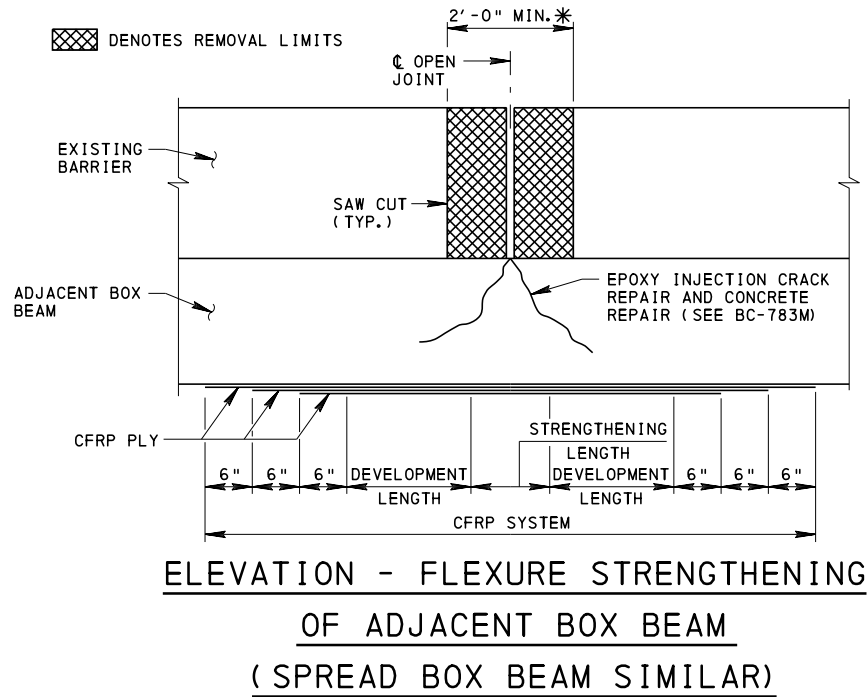
SHEET 3 OF 3
BD-665M

DESIGN NOTES:

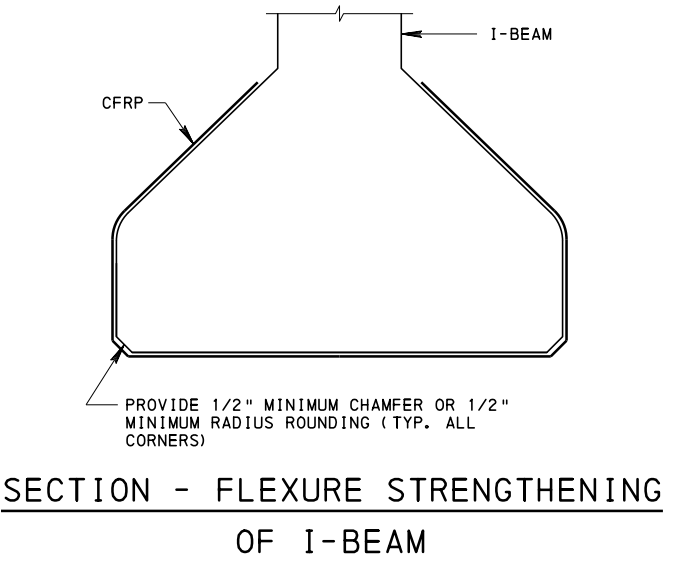
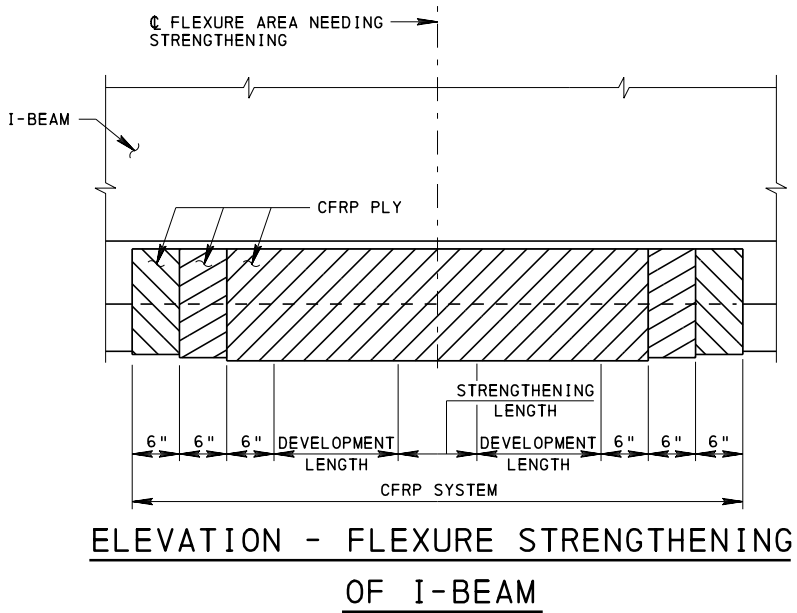
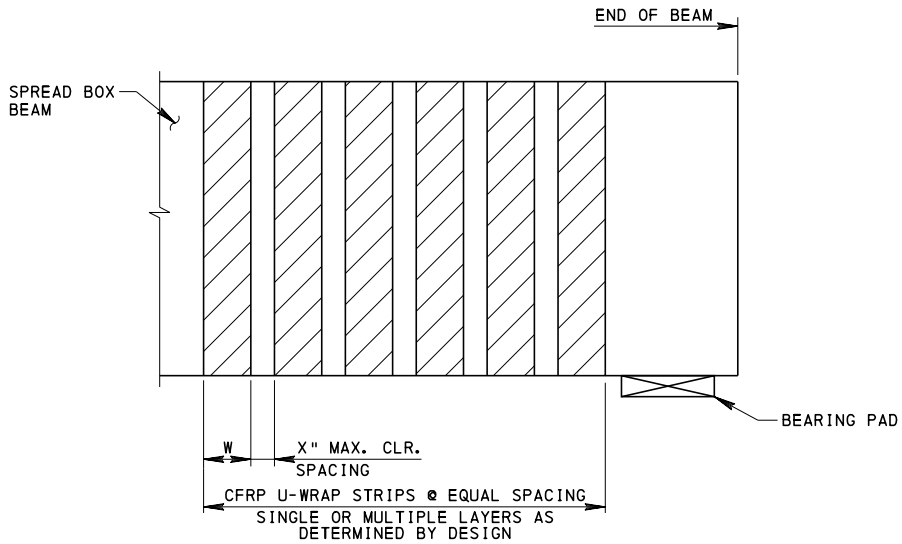
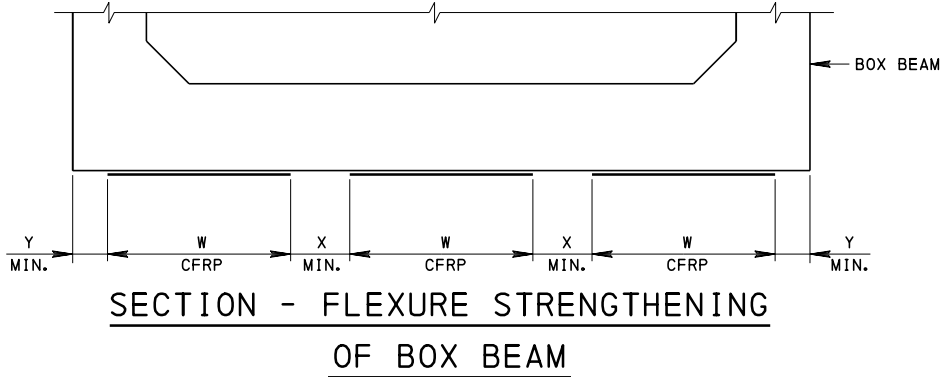
1. THE PROJECT DESIGNER WILL DETERMINE IF A CARBON FIBER REINFORCEMENT POLYMER (CFRP) SYSTEM IS A SUITABLE STRENGTHENING REPAIR TECHNIQUE FOR THE SPECIFIC PROJECT. PERFORM A CONDITION ASSESSMENT OF THE EXISTING BRIDGE THAT INCLUDES ESTABLISHING ITS LOAD-CARRYING CAPACITY, IDENTIFYING DEFICIENCIES AND 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-08 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. PROVIDE A LRFD RELIABILITY INDEX OF 3.5 IN ACCORDANCE WITH ACI 440.2R-08.
9. INCLUDE GENERAL NOTES ON THE CONTRACT DRAWINGS THAT LIST DESIGN LOADS AND ALLOWABLE STRAINS IN THE CFRP SYSTEM USED IN THE CONCEPTUAL DESIGN.
10. 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.
11. 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 A SURFACE MOUNTED CFRP SYSTEM TO STRENGTHEN EXISTING STRUCTURE COMPONENTS.
2. CONSTRUCT CONCRETE REPAIRS IN ACCORDANCE WITH BC-738M 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 PLIES, 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-WRAPPS 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.



* ELIMINATE OPEN JOINT IF APPLICABLE (NON-COMPOSITE ADJACENT BOX BEAM), REMOVE PORTION OF EXISTING CONCRETE BARRIER. MAINTAIN EXISTING REINFORCEMENT BARS AND PROVIDE ADDITIONAL EQUIVALENT LONGITUDINAL EPOXY COATED REINFORCEMENT BARS TO SPLICE TO EXISTING REINFORCEMENT BARS TO MAKE REINFORCEMENT BARS CONTINUOUS. BEND NEW EPOXY COATED NO.3 BARS TO PROVIDE VERTICAL TIE BARS TO ENCLOSE HORIZONTAL BARS AT 6" MAXIMUM SPACING. REPLACE BARRIER CONCRETE IN KIND WITH NO OPEN JOINT.



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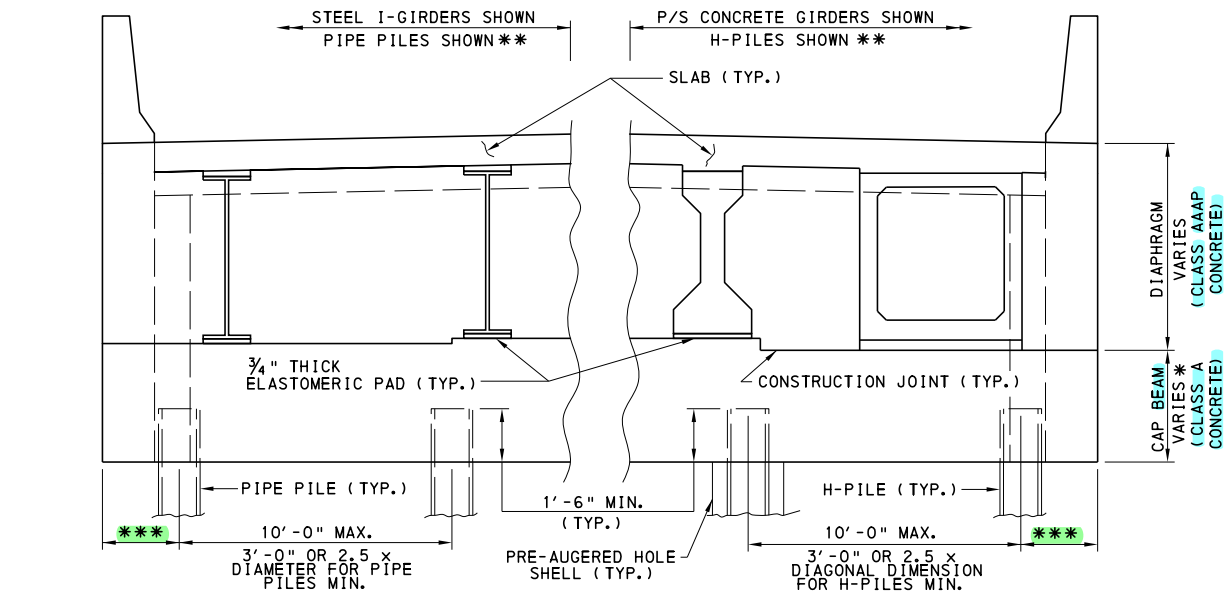
STANDARD
CFRP STRENGTHENING
PRESTRESSED CONCRETE BEAMS

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

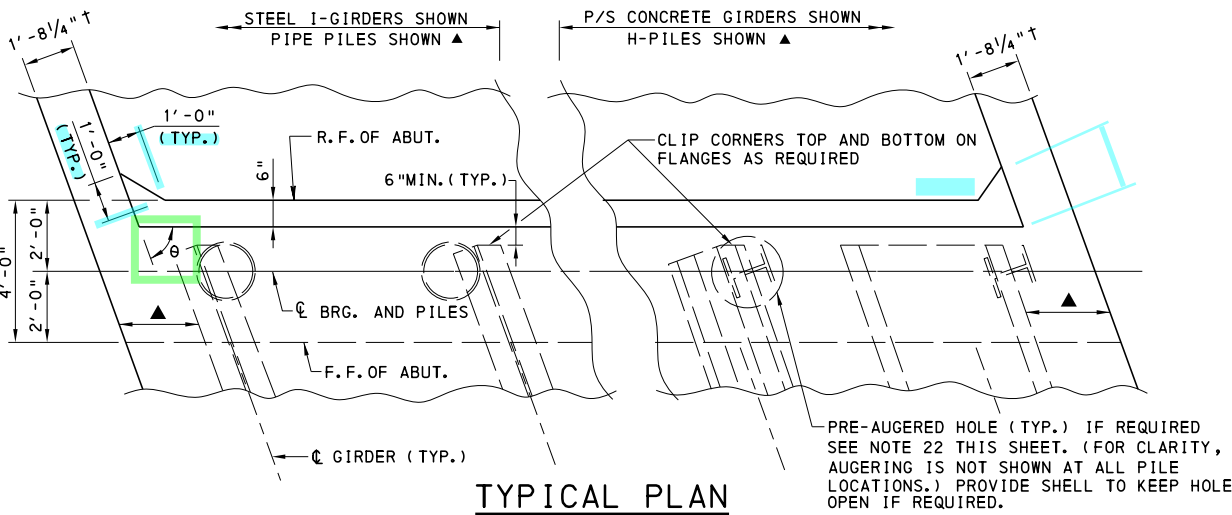
SHEET 1 OF 1
BD-666M

- CHANGE 1
- CHANGE 2
- CHANGE 3



TYPICAL ELEVATION

- * DEPTH OF ABUTMENT BELOW CONSTRUCTION JOINT IS 3'-3" AT SHALLOWEST POINT (SEE DM-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
- *** 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 $(W + dp \sin \theta / 2)$ (ROUNDED UP TO THE NEXT 3" INCREMENT)
 - WHERE: W: WIDTH OF WINGWALL AT REAR FACE OF INTEGRAL ABUTMENT, NEGLECTING THE 1' HAUNCH (ft.)
 - dp: 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 5) 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 5) 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 6.
- 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, APPENDIX G
- PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH PUBLICATION 408 AND THE CONTRACT SPECIAL PROVISIONS.
- MATERIAL STRENGTH
 - REINFORCEMENT STEEL $f_y = 60 \text{ ksi}$
 - CONCRETE $f'_c = 4000 \text{ psi}$ (CLASS AAAP CONCRETE) FOR DECK SLABS, APPROACH SLABS, AND END DIAPHRAGMS AND WINGWALLS ABOVE CONSTRUCTION JOINT, MODULAR RATIO (E_s/E_c) $n = 8$.
 - $f'_c = 3500 \text{ psi}$ (CLASS AA CONCRETE) FOR BARRIERS, MODULAR RATIO (E_s/E_c) $n = 8$.
 - $f'_c = 3000 \text{ psi}$ (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 (EQUIVALENT SURFACE AREA DENSITY) = 30 pcf
- 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 (IM) = 33% IS APPLIED TO LIVE LOADS ON THE ABUTMENTS AND THE PILES IN ACCORDANCE WITH 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"
 - UNLESS OTHERWISE INDICATED, USE THE FOLLOWING MINIMUM REINFORCEMENT SPLICE LENGTHS:

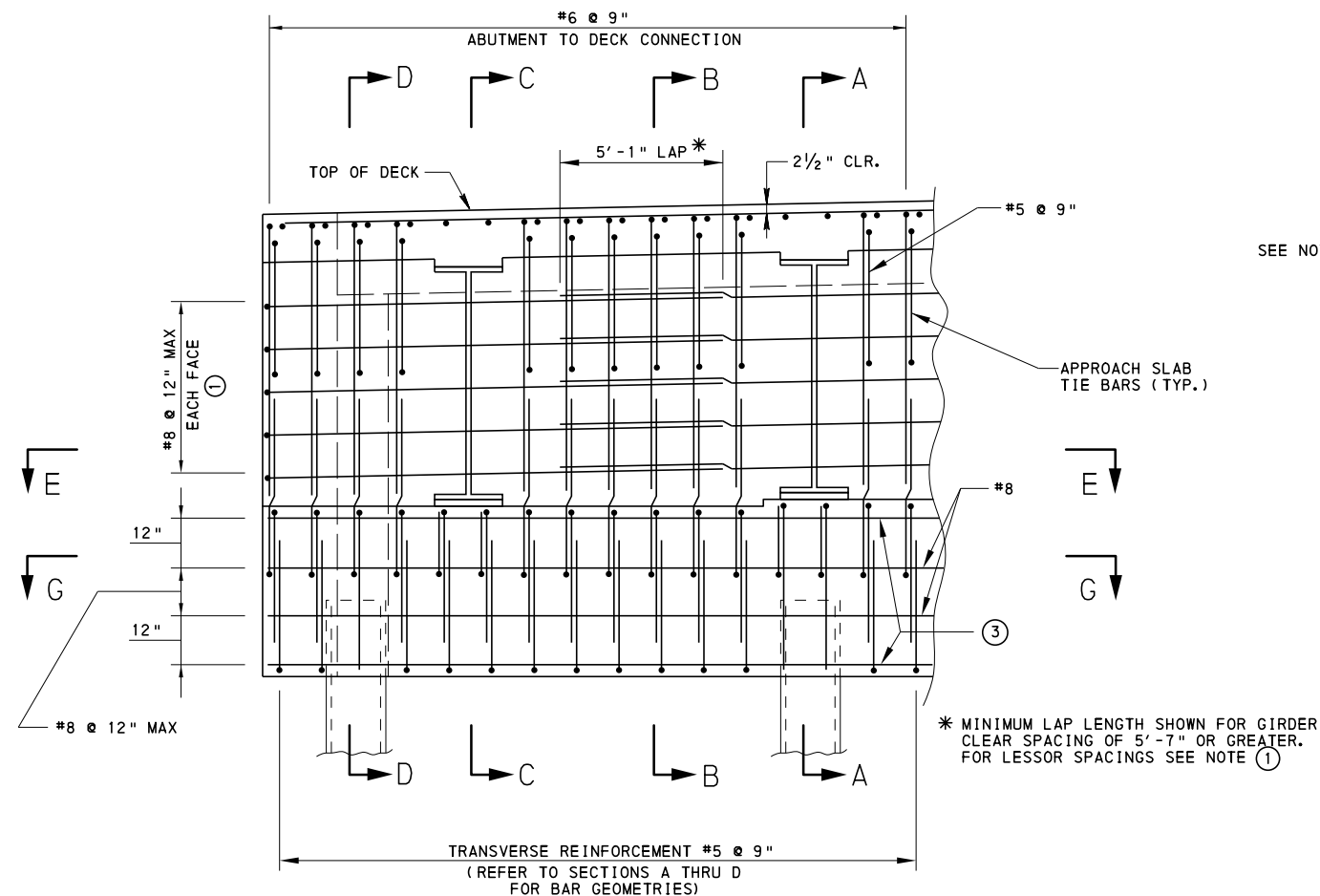
#4 2'-1"	#6 3'-1"	#8 5'-1"	#10 8'-2"
#5 2'-7"	#7 3'-10"	#9 6'-5"	#11 10'-0"
 - BAR SIZE: MAXIMUM BAR SIZE #11 MINIMUM BAR SIZE #4
- FOR DESIGN CONTROLS OF DECK AND BARRIERS, SEE STANDARD DRAWING BD-601M.
- USE ONLY ONE ROW OF VERTICAL PILES PER ABUTMENT. PILES MAY BE H-PILES OR PIPE PILES. FOR H-PILES, 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 STANDARD DRAWING RC-12M.
- FOR DETAILS OF INSERTS IN PRECAST CONCRETE BEAMS, SEE STANDARD DRAWING BD-655M IN ADDITION TO SHEETS 3 AND 8 OF THIS STANDARD.
- FOR DETAILS OF APPROACH SLABS FOR INTEGRAL ABUTMENT BRIDGES, SEE STANDARD DRAWING 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.
- 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.
- 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.
- USE OF ADJACENT BOX BEAMS IS NOT PERMITTED, 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.
- ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615M, A 996M OR A 706M.
- THE STLRD 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.
- IF AN INTEGRAL ABUTMENT BRIDGE IS BEING REDECKED, THE END DIAPHRAGM MUST BE REMOVED COMPLETELY PRIOR TO DECK REMOVAL TO AVOID SUBJECTING THE GIRDERS TO STRUCTURE AND PAVEMENT TEMPERATURE FORCES AND EARTH PRESSURE.

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STANDARD
INTEGRAL ABUTMENT
LAYOUT AND GENERAL NOTES

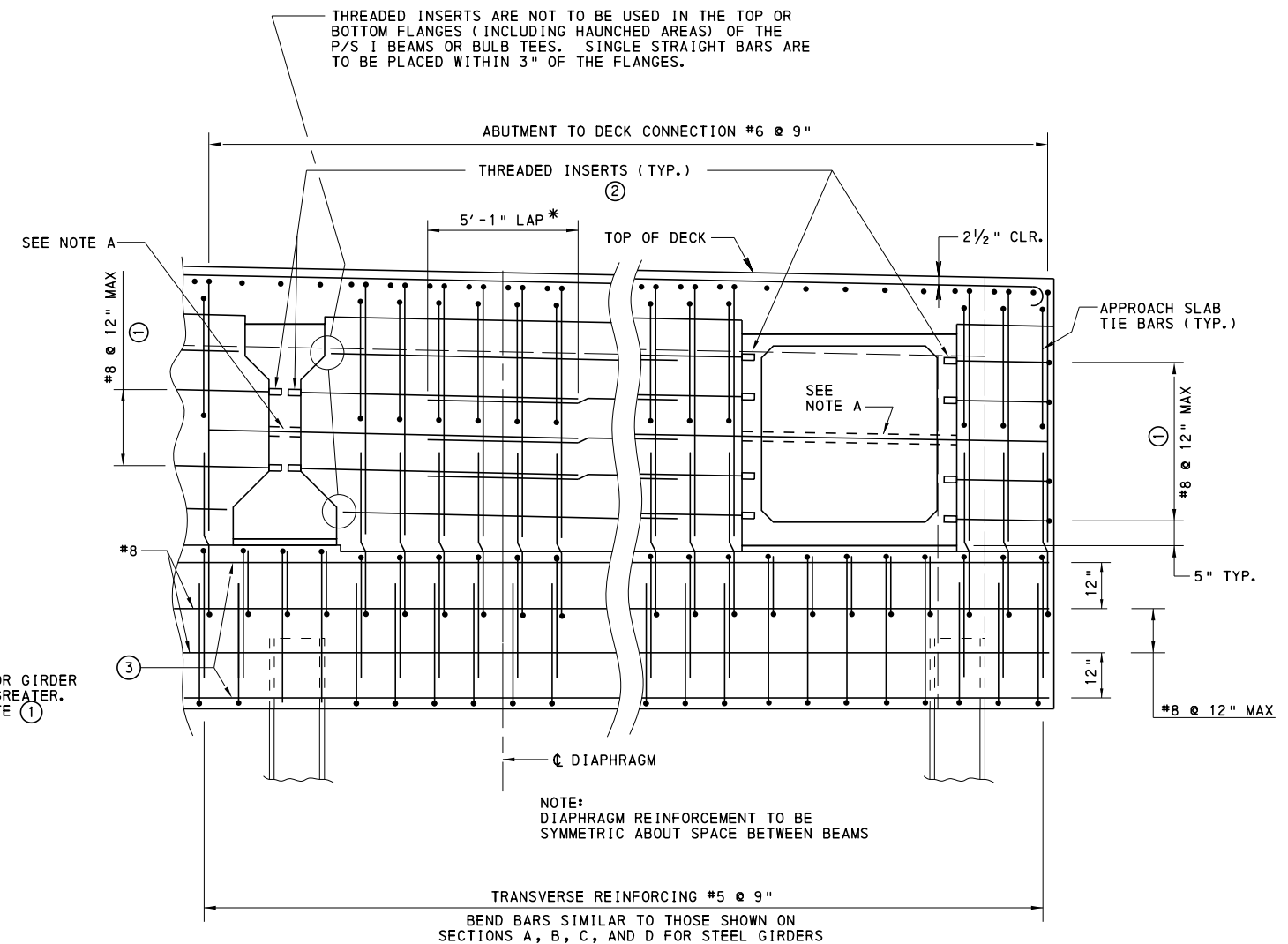
RECOMMENDED NOV. 21, 2014	RECOMMENDED NOV. 21, 2014	SHEET 1 OF 9
Thomas P. Maciore CHIEF BRIDGE ENGINEER	Brian S. Thompson ACTING DIR. BUR. OF PROJECT DELIVERY	BD-667M

BD-601M	CONCRETE DECK SLAB
BD-628M	BRIDGE APPROACH SLABS
BD-655M	TYPICAL SUPERSTRUCTURE SECTIONS
BD-656M	TYPICAL LONGITUDINAL SECTIONS
BC-736M	REINFORCEMENT BAR FABRICATION DETAILS
BC-739M	BRIDGE BARRIER TO GUIDE RAIL TRANSITION
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS
RC-12M	BACKFILL AT STRUCTURES
REFERENCE DRAWINGS	



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 4.
DECK REINFORCEMENT NOT SHOWN FOR CLARITY

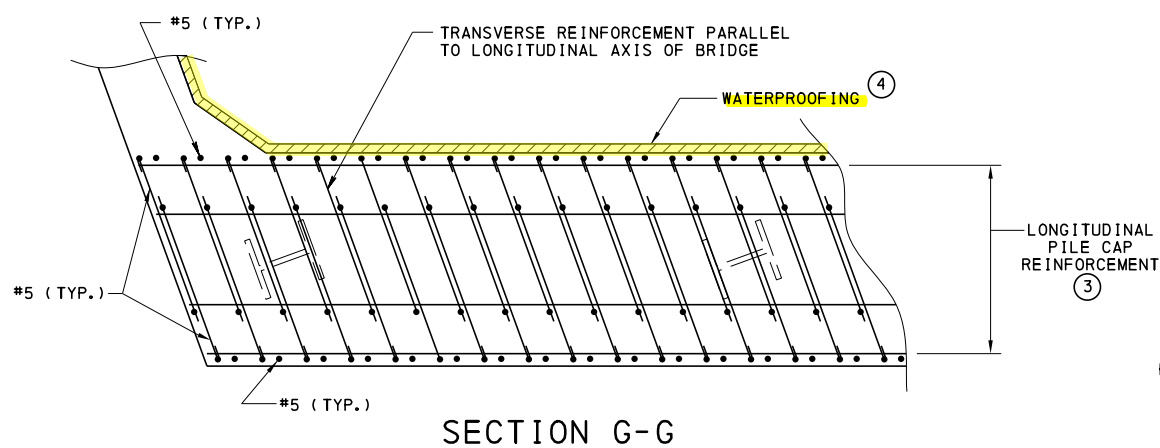


PARTIAL SECTION THRU ABUTMENT CONCRETE GIRDERS

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.



SECTION G-G

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 8.
- ③ FOR BAR SIZES OF PILE CAP BEAM TOP AND BOTTOM REINFORCEMENT, SEE DM-4 AP. G 1.4.3
- ④ REFER TO WATERPROOFING DETAIL ON SHEET 4 FOR ADDITIONAL INFORMATION.

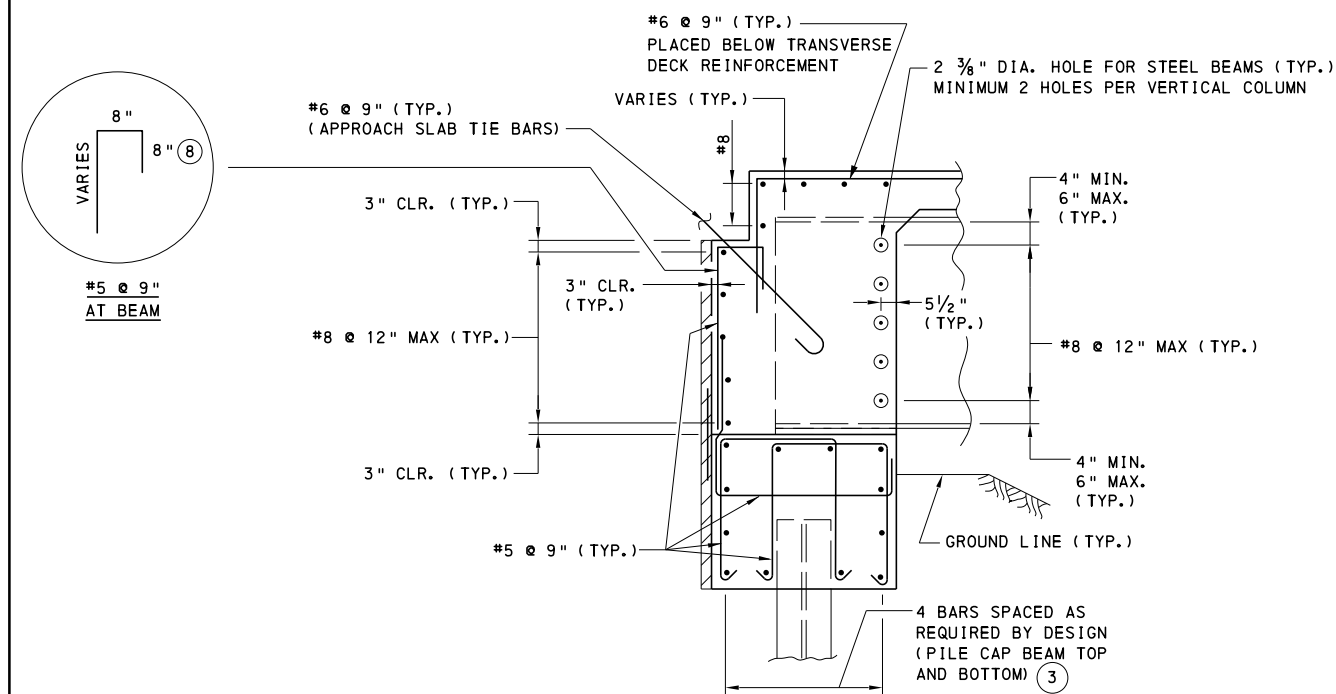
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STANDARD
INTEGRAL ABUTMENT
TYPICAL SECTIONS

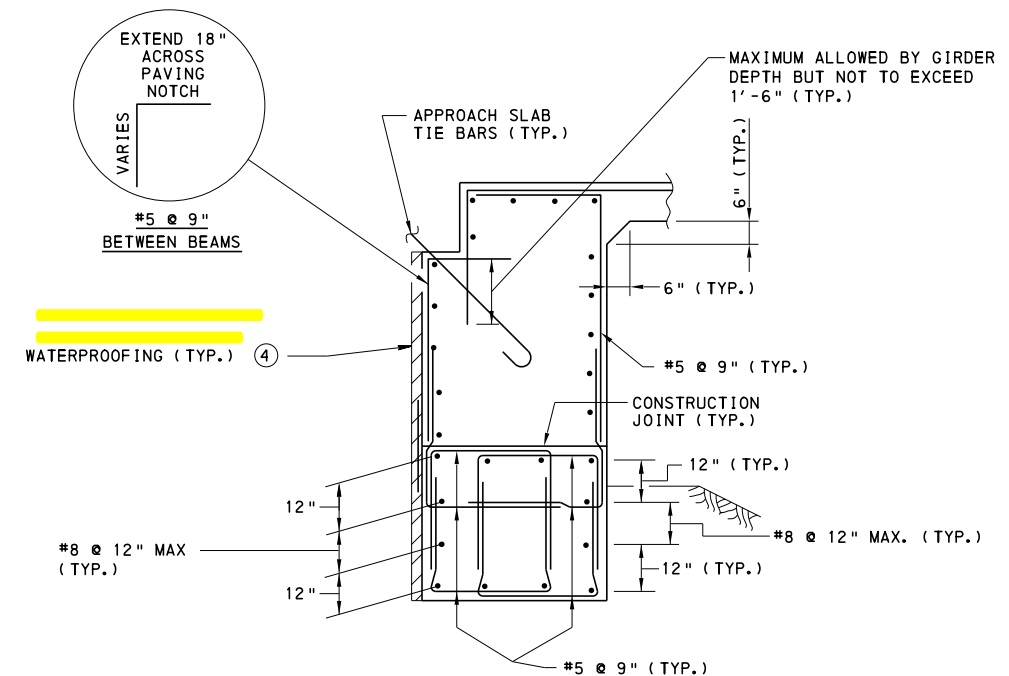
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CHIEF BRIDGE ENGINEER

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Brenda Thompson
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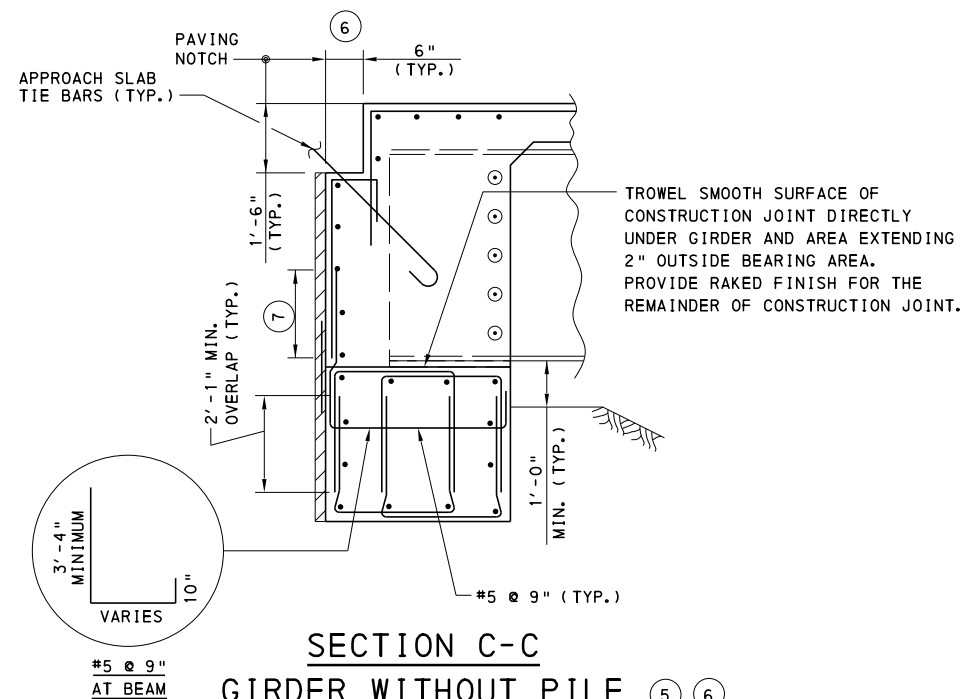
SHEET 2 OF 9
BD-667M



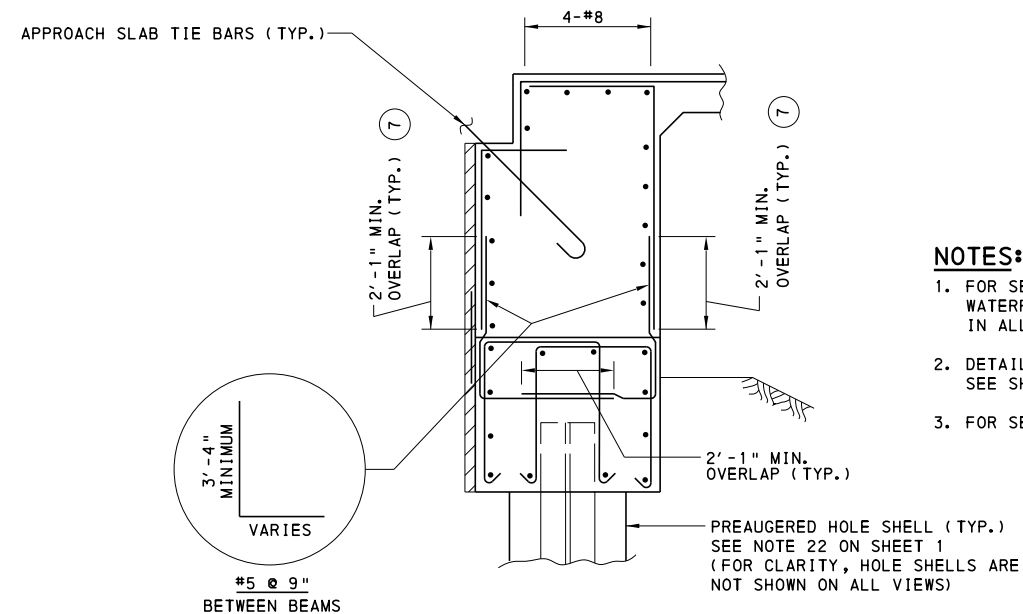
SECTION A-A
GIRDER WITH PILE ⑤ ⑥



SECTION B-B
NO GIRDER, NO PILE ⑤



SECTION C-C
GIRDER WITHOUT PILE ⑤ ⑥



SECTION D-D
PILE WITHOUT GIRDER ⑤

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 ABOVE SHOWN FOR STEEL BEAMS, DETAILS SIMILAR FOR P/S BEAMS. SEE SHEET 8 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 DM-4 AP. G 1.4.3
- ④ REFER TO WATERPROOFING DETAIL ON SHEET 4 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 6).
- ⑥ STEEL BEAM SHOWN P/S BEAMS SIMILAR. SEE SHEET 8 AND PARTIAL SECTION THRU ABUTMENT CONCRETE GIRDERS, ON SHEET 2 FOR INSERT/SLEEVE LOCATIONS.
- ⑦ FOR GIRDERS TOO SHALLOW TO PERMIT A 2'-1" OVERLAP, THE SPLICE IS NOT PERMITTED. ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.
- ⑧ IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.

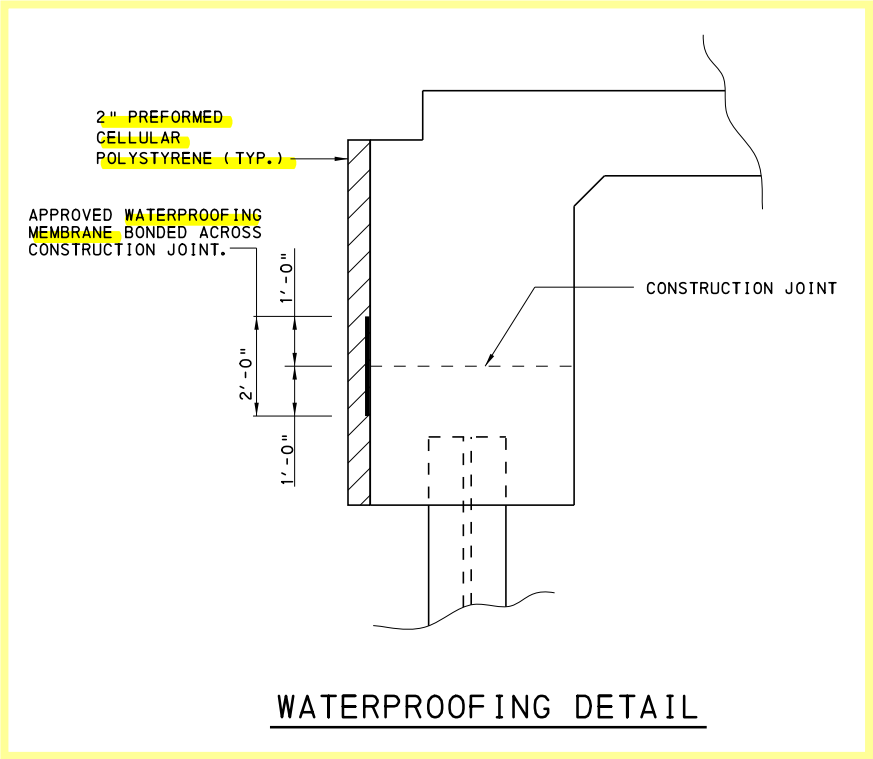
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TYPICAL SECTIONS

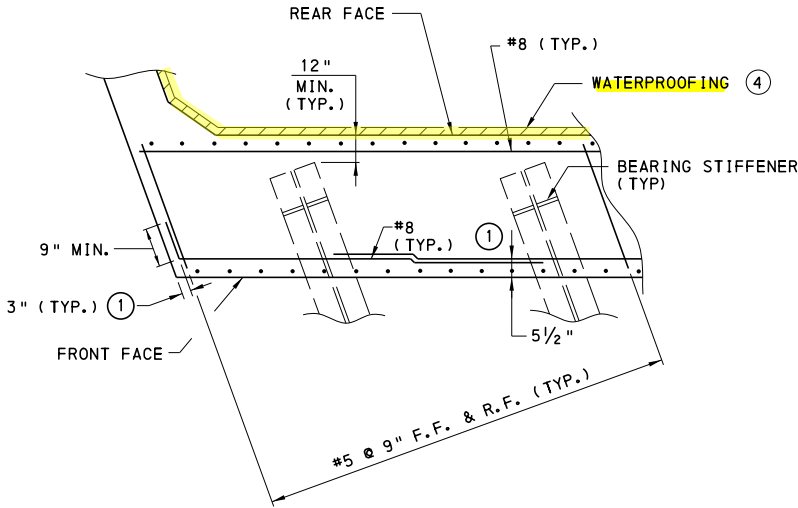
RECOMMENDED NOV. 21, 2014
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CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
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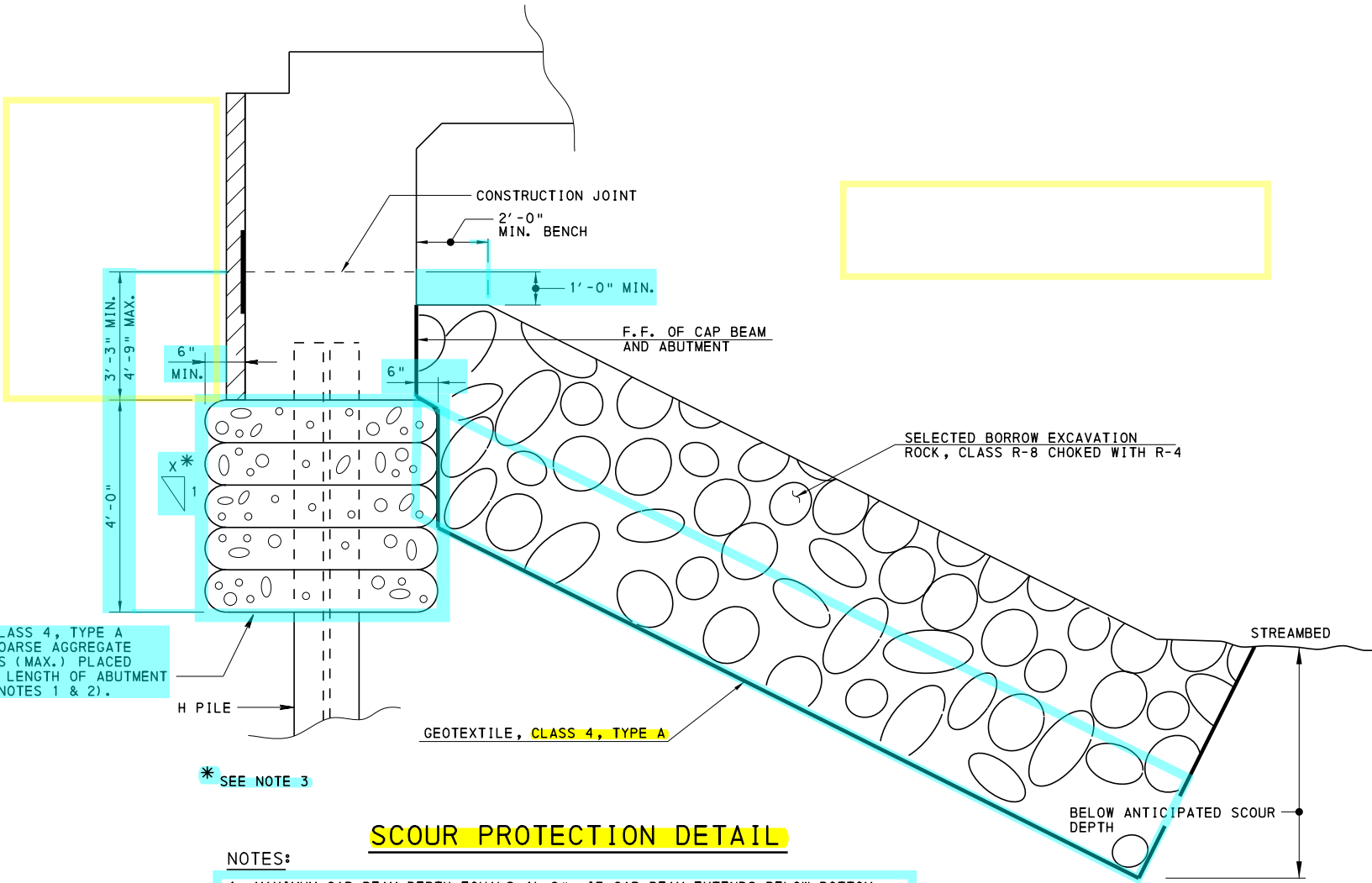
SHEET 3 OF 9
BD-667M



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
- ④ REFER TO WATERPROOFING DETAIL FOR ADDITIONAL INFORMATION.

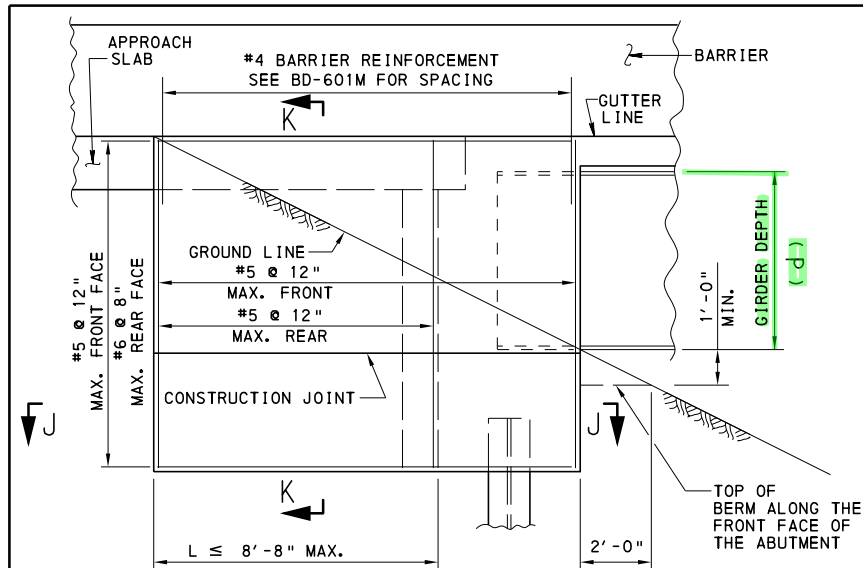
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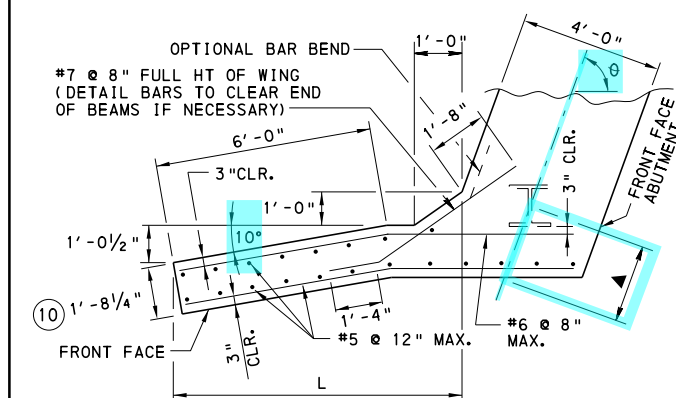
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SHEET 4 OF 9
BD-667M

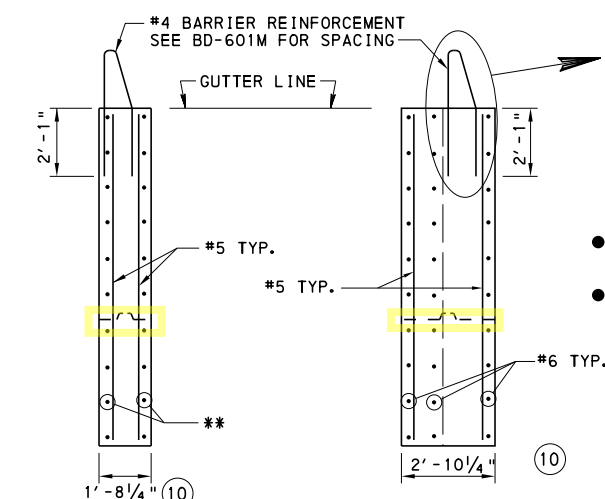


ATTACHED RECTANGULAR WINGWALL ELEVATION

(FOR GIRDER DEPTH $d < 5'-0"$)



SECTION J-J



SECTION K-K

(RECTANGULAR OR TAPERED WING)

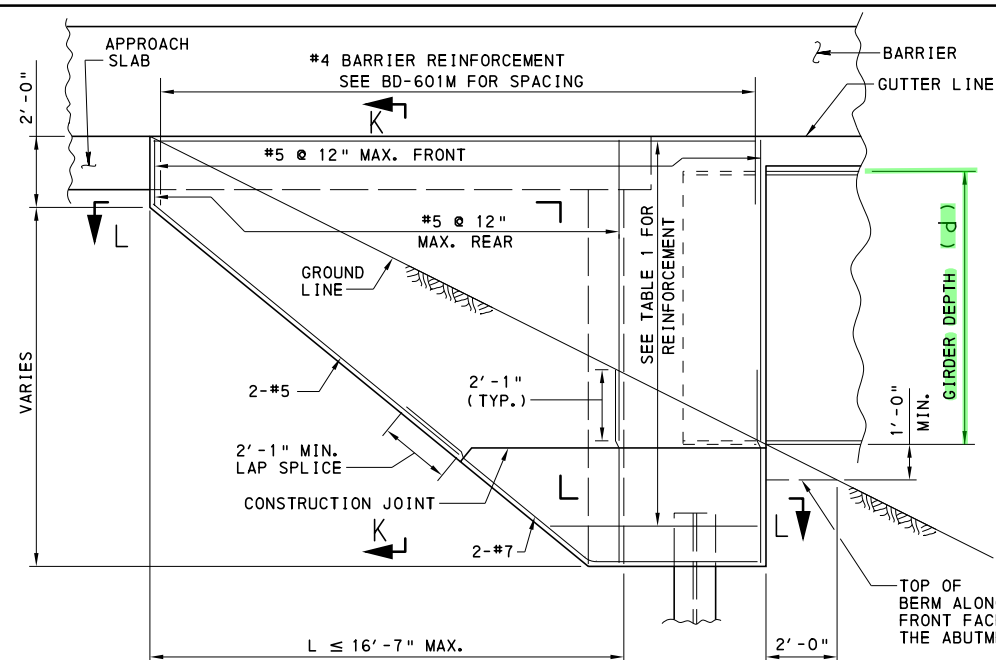
SECTION N-N

(DETACHED WING)

** FOR RECTANGULAR WINGWALL REINFORCEMENT:
SEE SECTION J-J.
FOR TAPERED WINGWALL REINFORCEMENT:
SEE TABLE 1 THIS SHEET.

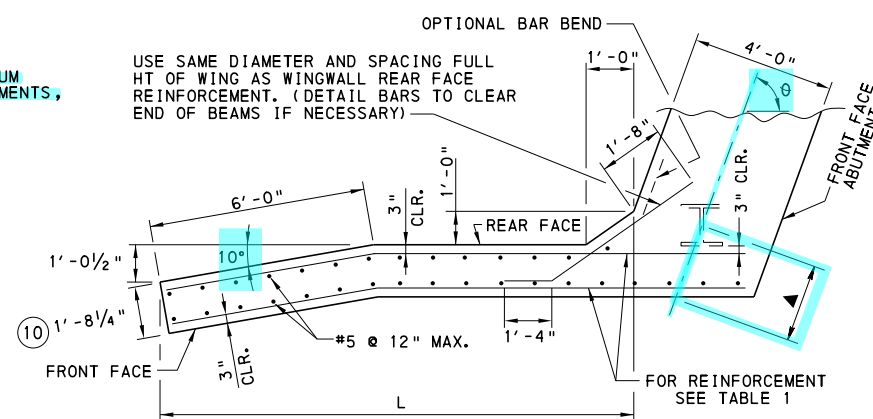
▲ FOR MINIMUM AND MAXIMUM
EDGE DISTANCE REQUIREMENTS,
SEE SHEET 1.

- DIMENSIONS ARE MEASURED
ALONG OUTSIDE FACE OF BAR
- INSIDE RADII ARE 2"



ATTACHED TAPERED WINGWALL ELEVATION

(FOR GIRDER DEPTH $5'-0" \leq d < 8'-0"$)



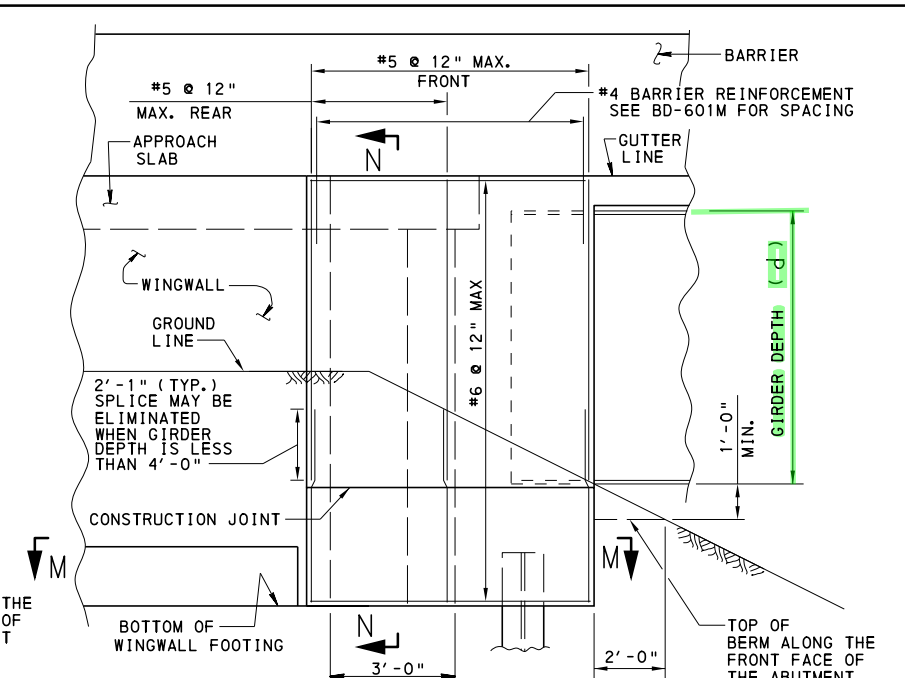
SECTION L-L

TABLE 1: TAPERED WINGWALL REINFORCEMENT			
GIRDER DEPTH (d) (in)	WINGWALL LENGTH BEYOND THE REAR FACE OF THE ABUTMENT (L) (ft)	REINFORCEMENT	
		REAR FACE	FRONT FACE
$60 \leq d < 72$	$L \leq 10'-7"$	#8 @ 12"	#5 @ 12"
	$10'-7" < L \leq 14'-2"$	#8 @ 6"	#5 @ 12"
$72 \leq d < 84$	$L \leq 10'-7"$	#8 @ 12"	#5 @ 12"
	$10'-7" < L \leq 15'-0"$	#8 @ 6"	#5 @ 12"
$84 \leq d < 96$	$L \leq 12'-0"$	#8 @ 10"	#5 @ 12"
	$12'-0" < L \leq 15'-10"$	#8 @ 6"	#5 @ 12"
$96 = d^*$	$L \leq 14'-2"$	#8 @ 8"	#5 @ 12"
	$14'-2" < L \leq 16'-7"$	#8 @ 6"	#5 @ 12"

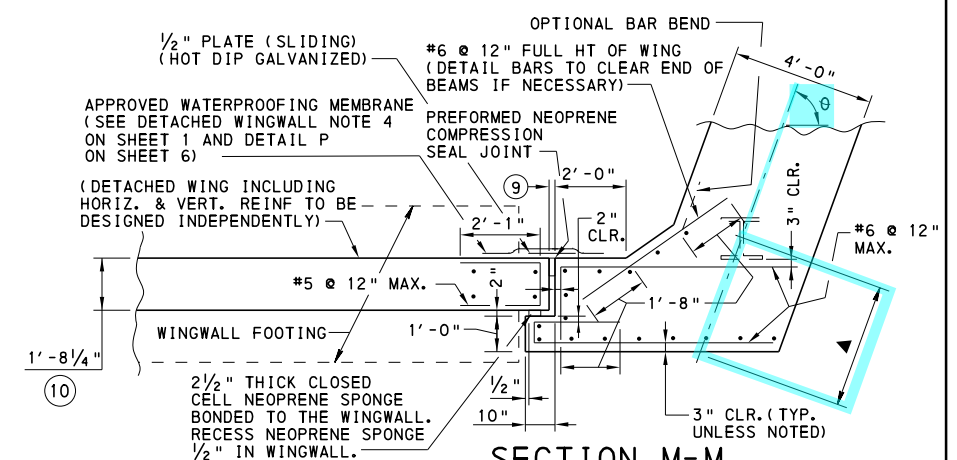
* CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED FOR BEAM DEPTHS
GREATER THAN 6'-0"

	MINIMUM ATTACHED WINGWALL LENGTH (L) ***	
	GIRDER DEPTH (d)	SKEW = 90° 45° ≤ SKEW < 90°
ATTACHED RECTANGULAR WINGWALL	$d < 48"$	7'-6" 7'-6"
	$48" \leq d < 60"$	7'-8" 8'-8"
ATTACHED TAPERED WINGWALL	$60" \leq d < 72"$	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.



DETACHED WINGWALL ELEVATION



SECTION M-M

FOR MEMBRANE SLACK, SEE DETAIL P SHEET 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".**

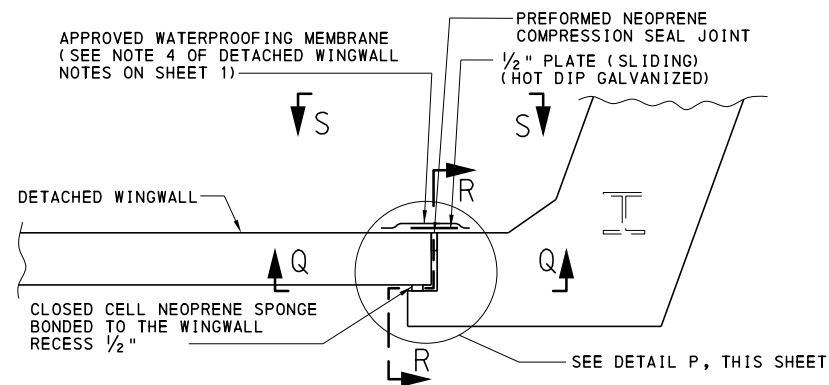
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WINGWALL DETAILS

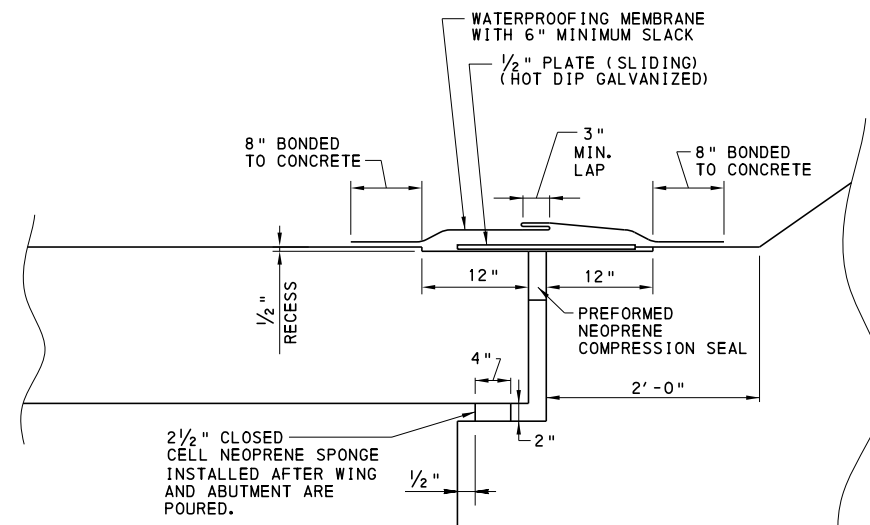
RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
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RECOMMENDED NOV. 21, 2014
Brian S. Thompson
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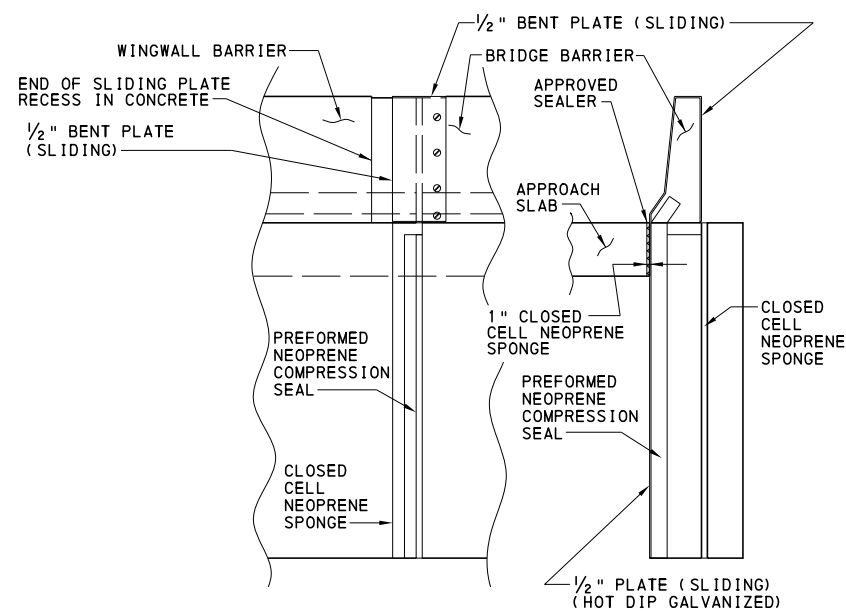
SHEET 5 OF 9
BD-667M



**PARTIAL SECTION THRU DETACHED
WINGWALL EXPANSION JOINT**

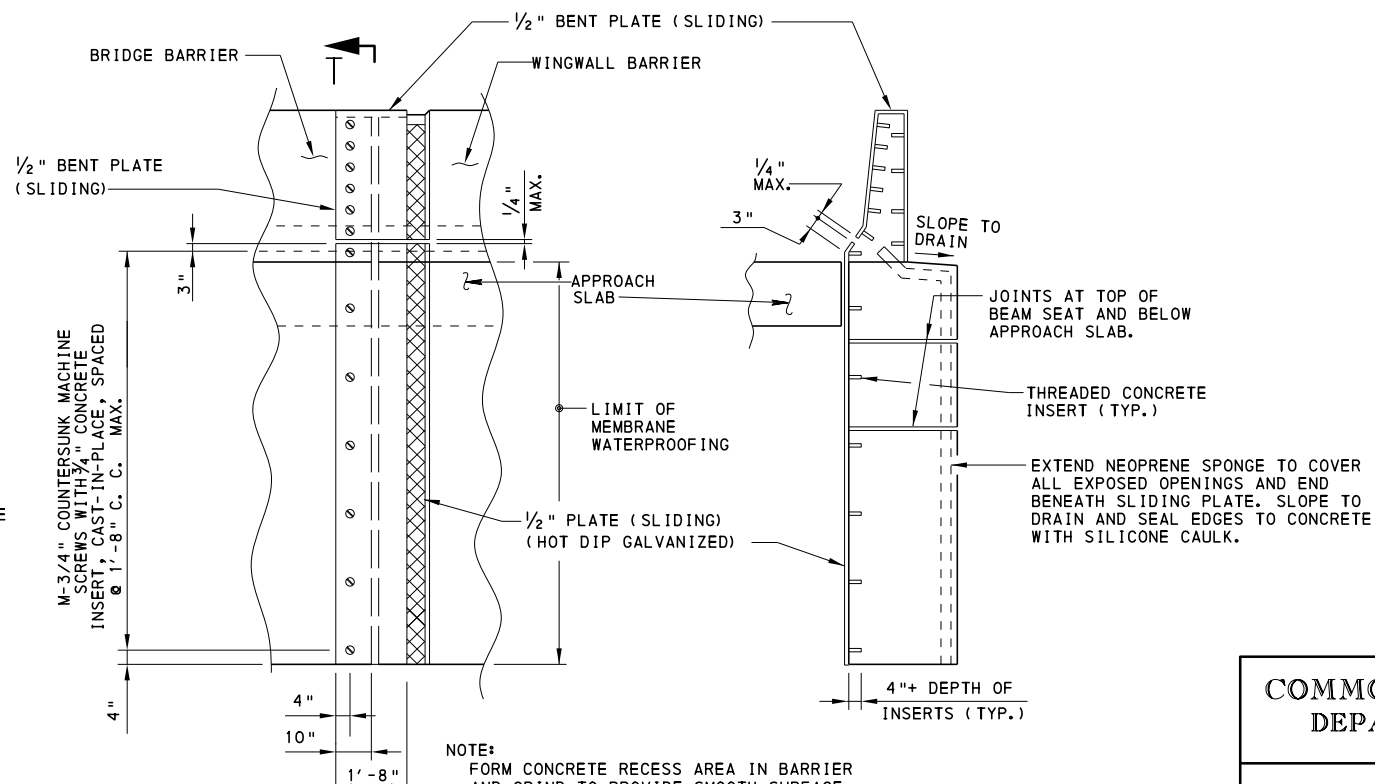


DETAIL P



SECTION Q-Q

SECTION R-R



VIEW S-S

SECTION T-T

(WATERPROOFING MEMBRANE AND LIMITS OF
RECESS IN CONCRETE REMOVED FOR CLARITY)

NOTE:
FORM CONCRETE RECESS AREA IN BARRIER
AND GRIND TO PROVIDE SMOOTH SURFACE.
APPLY ONE COAT OF ASPHALT CEMENT
PAINT WA-1 OR PERFORMANCE GRADED
ASPHALT CEMENT PG 64-22 TO ALLOW
BENT SLIDING PLATE TO MOVE FREELY
WITHOUT FRICTION.

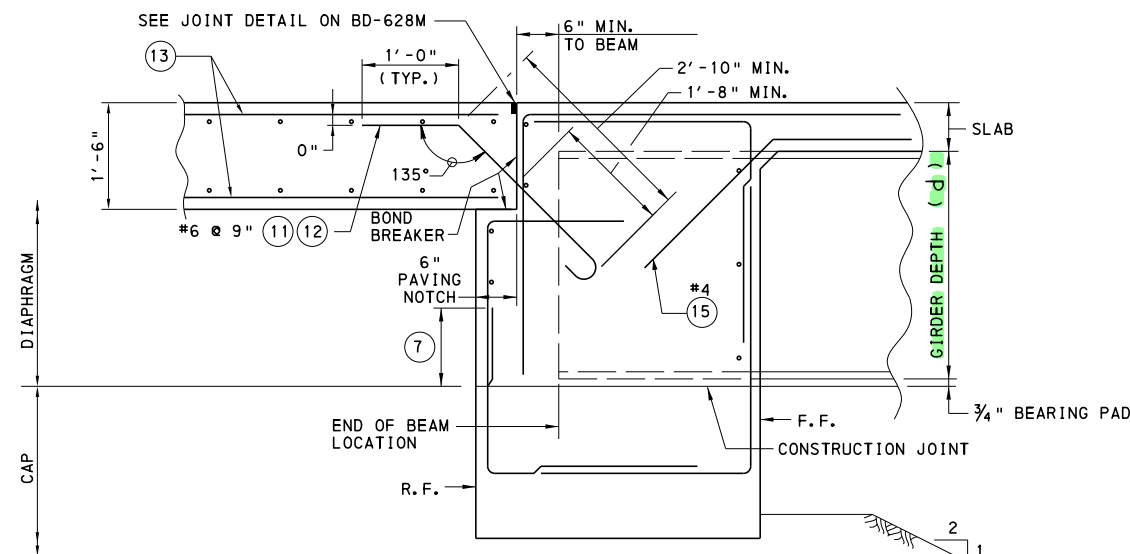
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STANDARD
INTEGRAL ABUTMENT
WINGWALL AND PILE CAP DETAILS

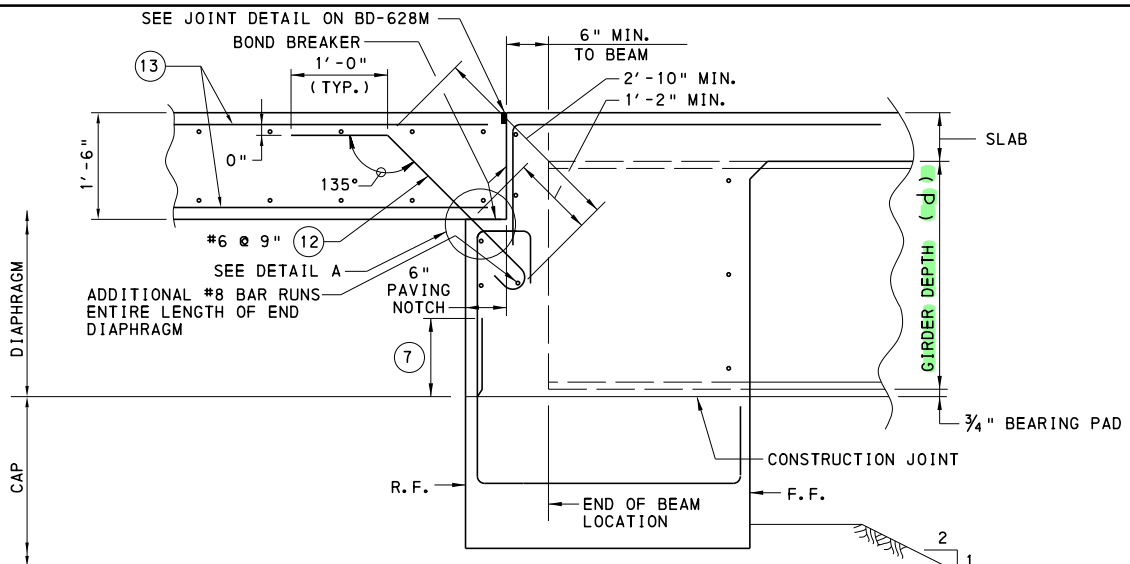
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Brenda Thompson
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SHEET 6 OF 9
BD-667M

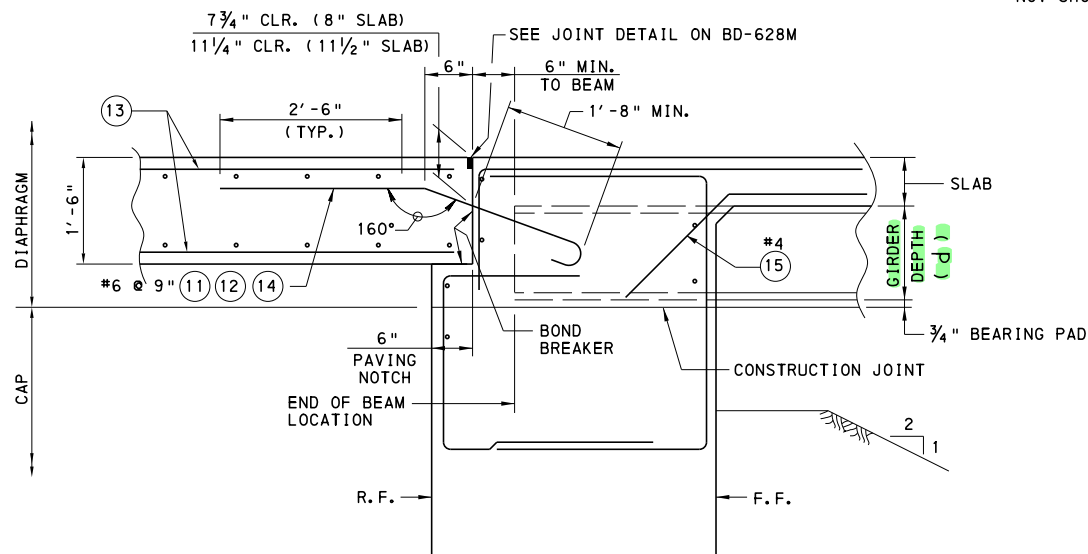


SECTION THRU
END DIAPHRAGM BETWEEN BEAMS
GIRDER DEPTH $\geq 2'-0"$

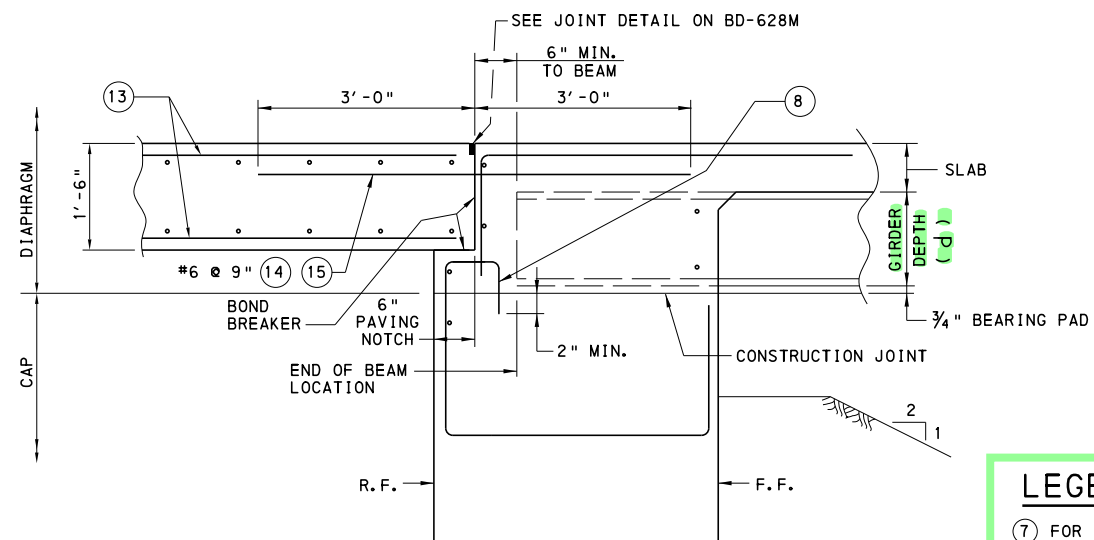


SECTION THRU
END DIAPHRAGM AT BEAMS
GIRDER DEPTH $\geq 2'-0"$

NOTE: DECK AND CAP REINFORCEMENT
NOT SHOWN FOR CLARITY.



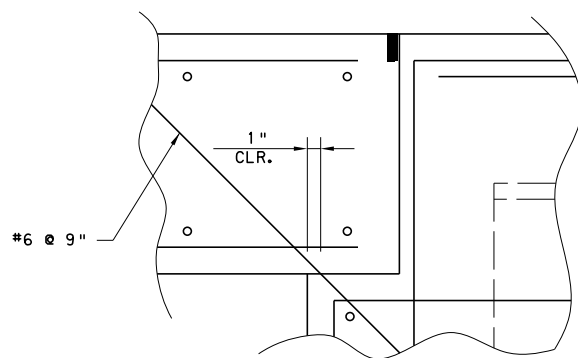
SECTION THRU
END DIAPHRAGM BETWEEN BEAMS
GIRDER DEPTH $< 2'-0"$



SECTION THRU
END DIAPHRAGM AT BEAMS
GIRDER DEPTH $< 2'-0"$

LEGEND:

- ⑦ FOR GIRDERS TOO SHALLOW TO PERMIT A 2'-1" OVERLAP, THE SPLICE IS NOT PERMITTED. ELIMINATING THE SPLICE IS OPTIONAL IN ALL OTHER CASES.
- ⑧ IF BAR EXTENDS INTO CAP EXTEND BAR TO PROVIDE 2" MIN. EMBEDMENT.
- ⑪ DETAIL SPACING TO CLEAR GIRDERS.
- ⑫ FOR 180° HOOK DIMENSIONS, REFER TO BC-736M.
- ⑬ FOR DIMENSIONS AND REINFORCEMENT OF APPROACH SLAB, SEE STANDARD DRAWING BD-628M.
- ⑭ THE HORIZONTAL LEG OF THE BAR IS TO BE LOCATED AT THE SAME PLANE AS THE LONGITUDINAL DECK REINFORCEMENT IN THE BOTTOM MAT OF THE DECK.
- ⑮ SPACED WITH LONGITUDINAL DECK REINFORCEMENT



DETAIL A

MINIMUM APPROACH SLAB LENGTH TABLE			
GIRDER DEPTH (d)	SKEW=90°	60° ≤ SKEW < 90°	45° ≤ SKEW < 90°
17" ≤ d ≤ 24"	12'-0"	14'-0"	18'-0"
24" < d ≤ 36"	14'-0"	16'-0"	20'-0"
36" < d ≤ 48"	15'-0"	18'-0"	22'-0"
48" < d ≤ 60"	17'-0"	20'-0"	24'-0"
60" < d ≤ 72"	18'-0"	22'-0"	25'-0"
72" < d* ≤ 84"	20'-0"	24'-0"	---
84" < d* ≤ 96"	22'-0"	25'-0"	---

NOTES FOR USE OF TABLE:

- THE 25'-0" APPROACH SLAB LENGTH SHOWN ON BD-628M, SHEET 35 OF 35 (TYPE 5), MAY BE REDUCED TO THE VALUE INDICATED ABOVE WHEN SITE CONDITIONS EXIST THAT RESTRICT THE USE OF THE 25'-0" APPROACH SLAB LENGTH OR WHEN DIRECTED BY THE DISTRICT BRIDGE ENGINEER.
- DO NOT CHANGE THE APPROACH SLAB REINFORCEMENT SPECIFIED ON BD-628M IF THE APPROACH SLAB LENGTH IS REDUCED.

* - CHIEF BRIDGE ENGINEER APPROVAL IS REQUIRED FOR BEAM DEPTHS GREATER THAN 6'-0"

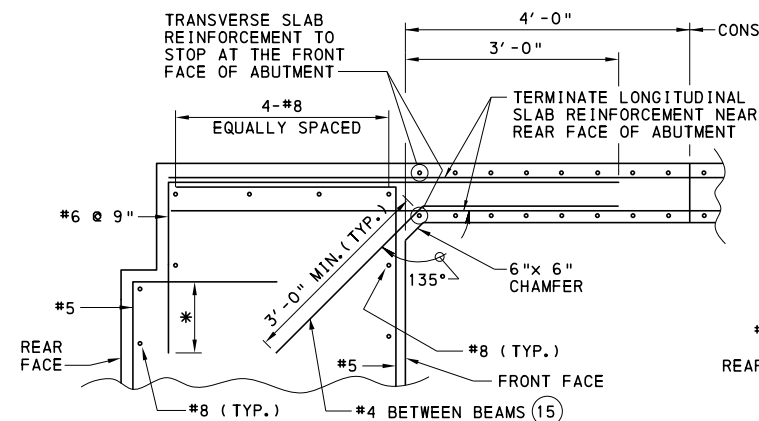
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APPROACH SLAB DETAILS

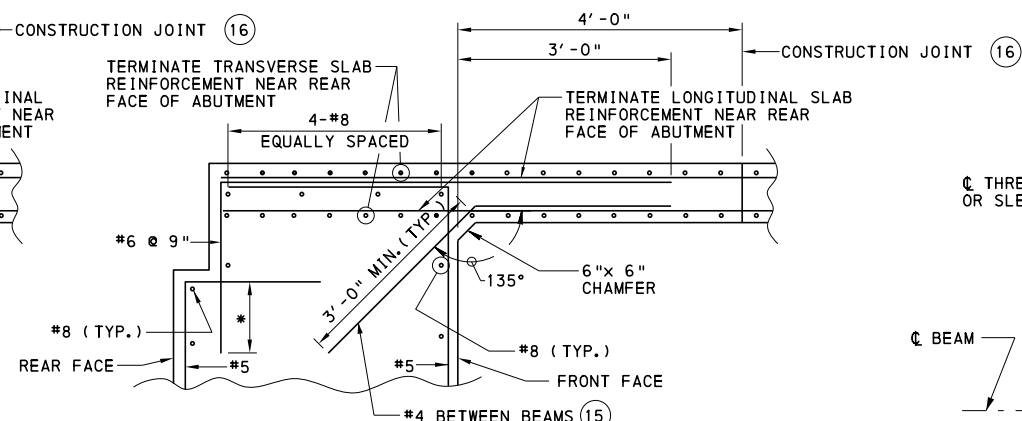
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SHEET 7 OF 9
BD-667M



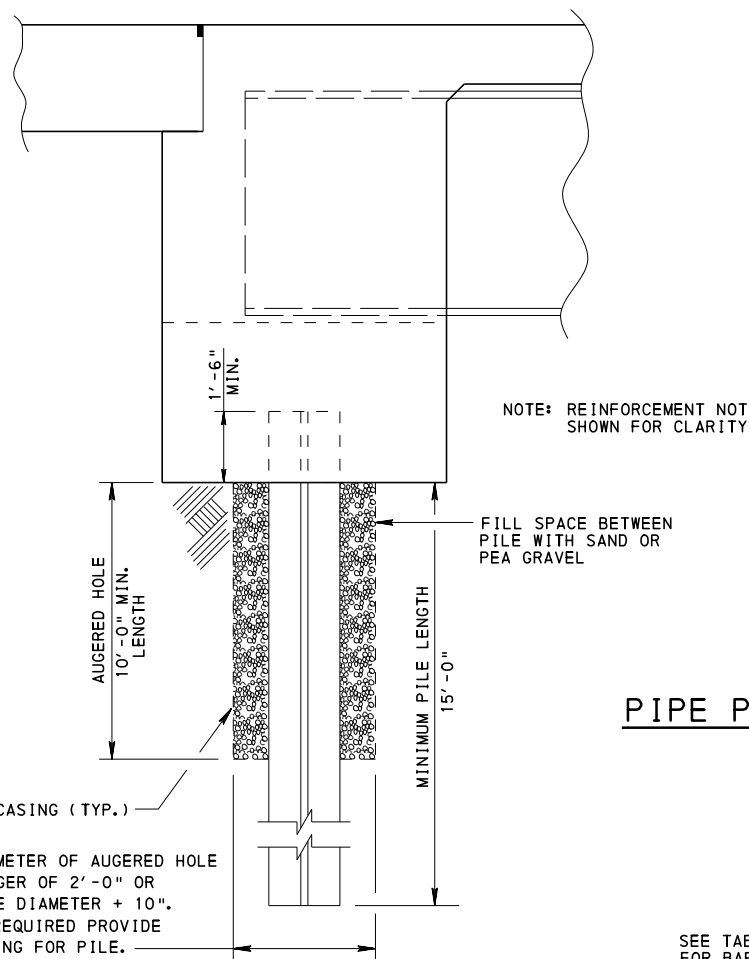
**TRANSVERSE SLAB REINFORCEMENT
PARALLEL TO ABUTMENT
(SKEWS OF 75° TO 90°)**



**TRANSVERSE SLAB REINFORCEMENT
NOT PARALLEL TO ABUTMENT
(SKEWS < 75°)**

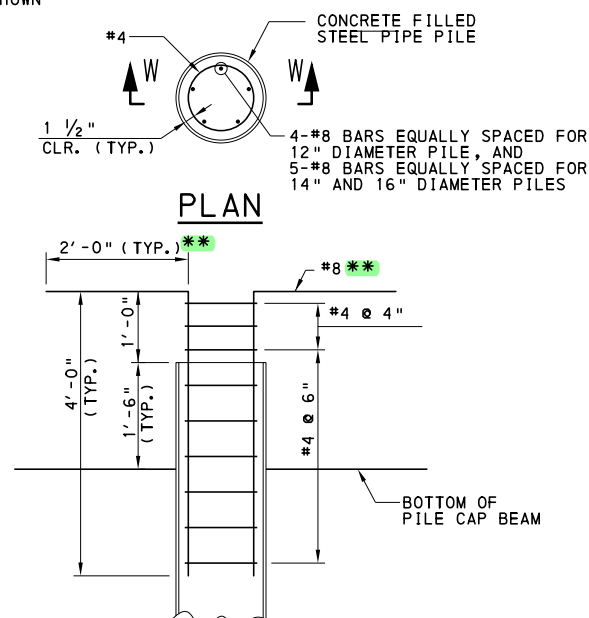
SLAB-ABUTMENT CONNECTION DETAIL

* MAXIMUM LENGTH ALLOWED BY GIRDER
DEPTH BUT NEED NOT TO EXCEED 1'-6"
SECTIONS BETWEEN GIRDERS SHOWN



**INTEGRAL ABUTMENT PILE
INSTALLATION DETAIL**

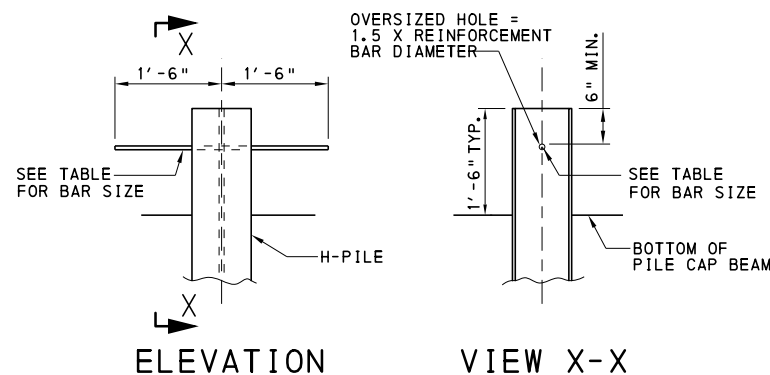
- SEE APPENDIX G OF DESIGN MANUAL PART 4 SECTION 1.4.2 FOR PRE AUGERING REQUIREMENTS
- PREDRILL OVERSIZED HOLES FOR ALL PILES IN ACCORDANCE WITH DESIGN MANUAL PART 4 AP.G.1.4.2.1. PLACE PILES VERTICAL IN THE HOLES BEFORE FILLING THE HOLES. FILL THE HOLES WITH DRY LOOSE SAND OR PEA GRAVEL BEFORE DRIVING THE PILES.



SECTION W-W

** HOOK 180° PER BC-736M OR
ROTATE TO FIT SHORTER CAP WIDTHS

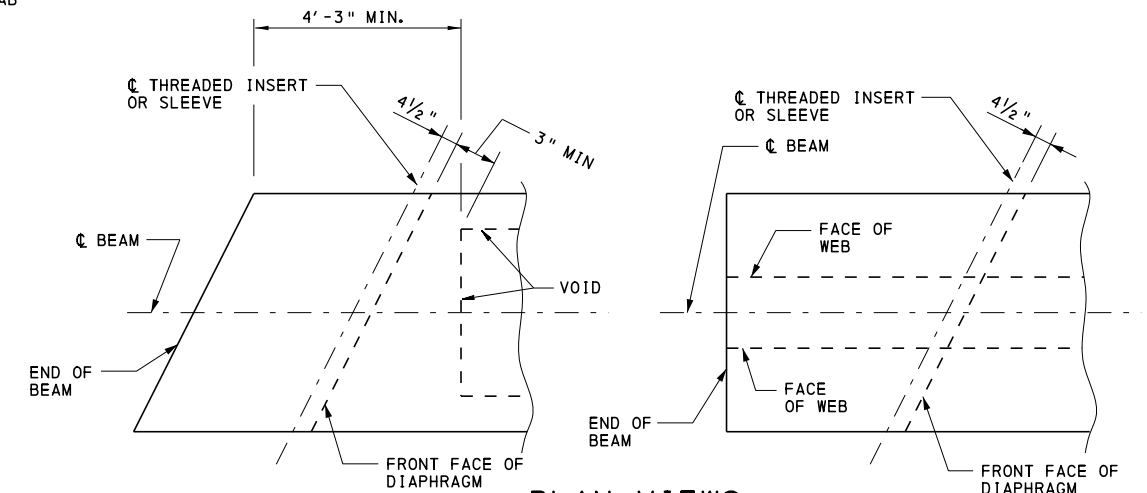
PIPE PILE-TO-PILE CAP CONNECTION DETAIL



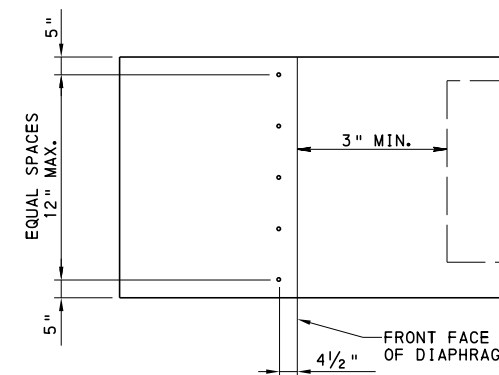
ELEVATION

VIEW X-X

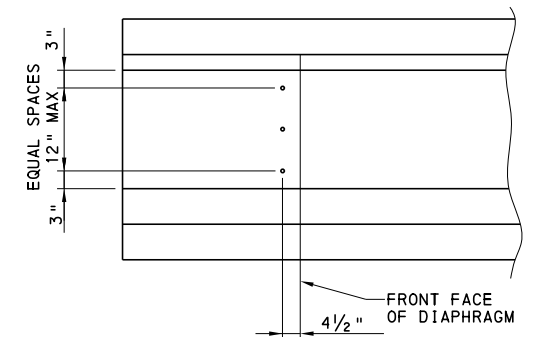
H-PILE-TO-PILE CAP CONNECTION DETAIL



PLAN VIEWS



CONCRETE BOX BEAMS



CONCRETE I-BEAMS

ELEVATION VIEWS

**THREADED INSERT LOCATIONS IN 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 SIMULTANEOUSLY WITH THE END DIAPHRAGMS.

H-PILE TO PILE CAP CONNECTION REINFORCEMENT	
PILE SIZE	BAR
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

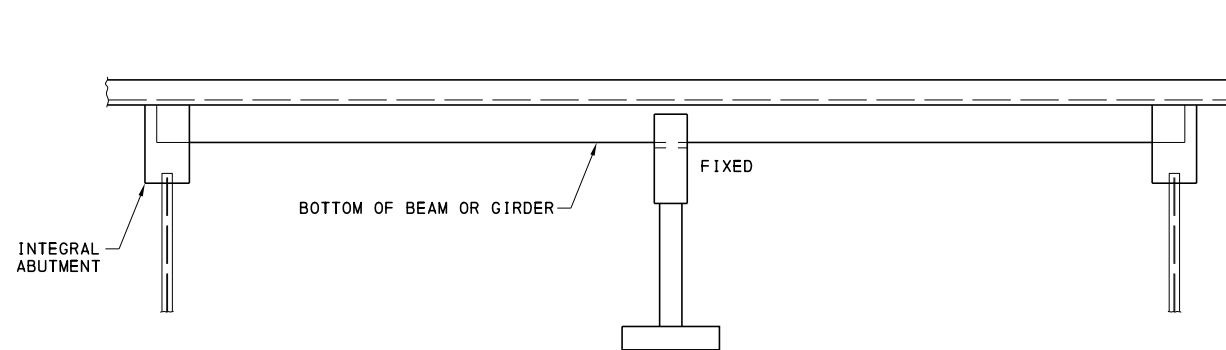
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STANDARD
INTEGRAL ABUTMENT
APPROACH SLAB AND PILE DETAILS

RECOMMENDED NOV. 21, 2014
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RECOMMENDED NOV. 21, 2014
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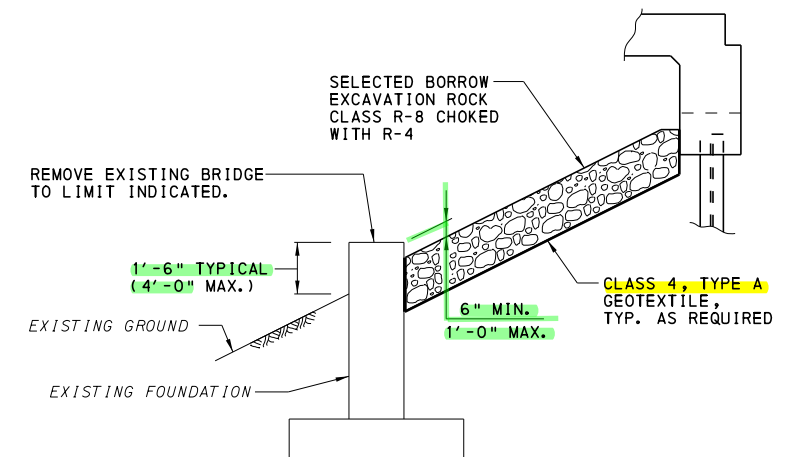
SHEET 8 OF 9
BD-667M



FIXITY ARRANGEMENT FOR MULTI SPAN STRUCTURES

NOTES:

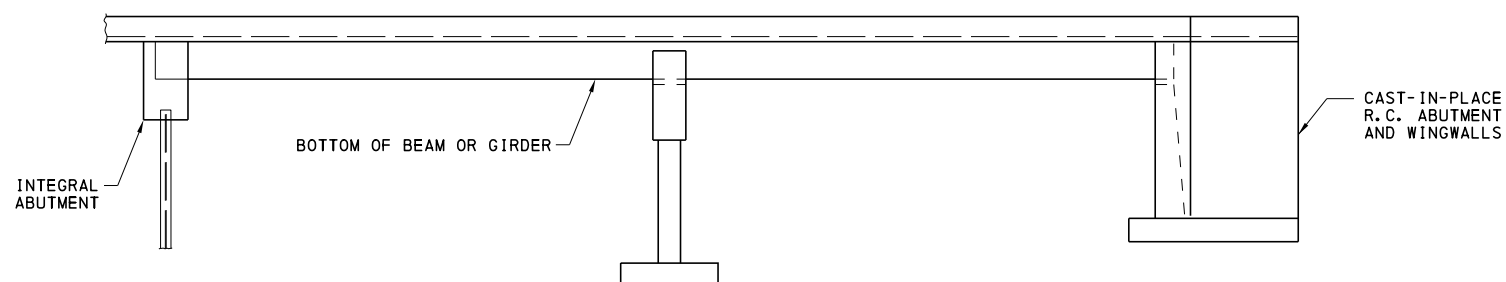
- FOR TWO SPAN ARRANGEMENT THE PIER SHOULD BE FIXED TO MINIMIZE LONGITUDINAL SUPERSTRUCTURE FORCES AT ABUTMENTS.
- FOR ADDITIONAL SPANS PIER STIFFNESS MUST BE CONSIDERED TO DEVELOP THE MOST EFFICIENT DESIGNS AND MINIMIZE MOVEMENT.



DETAIL FOR USING EXISTING SUBSTRUCTURE UNIT FOR SLOPE PROTECTION

NOTE:

THE ABOVE DETAIL HAS PROVEN AN ECONOMICAL OPTION FOR MANY BRIDGE REPLACEMENTS. ADDITIONAL RIPRAP CAN BE ADDED TO AUGMENT THE EXISTING SUBSTRUCTURE UNIT IF THE LENGTH OR POSITION DOES NOT MEET SITE NEEDS COMPLETELY.



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.

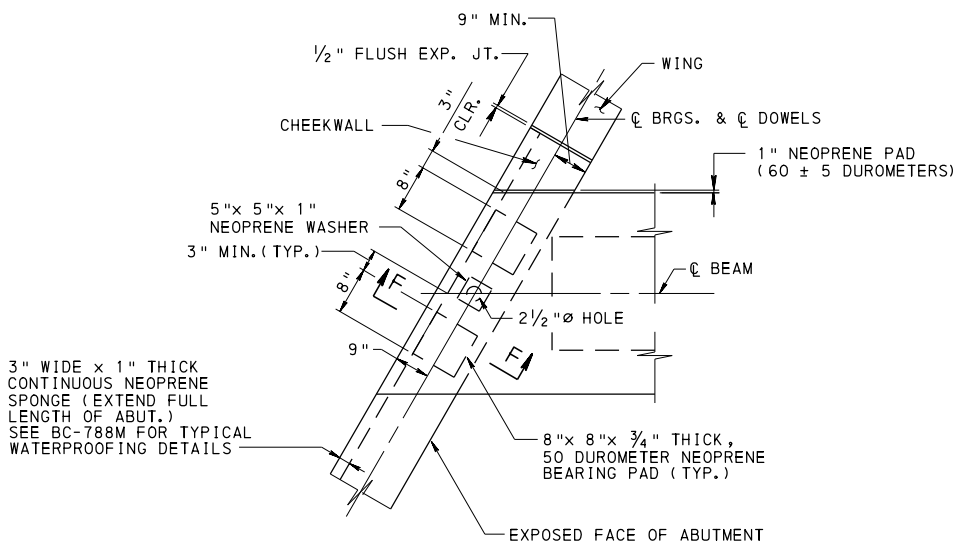
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STANDARD
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MISCELLANEOUS DETAILS

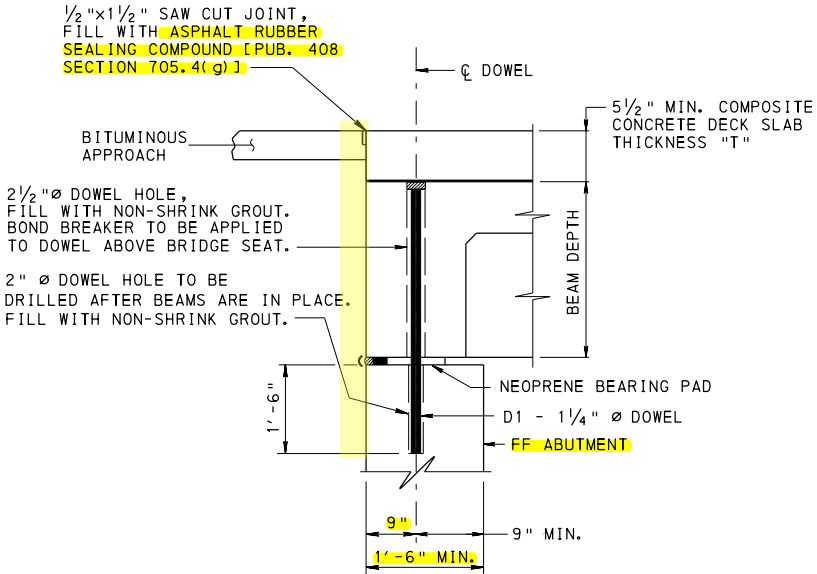
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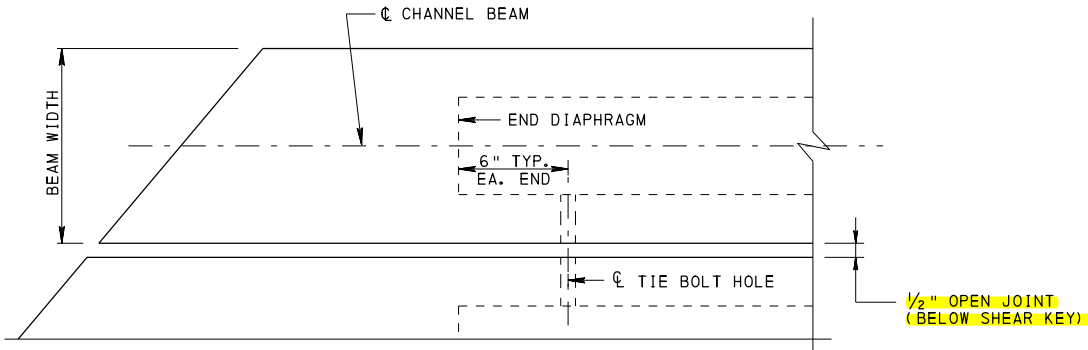
SHEET 9 OF 9
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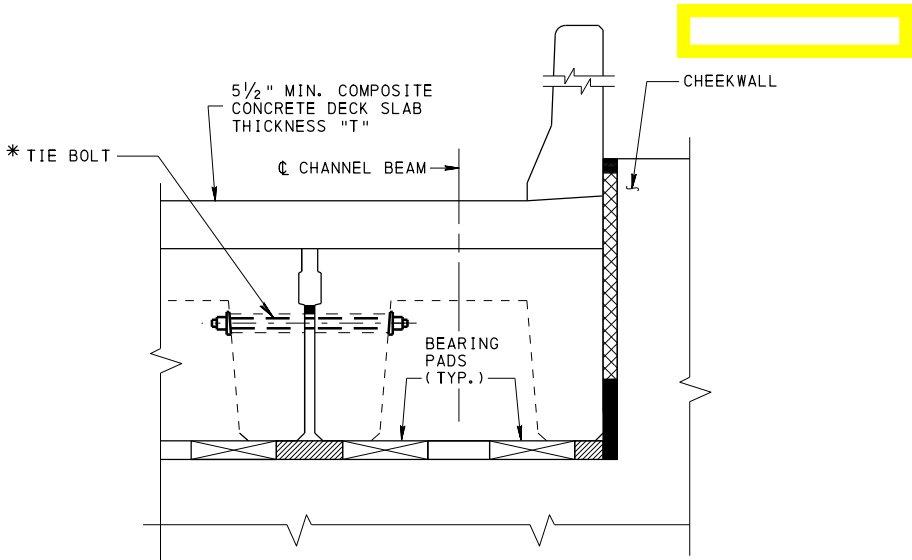
BEARING PAD DETAIL



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 STANDARD DRAWING BC-775M
2. FOR STANDARD TYPICAL WATERPROOFING AND EXPANSION DETAILS, SEE BC-788M.

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STANDARD
PRECAST CHANNEL BEAM BRIDGES
BEAM SIZES & DETAILS

RECOMMENDED AUG. 31, 2012
Thomas P. Maciora
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RECOMMENDED AUG. 31, 2012
R. J. [Signature]
ACTING DIR., BUREAU OF PROJECT DELIVERY

SHEET 2 OF 3
BD-668M

1. CONCRETE COVER:
BEAM SLAB TOP AND BOTTOM COVER 1 1/2", CHANNEL LEG COVER 2",
EXCEPT AS NOTED.

BEAM SLAB TOP AND BOTTOM COVER 1/2" EXCEPT AS NOTED.

2. SPlicing OF LONGITUDINAL STEEL IS

1'-0"

4-#6

#4 @ 8" MAX.

1 1/2" CLR. (TYP.)

6-#4 BARS

TOP SLAB OF BEAM

4-#4 BARS

BOTTOM SLAB OF BEAM

3'-6"

CL BEAM

3" 3"

1'-4" MIN.

2 1/2" CLR.

#4 BAR, MATCH W/STIRRUP

5 1/2" MIN. COMPOSITE CONCRETE DECK SLAB THICKNESS "T"

2 1/2" TO TOP OF STIRRUP PROJECTION (TYP.)

2" MIN. STIRRUP PROJECTION INTO BEAM SLAB (TYP.)

CONSTRUCTION JOINT & V-NOTCH (RAKED FINISH)

2"

3/4" CHAMFER ON OUTSIDE FACE OF FASCIA BEAMS

OMIT SHEAR KEY ON FASCIA SIDE

(TOP ROW) *

(BOT. ROW) *

3/4" x 3/4" CHAMFER (TYP.)

3 1/2" 3 1/2"

#4 STIRRUP

BATTER 1:12

1'-2"

5 1/2"

VARIES

6 1/2"

BEAM DEPTH (SEE TYP. SECTION ON SHEET 1)

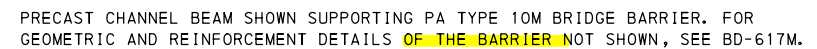
10 1/2" 10 1/2"

3'-0"

FASCIA BEAM

PRECAST CHANNEL BEAM SHOWN SUPPORTING CONCRETE VERTICAL WALL BRIDGE BARRIER.
FOR GEOMETRIC AND REINFORCEMENT DETAILS OF THE BARRIER NOT SHOWN, SEE BD-618M.

▲ DECK SLAB REINFORCEMENT PER BD-660M, SHEET 1.



▲ DECK SLAB REINFORCEMENT PER BD-660M, SHEET 1.

BD-617M	PA TYPE 10M BRIDGE BARRIER
BD-618M	CONCRETE VERTICAL WALL BRIDGE BARRIER
REFERENCE DRAWINGS	

RECOMMENDED AUG. 31, 2012
R. W. Wiley
 ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 3 OF 3

8D-668M

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESIS.
2. ALL "DESIGN" METRIC UNITS INDICATED ARE SOFT CONVERTED FROM U.S. CUSTOMARY UNITS.
3. DESIGN SPECIFICATIONS:
 - PENNDOT DESIGN MANUAL PART 4, STRUCTURES.
 - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.
 - 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
 - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
 - 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.)
4. CONSTRUCTION SPECIFICATIONS AND WORKMANSHIP:
 - 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 2002 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M 2002 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5M/D1.5 2002.)
5. 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 9144 mm (30'-0") ABOVE THE GROUND SURFACE OF 130 km/hr (80 mph).
 - PRECAST CONCRETE PANELS ARE DESIGNED FOR A WIND PRESSURE OF 1.34 kPa (28 PSF).
 - ICE LOAD: 0.14 kPa (3 PSF) APPLIED TO ONE SIDE OF PANEL AND POST.
 - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
6. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
7. PANEL HEIGHTS:
 - 610 mm (2'-0") MINIMUM TO 2743 mm (9'-0") MAXIMUM
 - PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 2743 mm (9'-0")
8. 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 150 mm (6") OR GREATER THAN 610 mm (2'-0").
9. 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 1500 mm (5'-0") ABOVE THE EDGE OF PAVEMENT.
10. ALL REINFORCEMENT STEEL BARS AND WELDED WIRE FABRIC SHOWN ARE SOFT CONVERTED METRIC SIZES.
11. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN THE PANELS WHERE THE WALL IS WITHIN 4300 mm (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 20 DEGREES C (68 DEGREES F).
14. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
15. FOR ADDITIONAL INFORMATION REFER TO BC-776M.

MATERIAL NOTES

1. REFER TO BC-776M FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS ARE DEVELOPED FOR A WIND PRESSURE OF 1.34 kPa (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 610 mm (2'-0") OR GREATER THAN 2743 mm (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

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

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-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 DESIGN

STANDARD

GROUND MOUNTED SOUND BARRIERS

PRECAST CONCRETE PANELS

GENERAL NOTES - 1

RECOMMENDED SEPT. 20, 2010

RECOMMENDED SEPT. 20, 2010

SHEET 1 OF 6

Thomas P. Maciore

BD-676M

CHIEF BRIDGE ENGINEER

DIRECTOR, BUREAU OF DESIGN

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 DESIGN PLANS FOR SIGNATURE BY THE DISTRICT ENVIRONMENTAL MANAGER INDICATING THAT THE DESIGN 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 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 1500 mm (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.

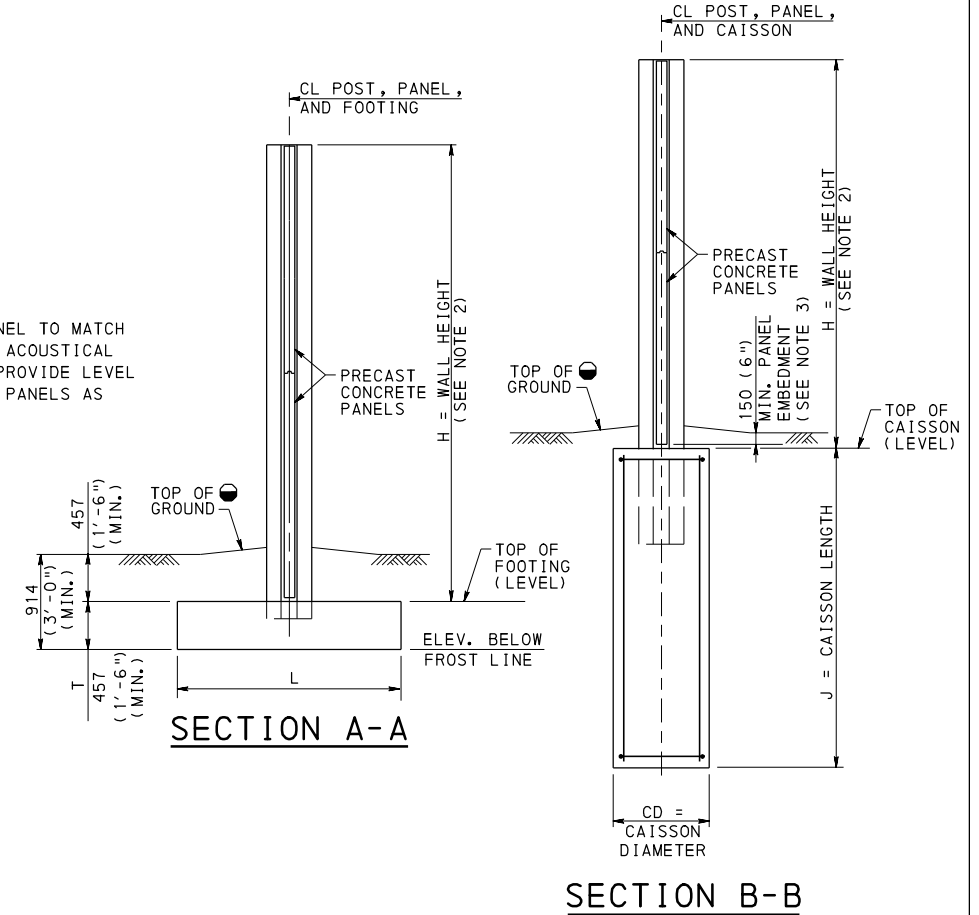
19. SPECIFY IF A SOUND BARRIER ABSORPTIVE CONCRETE FACING IS REQUIRED ON THE FACE OF THE PRECAST CONCRETE PANELS. SOUND ABSORPTIVE PANELS MUST BE APPROVED BY THE DEPARTMENT USING THE NEW PRODUCT EVALUATION PROCESS. DESIGNER MUST PREPARE DESIGN CALCULATIONS FOR THE FOUNDATIONS DUE TO THE INCREASED PANEL 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 1.34 kPa (28 PSF).
 - PANELS ARE DESIGNED USING A 127 mm (5 INCH) STRUCTURAL THICKNESS.
 - PANELS ARE DESIGNED FOR AN ADDITIONAL CONCRETE WEIGHT OF 38 mm (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 38 mm (1½ INCH) BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 38 mm (1½ INCH).
 - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 38 mm (1½ INCH).
 - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING BETWEEN POSTS.
 - PANELS ARE DESIGNED USING A 305 mm (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 27.6 MPa (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

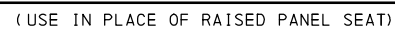
2. THE AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, PER SIDE OF PANEL, IS PERMITTED TO VARY FROM 0 TO 38 mm (1½ INCH), BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 38 mm (1½ INCH) UNLESS OTHERWISE INDICATED ON THE CONTRACT DRAWINGS.

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.
- NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.
- COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN
- STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE PANELS
- GENERAL NOTES - 2
- | | | |
|---|---|-------------------------|
| RECOMMENDED SEPT. 20, 2010
<i>Thomas P. Maciore</i>
CHIEF BRIDGE ENGINEER | RECOMMENDED SEPT. 20, 2010
<i>Brenda S. Thompson</i>
DIRECTOR, BUREAU OF DESIGN | SHEET 2 OF 6
BD-676M |
|---|---|-------------------------|



(PRECAST CONCRETE POST SHOWN,
STEEL POST SIMILAR)



● GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 300 mm (1'-0") DIFFERENCE.

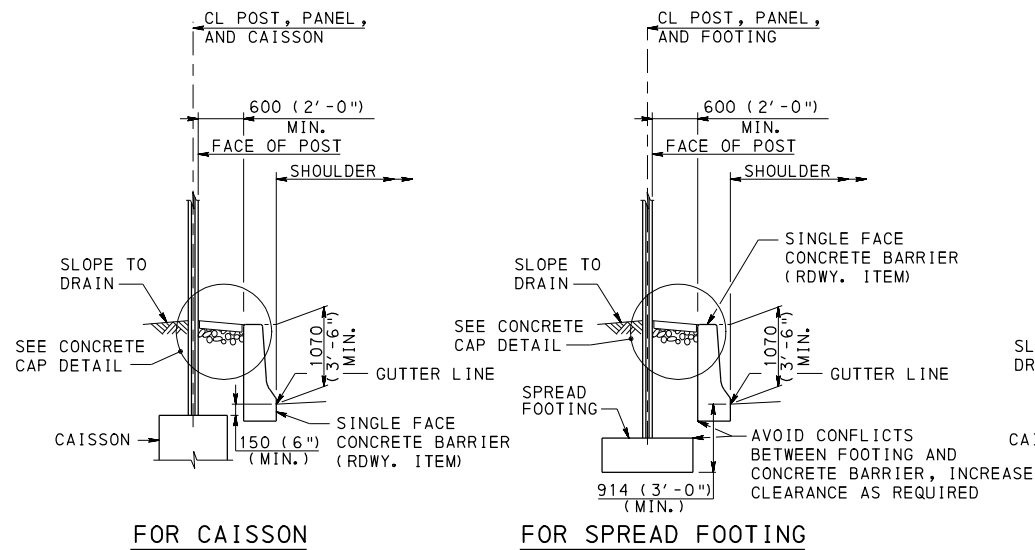
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. WALL HEIGHT IS DEFINED AS FOLLOWS:
 - POST WITH BASE PLATE: H = HEIGHT FROM TOP OF BASE PLATE TO TOP OF WALL
 - POST WITHOUT BASE PLATE: H = HEIGHT FROM TOP OF FOOTING/CAISSON TO TOP OF WALL
3. PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
ENGLISH VALUES SHOWN MAY NOT BE MIXED.

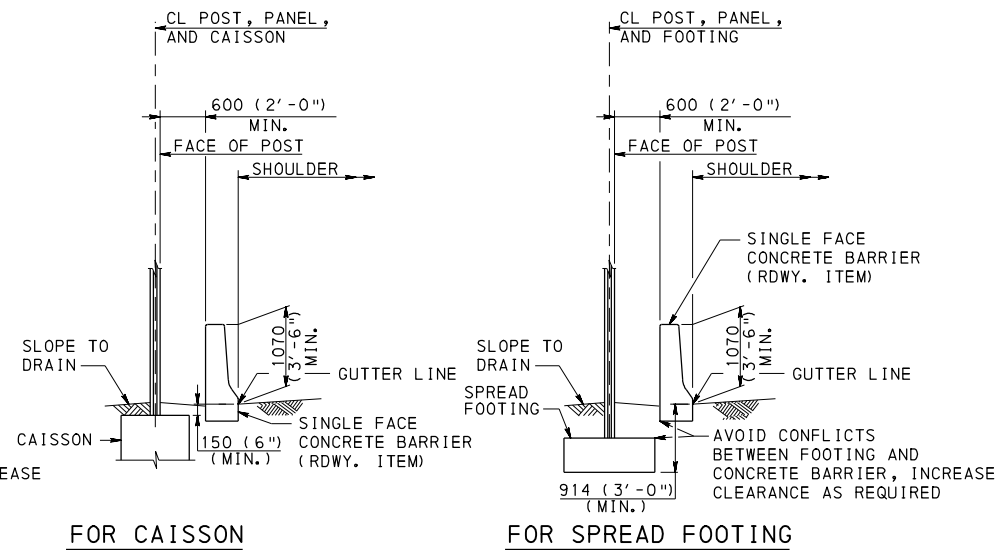
GEOMETRY AND LAYOUT -1

SHEET 3 OF 6

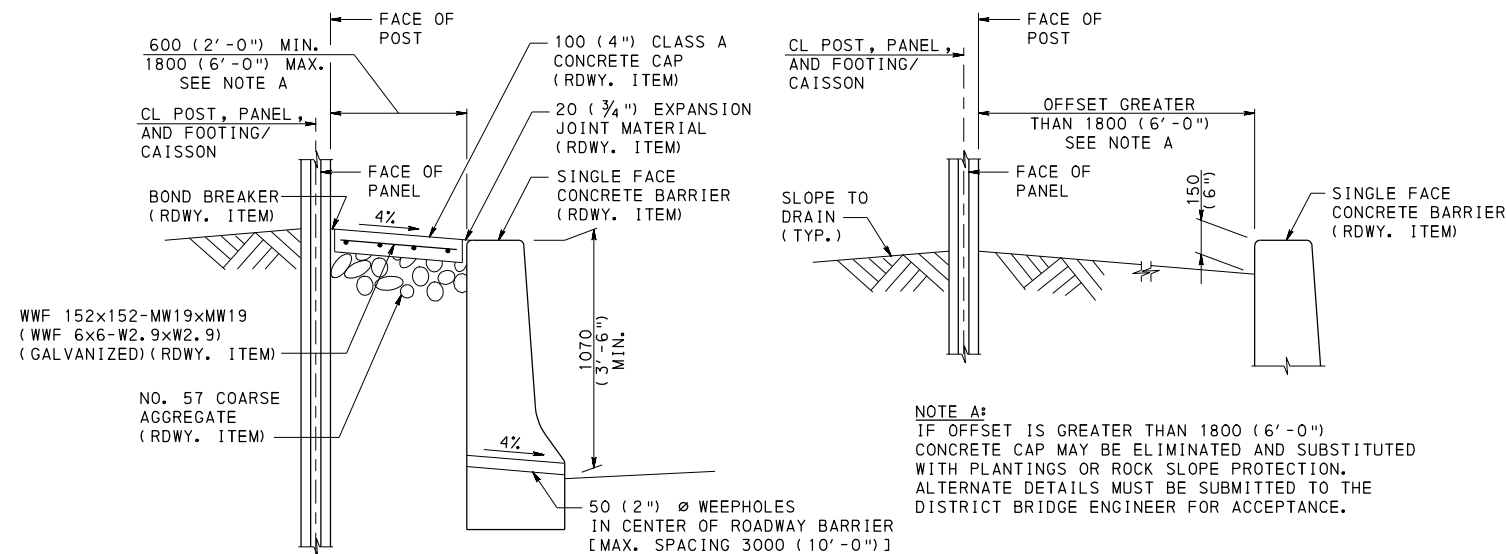
BD-676M



SECTION - GROUND MOUNTED
SOUND BARRIER WALL
ADJACENT TO ROADWAY BARRIER
OPTION 1 (SEE NOTE 2)



SECTION - GROUND MOUNTED
SOUND BARRIER WALL
ADJACENT TO ROADWAY BARRIER
OPTION 2 (SEE NOTE 2)



NOTE A:
IF OFFSET IS GREATER THAN 1800 (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.

CONCRETE CAP DETAIL

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.)

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

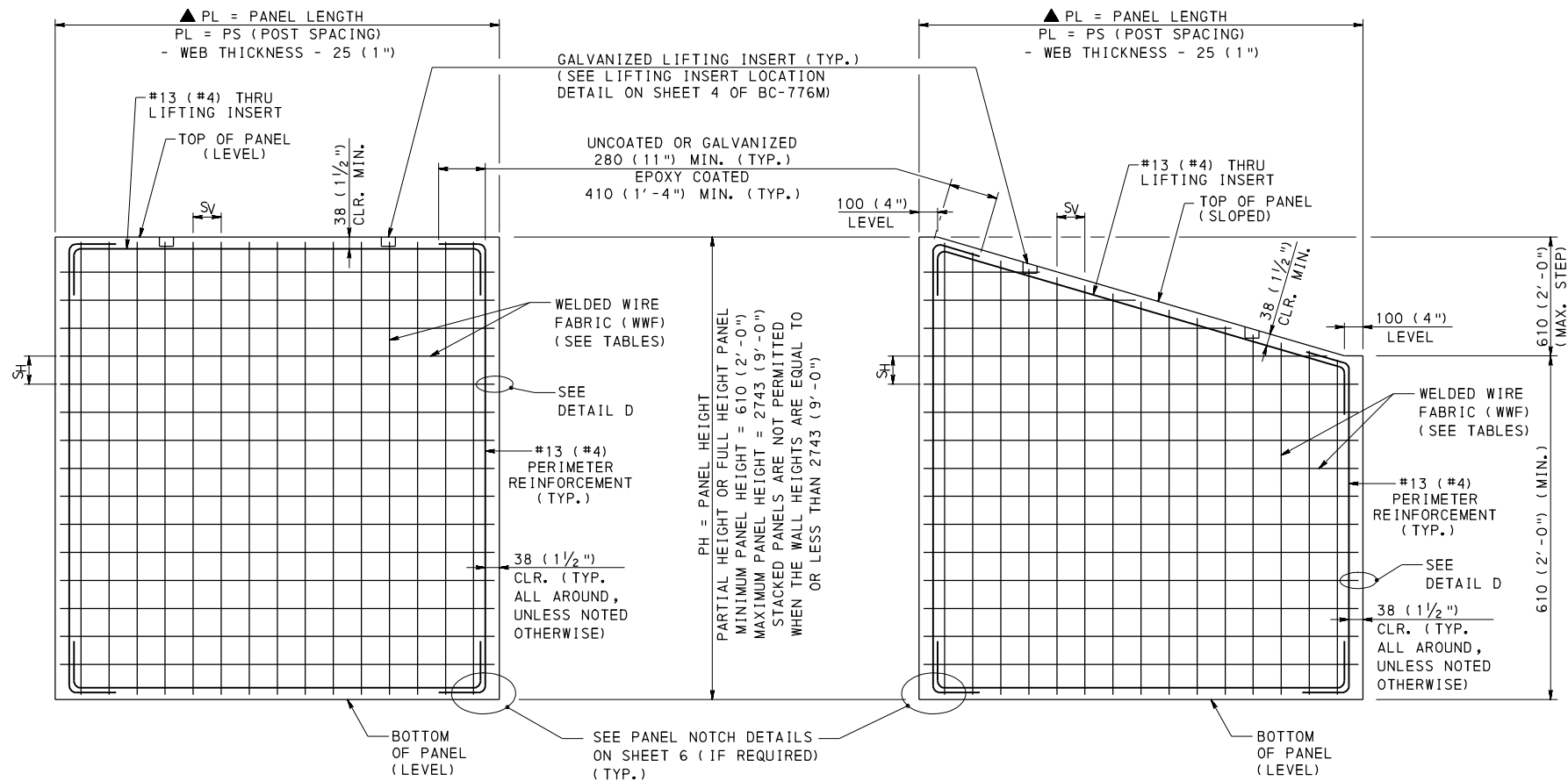
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE PANELS

GEOMETRY AND LAYOUT - 2

RECOMMENDED SEPT. 20, 2010
Thomas P. Macioro
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thomas
DIRECTOR, BUREAU OF DESIGN

SHEET 4 OF 6
BD-676M



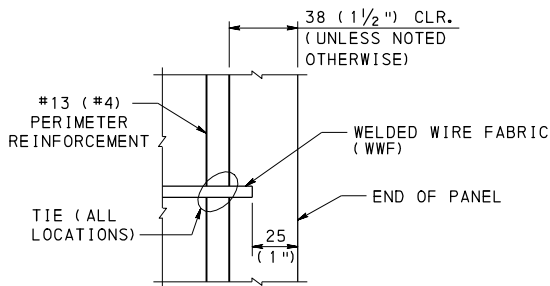
ELEVATION - LEVEL TOP

ELEVATION - SLOPED TOP

PRECAST CONCRETE PANEL

DIMENSION TABLE U.S. CUSTOMARY UNITS	
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

DIMENSION TABLE METRIC UNITS	
POST SIZE	"X" (mm)
PRECAST CONCRETE	140
W200 (STEEL)	140
W250 (STEEL)	165
W310 (STEEL)	190
508 mm DIA. (STEEL)	140



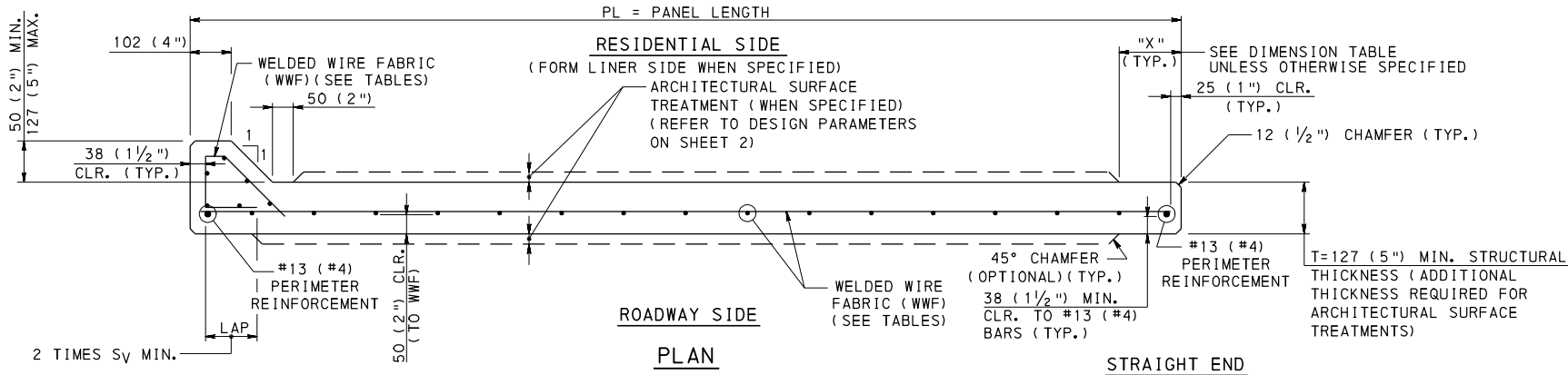
DETAIL D

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 ² /ft)		MIN. NUMBER OF LIFTING INSERTS
			HORIZONTAL	VERTICAL	
12.0	2.0	WWF 6x6-W8×W4	0.16	0.08	2
	4.0	WWF 6x6-W8×W4	0.16	0.08	2
	6.0	WWF 6x6-W8×W8	0.16	0.16	2
	8.0	WWF 6x4-W8×W12	0.16	0.36	2
	9.0	WWF 6x4-W8×W12	0.16	0.36	4
16.0	2.0	WWF 4x6-W8×W4	0.24	0.08	2
	4.0	WWF 4x6-W8×W4	0.24	0.08	2
	6.0	WWF 4x6-W8×W8	0.24	0.16	2
	8.0	WWF 4x4-W8×W12	0.24	0.36	4
	9.0	WWF 4x4-W8×W12	0.24	0.36	4
20.0	2.0	WWF 6x6-W20×W4	0.40	0.08	2
	4.0	WWF 6x6-W20×W4	0.40	0.08	2
	6.0	WWF 6x6-W20×W8	0.40	0.16	4
	8.0	WWF 6x4-W20×W12	0.40	0.36	4
	9.0	WWF 6x4-W20×W12	0.40	0.36	4

PRECAST CONCRETE PANEL REINFORCEMENT METRIC UNITS

WIND PRESSURE = 1.34 kPa

POST SPACING PS (mm)	PANEL HEIGHT PH (mm)	WELDED WIRE FABRIC ** WWF AxB-MWC×MWD	WELDED WIRE STEEL AREA (mm ² /m)		MIN. NUMBER OF LIFTING INSERTS
			HORIZONTAL	VERTICAL	
3658	610	WWF 152×152-MW52×MW26	342	171	2
	1219	WWF 152×152-MW52×MW26	342	171	2
	1829	WWF 152×152-MW52×MW52	342	342	2
	2438	WWF 152×102-MW52×MW77	342	755	2
	2743	WWF 152×102-MW52×MW77	342	755	4
4877	610	WWF 102×152-MW52×MW26	510	171	2
	1219	WWF 102×152-MW52×MW26	510	171	2
	1829	WWF 102×152-MW52×MW52	510	342	2
	2438	WWF 102×102-MW52×MW77	510	755	4
	2743	WWF 102×102-MW52×MW77	510	755	4
6096	610	WWF 152×152-MW130×MW26	855	171	2
	1219	WWF 152×152-MW130×MW26	855	171	2
	1829	WWF 152×152-MW130×MW52	855	342	4
	2438	WWF 152×102-MW130×MW77	855	755	4
	2743	WWF 152×102-MW130×MW77	855	755	4

** WWF AxB-WC×WD (U.S. CUSTOMARY)
WWF AxB-MWC×MWD (METRIC)
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

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN

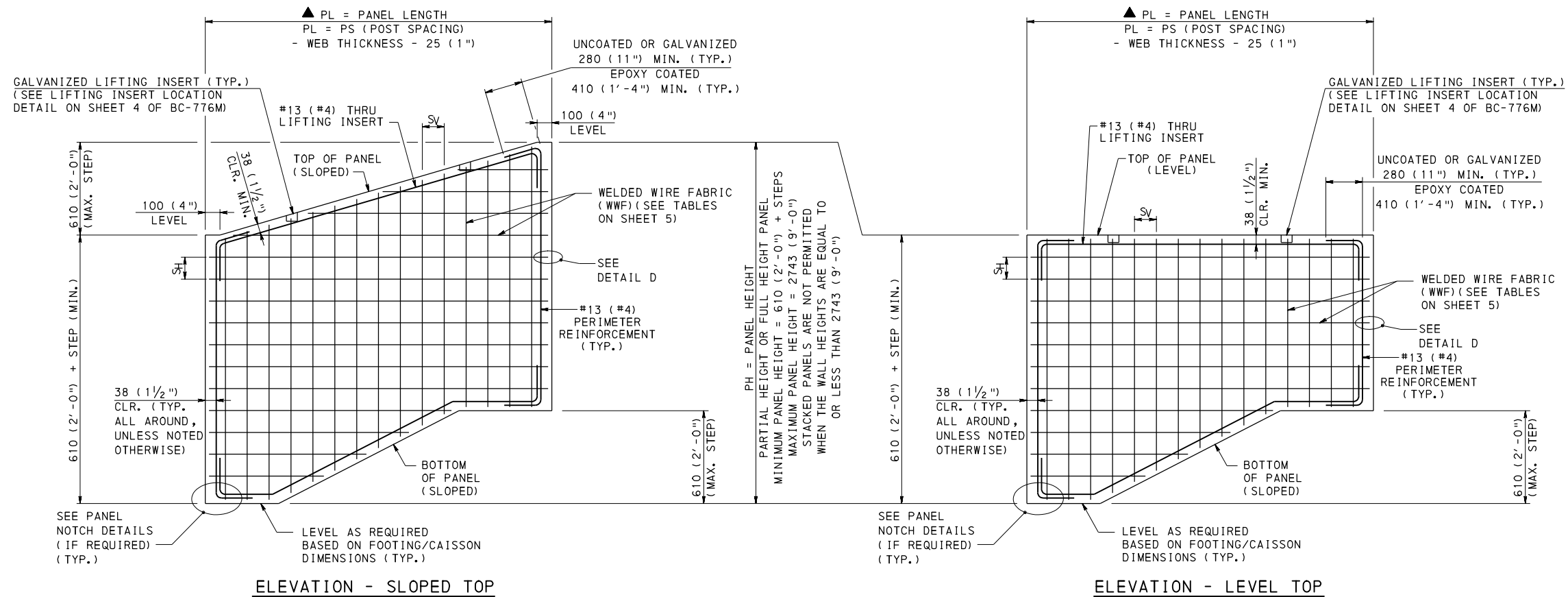
STANDARD GROUND MOUNTED SOUND BARRIERS PRECAST CONCRETE PANELS

PRECAST CONCRETE PANEL DETAILS - 1

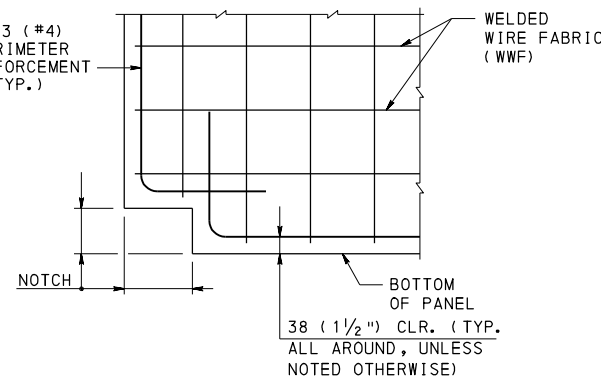
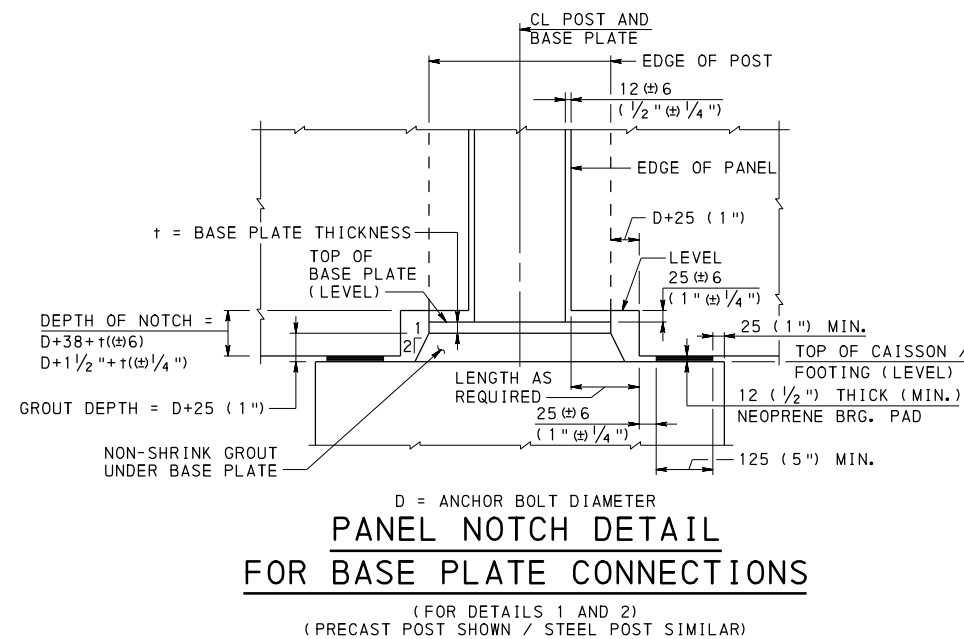
RECOMMENDED SEPT. 20, 2010
Thomas P. Macioro
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 5 OF 6
BD-676M



PRECAST CONCRETE PANEL WITH OPTIONAL SLOPED BOTTOM



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

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN**

**STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE PANELS**

PRECAST CONCRETE PANEL DETAILS - 2

RECOMMENDED SEPT. 20, 2010
Thomas P. Maciara
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

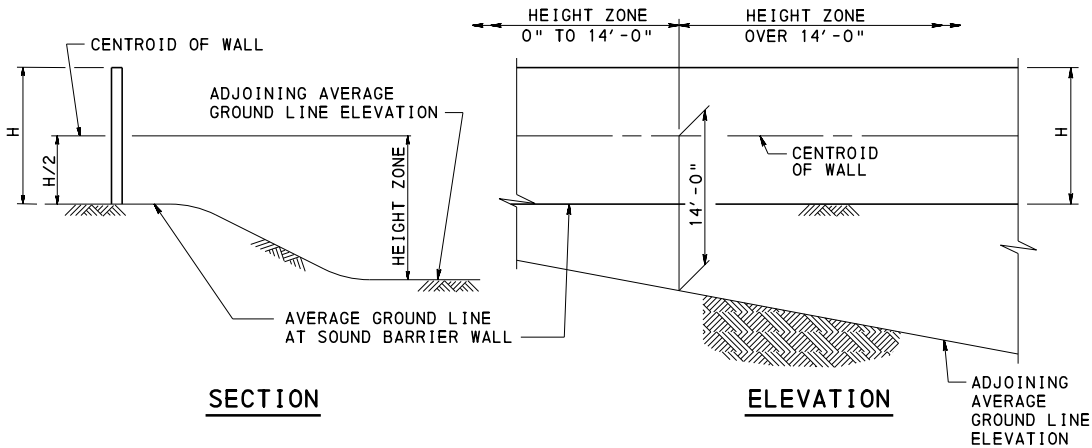
SHEET 6 OF 6
BD-676M

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.
 - 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
 - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
 - 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 WORKMANSHIP:
- 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 2002 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M 2002 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5M/D1.5 2002.)
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 (FEET)	WIND PRESSURE (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.

Standard reduced from
28 Shts. to 20 Shts. with the
removal of Metric info.

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

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

GENERAL NOTES - 1

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 1 OF 20

BD-677M

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 THE 2002 AND 2003 INTERIMS.
 - 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 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
 - 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 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 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 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 DEPARTMENT.

NOTES TO DESIGNER

1. REFER TO BD-676M FOR NOTES TO DESIGNER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

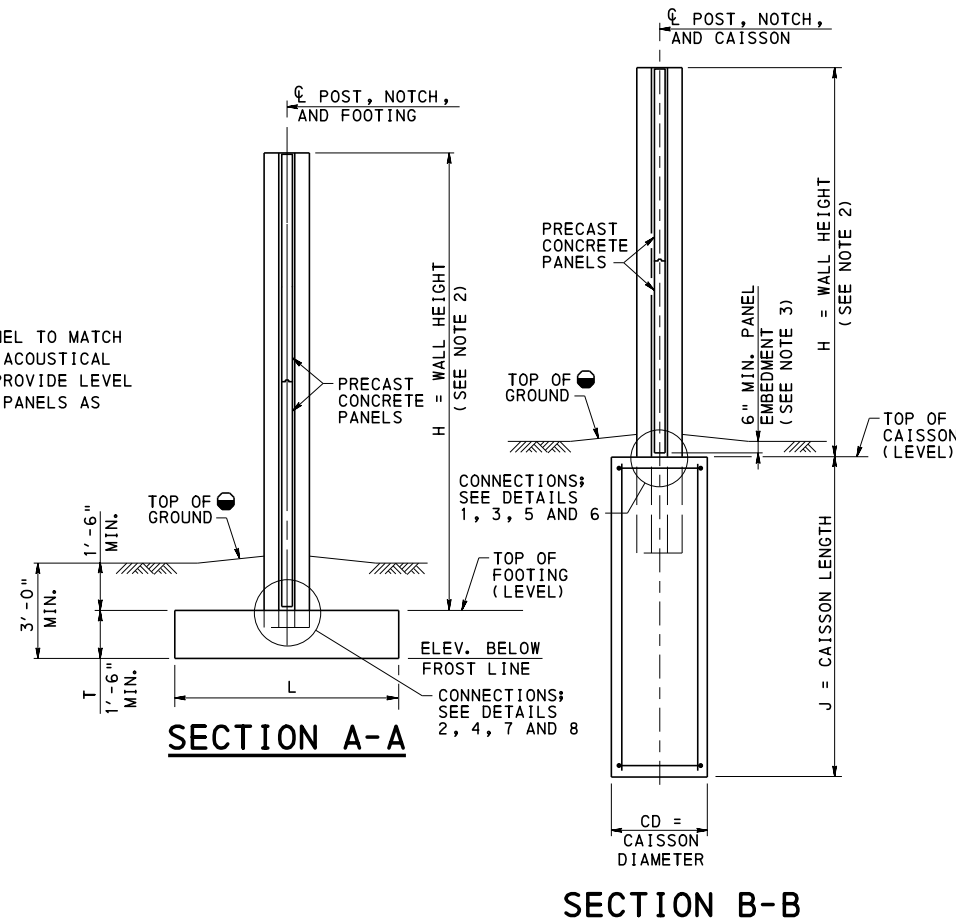
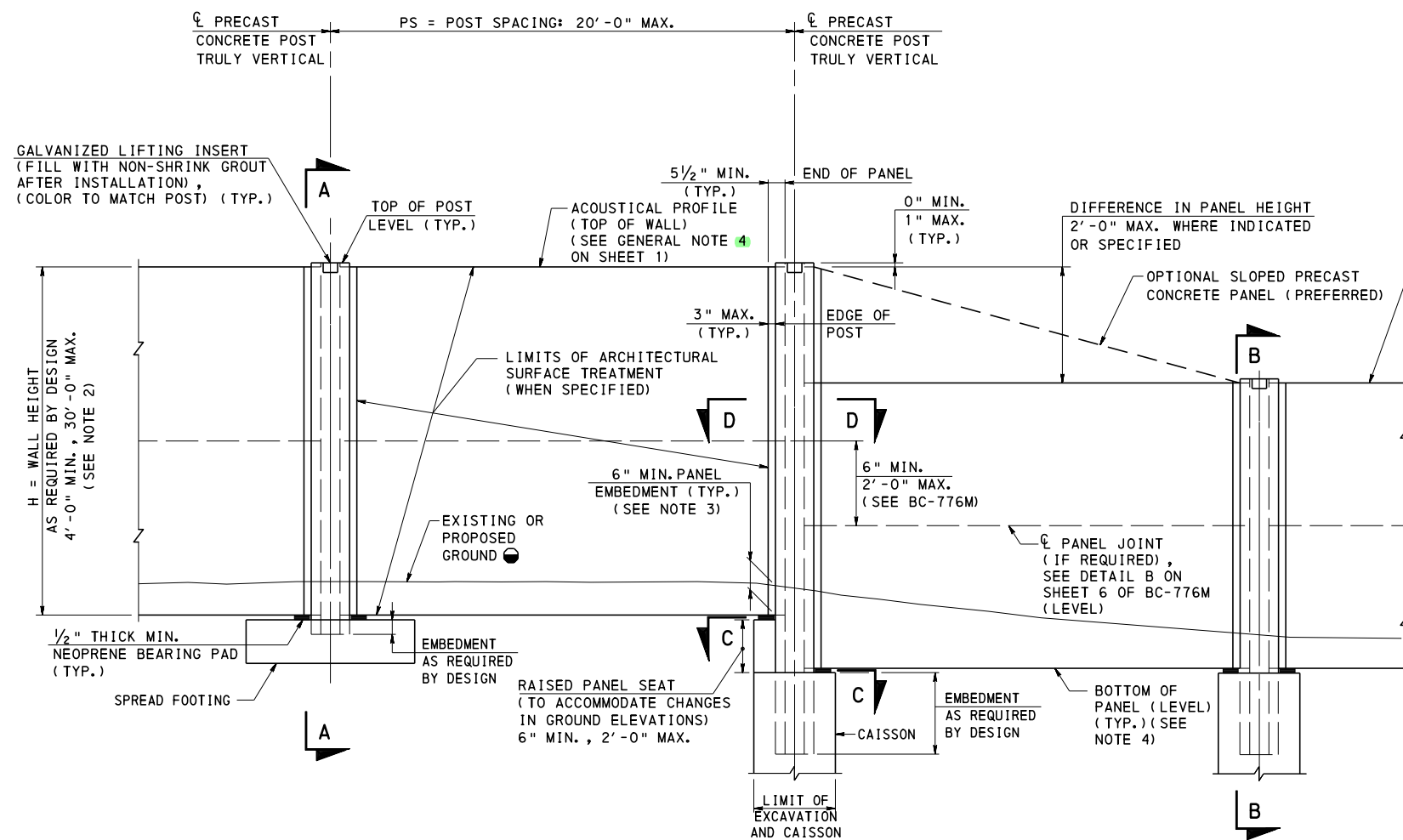
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

GENERAL NOTES - 2

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
[Signature]
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 2 OF 20
BD-677M



GROUND MOUNTED SOUND BARRIER ELEVATION

FOR POSTS WITH BASE PLATES REFER TO "PANEL NOTCH DETAIL FOR BASE PLATE CONNECTIONS" ON BD-676M, SHT. 6.

LEGEND:

● GRADE GROUND TO DRAIN WATER AWAY FROM THE WALL. FILL DEPTH ON EACH SIDE OF WALL TO BE WITHIN 1'-0" DIFFERENCE.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
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
3. PANEL EMBEDMENT MAY NEED TO BE INCREASED TO ACCOMMODATE BASE PLATES AND ANCHOR BOLT PROJECTIONS.
4. FOR OPTIONAL SLOPED BOTTOM PANEL REFER TO BD-676M, SHEET 3.
5. FOR SECTIONS C-C AND D-D REFER TO BC-777M, SHEETS 2 AND 3.

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

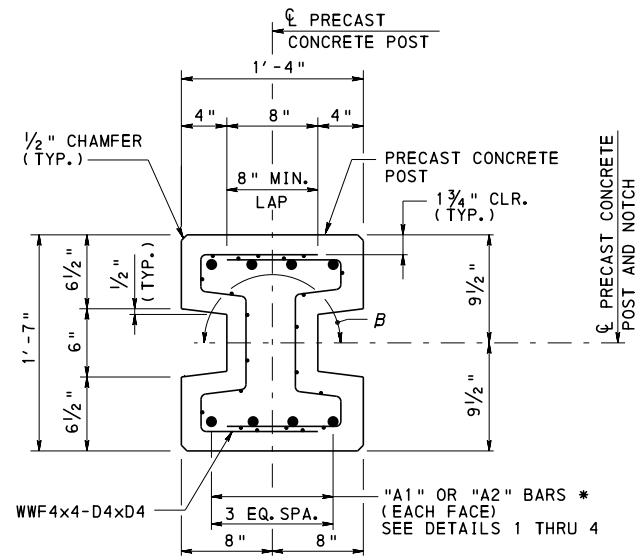
**STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS**

GEOMETRY AND LAYOUT

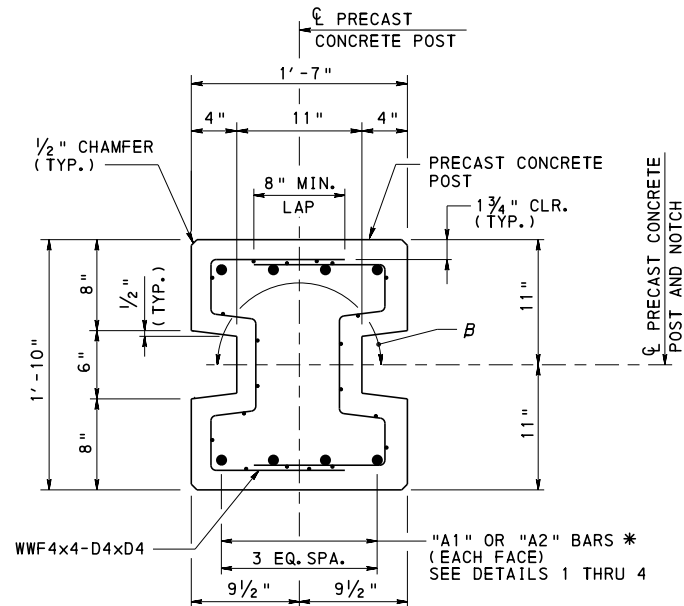
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David A. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

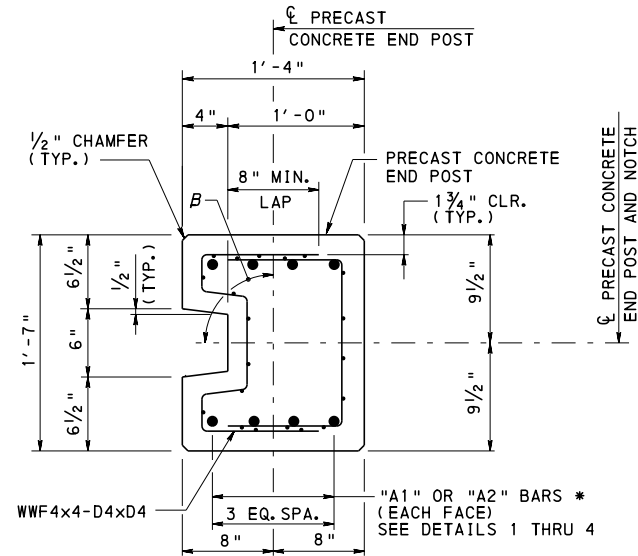
SHEET 3 OF 20
BD-677M



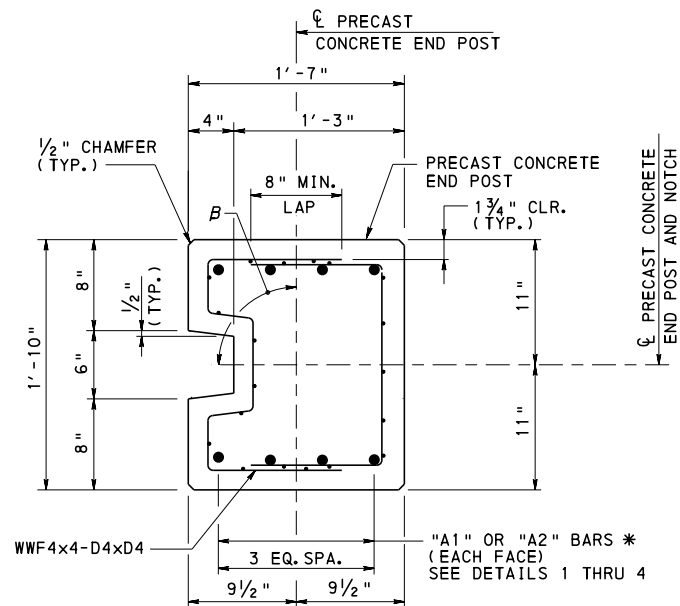
POST TYPE A - IN-LINE
 $B = 180^\circ (\pm 12^\circ)$



POST TYPE C - IN-LINE
 $B = 180^\circ (\pm 12^\circ)$



POST TYPE B - END POST
 $B = 90^\circ (\pm 6^\circ)$



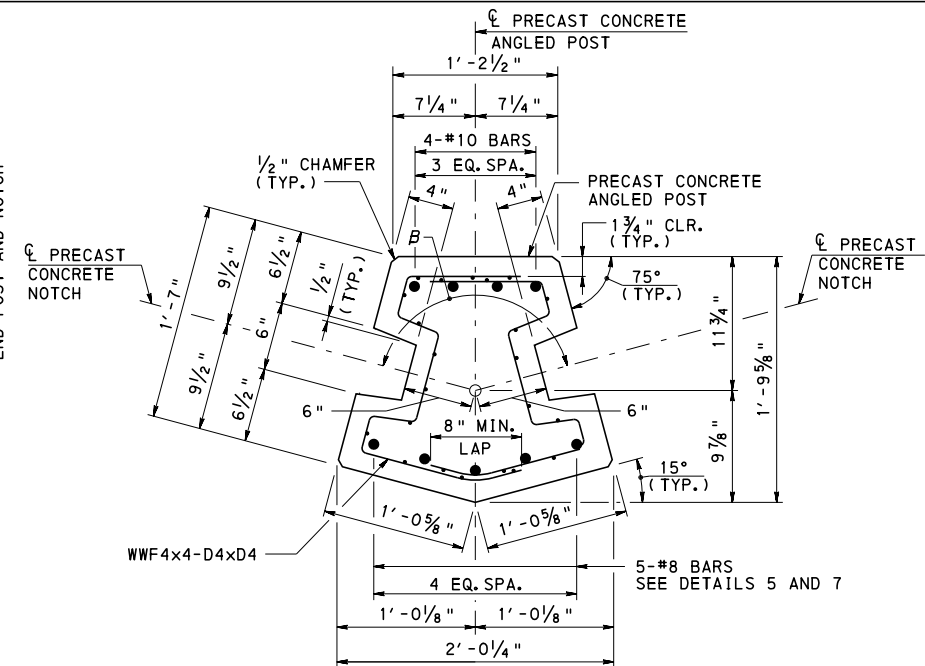
POST TYPE D - END POST
 $B = 90^\circ (\pm 6^\circ)$

* "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)

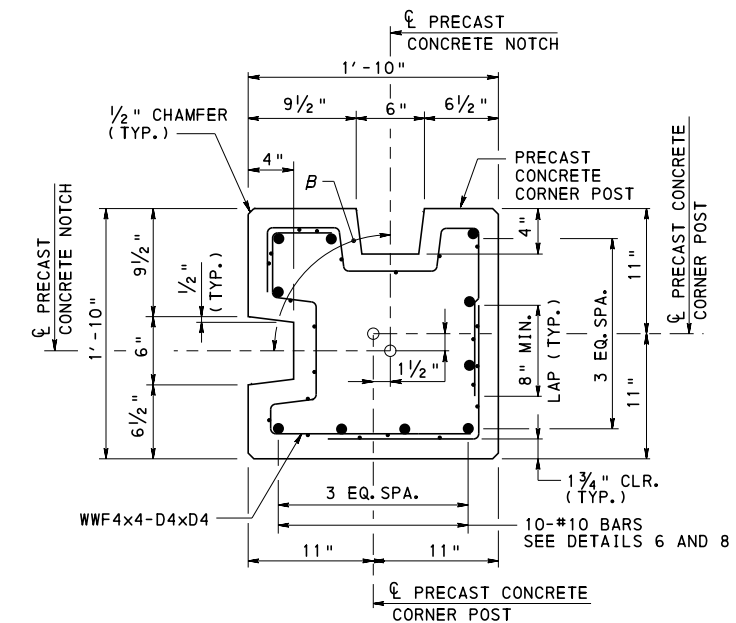
"A2" BARS ARE NOT THREADED. (SEE DETAILS 3 AND 4)

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.



POST TYPE E - ANGLED IN-LINE
 $B = 150^\circ (\pm 12^\circ)$



POST TYPE F - CORNER
 $B = 90^\circ (\pm 12^\circ)$

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
 BUREAU OF PROJECT DELIVERY

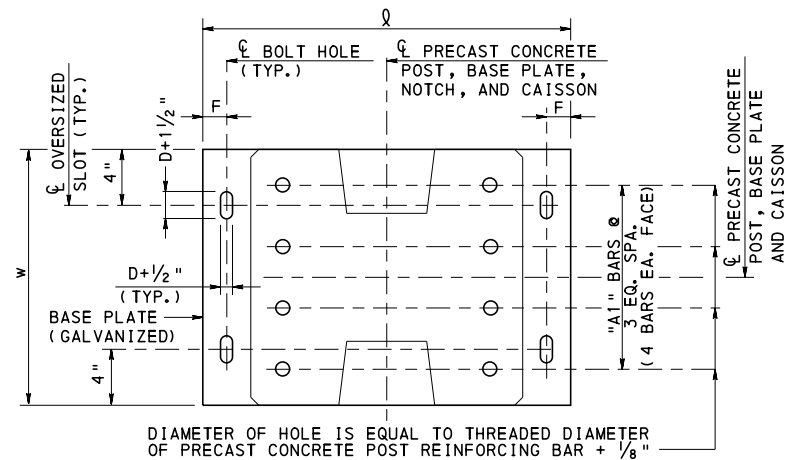
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

POST DETAILS

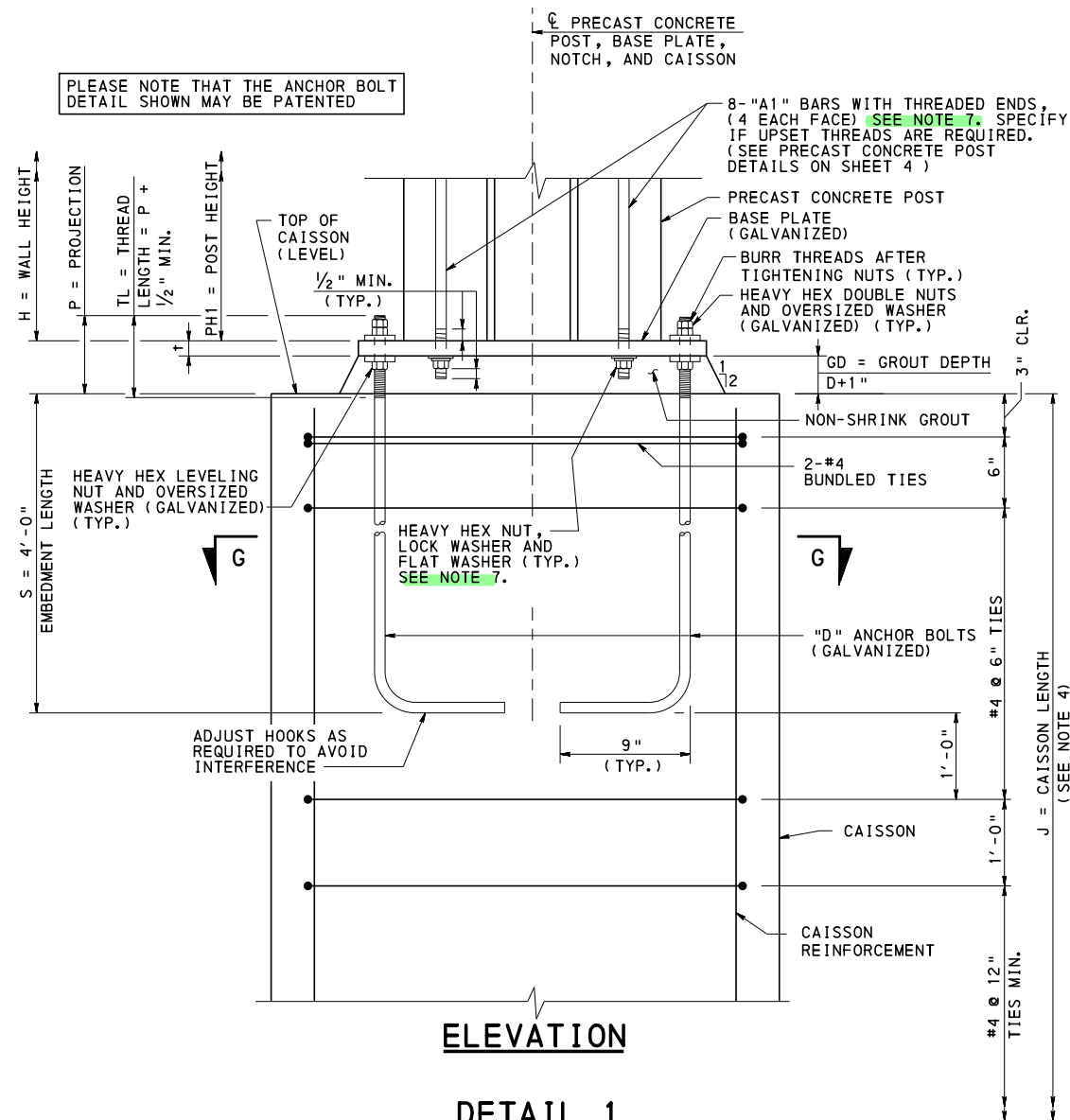
RECOMMENDED NOV. 26, 2013
 Thomas P. Macieira
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
 [Signature]
 ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 4 OF 20
 BD-677M



PLAN



ELEVATION

DETAIL 1
PRECAST CONCRETE POST WITH
BASE PLATE CONNECTION
TO CAISSON

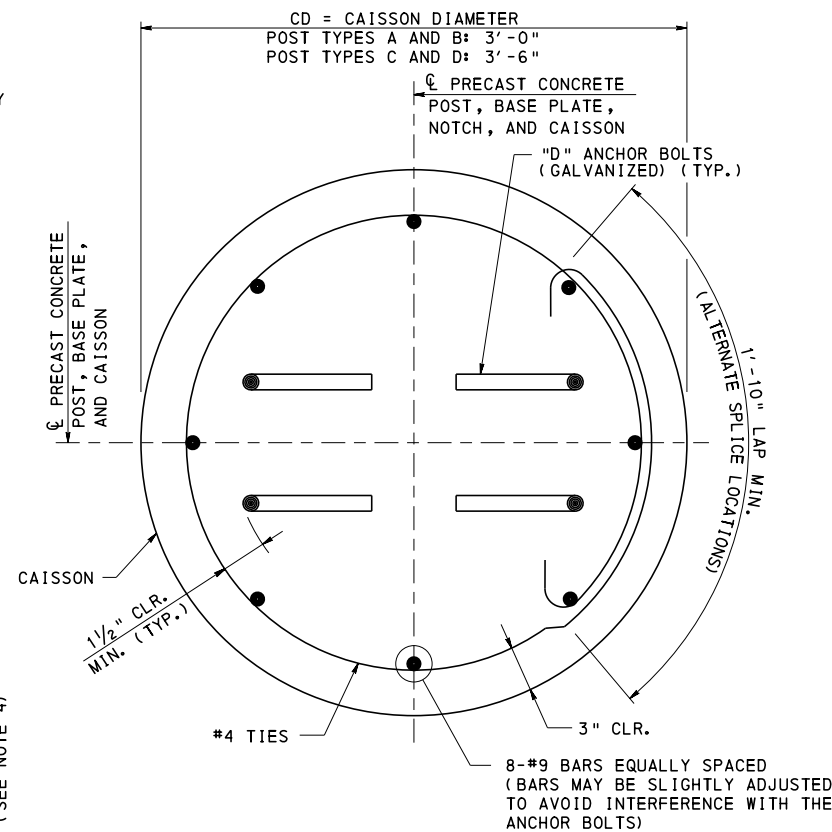
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON DIMENSION TABLE

HEIGHT ZONE =
WIND PRESSURE =

CONCRETE POST					BASE PLATE				ANCHOR BOLTS				GROUT	CAISSON			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST HEIGHT PH1 (FT.)	"A1" (BAR SIZE)	THICKNESS t (IN.)	LENGTH l (IN.)	WIDTH w (IN.)	F (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:

- 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.
- FOR OVERSIZED WASHER DETAIL REFER TO BC-777M.
- 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 NOV. 26, 2013
THOMAS P. MACIVER
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 5 OF 20
BD-677M

DETAIL 1								
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO CAISSON								
POST TYPES A AND B								
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF								
CONCRETE POST			BASE PLATE				ANCHOR BOLTS	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Ø (IN.)	w (IN.)	F (IN.)	D (IN.)	P (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
	24.0	#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	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 CONNECTION TO CAISSON								
POST TYPES A AND B								
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF								
CONCRETE POST			BASE PLATE				ANCHOR BOLTS	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Ø (IN.)	w (IN.)	F (IN.)	D (IN.)	P (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.

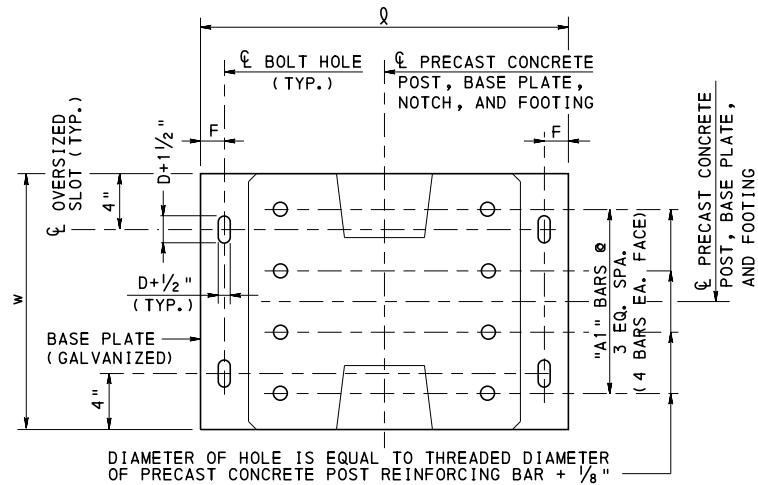
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS
DETAIL 1 - POST TYPES A AND B
DESIGN TABLES

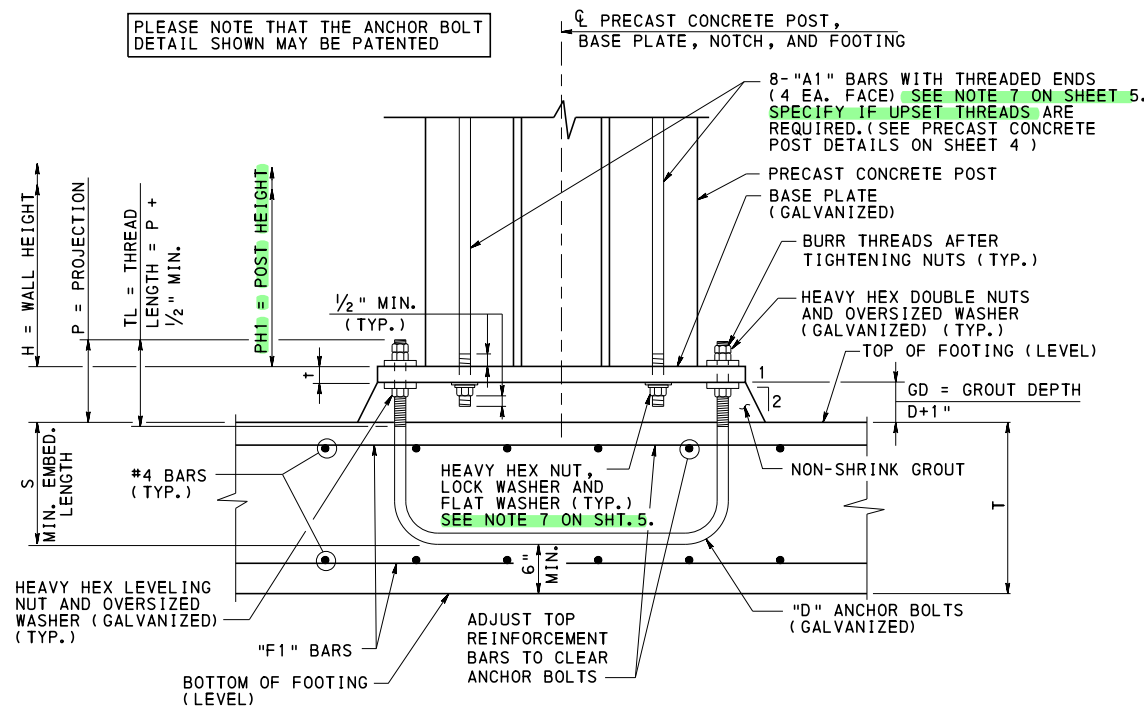
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
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SHEET 6 OF 20
BD-677M



PLAN



ELEVATION

DETAIL 2
PRECAST CONCRETE POST WITH
BASE PLATE CONNECTION
TO SPREAD FOOTING

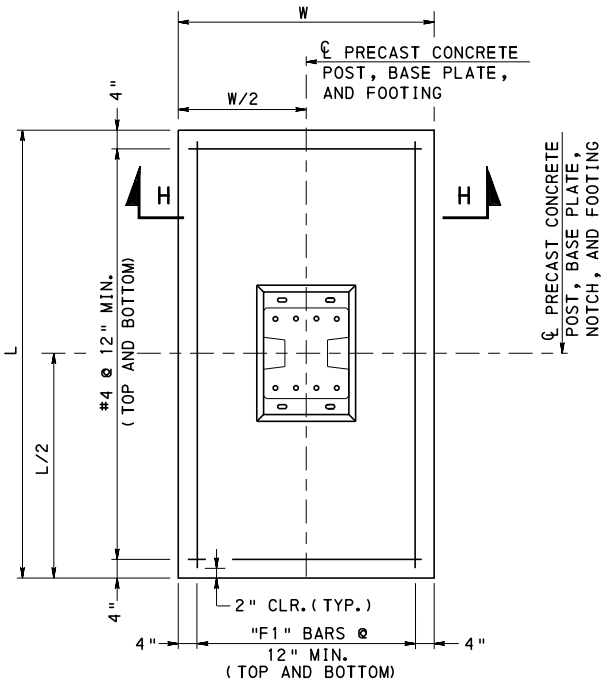
PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING DIMENSION TABLE

HEIGHT ZONE =
WIND PRESSURE =

CONCRETE POST					BASE PLATE				ANCHOR BOLTS				GROUT	SPREAD FOOTING			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST HEIGHT PH1 (FT.)	"A1" (BAR SIZE)	THICKNESS (IN.)	LENGTH (IN.)	WIDTH (IN.)	F (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	PROJECTION P (IN.)	THREAD LENGTH TL (IN.)	GROUT DEPTH GD (IN.)	THICKNESS T (FT.)	LENGTH L (FT.)	WIDTH W (FT.)	"F1" (BAR SIZE)

TABLE NOTES:

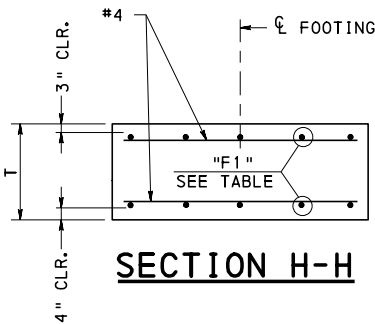
- DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
- TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
- SPECIFY IF UPSET THREADS ARE REQUIRED FOR THE "A1" BARS. (REFER TO SHEET 4)
- SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT 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.
- FOR PANEL SEAT DETAILS REFER TO BC-777M.



SECTION H-H

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 2

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CHIEF BRIDGE ENGINEER

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SHEET 8 OF 20
BD-677M

DETAIL 2 PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING													
POST TYPES A AND B													
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF													
CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING													
POST TYPES A AND B													
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF													
CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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	1⅛	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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 9 OF 20
BD-677M

DETAIL 2 PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING													
POST TYPES C AND D													
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF													
CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 PRECAST CONCRETE POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING													
POST TYPES C AND D													
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF													
CONCRETE POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A1 (BAR SIZE)	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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	#4
	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

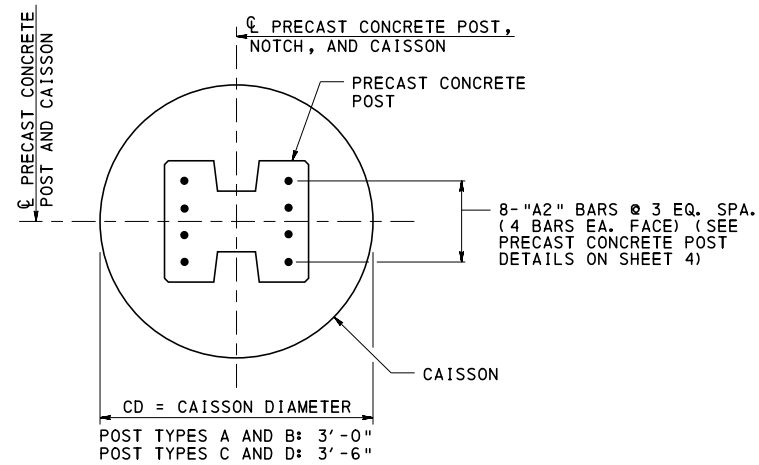
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS
DETAIL 2 - POST TYPES C AND D
DESIGN TABLES

RECOMMENDED NOV. 26, 2013
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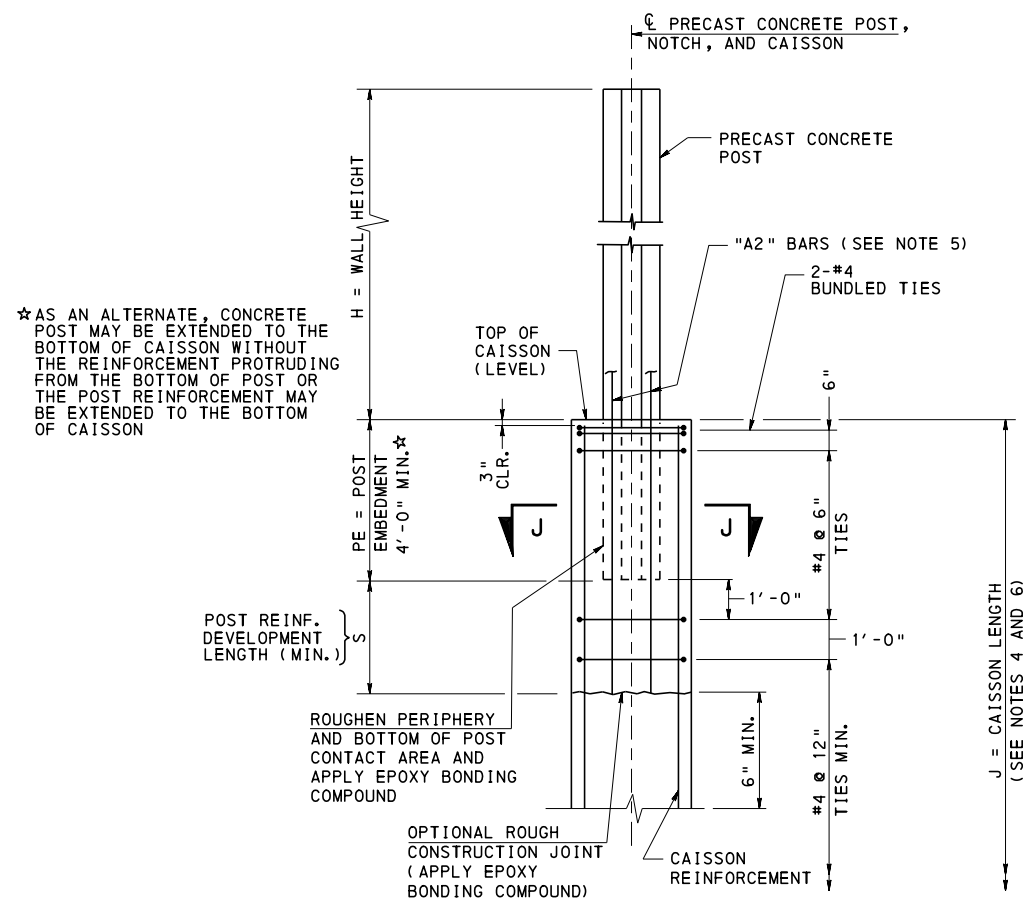
RECOMMENDED NOV. 26, 2013
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SHEET 10 OF 20

BD-677M

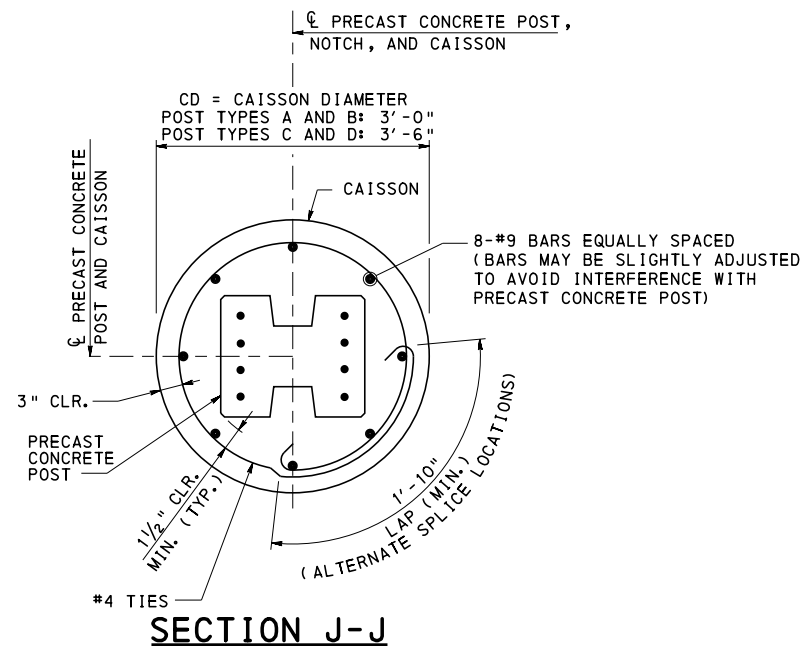


PLAN



ELEVATION

**DETAIL 3
PRECAST CONCRETE POST
EMBEDDED IN CAISSON**



SECTION J-J

PRECAST CONCRETE POST EMBEDDED IN CAISSON DIMENSION TABLE									
HEIGHT ZONE = WIND PRESSURE =									
CONCRETE POST						CAISSON			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	POST EMBEDMENT PE (FT.-IN.)	"A2" (BAR SIZE)	POST REINFORCEMENT DEVELOPMENT LENGTH S (FT.-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. 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 PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DESIGN TABLES REFER TO SHEET 12.
4. FOR CAISSON LENGTHS REFER TO SHEETS 20.
5. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.
6. 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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David P. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 11 OF 20
BD-677M

DETAIL 3 PRECAST CONCRETE POST EMBEDDED IN CAISSON				
POST TYPES A AND B				
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF				
CONCRETE POST REINFORCEMENT				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	EPOXY COATED 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
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
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

DETAIL 3 PRECAST CONCRETE POST EMBEDDED IN CAISSON				
POST TYPES A AND B				
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF				
CONCRETE POST REINFORCEMENT				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	EPOXY COATED 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
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
20.0	6.0	#4	12	18
	8.0	#4	12	18
	10.0	#5	15	23
	14.0	#7	26	39
	16.0	#8	35	52
	20.0	#10	55	83

DETAIL 3 PRECAST CONCRETE POST EMBEDDED IN CAISSON				
POST TYPES C AND D				
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF				
CONCRETE POST REINFORCEMENT				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	EPOXY COATED 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
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
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

DETAIL 3 PRECAST CONCRETE POST EMBEDDED IN CAISSON				
POST TYPES C AND D				
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF				
CONCRETE POST REINFORCEMENT				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	S (IN.) UNCOATED OR GALVANIZED BARS	EPOXY COATED 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
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	#6	20	29
	18.0	#7	26	39
	20.0	#8	35	52
	22.0	#9	44	65
	28.0	#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	#6	20	29
	16.0	#7	26	39
	18.0	#8	35	52
	20.0	#9	44	65
	22.0	#10	55	83
	25.0	#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

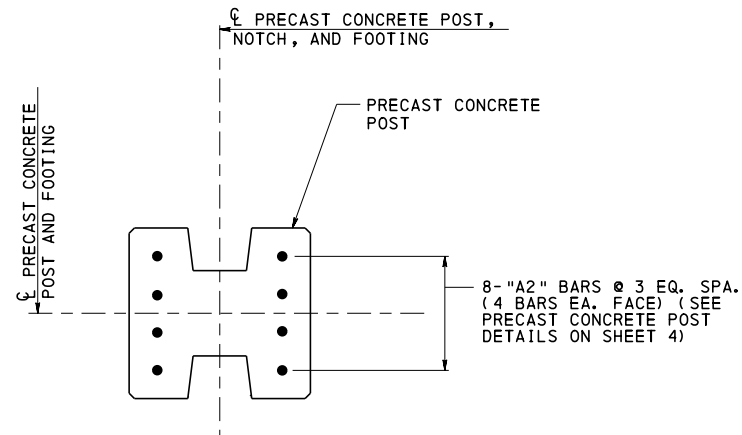
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS
DETAIL 3 - POST TYPES A, B, C AND D
DESIGN TABLES

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

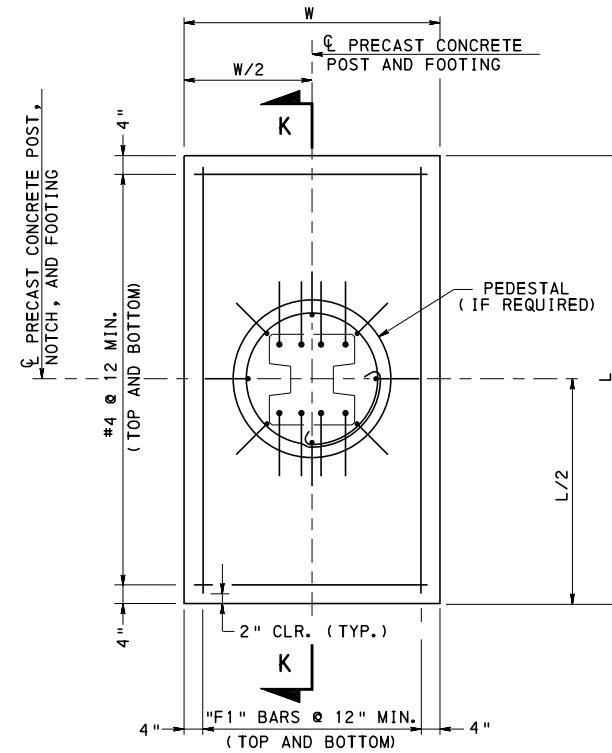
RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 12 OF 20

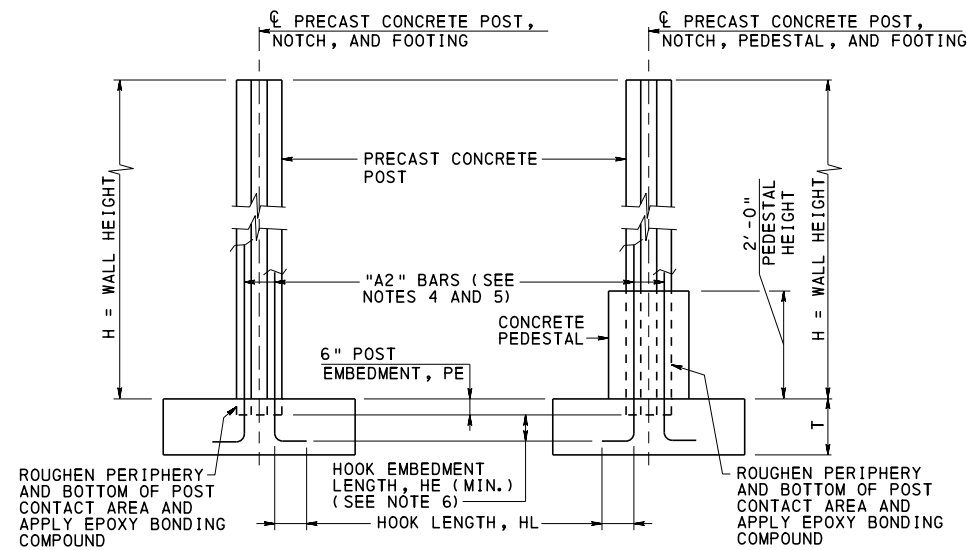
BD-677M



PLAN

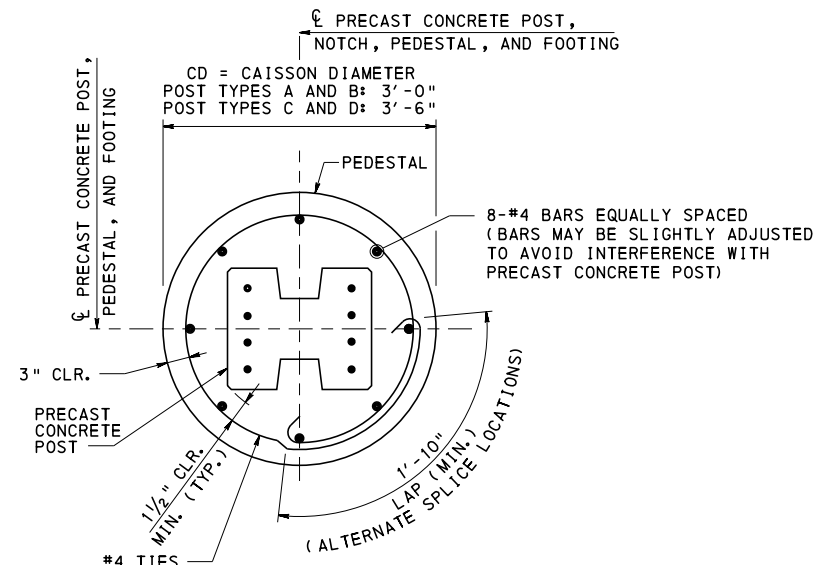


SPREAD FOOTING PLAN



WITHOUT PEDESTAL WITH PEDESTAL
ELEVATION

DETAIL 4
PRECAST CONCRETE POST
EMBEDDED IN SPREAD FOOTING
(WITH OR WITHOUT PEDESTAL)



SECTION L-L
PEDESTAL (IF SPECIFIED)

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
3. FOR DESIGN TABLES REFER TO SHEETS 14 AND 15.
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.
5. BARS MAY BE BENT AFTER FABRICATION OF POST. TOUCH-UP EPOXY COATED BARS WITH AN APPROVED EPOXY PAINT.
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.

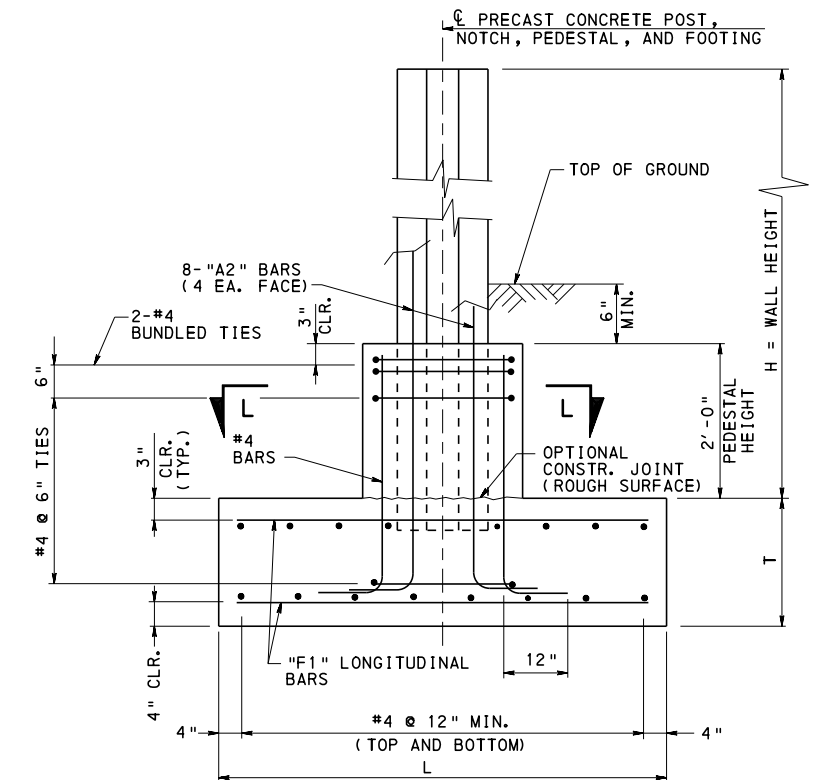
PRECAST CONCRETE POST EMBEDDED IN
SPREAD FOOTING
DIMENSION TABLE

HEIGHT ZONE =
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:

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.
5. INDICATE AND DETAIL PEDESTAL IF REQUIRED.



SECTION K-K (WITH PEDESTAL)
ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 4

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
[Signature]
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 13 OF 20
BD-677M

DETAIL 4 PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING									
POST TYPES A AND B									
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF									
CONCRETE POST REINFORCEMENT					SPREAD FOOTING				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.)		HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING									
POST TYPES A AND B									
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF									
CONCRETE POST REINFORCEMENT					SPREAD FOOTING				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.)		HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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
	8.0	#4	8	10	8	2.5	6.5	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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 14 OF 20
BD-677M

DETAIL 4 PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING									
POST TYPES C AND D									
HEIGHT ZONE 0' TO 14' WIND PRESSURE = 20 PSF									
CONCRETE POST REINFORCEMENT					SPREAD FOOTING				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.)		HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 PRECAST CONCRETE POST EMBEDDED IN SPREAD FOOTING									
POST TYPES C AND D									
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 PSF									
CONCRETE POST REINFORCEMENT					SPREAD FOOTING				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	A2 (BAR SIZE)	HE (IN.)(MIN.)		HL (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 15 OF 20
BD-677M

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 DEPTH (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.

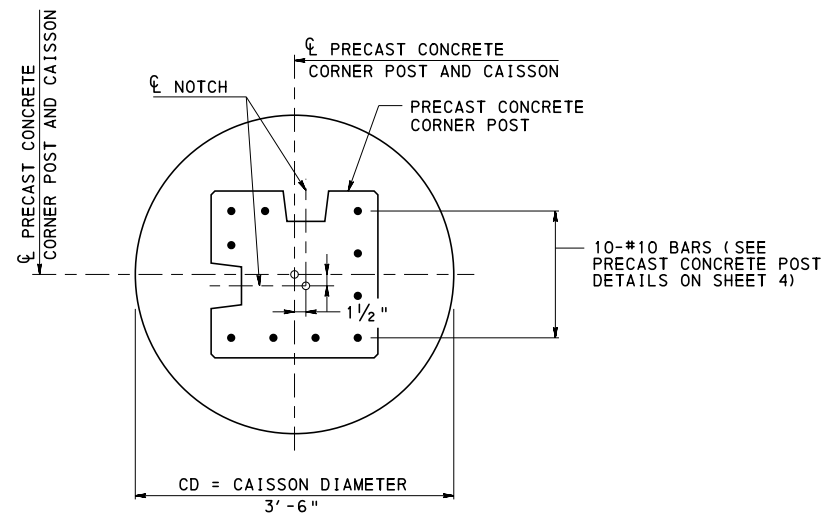


SECTION M-M

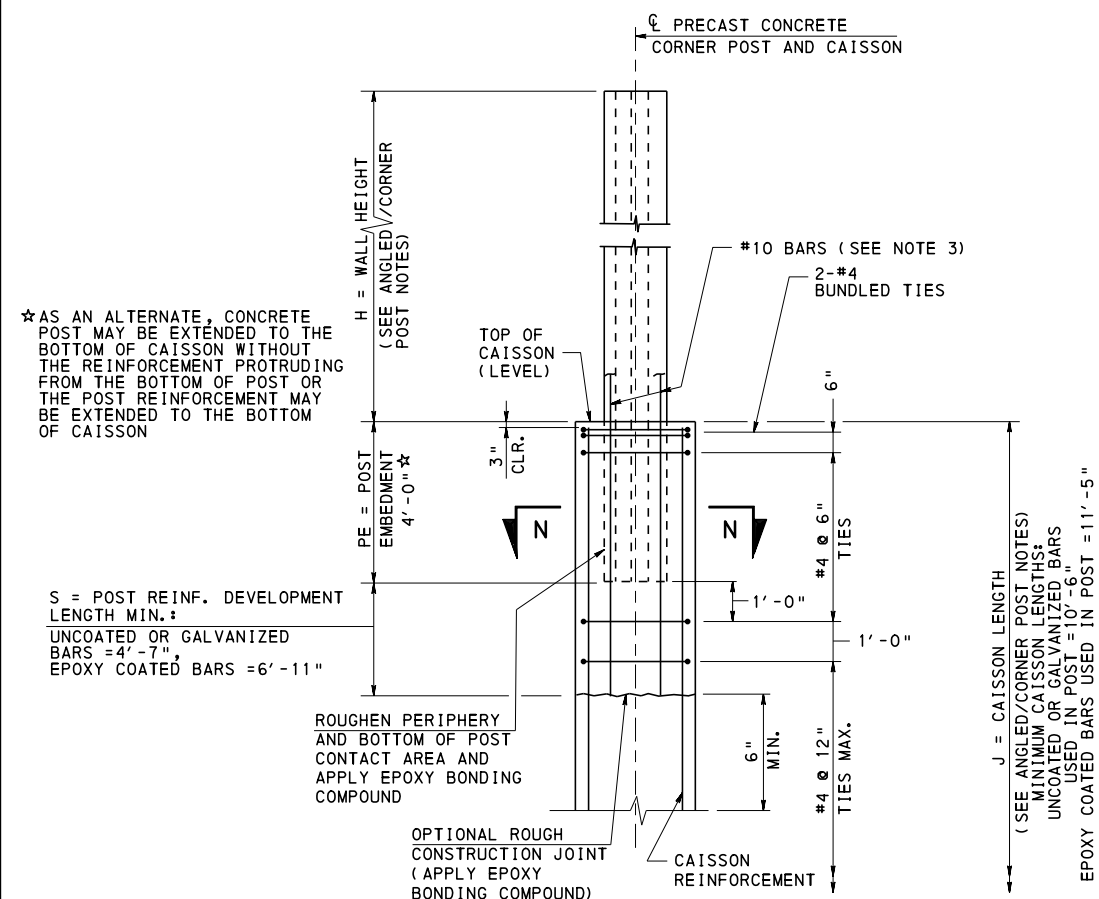
1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DETAIL 6, REFER TO SHEET 17.
3. FOR DETAIL 7, REFER TO SHEET 18.
4. FOR DETAIL 8, REFER TO SHEET 19.
5. FOR PRECAST CONCRETE POST DETAILS REFER TO SHEET 4.
6. PROVIDE UNCOATED, EPOXY COATED, OR GALVANIZED BARS IN ACCORDANCE WITH GENERAL NOTE 7, ON SHEET 1. DESIGNER TO SPECIFY ON THE CONTRACT DRAWINGS.

SHEET 16 OF 20

BD-677M

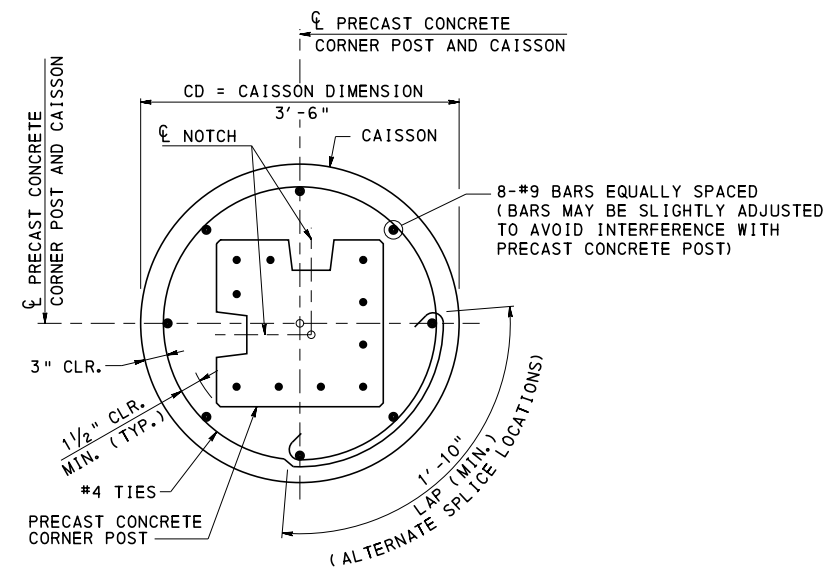


PLAN



ELEVATION

DETAIL 6
CORNER PRECAST CONCRETE POST TYPE F
EMBEDDED IN CAISSON



SECTION N-N

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, 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 POST NOTES REFER TO SHEET 16.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

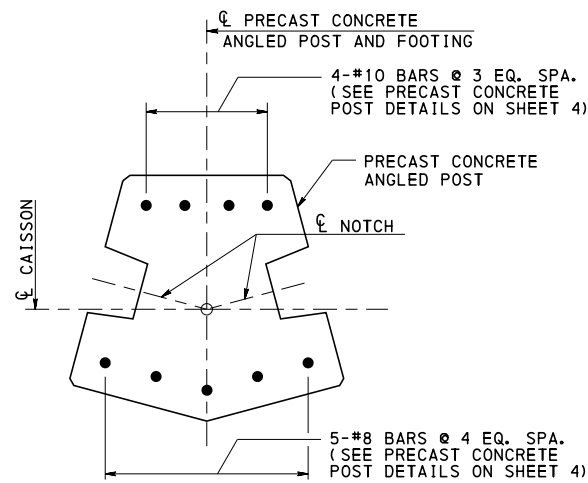
STANDARD
GROUND MOUNTED SOUND BARRIERS
PRECAST CONCRETE POSTS

DETAIL 6

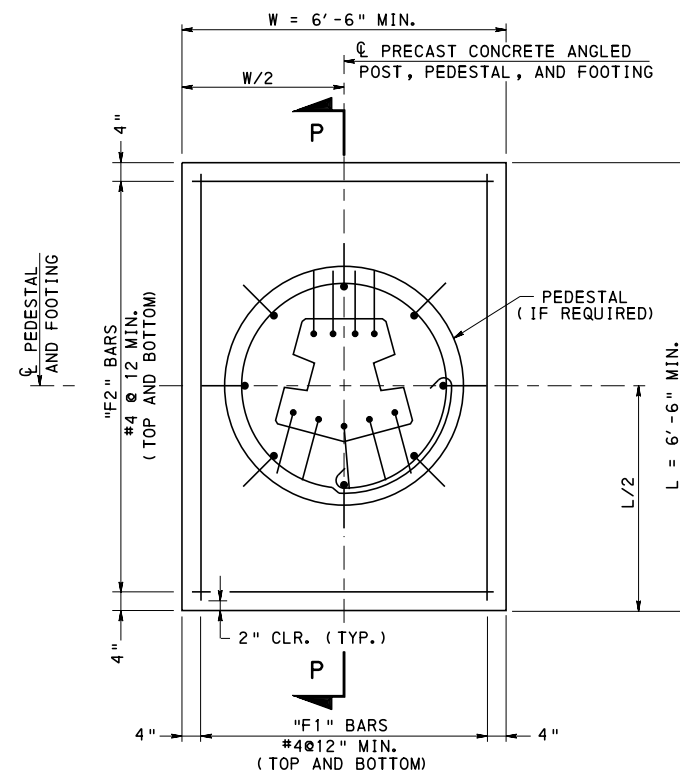
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David A. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

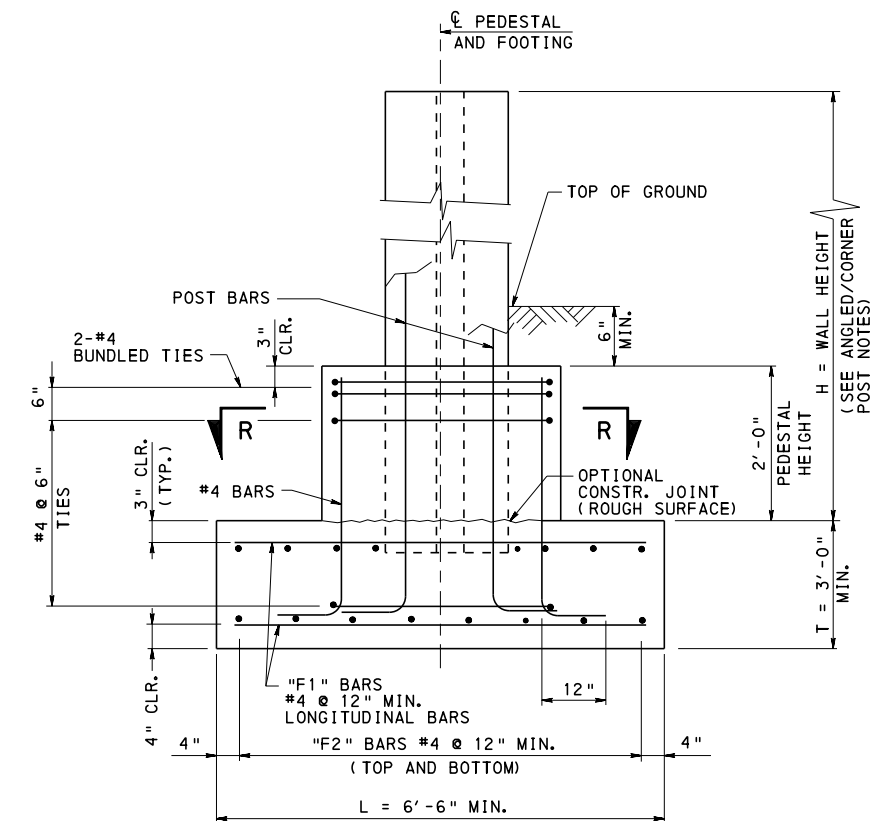
SHEET 17 OF 20
BD-677M



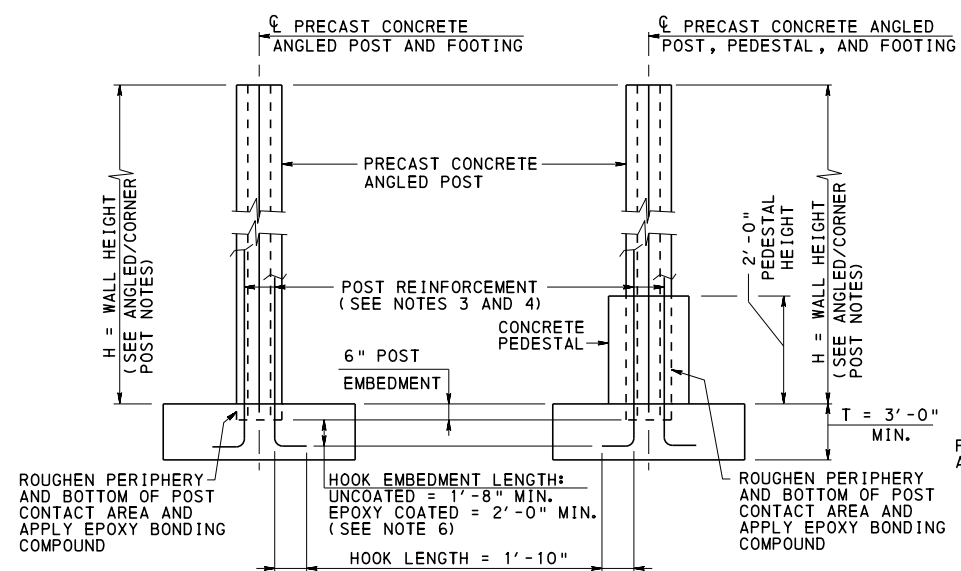
PLAN



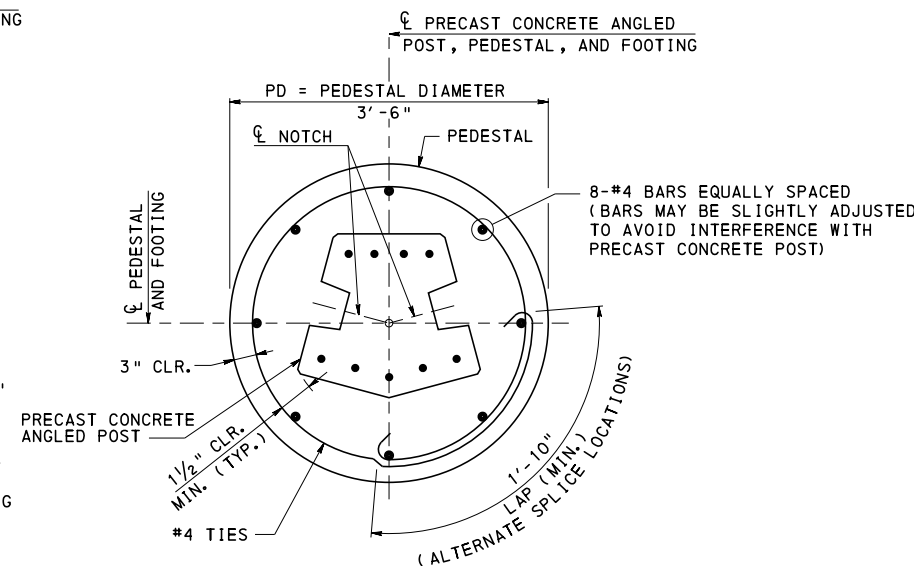
SPREAD FOOTING PLAN



SECTION P-P (WITH PEDESTAL)
ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.



WITHOUT PEDESTAL WITH PEDESTAL
ELEVATION

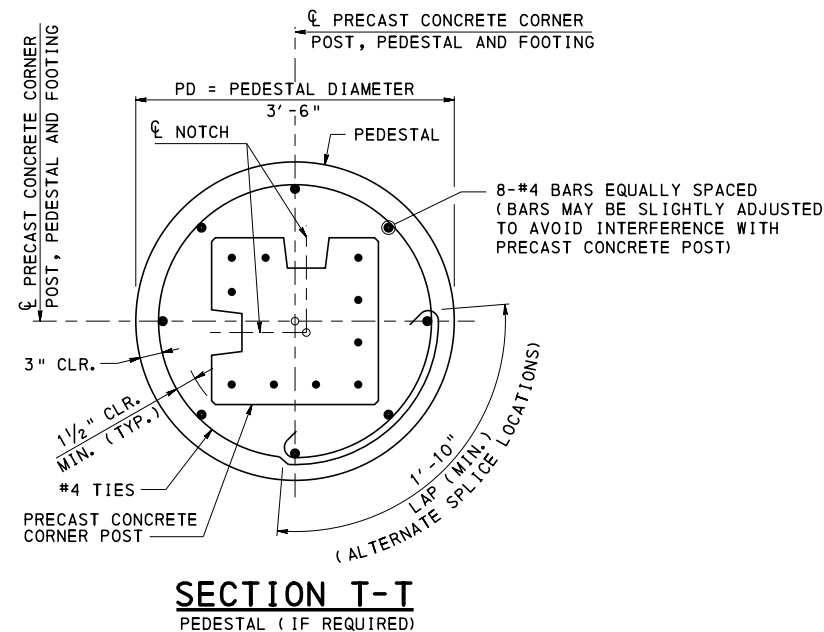
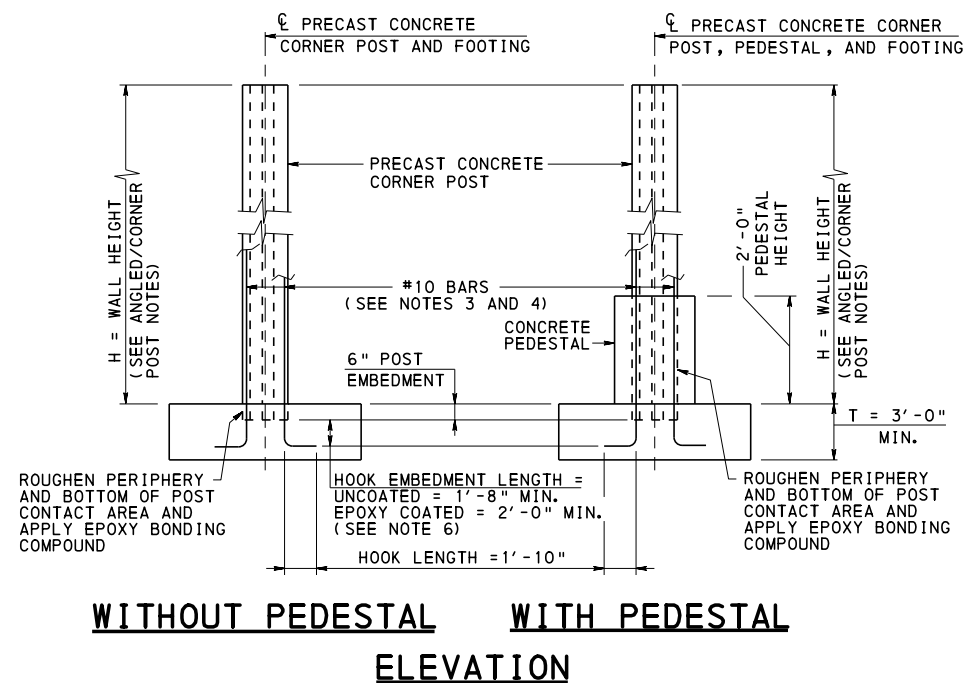
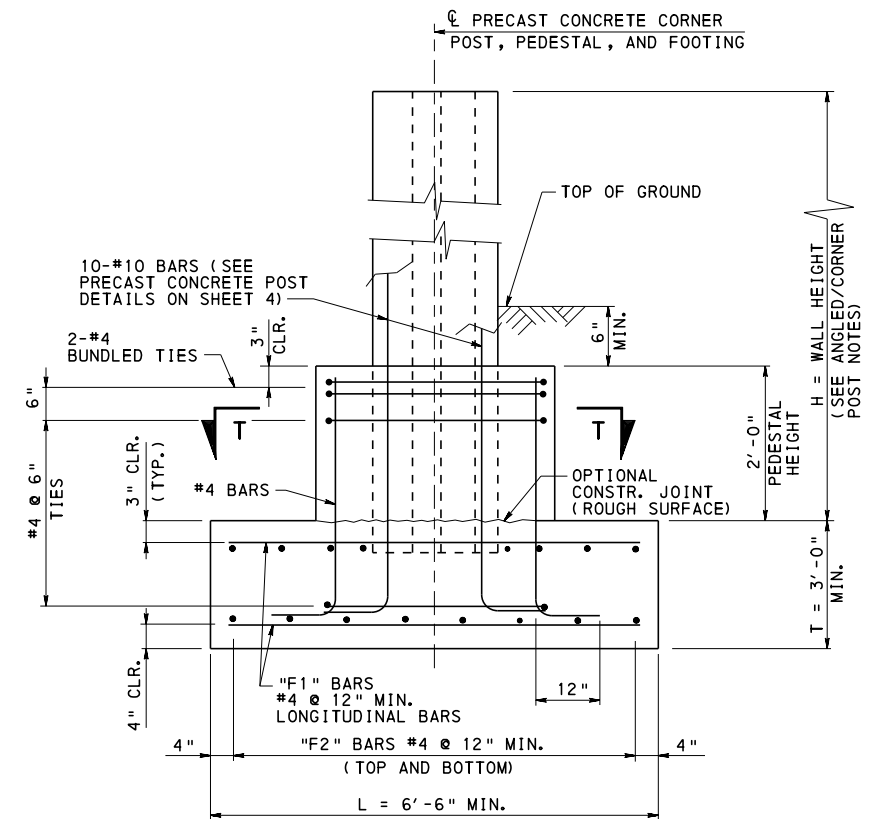
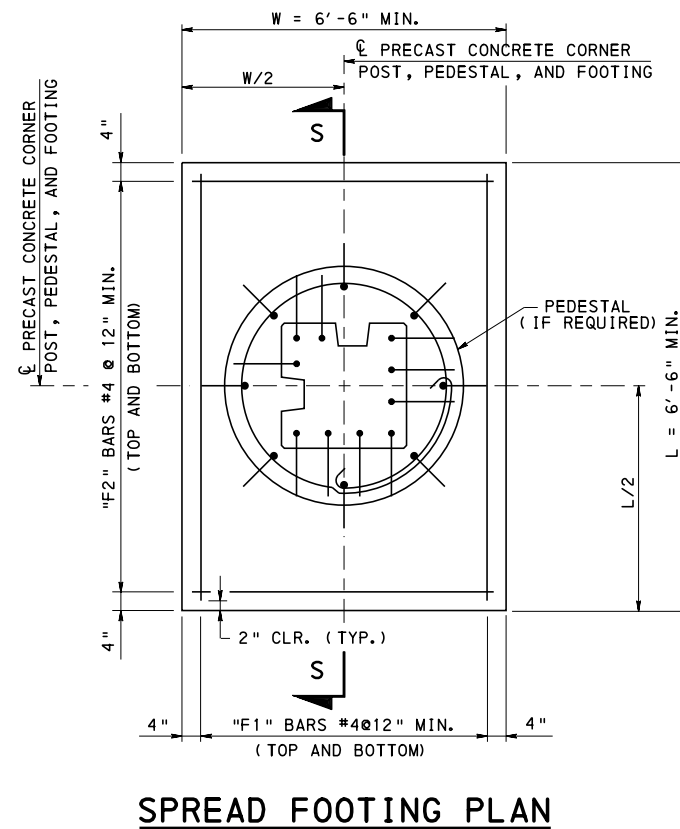
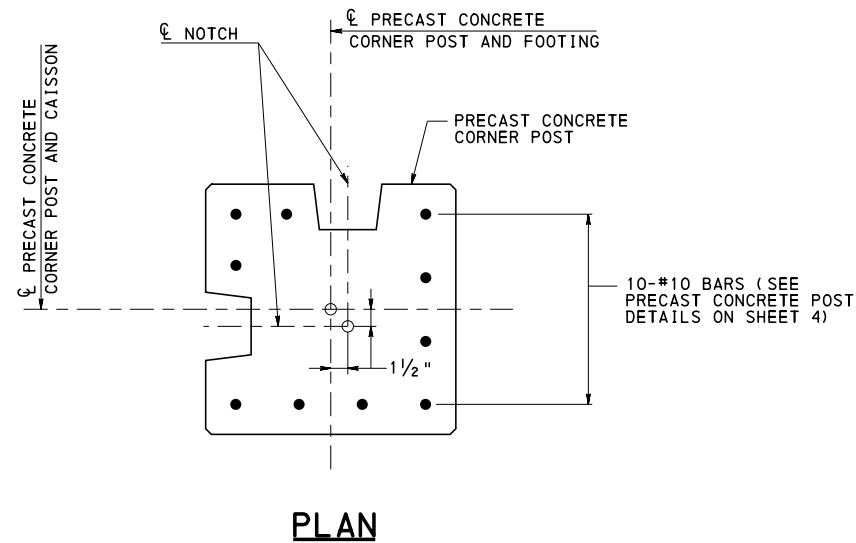


SECTION R-R
PEDESTAL (IF REQUIRED)

- 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 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 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 NOV. 26, 2013 <i>Thomas P. Macieira</i> CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 26, 2013 <i>David A. Kelly</i> ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 18 OF 20 BD-677M



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 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

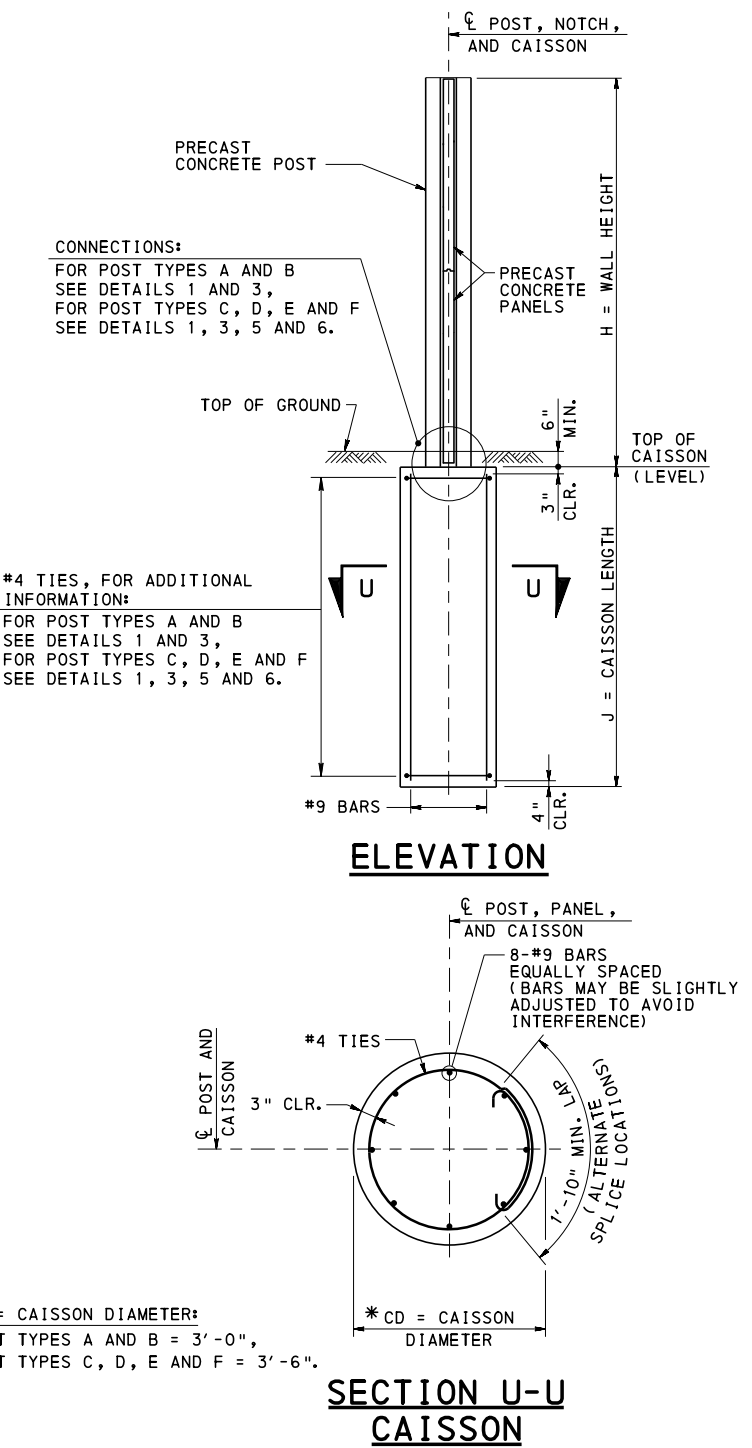
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 19 OF 20
BD-677M

CAISSON LENGTH											
PRECAST CONCRETE POST TYPES A AND B											
WIND PRESSURE = 28 PSF											
TYPE 1 SOIL SATURATED LOOSE SAND			TYPE 2 SOIL DRY MEDIUM DENSE SAND			TYPE 3 SOIL SATURATED SOFT CLAY			TYPE 4 SOIL DRY MEDIUM STIFF CLAY		
SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 30° 2. C = 0 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 20 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 34° 2. C = 0.0 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 90 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 500 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 100 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 1000 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 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	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 SATURATED LOOSE SAND			TYPE 2 SOIL DRY MEDIUM DENSE SAND			TYPE 3 SOIL SATURATED SOFT CLAY			TYPE 4 SOIL DRY MEDIUM STIFF CLAY		
SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 30° 2. C = 0 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 20 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 34° 2. C = 0.0 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 90 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 500 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 100 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 1000 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 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	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	6.0	13.5	20.0	6.0	10.5	20.0	6.0	11.5	20.0	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 TYPE A AND B = 9'-0"
POST TYPE C, D, E AND F = 10'-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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David A. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 20 OF 20

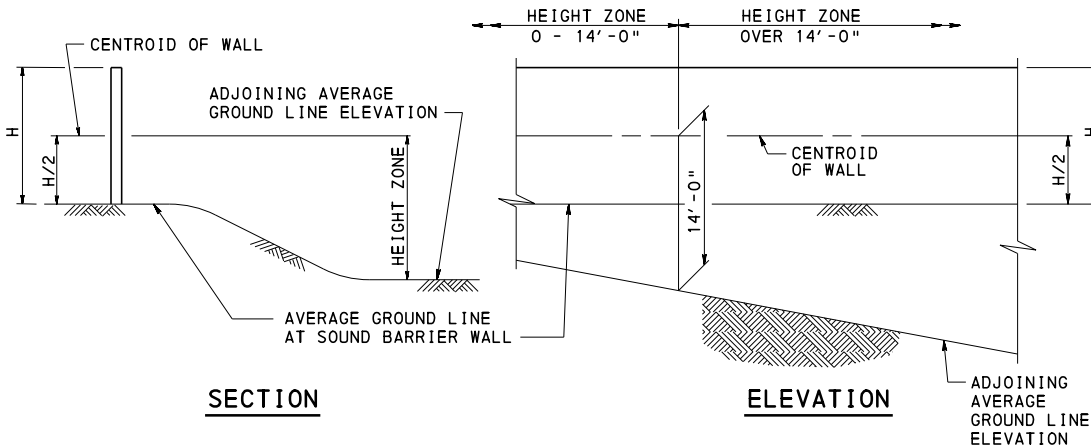
BD-677M

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.
 - 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
 - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
 - 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 WORKMANSHIP:
- 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 2002 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M 2002 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5M/D1.5 2002.)
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 0.09.
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 12.



HEIGHT ZONES FOR GROUND MOUNTED SOUND BARRIERS

MATERIAL NOTES

1. REFER TO BC-778M FOR MATERIAL NOTES.

INDEX OF SHEETS

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1	GENERAL NOTES - 1
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3	GEOMETRY AND LAYOUT
4	DETAIL 1
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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

RECOMMENDED NOV. 21, 2014

Thomas P. Maciora
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR. OF PROJECT DELIVERY

SHEET 1 OF 14

BD-678M

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-677M	GROUND MOUNTED SOUND BARRIERS - PRECAST CONCRETE POSTS
BD-679M	STRUCTURE MOUNTED SOUND BARRIER WALLS

CHANGE 3

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, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
 - 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 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
 - 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, 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 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 INCH
 - 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 BD-676M FOR NOTES TO DESIGNER.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

GENERAL NOTES - 2

RECOMMENDED NOV. 21, 2014
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 2 OF 14
BD-678M

SHEET 4 OF 14
BD-678M

DETAIL 1 DESIGN TABLE										
STEEL POST WITH BASE PLATE CONNECTION TO CAISSON HEIGHT ZONE 0'-14' WIND PRESSURE = 20 psf										
STEEL POST			BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)	Q1 (IN.)	F1 (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 DESIGN TABLE										
STEEL POST WITH BASE PLATE CONNECTION TO CAISSON HEIGHT ZONES OVER 14' WIND PRESSURE = 28 psf										
STEEL POST			BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES	
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Q (IN.)	w (IN.)	F (IN.)	D (IN.)	P (IN.)	Q1 (IN.)	F1 (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
	20.0	W12x136	2 1/8	26	16	3 1/2	2	10	23	2
	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 NOV. 21, 2014

Thomas P. Maciore

CHIEF BRIDGE ENGINEER

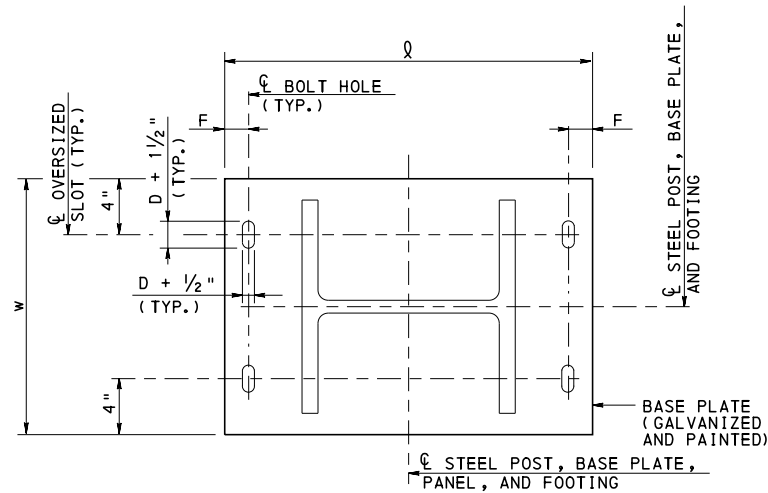
RECOMMENDED NOV. 21, 2014

Brian S. Thompson

ACTING DIR., BUR. OF PROJECT DELIVERY

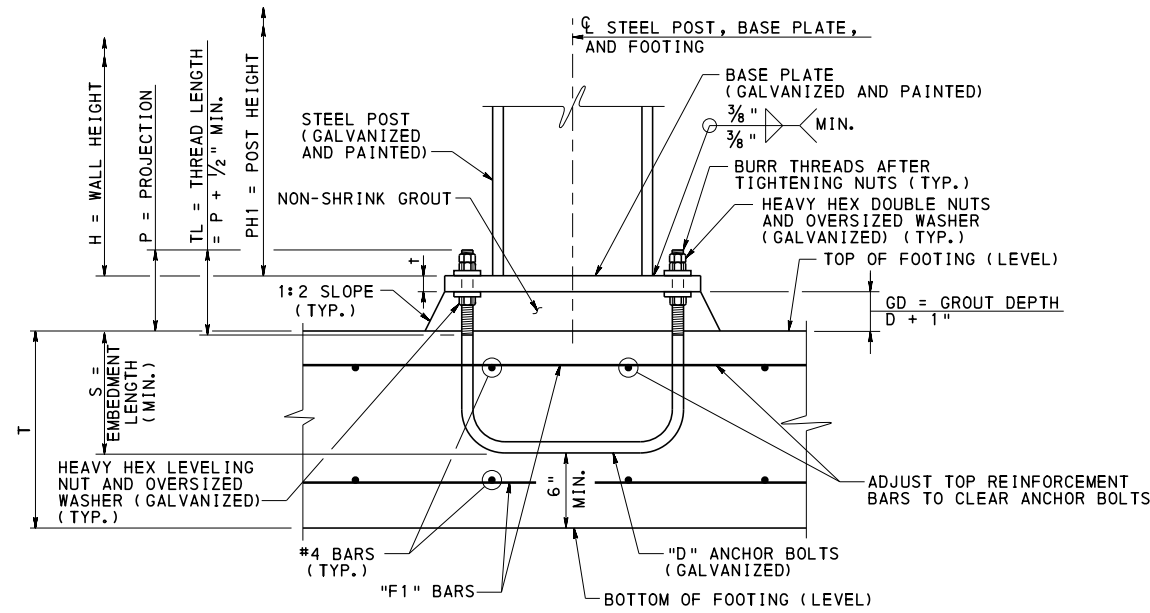
SHEET 5 OF 14

BD-678M



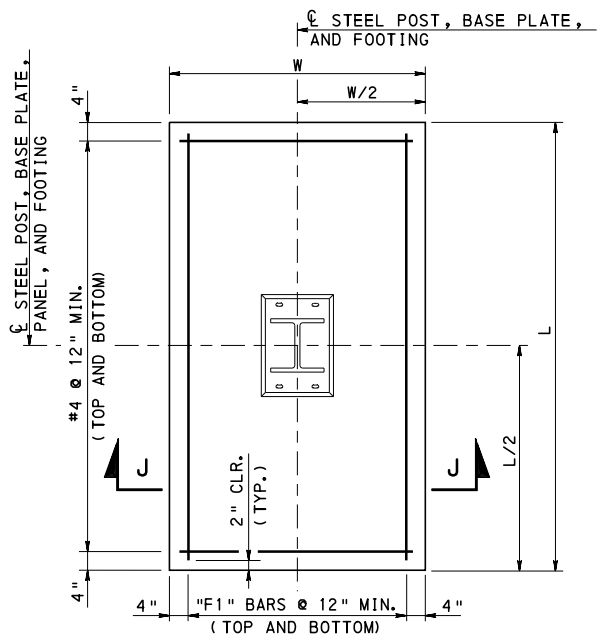
PLAN

PLEASE NOTE THAT THE ANCHOR BOLT
DETAIL SHOWN MAY BE PATENTED

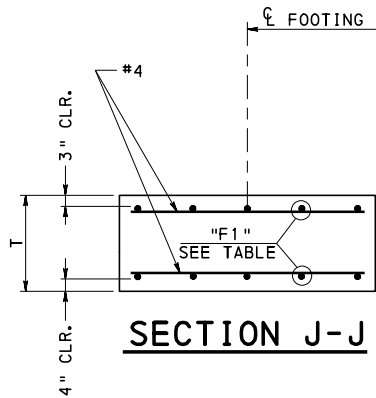


ELEVATION

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-776M.

STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING DIMENSION TABLE																	
HEIGHT ZONE= WIND PRESSURE =																	
STEEL POST					BASE PLATE				ANCHOR BOLTS				GROUT	SPREAD FOOTING			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	POST HEIGHT PH1 (FT.)	THICKNESS ↑ (IN.)	LENGTH Q (IN.)	WIDTH W (IN.)	F (IN.)	DIAMETER D (IN.)	EMBEDMENT LENGTH S (IN.)	PROJECTION P (IN.)	THREAD LENGTH TL (IN.)	GROUT DEPTH GD (IN.)	THICKNESS T (FT.-IN.)	LENGTH L (FT.)	WIDTH W (FT.)	"F1" 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

DETAIL 2 DESIGN TABLE													
STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING HEIGHT ZONE 0' - 14' WIND PRESSURE = 20 psf													
STEEL POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Ø (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 DESIGN TABLE													
STEEL POST WITH BASE PLATE CONNECTION TO SPREAD FOOTING HEIGHT ZONES OVER 14' WIND PRESSURE = 28 psf													
STEEL POST			BASE PLATE				ANCHOR BOLTS			SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	t (IN.)	Ø (IN.)	w (IN.)	F (IN.)	D (IN.)	S (IN.)	P (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (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 NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 7 OF 14

BD-678M



CD = CAISSON DIAMETER

3'-0"

STEEL POST, PANEL, AND CAISSON

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

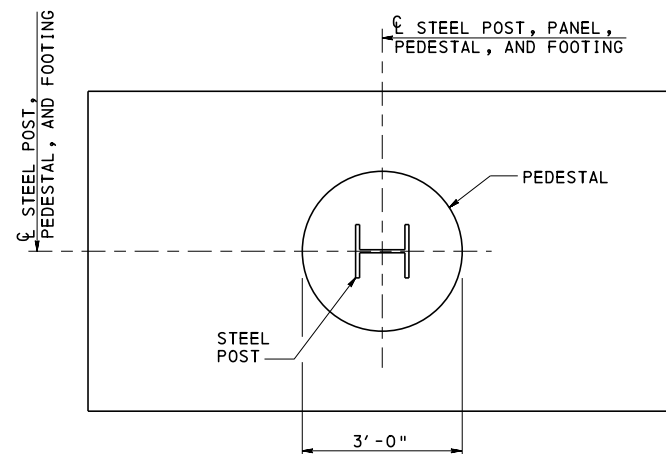
1 1/2" CLR. (TYP.)

STEEL POST AND CAISSON

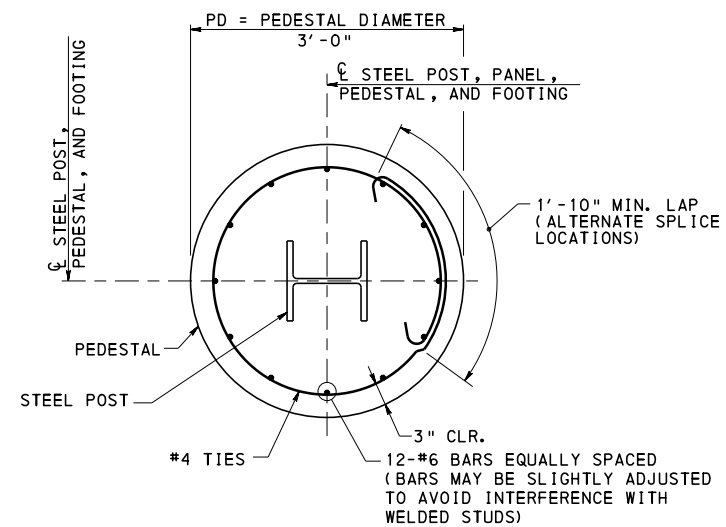
SECTION K-K

[illegible]

BD-678M



PLAN

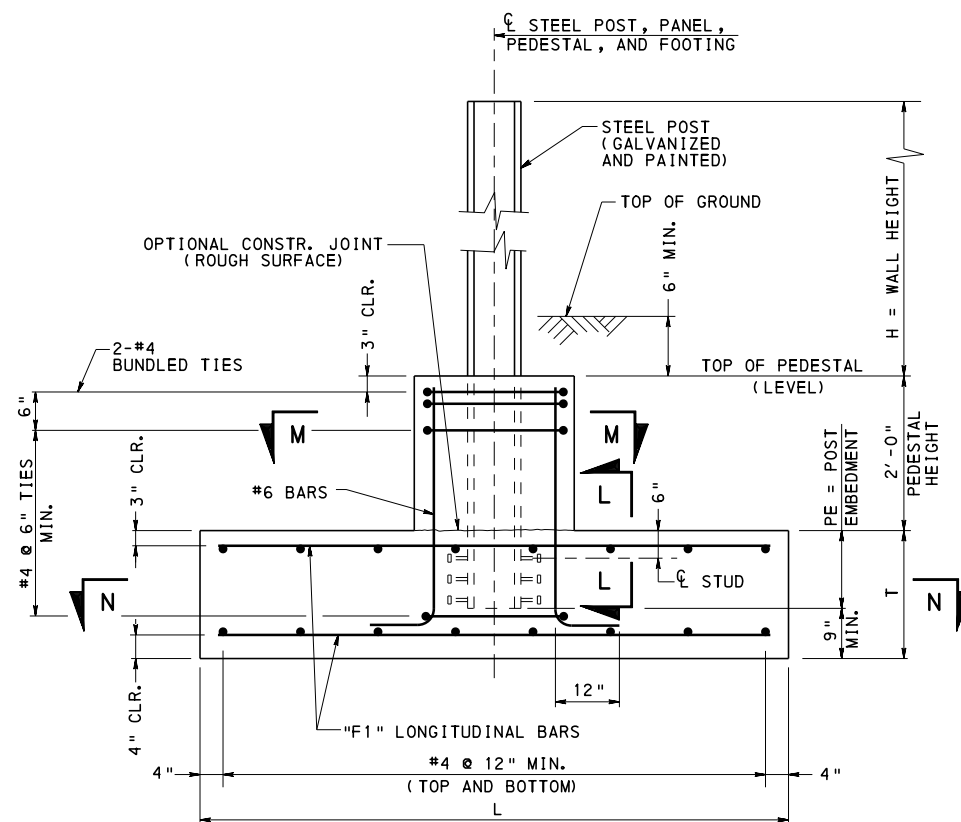


SECTION M-M

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TABLE NOTES:

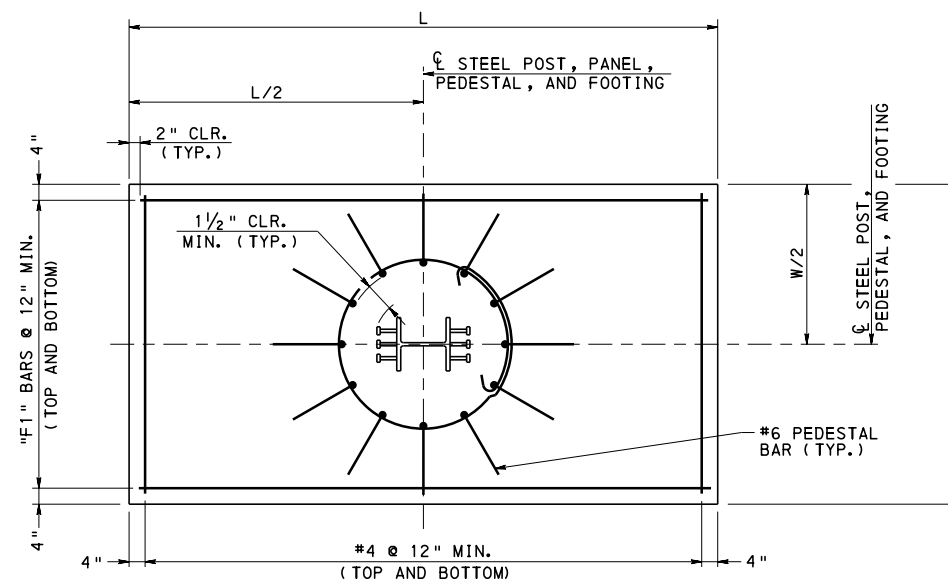
1. DESIGNER TO COMPLETE TABLE AND INCLUDE ON CONTRACT DRAWINGS.
2. TABLE IS PERMITTED TO BE MODIFIED AS REQUIRED AS LONG AS ALL INFORMATION IS SHOWN ON THE CONTRACT DRAWINGS.
3. SPREAD FOOTING REINFORCEMENT TO BE DETAILED ON CONTRACT DRAWINGS.
4. PROVIDE ELEVATIONS AS REQUIRED ON CONTRACT DRAWINGS.



ELEVATION

ADJUST FOOTING TOP REINFORCING 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 NOV. 21, 2014
Thomas P Macioce
 CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014
Brenda Thompson
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 9 OF 14

3D-678M

DETAIL 3				
STEEL POST EMBEDDED IN CAISSON HEIGHT ZONE 0'-14' WIND PRESSURE = 20 psf				
STEEL POST				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	PE (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
	24.0	W12x152	18	69
	26.0	W12x170	21	73

DETAIL 3				
STEEL POST EMBEDDED IN CAISSON HEIGHT ZONES OVER 14' WIND PRESSURE = 28 psf				
STEEL POST				
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	PE (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 EMBEDDED IN SPREAD FOOTING WITH PEDESTAL HEIGHT ZONE 0'-14' WIND PRESSURE 20 psf								
STEEL POST					SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR 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 EMBEDDED IN SPREAD FOOTING WITH PEDESTAL HEIGHT ZONES OVER 14' WIND PRESSURE 28 psf								
STEEL POST					SPREAD FOOTING			
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	NUMBER OF WELDED STUDS	POST EMBEDMENT PE (IN.)	T (FT.)	L (FT.)	W (FT.)	F1 (BAR 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 SHEET 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 NOV. 21, 2014

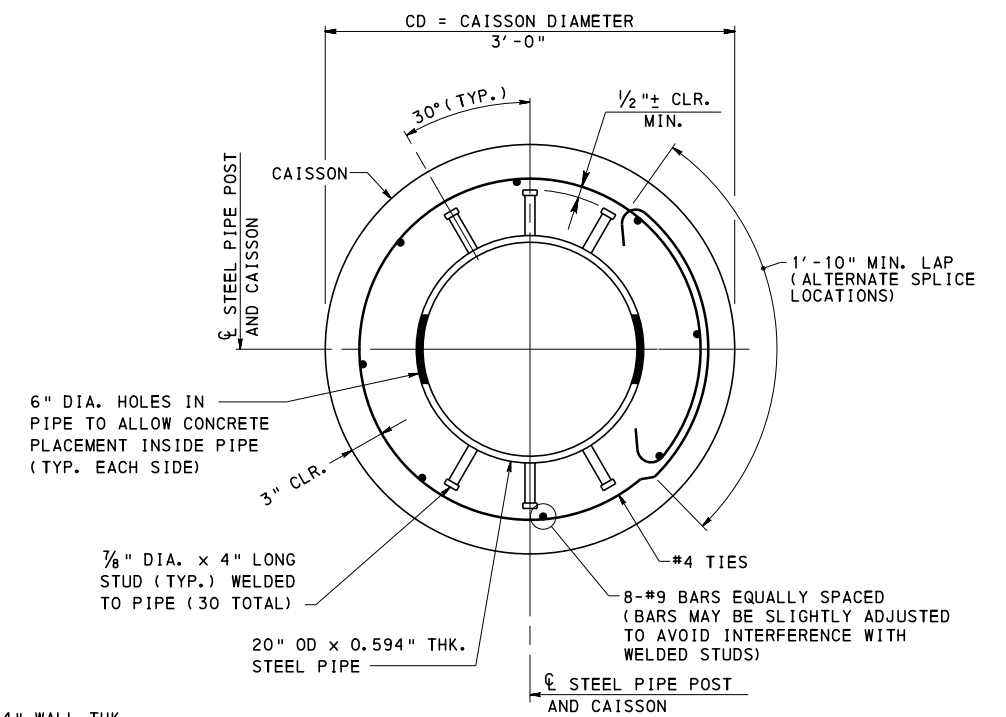
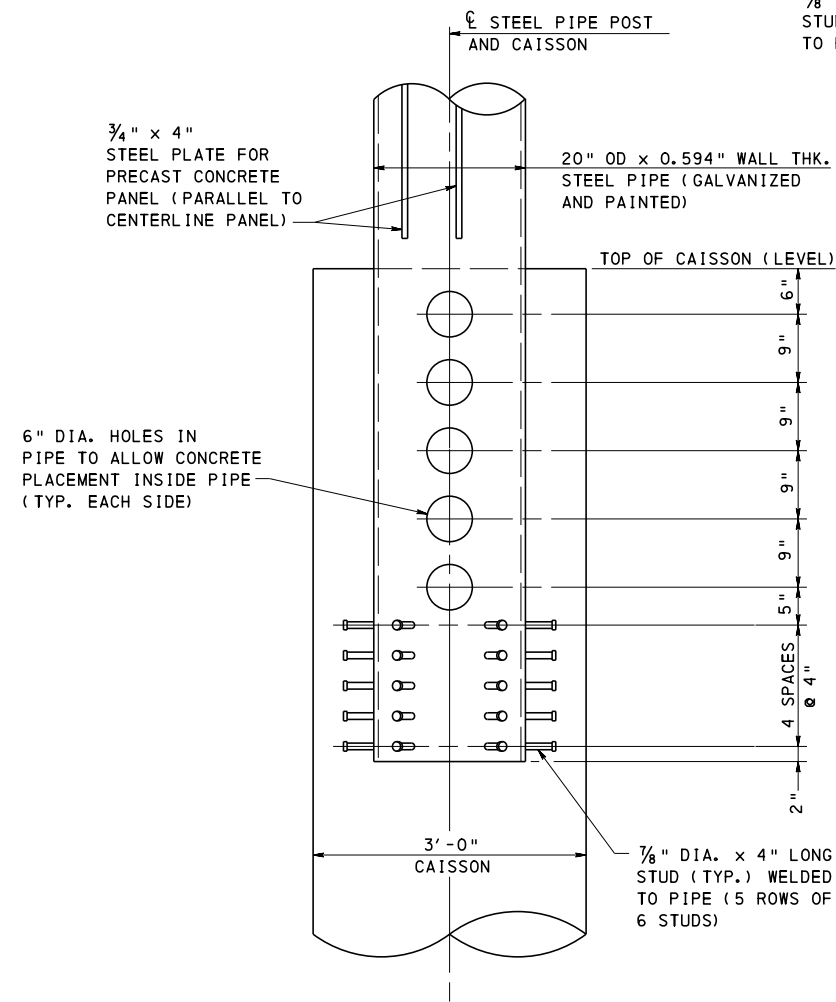
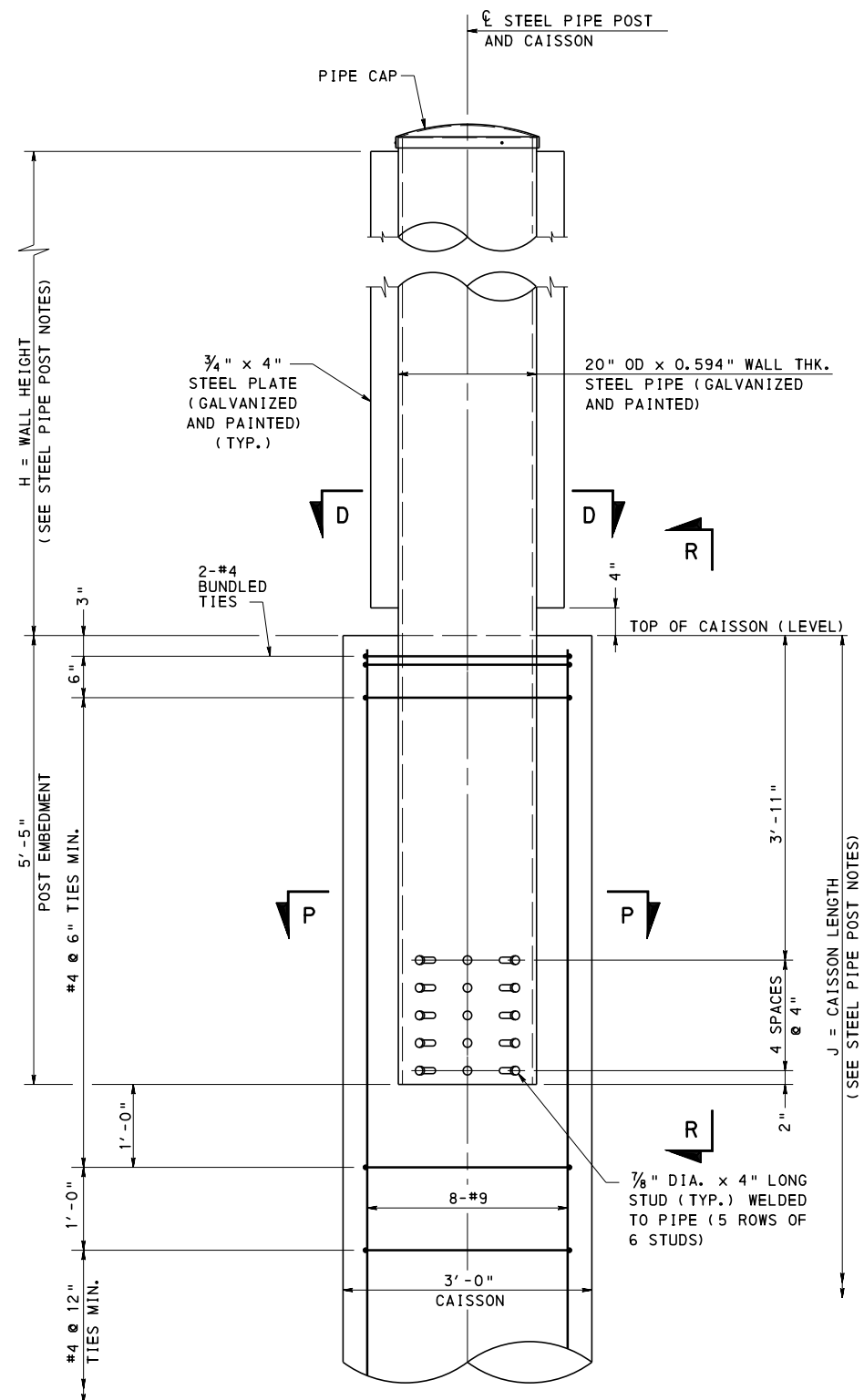
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR., BUR. OF PROJECT DELIVERY

SHEET 10 OF 14

BD-678M



- 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 SHEET 9 OF BC-778M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 5

RECOMMENDED NOV. 21, 2014

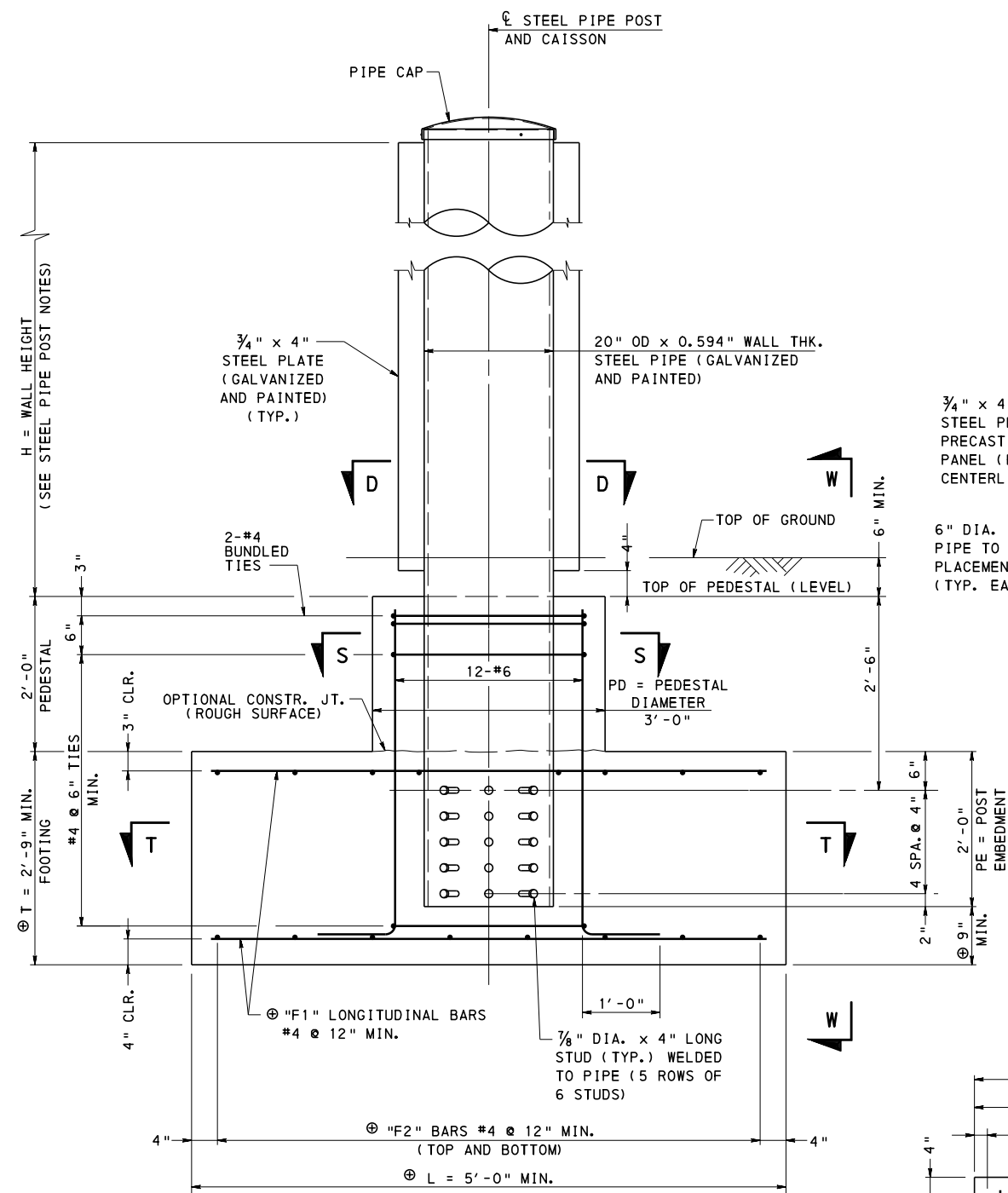
Thomas P Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014	
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Brenda Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

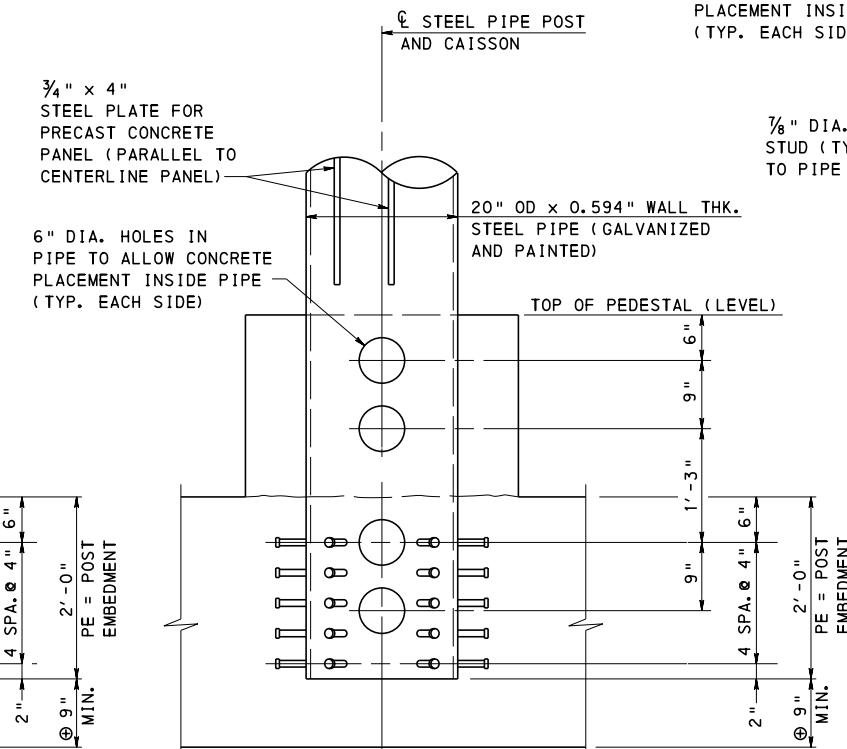
SHEET 11 OF 14

BD-678M

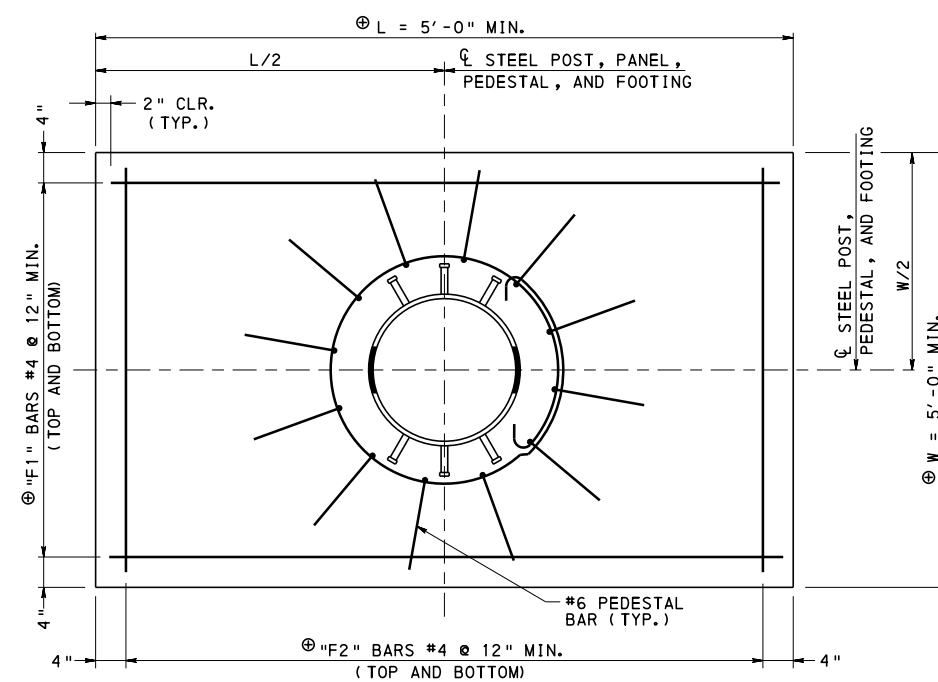
ELEVATION

ADJUST FOOTING TOP REINFORCING SPACING TO CLEAR POST.

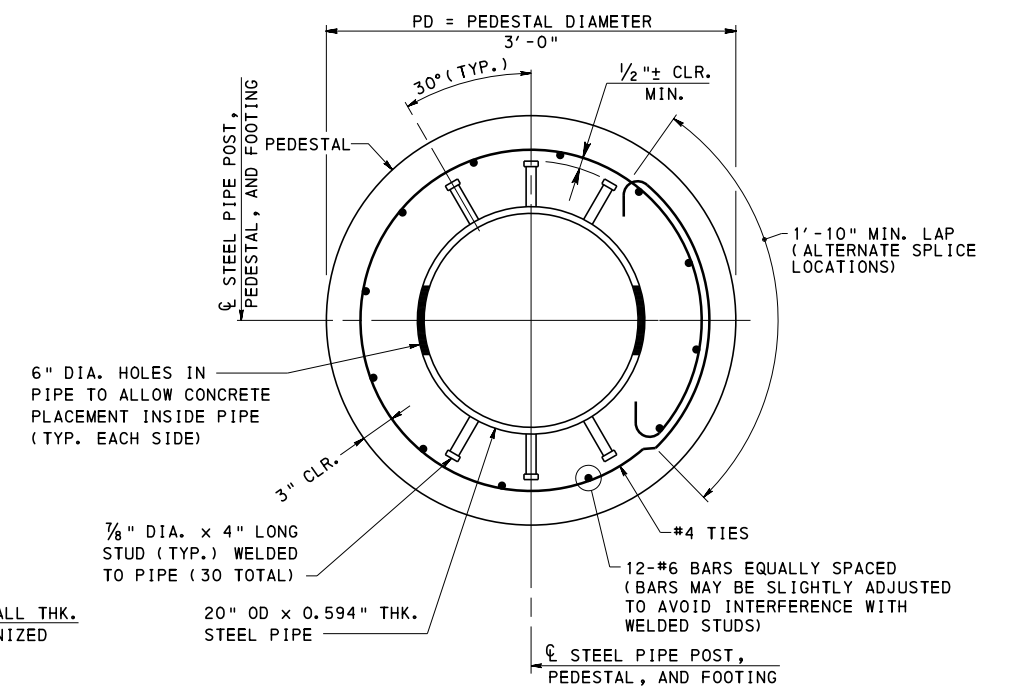
DETAIL 6
CORNER/ANGLED STEEL PIPE POST EMBEDDED
IN SPREAD FOOTING WITH PEDESTAL



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 SHEET 9 OF BC-778M.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
GROUND MOUNTED SOUND BARRIERS
STEEL POSTS

DETAIL 6

RECOMMENDED NOV. 21, 2014

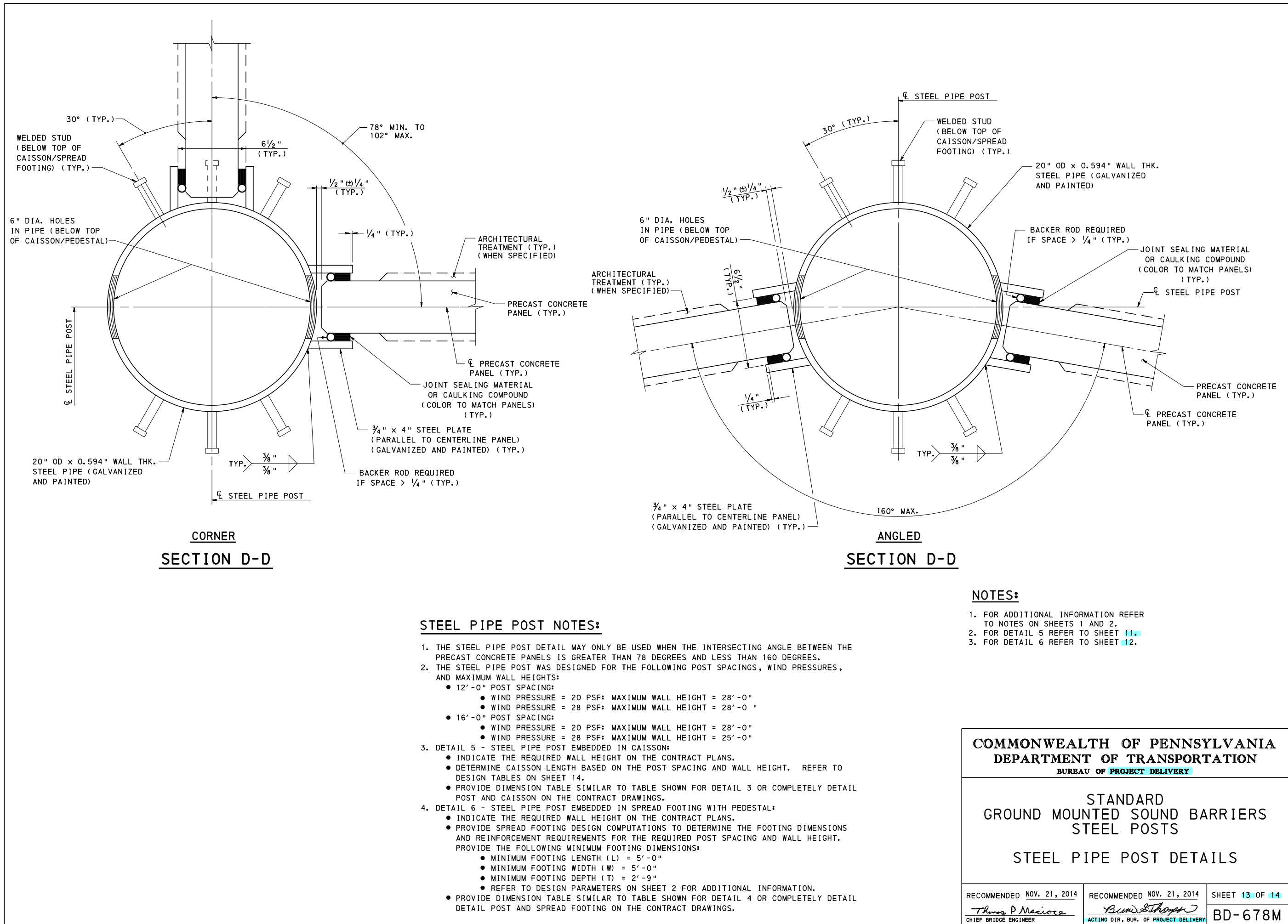
Thomas P Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brenda Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

SHEET 12 OF 14

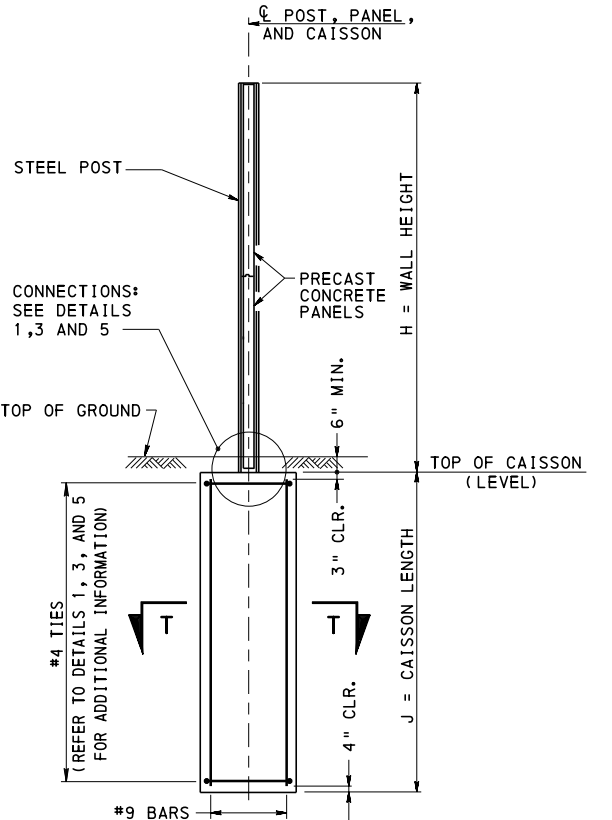
BD-678M



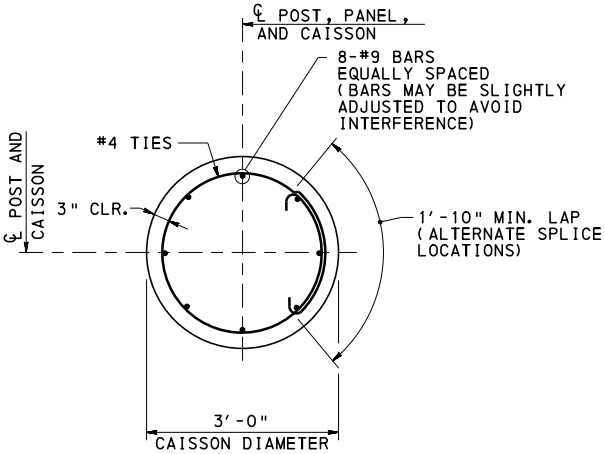
CAISSON LENGTH WIND PRESSURE = 28 psf											
TYPE 1 SOIL SATURATED LOOSE SAND			TYPE 2 SOIL DRY MEDIUM DENSE SAND			TYPE 3 SOIL SATURATED SOFT CLAY			TYPE 4 SOIL DRY MEDIUM STIFF CLAY		
SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 30° 2. C = 0 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 20 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 34° 2. C = 0.0 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 4. K = 90 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 500 LB./SQ. FT. 3. UNIT WEIGHT = 100 LB./CU. FT. 4. K = 100 LB./CU. IN.			SOIL PROPERTIES: 1. ANGLE OF INT. FRICT. = 0° 2. C = 1000 LB./SQ. FT. 3. UNIT WEIGHT = 120 LB./CU. FT. 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

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 NOV. 21, 2014

Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 21, 2014

Brian S. Thompson
ACTING DIR, BUR. OF PROJECT DELIVERY

SHEET 14 OF 14

BD-678M

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.

• 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.

• 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.

• 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 WORKMANSHIP:
- 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 2002 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M 2002 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5M/D1.5 2002)
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.

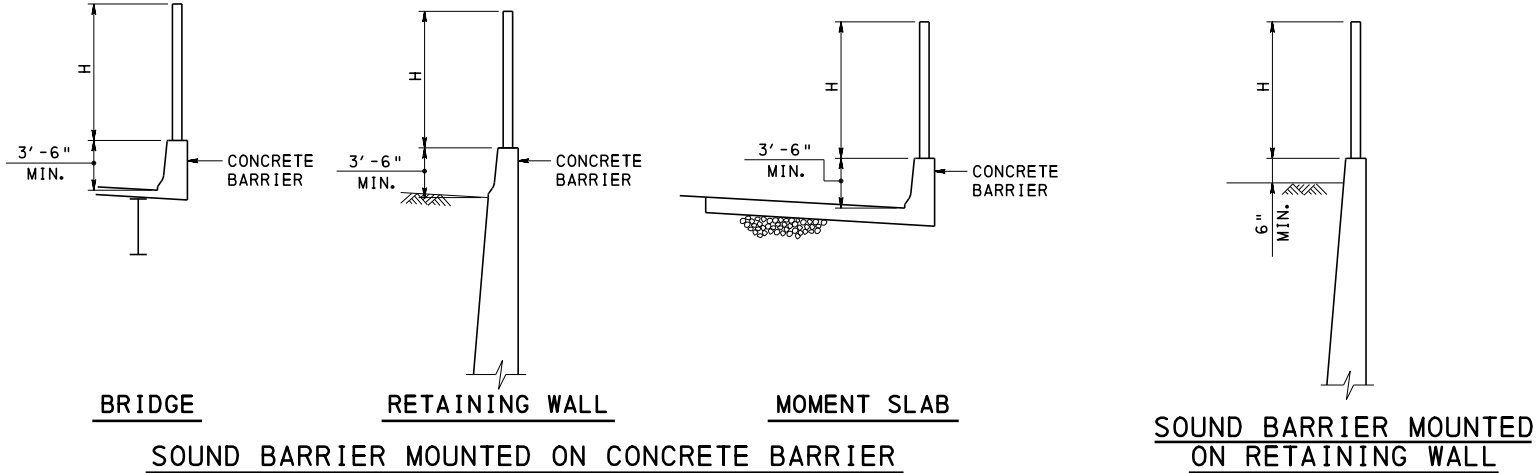
• IF STEPS ARE REQUIRED, THE ELEVATION DIFFERENCE BETWEEN ADJACENT PANELS IS NOT PERMITTED TO BE LESS THAN 6" OR GREATER THAN 2'-0" AND MAY NOT OCCUR MORE FREQUENTLY THAN ONCE EVERY 50'-0" OF WALL LENGTH.
7. PRECAST CONCRETE POSTS ARE NOT PERMITTED FOR STRUCTURE MOUNTED SOUND BARRIERS, PROVIDE STEEL 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	CONCRETE VERTICAL WALL BRIDGE 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
BC-766M	PREFORMED NEOPRENE COMPRESSION SEAL JOINT
BC-767M	NEOPRENE STRIP SEAL DAM
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 NOV. 26, 2013 Thomas P. MacIsaac CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 26, 2013 [Signature] ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 1 OF 11 BD-679M
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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 (LIGHT WEIGHT) 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 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 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 (LIGHT WEIGHT) CONCRETE AS INDICATED IN THE PANEL REINFORCEMENT TABLES.

• USE LOW-DENSITY (LIGHT WEIGHT) CONCRETE PANELS FOR SOUND BARRIERS MOUNTED ON BRIDGES WHEN REQUIRED IN ACCORDANCE WITH BD-601M, SHEET 1, NOTE 28.

• DESIGNER TO INDICATE IF LOW-DENSITY (LIGHT WEIGHT) 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 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, 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 THE 2002 AND 2003 INTERIMS.

• 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 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION INCLUDING THE 1993 AND 1994 INTERIMS.

• 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 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. 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.

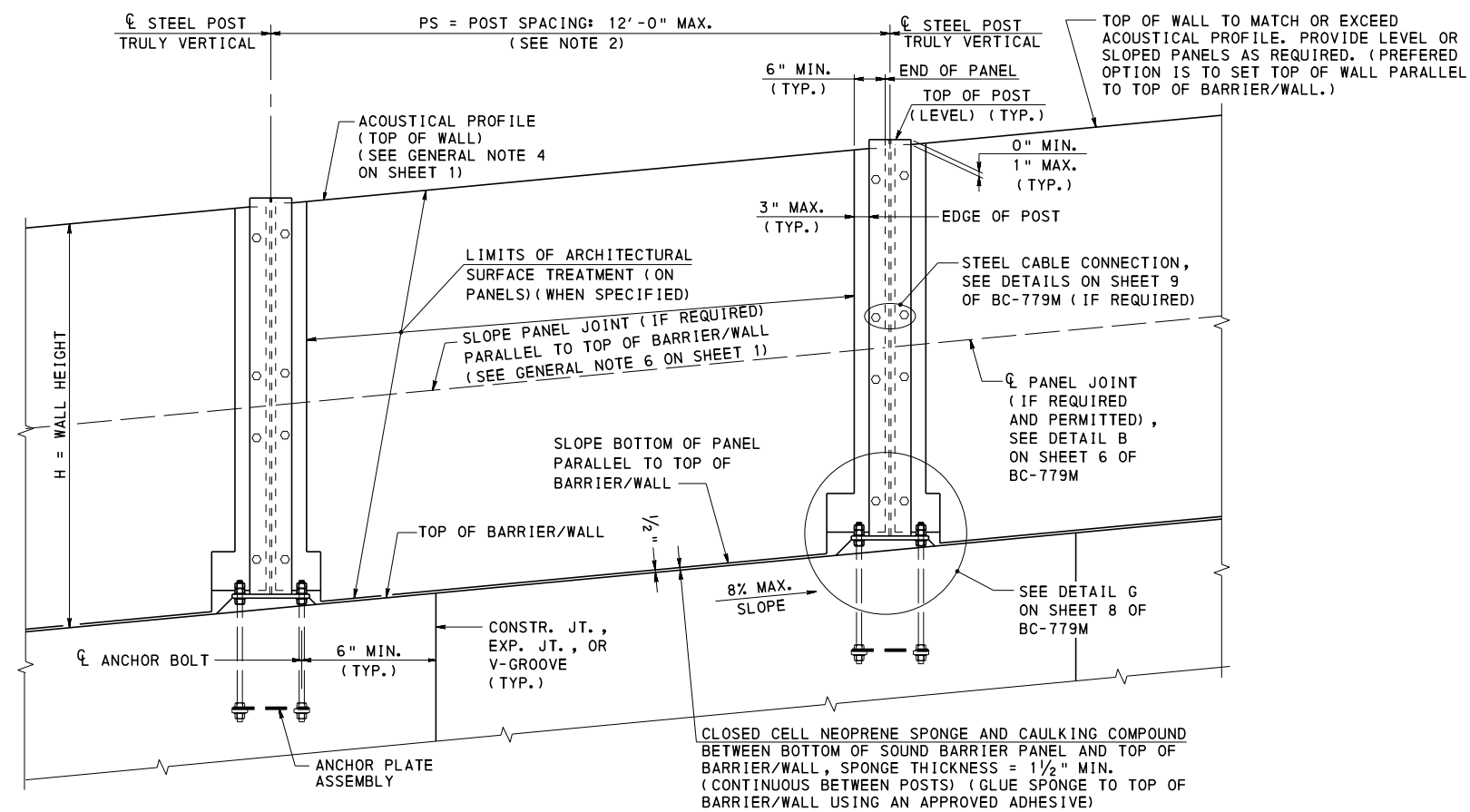
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
GENERAL NOTES - 2

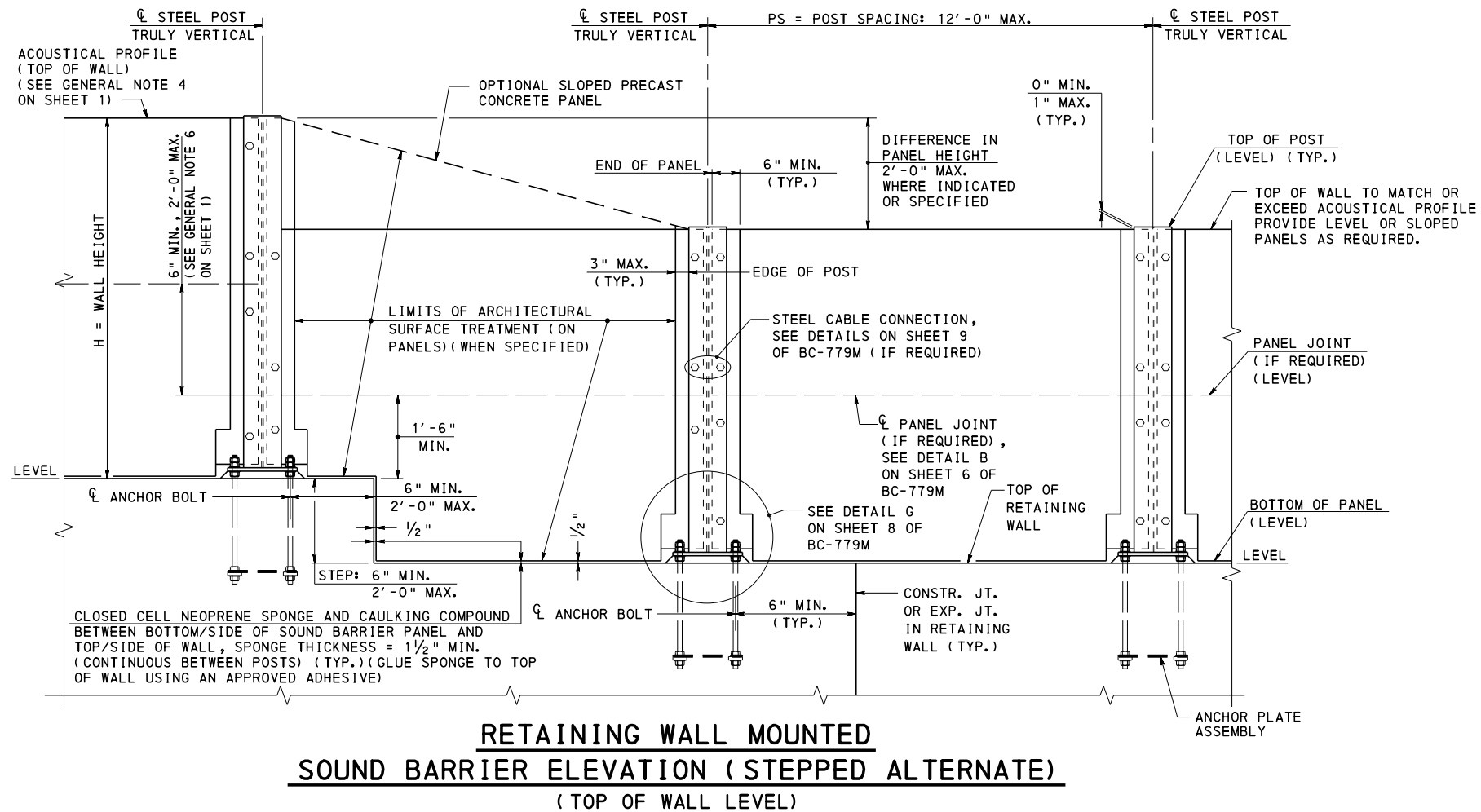
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
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SHEET 2 OF 11
BD-679M



BARRIER MOUNTED/RETAINING WALL MOUNTED SOUND BARRIER ELEVATION
(TOP OF BARRIER/WALL SLOPED)



RETAINING WALL MOUNTED
SOUND BARRIER ELEVATION (STEPPED ALTERNATE)
(TOP OF WALL LEVEL)

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".

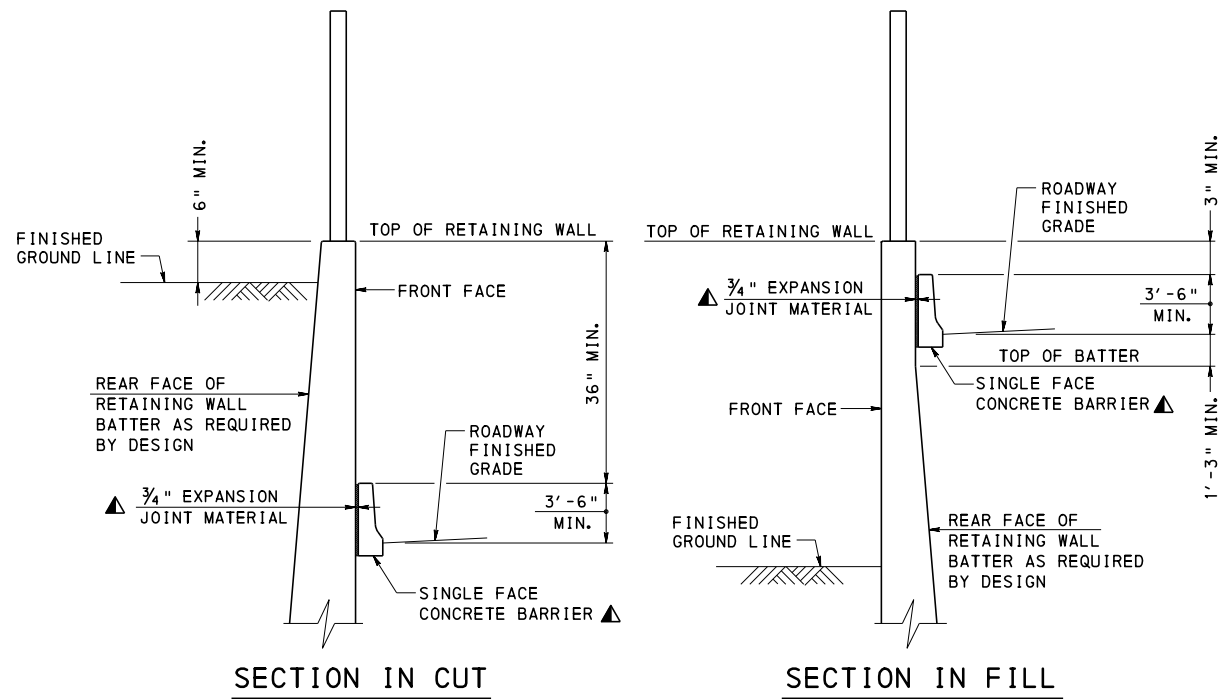
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
GEOMETRY AND LAYOUT

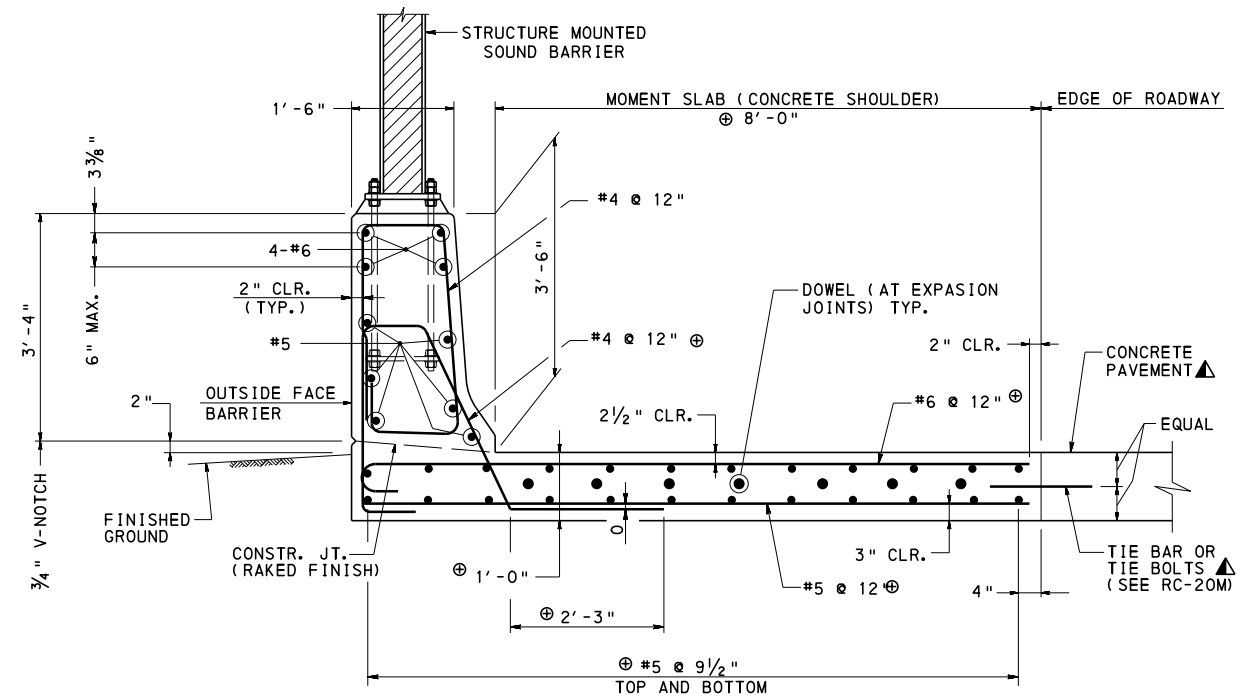
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David A. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 3 OF 11
BD-679M



PROTECTION OF RETAINING WALLS WITH ROADWAY BARRIER



LEGEND:

- ▲ ROADWAY ITEM
- ⊕ MIN. SIZE SHOWN, PROVIDE SIZE REQUIRED PER DESIGN

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, BITUMINOUS CONCRETE SHOULDER SIMILAR, REFER TO BC-799M FOR ADDITIONAL DETAILS,
4. FOR CONCRETE SHOULDER AT GRADE, CONSTRUCT ROADWAY PAVEMENT PRIOR TO THE MOMENT SLAB, BARRIER, AND SOUND BARRIER WALL.

**STRUCTURE MOUNTED SOUND BARRIER
DIMENSION TABLE**

WIND PRESSURE =

POST					BASE PLATE				ANCHOR BOLTS		ANCHOR PLATES			
POST NUMBER	DESIGN POST SPACING (FT.)	DESIGN WALL HEIGHT (FT.)	STEEL POST SIZE	POST HEIGHT PH1 (FT.)	THICKNESS (IN.)	LENGTH (IN.)	WIDTH (IN.)	F (IN.)	DIAMETER (IN.)	EMBEDMENT LENGTH (IN.)	LENGTH (IN.)	F1 (IN.)	SLOPE AT POST	GROUT DEPTH AT CL POST GD (IN.)

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.

**COMMONWEALTH OF PENNSYLVANIA
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**STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
MISCELLANEOUS DETAILS**

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
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RECOMMENDED NOV. 26, 2013
David A. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 4 OF 11
BD-679M

PRECAST CONCRETE PANEL REINFORCEMENT FOR LIGHT WEIGHT CONCRETE (115 LB./CU.FT.)					
WIND PRESSURE = 37 psf					
POST SPACING PS (FT.)	PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN ² /FT)		MIN. NUMBER OF LIFTING 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

PRECAST CONCRETE PANEL REINFORCEMENT FOR NORMAL WEIGHT CONCRETE (150 LB./CU.FT.)					
WIND PRESSURE = 37 psf					
POST SPACING PS (FT.)	PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WCxWD	WELDED WIRE STEEL AREA (IN ² /FT)		MIN. NUMBER OF LIFTING 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

** WWF AxB-WCxWD (U.S. CUSTOMARY)
WWF AxB-MWCxMWD (METRIC)
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

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 (LIGHT WEIGHT) CONCRETE WITH A POST SPACING LESS THAN OR EQUAL TO 8'-0":
 - U.S. CUSTOMARY UNITS: WWF 4x4-W12xW12
 - AREA OF STEEL:
 - HORIZONTAL = 0.36 in²/ft
 - VERTICAL = 0.36 in²/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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

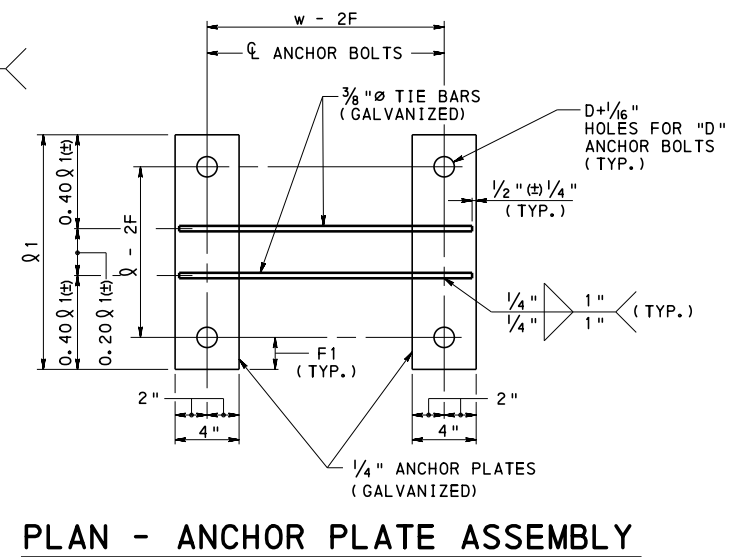
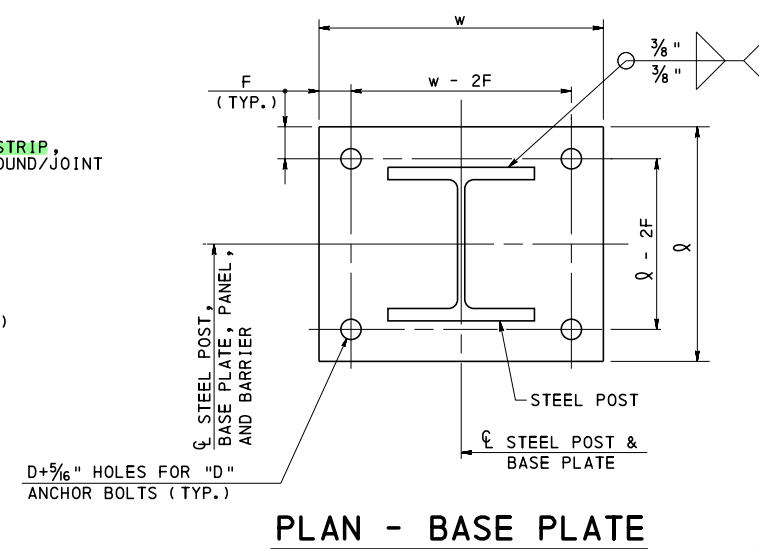
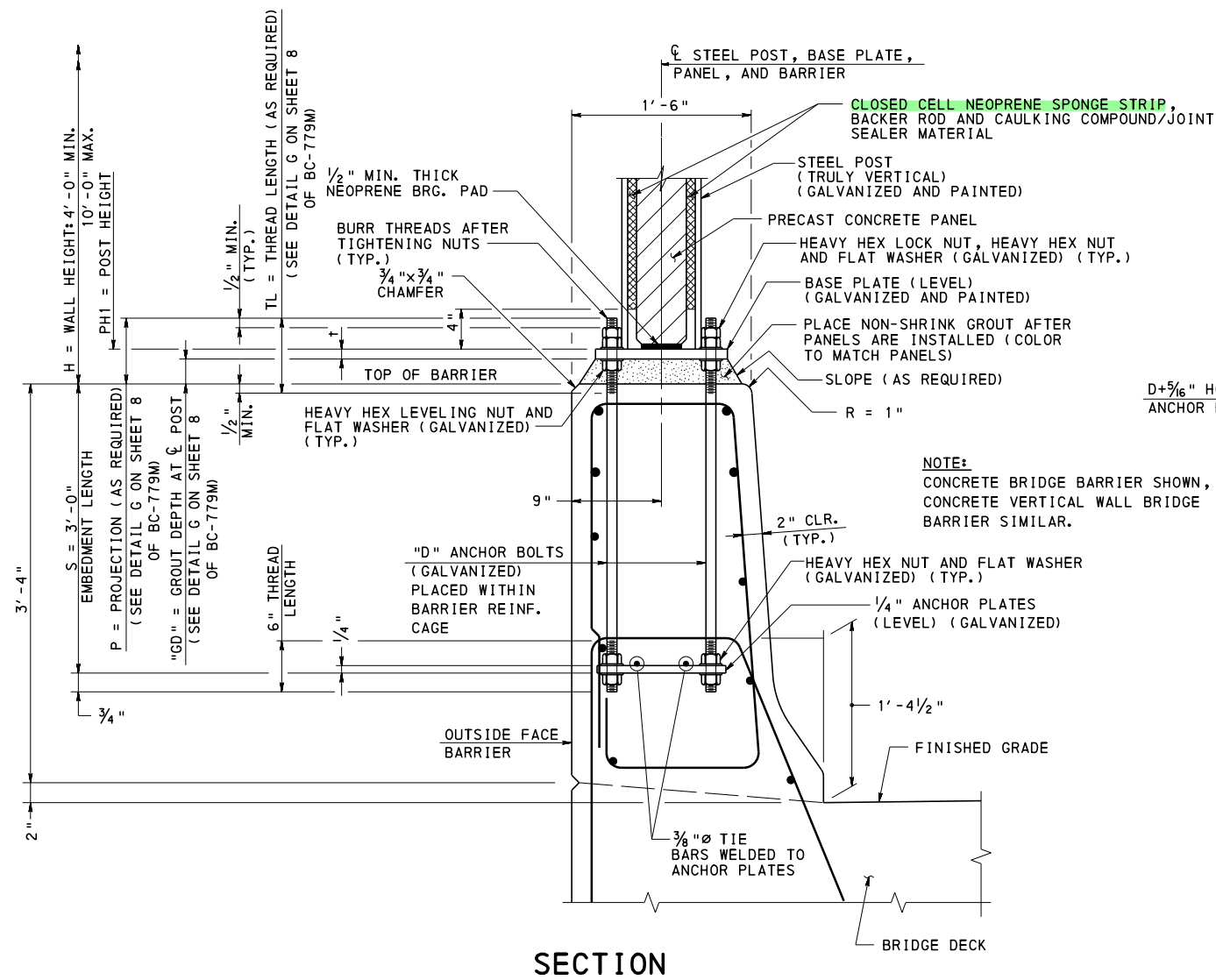
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SHEET 6 OF 11
BD-679M

BARRIER MOUNTED SOUND BARRIER ON BRIDGES

STEEL POST, BASE PLATE, ANCHOR BOLT,
AND ANCHOR PLATE GEOMETRY
WIND PRESSURE = 37 psf

POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	BASE PLATE				ANCHOR BOLTS	ANCHOR PLATES	
			\uparrow (IN.)	\emptyset (IN.)	w (IN.)	F (IN.)	\emptyset (IN.)	\emptyset 1 (IN.)	F1 (IN.)
6.0	6.0	W8x48	1	13½	16	2⅞	1¼	11¾	1¼
	8.0	W8x48	1½	14	18	2½	1½	12	1½
	10.0	W8x48	1¾	14	18	2½	1½	12	1½
8.0	6.0	W8x48	1	13½	16	2⅞	1¼	11¾	1¼
	8.0	W8x48	1¼	14	18	2½	1½	12	1½
	10.0	W8x48	1½	14½	19	2½	1¾	12¼	1¾
10.0	6.0	W8x48	1½	14	18	2½	1½	12	1½
	8.0	W8x48	1½	14½	19	2¾	1¾	12¼	1¾
	9.0	W8x48	1¾	14½	19	2¾	1¾	12¼	1¾
12.0	6.0	W8x48	1½	14	18	2½	1½	12	1½
	8.0	W8x48	1½	14½	19	2¾	1¾	12¼	1¾



NOTES:

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.

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DEPARTMENT OF TRANSPORTATION
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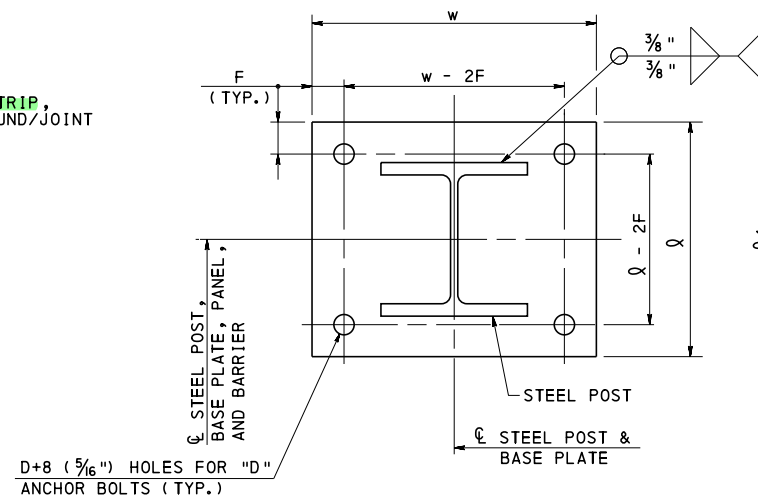
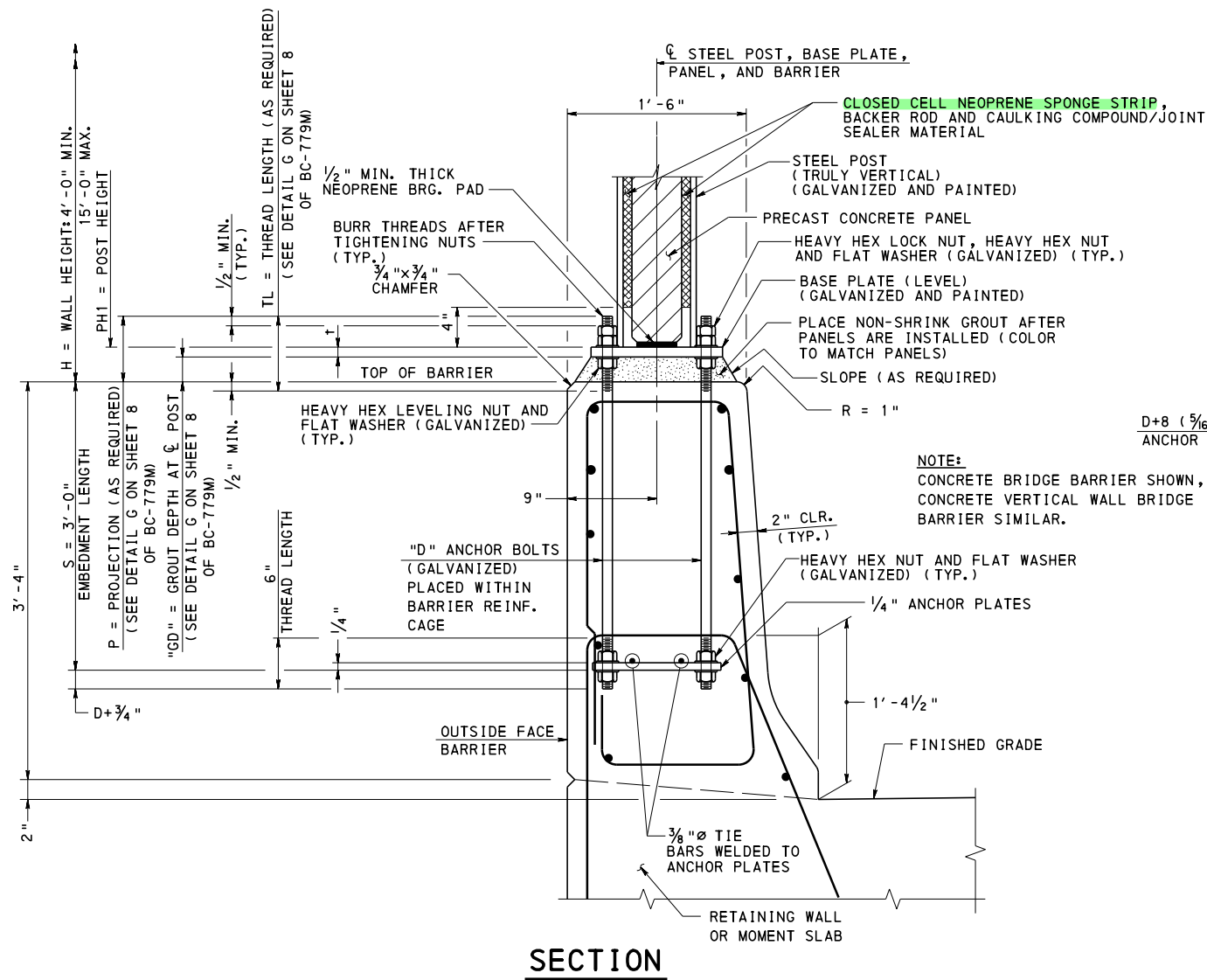
STANDARD STRUCTURE MOUNTED SOUND BARRIER WALLS BARRIER MOUNTED ON BRIDGES DESIGN TABLES AND DETAILS

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Thomas P. MacIsaac
 CHIEF BRIDGE ENGINEER

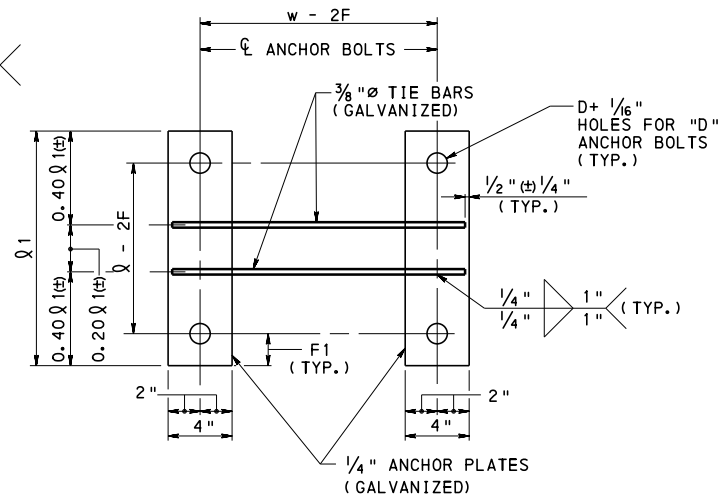
RECOMMENDED NOV. 26, 2013
George M. Kelly
 ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 7 OF 11

BARRIER MOUNTED SOUND BARRIER ON RETAINING WALLS OR MOMENT SLABS									
STEEL POST, BASE PLATE, ANCHOR BOLT, AND ANCHOR PLATE GEOMETRY WIND PRESSURE = 37 psf									
POST SPACING PS (FT.)	WALL HEIGHT H (FT.)	STEEL POST	BASE PLATE				ANCHOR BOLTS	ANCHOR PLATES	
			(↑ (IN.))	(Ø (IN.))	(W (IN.))	(F (IN.))		(Ø1 (IN.))	(F1 (IN.))
6.0	6.0	W8x48	¾	12¾	15	1⅝	1	11½	1
	8.0	W8x48	1	13½	16	2⅛	1¼	11¾	1¼
	10.0	W8x48	1⅛	13½	16	2⅛	1¼	11¾	1¼
	12.0	W8x48	1⅜	14	18	2½	1½	12	1½
	14.0	W8x48	1½	14½	19	2⅞	1¾	12¼	1¾
	15.0	W8x48	1⅝	14½	19	2⅞	1¾	12¼	1¾
8.0	6.0	W8x48	¾	13½	16	2⅛	1¼	11¾	1¼
	8.0	W8x48	1	13½	16	2⅛	1¼	11¾	1¼
	10.0	W8x48	1¼	14	18	2½	1½	12	1½
	12.0	W8x48	1½	14½	19	2⅞	1¾	12¼	1¾
	13.0	W8x48	1¾	14½	19	2⅞	1¾	12¼	1¾
10.0	6.0	W8x48	⅞	13½	16	2⅛	1¼	11¾	1¼
	8.0	W8x48	1⅛	14	18	2½	1½	12	1½
	10.0	W8x48	1⅜	14	18	2½	1½	12	1½
	12.0	W8x48	1¾	14½	19	2⅞	1¾	12¼	1¾
12.0	6.0	W8x48	⅞	13½	16	2⅛	1¼	11¾	1¼
	8.0	W8x48	1¼	14	18	2½	1½	12	1½
	10.0	W8x48	1½	14½	19	2⅞	1¾	12¼	1¾
	11.0	W8x48	1¾	14½	19	2⅞	1¾	12¼	1¾



PLAN - BASE PLATE



PLAN - ANCHOR PLATE ASSEMBLY

NOTES:

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.

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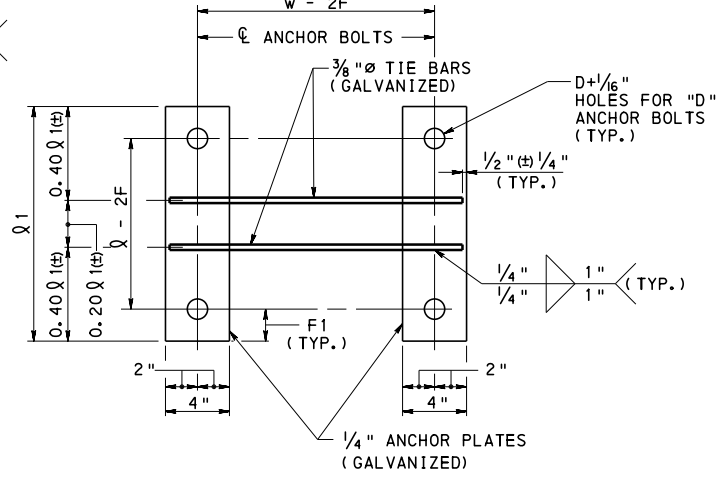
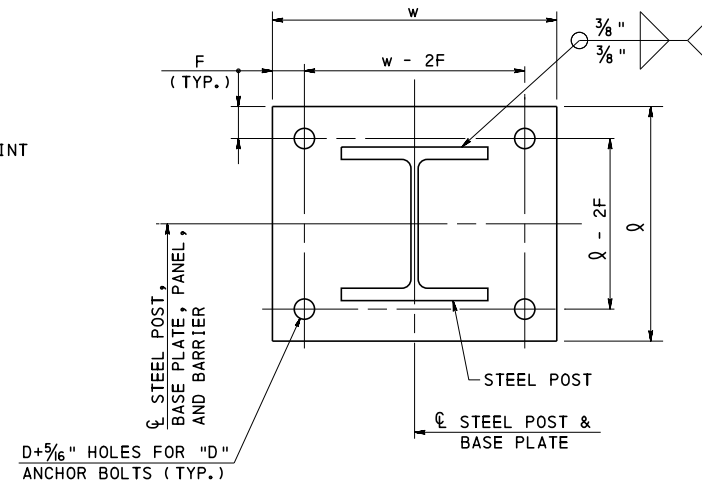
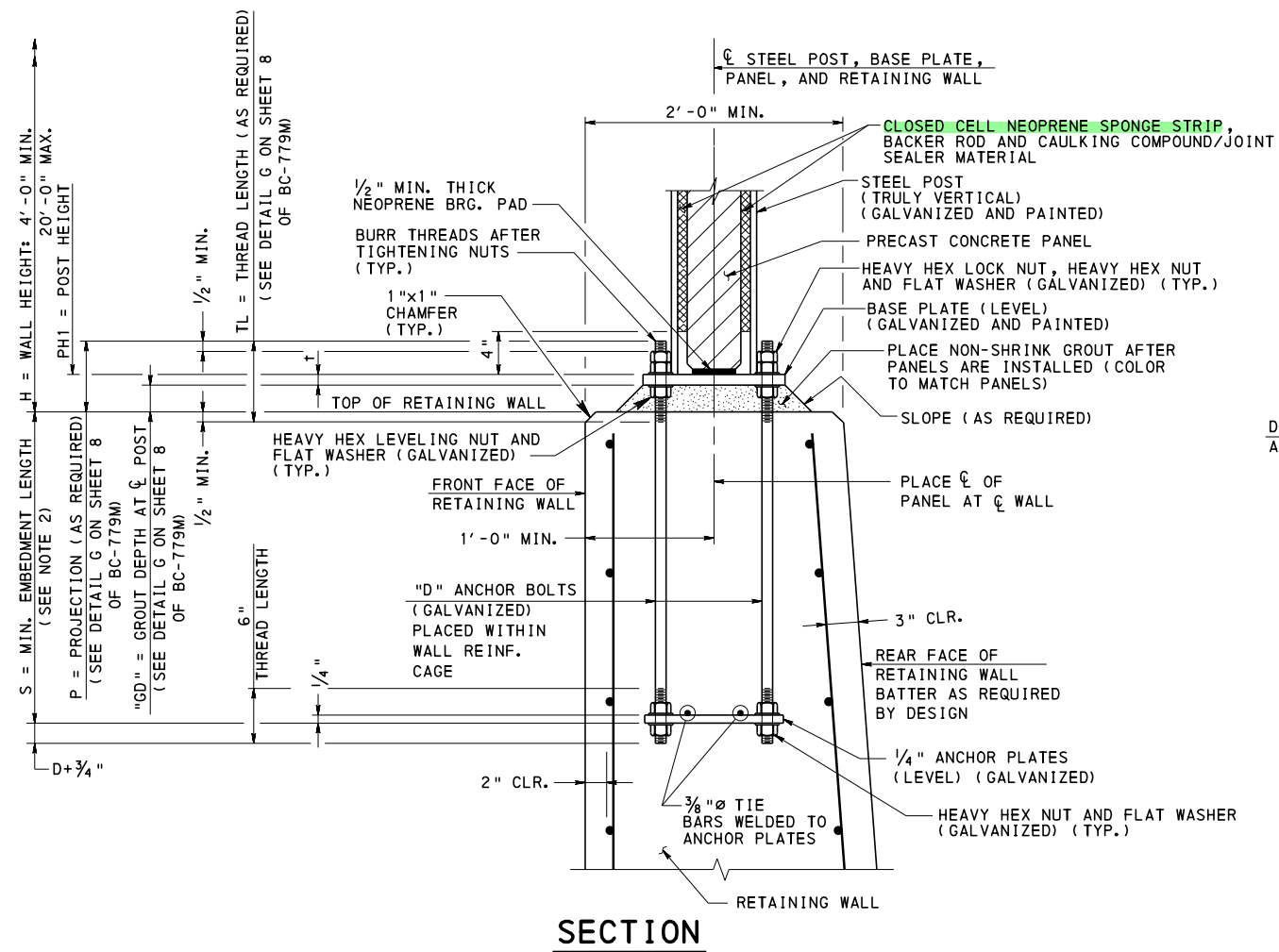
STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
BARRIER MOUNTED ON WALLS AND MOMENT SLABS
DESIGN TABLE AND DETAILS

RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
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SHEET 8 OF 11
BD-679M

WALL MOUNTED SOUND BARRIER U. S. CUSTOMARY UNITS										
STEEL POST, BASE PLATE, ANCHOR BOLT, AND ANCHOR PLATE GEOMETRY 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.)	S (IN.)	Q1 (IN.)	F1 (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
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



- NOTES:**
- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
 - EMBEDMENT LENGTH OF ANCHOR BOLTS MUST EXTEND TO A DEPTH WHERE THE VERTICAL WALL REINFORCEMENT IS FULLY DEVELOPED. INCREASE EMBEDMENT LENGTH AS REQUIRED.
 - REFER TO SHEET 4 FOR DIMENSION TABLE TO BE SHOWN ON THE CONTRACT DRAWINGS.

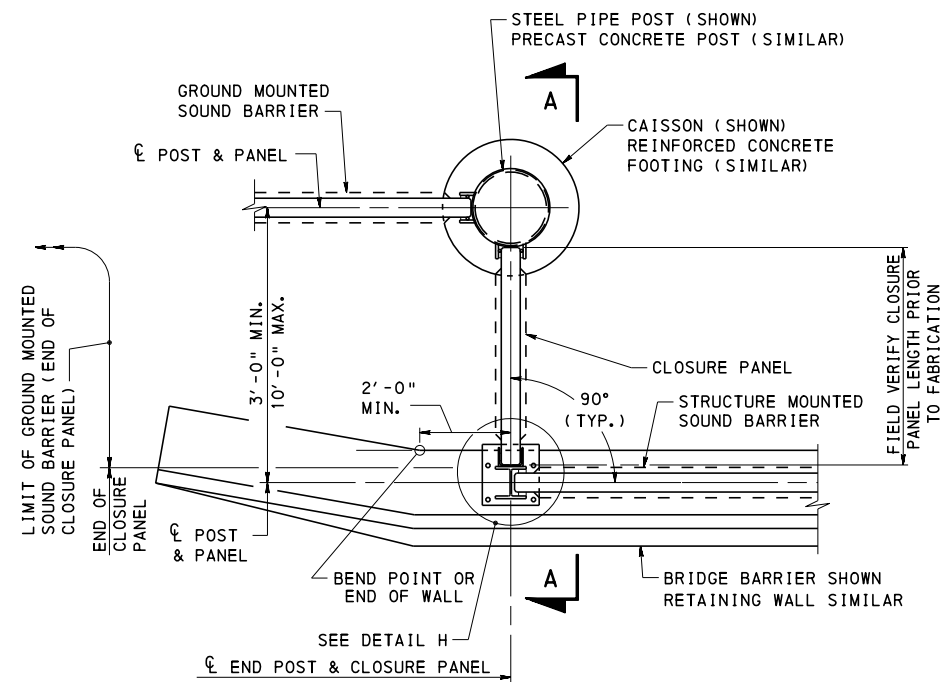
COMMONWEALTH OF PENNSYLVANIA
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BUREAU OF PROJECT DELIVERY

STANDARD
STRUCTURE MOUNTED SOUND BARRIER WALLS
WALL MOUNTED
DESIGN TABLE AND DETAILS

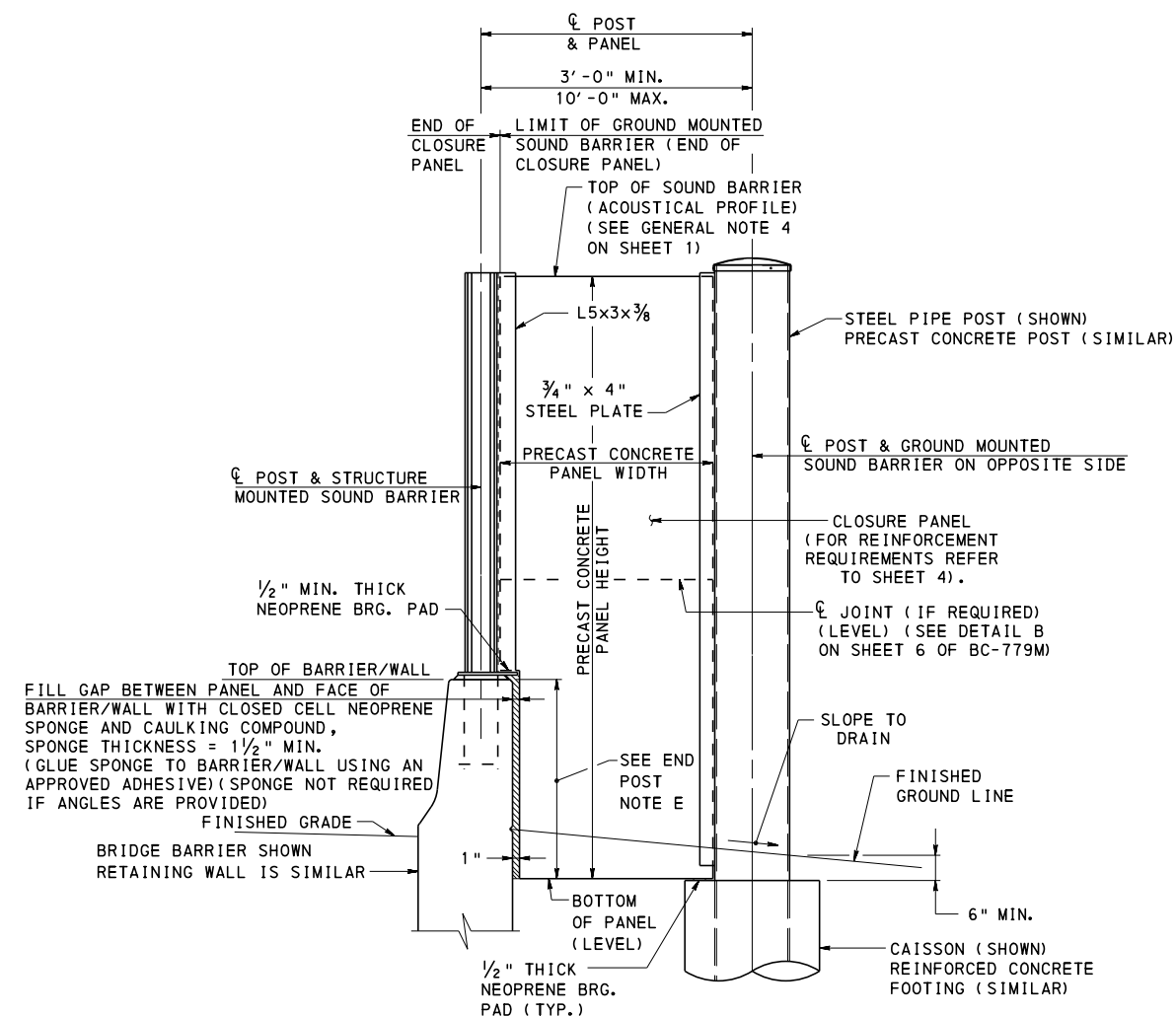
RECOMMENDED NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David A. Kelly
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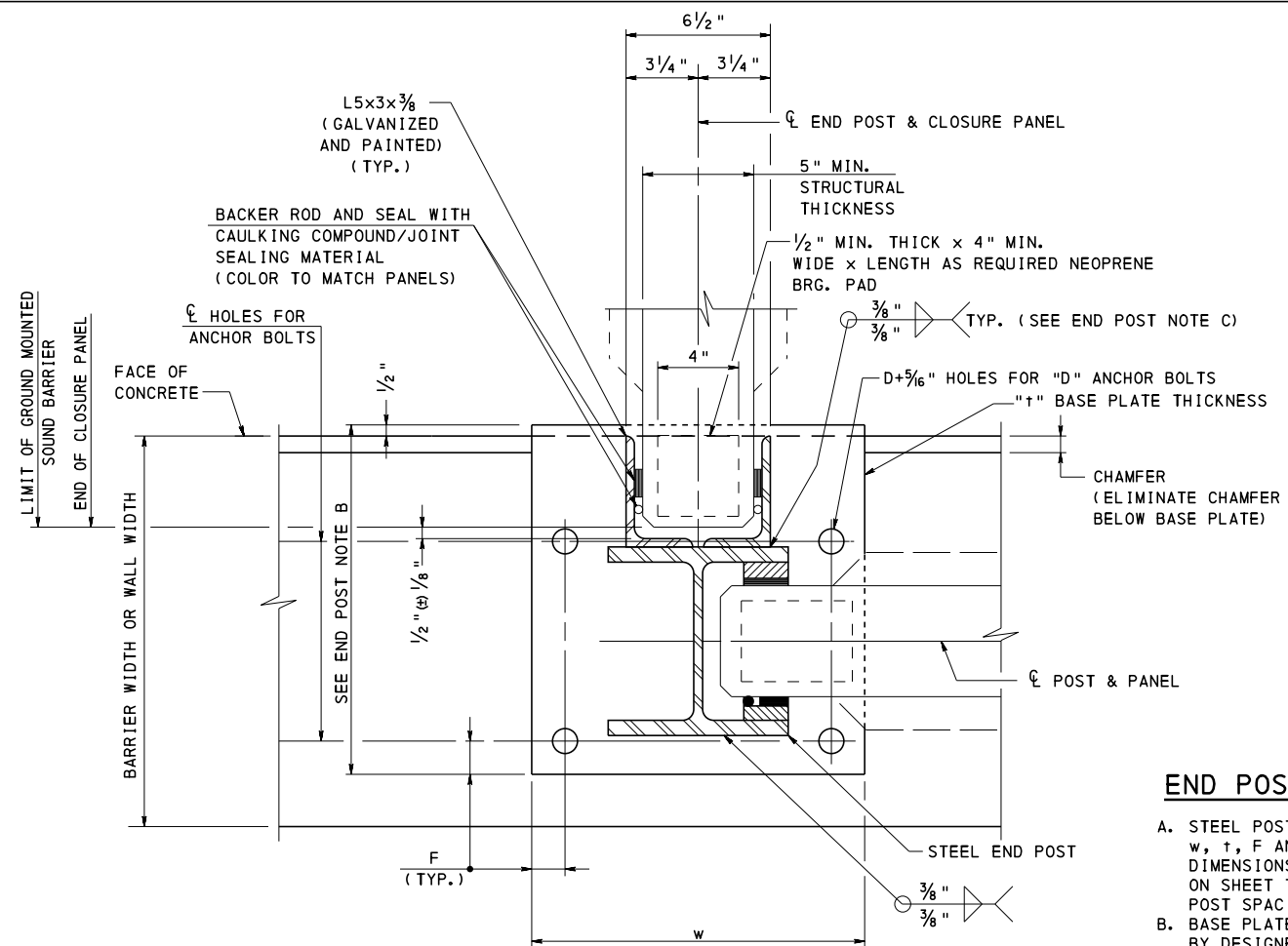
SHEET 9 OF 11
BD-679M



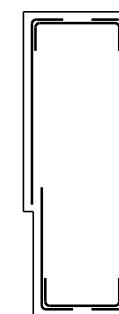
**PLAN - STRUCTURE MOUNTED SOUND BARRIER
TO GROUND MOUNTED SOUND BARRIER
(BARRIER/RETAINING WALL WITH 10° FLARE)**



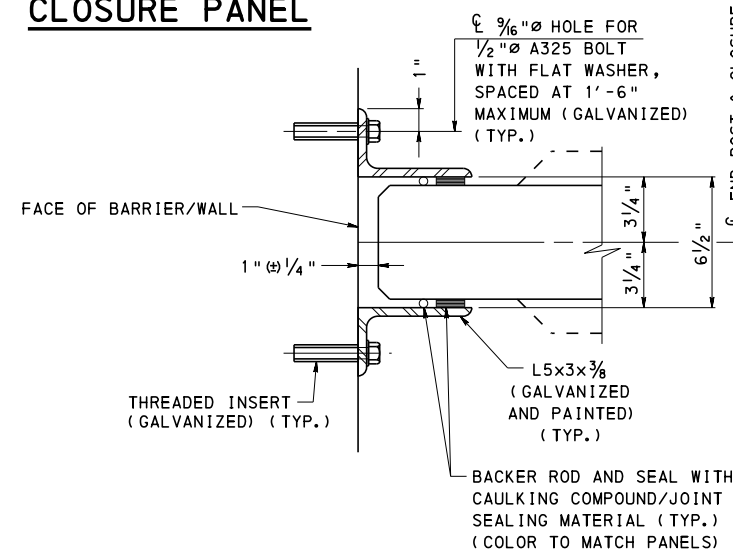
SECTION A-A



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 NOV. 26, 2013
Thomas P. Macieira
CHIEF BRIDGE ENGINEER

RECOMMENDED NOV. 26, 2013
David A. Kelly
ACTING DIR. BUR. OF PROJECT DELIVERY

SHEET 10 OF 11
BD-679M

- JOINT OPENING AS REQUIRED FOR BRIDGE EXPANSION AND CONTRACTION AT 68 DEGREES F.

-

PROVIDE STEEL PIPE AND BOLTS ON "FIXED" END OF EXPANSION PANEL (SEE DETAILS ON SHEET 9 OF BC-779M)

EXPANSION POST
 EXPANSION PANEL
 7/8" DIA. A325 BOLTS WITH 1 1/4" DIA. STD. WT. GALVANIZED STEEL PIPE (TYP.)
 NON-SHRINK GROUT VERTICAL FACE
 TOP OF BARRIER
 TOTAL MOVEMENT + 1" MIN.
 1/2"
 SLIDING PLATE
 ANCHOR PLATE ASSEMBLY (TYP.)
 2'-0" MAX. SPA.
 CLOSED CELL NEOPRENE SPONGE AND CAULKING COMPOUND
 6" MIN.
 1'-0" MAX.
 BOTTOM OF PANEL / TOP OF BEARING PAD
 3" + F MIN. (TYP.)
 ANCHOR BOLT

TOTAL MOVEMENT + 1/2" MIN.
 EXPANSION POST
 AS REQUIRED BY DESIGN
 AS REQUIRED TO ACCOMMODATE TOTAL MOVEMENT
 CLOSED CELL NEOPRENE SPONGE STRIP, 1/2" THICK BY 4" MIN. WIDTH, GLUED TO FLANGE USING APPROVED ADHESIVE (TYP.) (LEAVE A 4" GAP AT BOTTOM OF PANEL FOR DRAINAGE)
 NEOPRENE BRG. PAD, GLUED TO BASE PLATE USING AN APPROVED ADHESIVE THICKNESS = 1/2" MIN. LENGTH = 5" + TOTAL MOVEMENT WIDTH = 4" (MIN.) (SEE NOTE 5)
 PROVIDE 1/4" MAX. GAP BETWEEN PANEL AND CLOSED CELL NEOPRENE SPONGE STRIP FOR EXPANSION AND CONTRACTION.
 EXPANSION PANEL
 D + 5/16" HOLES FOR "D" ANCHOR BOLTS
 3/8" BASE PLATE THICKNESS
 PL 3/4 x 12 MIN. x FULL HEIGHT
 3/8"

(FOR ADDITIONAL PANEL DETAILS SEE SHEET 5)

- A. DIMENSIONS FOR Q , r , F AND D IS TO BE BASED ON THE DIMENSIONS SHOWN IN THE DESIGN TABLES ON SHEETS 7 AND 8 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 AND 8 FOR THE REQUIRED POST SPACING AND WALL HEIGHT.
- C. REMAINING DIMENSIONS TO BE DETERMINED BY THE ENGINEER.

⊕ MIN. SIZE SHOWN,
PROVIDE SIZE REQUIRED PER DESIGN

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.

STANDARD STRUCTURE MOUNTED SOUND BARRIER WALLS EXPANSION PANEL DETAILS

SHEET 11 OF 11

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED. U.S. CUSTOMARY UNITS IN () PARENTHESIS.
2. ALL "DESIGN" METRIC UNITS INDICATED ARE SOFT CONVERTED FROM U.S. CUSTOMARY UNITS.
3. DESIGN SPECIFICATIONS:
 - PENNDOT DESIGN MANUAL, PART 4, STRUCTURES.
 - 1989 AASHTO "GUIDE SPECIFICATIONS FOR STRUCTURAL DESIGN OF SOUND BARRIERS", INCLUDING THE 1992 AND 2002 INTERIMS.
 - 1992 AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES", 15TH EDITION, INCLUDING THE 1993 AND 1994 INTERIMS.
 - 2001 AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 4TH EDITION, INCLUDING THE 2002 AND 2003 INTERIMS.
 - 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).
4. CONSTRUCTION SPECIFICATIONS AND WORKMANSHIP:
 - PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408, AASHTO/AWS/D1.5M/D1.5-2002 - BRIDGE WELDING CODE AND THE CONTRACT SPECIAL PROVISIONS. (USE AWS/D1.1/D1.1M-2002 FOR WELDING NOT COVERED IN AASHTO/AWS/D1.5M/D1.5-2002).
5. 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 9144 mm (30'-0") ABOVE THE GROUND SURFACE OF 130 km/hr (80 mph).
 - OFFSET SOUND BARRIER WALLS (GROUND MOUNTED):

METRIC UNITS:
 - HEIGHT ZONE: 0 mm TO 4267 mm = 0.96 kPa
 - HEIGHT ZONE: OVER 4267 mm = 1.34 kPaU.S. CUSTOMARY UNITS:
 - HEIGHT ZONE: 0' TO 14'-0" = 20 PSF
 - HEIGHT ZONE: OVER 14'-0" = 28 PSF
 - ICE LOAD: 0.14 kPa (3 PSF) APPLIED TO ONE SIDE OF PANEL
 - SEISMIC LOAD: SEISMIC ACCELERATION COEFFICIENT "A" EQUAL TO 0.15.
6. WALL HEIGHTS MUST EQUAL OR EXCEED THE ACOUSTICAL PROFILE.
7. STANDARD PANEL HEIGHTS:
 - 1219 mm (4'-0") MINIMUM TO 3658 mm (12'-0") MAXIMUM.
 - PROVIDE STACKED PANELS WHEN THE WALL HEIGHT EXCEEDS 3658 mm (12'-0").
8. END PANEL HEIGHTS:
 - 1829 mm (6'-0") MINIMUM TO 6706 mm (22'-0") MAXIMUM.
 - PROVIDE SINGLE END PANELS. STACKED PANELS ARE NOT PERMITTED.
 - IF WALL HEIGHT IS GREATER THAN 6706 mm (22'-0"), ADJUST WALL LENGTH AS REQUIRED SO THE MAXIMUM END PANEL HEIGHT IS 6706 mm (22'-0") OR LESS.
9. 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 150 mm (6") OR GREATER THAN 610 mm (2'-0").
10. PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL-TO-PANEL CONNECTION.
11. 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 1500 mm (5'-0") ABOVE THE EDGE OF PAVEMENT.
12. ALL REINFORCEMENT STEEL BARS AND WELDED WIRE FABRIC SHOWN ARE SOFT CONVERTED METAL SIZES.
13. PROVIDE UNCOATED REINFORCEMENT BARS IN THE FOOTING.
14. PROVIDE EPOXY COATED OR GALVANIZED REINFORCEMENT BARS IN PANELS WHERE THE WALL IS WITHIN 4300 mm (14'-0") OF THE EDGE OF TRAVEL LANE. EPOXY COATED OR GALVANIZED REINFORCEMENT MAY BE REQUIRED IF FUTURE WIDENING IS ANTICIPATED.
15. ALL DIMENSIONS SHOWN ARE HORIZONTAL, EXCEPT AS NOTED.
16. DIMENSIONS SHOWN ARE FOR A NORMAL TEMPERATURE OF 20 DEGREES C (68 DEGREES F).
17. REINFORCEMENT IN SOME SECTIONS IS NOT SHOWN FOR CLARITY.
18. FOR ADDITIONAL INFORMATION, REFER TO BC-780M.

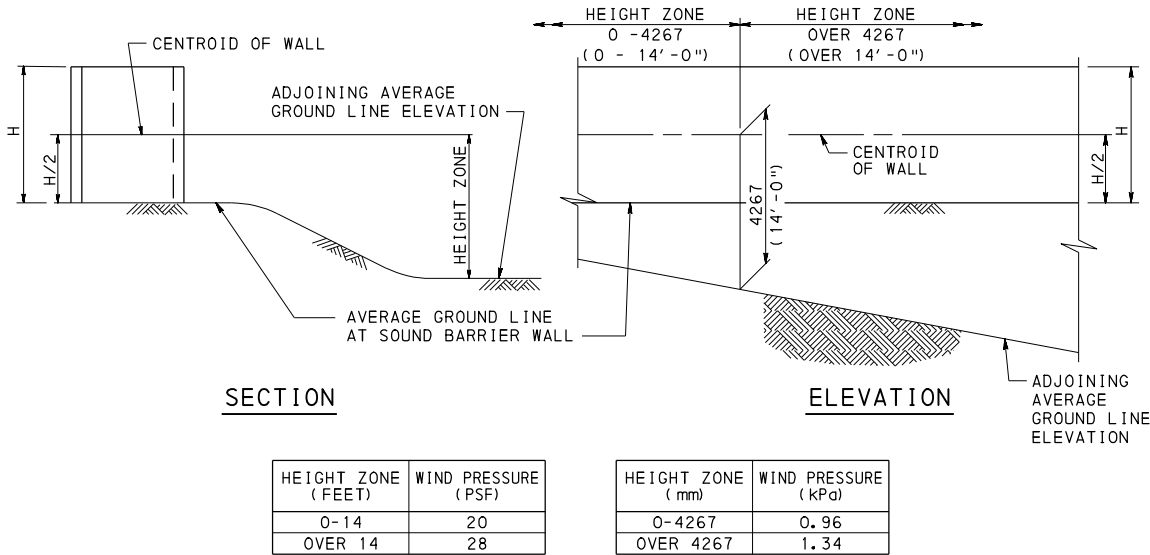
MATERIAL NOTES

1. REFER TO BC-780M FOR MATERIAL NOTES.

DESIGN TABLE NOTES

1. DESIGN TABLES SHOWN FOR THE WALL SYSTEM ARE DEVELOPED FOR TWO SEPARATE WIND PRESSURES OF 0.96 kPa (20 PSF) AND 1.34 kPa (28 PSF)
2. DESIGN TABLES SHOWN FOR THE PRECAST CONCRETE PANELS (STANDARD AND END PANELS) ARE DEVELOPED FOR A WIND PRESSURE OF 1.34 kPa (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 1219 mm (4'-0") OR GREATER THAN 3658 mm (12'-0").
6. END PANEL HEIGHTS ARE PERMITTED TO BE ANY DIMENSION REQUIRED, BUT ARE NOT PERMITTED TO BE LESS THAN 1829 mm (6'-0") OR GREATER THAN 6706 mm (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



HEIGHT ZONES FOR
OFFSET SOUND BARRIERS (GROUND MOUNTED)

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

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 DESIGN		
STANDARD OFFSET SOUND BARRIER WALLS GENERAL NOTES - 1		
RECOMMENDED SEPT. 20, 2010 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED SEPT. 20, 2010 <i>Brenda S. Thompson</i> DIRECTOR, BUREAU OF DESIGN	SHEET 1 OF 8 BD-680M

DESIGN PARAMETERS

1. GENERAL:
- THE WALL SYSTEM IS DESIGNED BASED ON A 4 PANEL UNIT LENGTH (WHICH MAY INCLUDE THE END PANEL) WITH A 610 mm (2'-0") MINIMUM WALL EMBEDMENT FOR WIND PRESSURES EQUAL TO 0.96 kPa (20 PSF) AND 1.34 kPa (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 1.34 kPa (28 PSF).
 - PANELS ARE DESIGNED USING A 254 mm (10 INCH) STRUCTURAL THICKNESS.
 - PANELS ARE DESIGNED FOR AN ADDITIONAL CONCRETE WEIGHT OF 38 mm (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 38 mm (1½ INCH) BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT THICKNESS, ON BOTH SIDES OF THE PANEL, MUST NOT BE GREATER THAN 38 mm (1½ INCH).
 - DESIGN CALCULATIONS ARE REQUIRED FOR PANELS WHICH HAVE A TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT GREATER THAN 38 mm (1½ INCH).
 - PANELS ARE DESIGNED AS SIMPLY SUPPORTED BEAMS SPANNING 4572 mm (15'-0").
 - PANELS ARE DESIGNED ON A 305 mm (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 610 mm (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 27.6 MPa (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 3048 mm (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 0.140 MPa (1.50 TONS/SQ. FT.) AND A COEFFICIENT OF SLIDING FRICTION EQUAL TO 0.30.
 - MAXIMUM ALLOWABLE BEARING PRESSURE ON CONCRETE = 6.20 MPa (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
 - DENSITY OF BACKFILL MATERIAL = 1600 Kg/m3
 - (WEIGHT OF BACKFILL MATERIAL = 100 LB. / CU. FT.)
 - PROVIDE A MINIMUM SOIL DEPTH OF 610 mm (2'-0") ABOVE THE TOP OF FOOTING.
 - PROVIDE A MINIMUM FOOTING THICKNESS OF 305 mm (1'-0").
 - PROVIDE A MINIMUM FOOTING WIDTH OF 914 mm (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 38 mm (1½"), BUT THE TOTAL AVERAGE ARCHITECTURAL SURFACE TREATMENT ON BOTH SIDES OF THE PANEL MUST NOT BE GREATER THAN 38 mm (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.

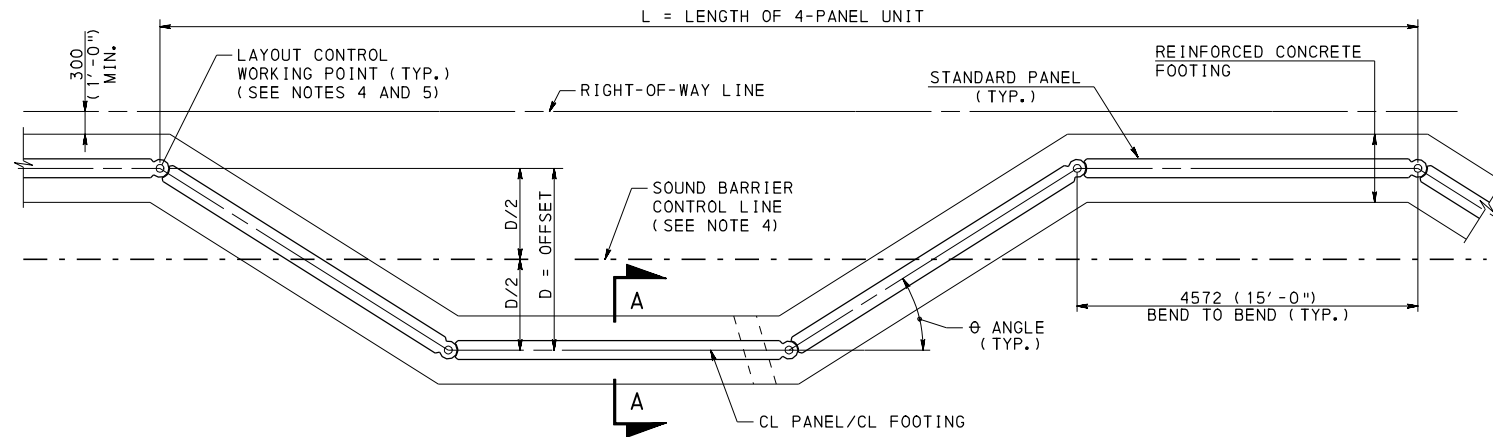
DISTRICT ENVIRONMENTAL MANAGER
3. DETERMINE HEIGHT ZONE AND WIND PRESSURE REQUIRED FOR WALL DESIGN AND INDICATE ON THE CONTRACT DRAWINGS.
4. SPECIFY IF THE REINFORCEMENT BARS ARE UNCOATED, EPOXY COATED OR GALVANIZED.
5. SPECIFY IF THE WELDED WIRE FABRIC IS UNCOATED, EPOXY COATED OR GALVANIZED.
6. OFFSET 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 1500 mm (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.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

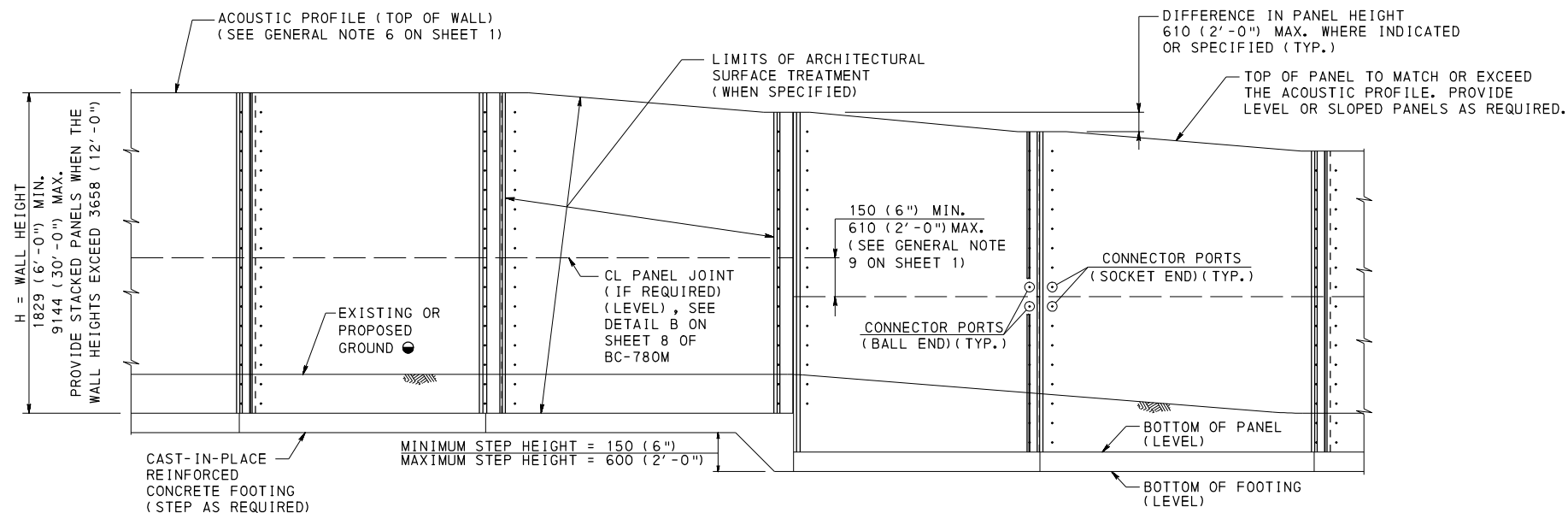
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

STANDARD
OFFSET SOUND BARRIER WALLS
GENERAL NOTES - 2

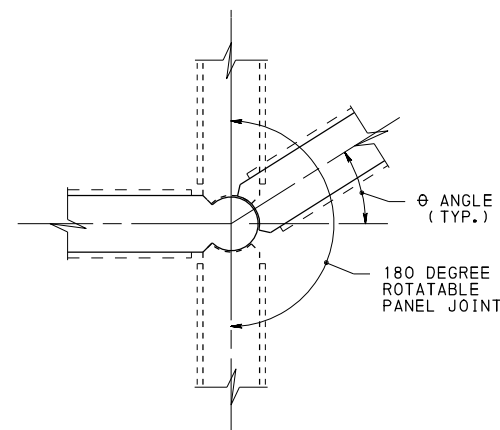
RECOMMENDED SEPT. 20, 2010 <i>Thomas P. Maciore</i> CHIEF BRIDGE ENGINEER	RECOMMENDED SEPT. 20, 2010 <i>Brenda S. Thomas</i> DIRECTOR, BUREAU OF DESIGN	SHEET 2 OF 8 BD-680M
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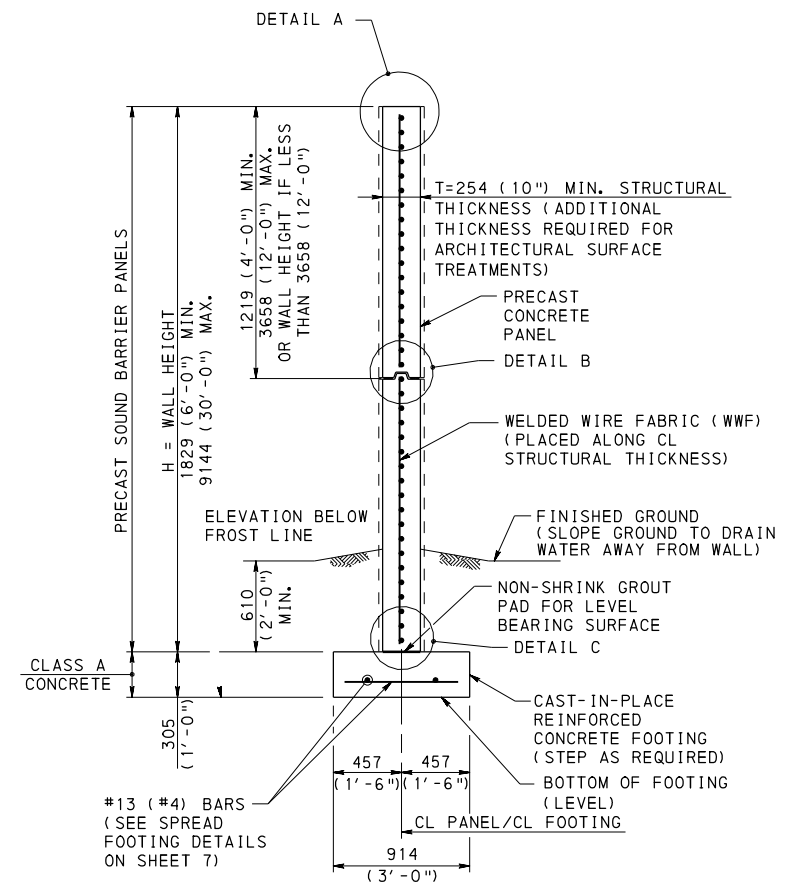
PLAN - OFFSET SOUND BARRIER
(END PANEL NOT SHOWN)



ELEVATION - OFFSET SOUND BARRIER
(END PANEL NOT SHOWN)



PANEL JOINT



SECTION A-A

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
2. FOR DESIGN TABLES REFER TO SHEET 4.
3. FOR DETAILS A, B, AND C REFER TO BC-780M, SHEET 8.
4. LOCATE SOUND BARRIER CONTROL LINE AND WORKING POINTS BASED ON THE ROADWAY GEOMETRY ON THE STAKE-OUT PLAN.
5. 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.
6. DESIGNER TO INDICATE THE GEOMETRY OF THE WALL ON THE CONTRACT DRAWINGS.

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN**

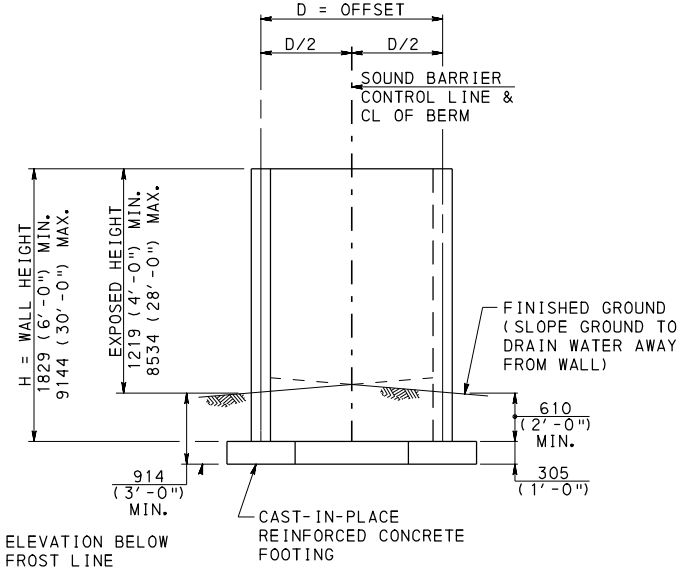
**STANDARD
OFFSET SOUND BARRIER WALLS
GEOMETRY AND LAYOUT - 1**

OFFSET SOUND BARRIER DESIGN TABLE METRIC UNITS				
HEIGHT ZONE 0mm - 4267mm WIND PRESSURE = 0.96 kPa				
WALL HEIGHT H (mm)	OFFSET D (mm)	ANGLE θ (D M S)	4-PANEL UNIT LENGTH L (mm)	MINIMUM NUMBER OF CABLES ▲
1829	610	07°39'44.1"	18 206	4
2438	762	09°35'38.6"	18 160	5
3048	914	11°32'13.1"	18 103	5
3658	1067	13°29'36.2"	18 036	5
4267	1067	13°29'36.2"	18 036	6
4877	1219	15°27'57.6"	17 957	6
5486	1372	17°27'27.4"	17 867	6
6096	1524	19°28'16.4"	17 765	6
6706	1676	21°30'36.7"	17 651	6
7315	1829	23°34'41.4"	17 525	6
7925	1981	25°40'45.4"	17 385	6
8534	2134	27°49'05.3"	17 231	6

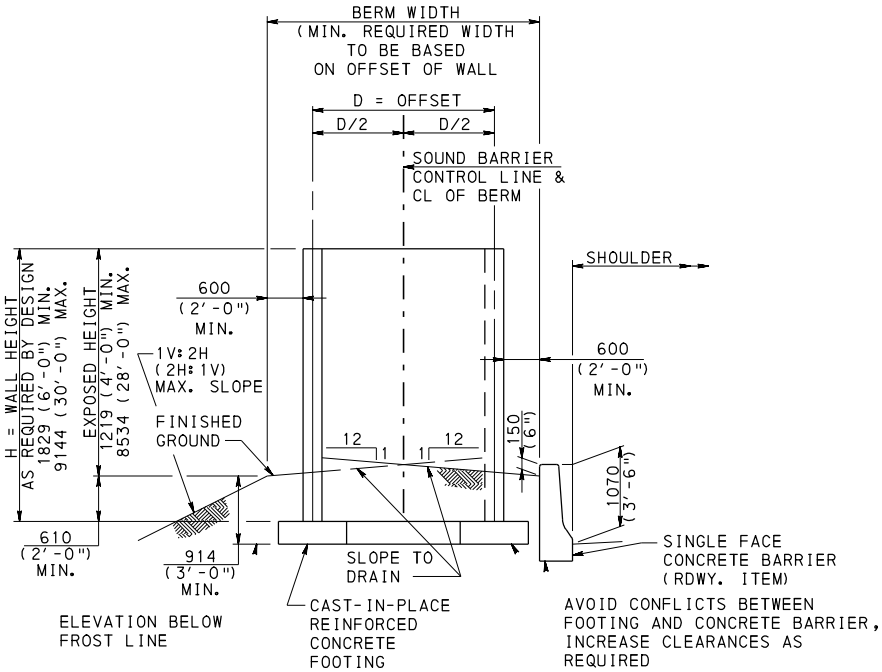
OFFSET SOUND BARRIER DESIGN TABLE METRIC UNITS				
HEIGHT ZONES OVER 4267mm WIND PRESSURE = 1.34 kPa				
WALL HEIGHT H (mm)	OFFSET D (mm)	ANGLE θ (D M S)	4-PANEL UNIT LENGTH L (mm)	MINIMUM NUMBER OF CABLES ▲
1829	762	09°35'38.6"	18 160	4
2438	914	11°32'13.1"	18 103	5
3048	1067	13°29'36.2"	18 036	5
3658	1372	17°27'27.4"	17 867	5
4267	1524	19°28'16.4"	17 765	6
4877	1676	21°30'36.7"	17 651	6
5486	1829	23°34'41.4"	17 525	6
6096	2134	27°49'05.3"	17 231	6
6706	2286	30°00'00.0"	17 063	6
7315	2438	32°13'51.4"	16 879	6
7925	2591	34°31'05.2"	16 678	6
8534	2743	36°52'11.6"	16 459	7
9144	3048	41°48'37.1"	15 960	7

OFFSET SOUND BARRIER DESIGN TABLE U.S. CUSTOMARY UNITS				
HEIGHT ZONE 0'-14' WIND PRESSURE = 20 psf				
WALL HEIGHT H (FT.)	OFFSET D (FT.)	ANGLE θ (D M S)	4-PANEL UNIT LENGTH L (FT.)	MINIMUM NUMBER 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

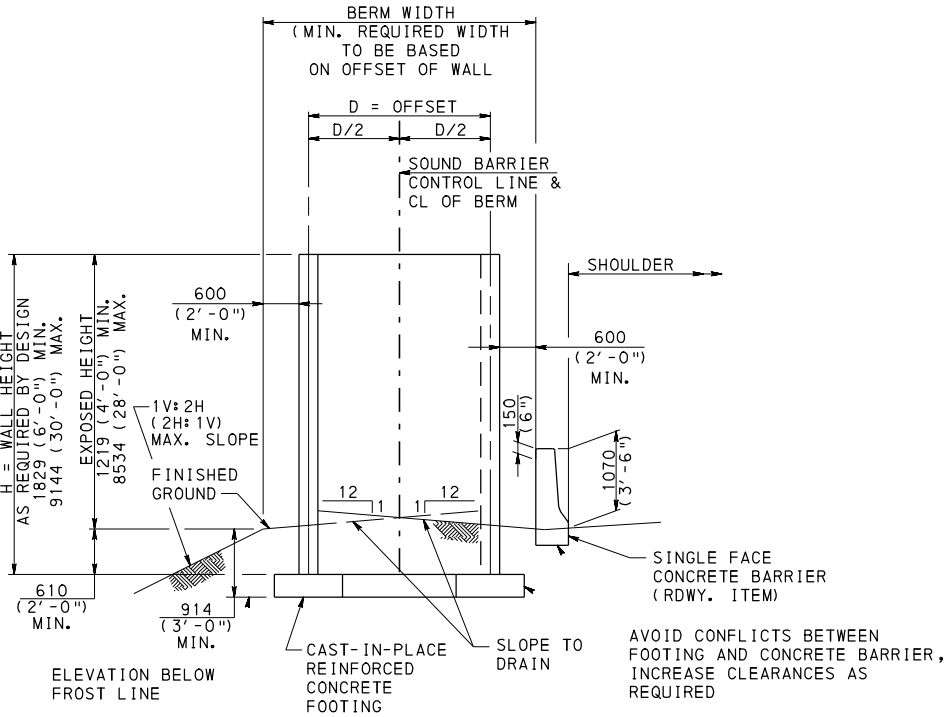
OFFSET SOUND BARRIER DESIGN TABLE U.S. CUSTOMARY UNITS				
HEIGHT ZONES OVER 14' WIND PRESSURE = 28 psf				
WALL HEIGHT H (FT.)	OFFSET D (FT.)	ANGLE θ (D M S)	4-PANEL UNIT LENGTH L (FT.)	MINIMUM NUMBER OF CABLES ▲
6.0	2.5	09°35'38.6"	59.5804	4
8.0	3.0	11°32'13.1"	59.3939	5
10.0	3.5	13°29'36.2"	59.1719	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)

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES
MUST BE USED ON PLANS. METRIC AND
ENGLISH VALUES SHOWN MAY NOT BE MIXED.

NOTES:

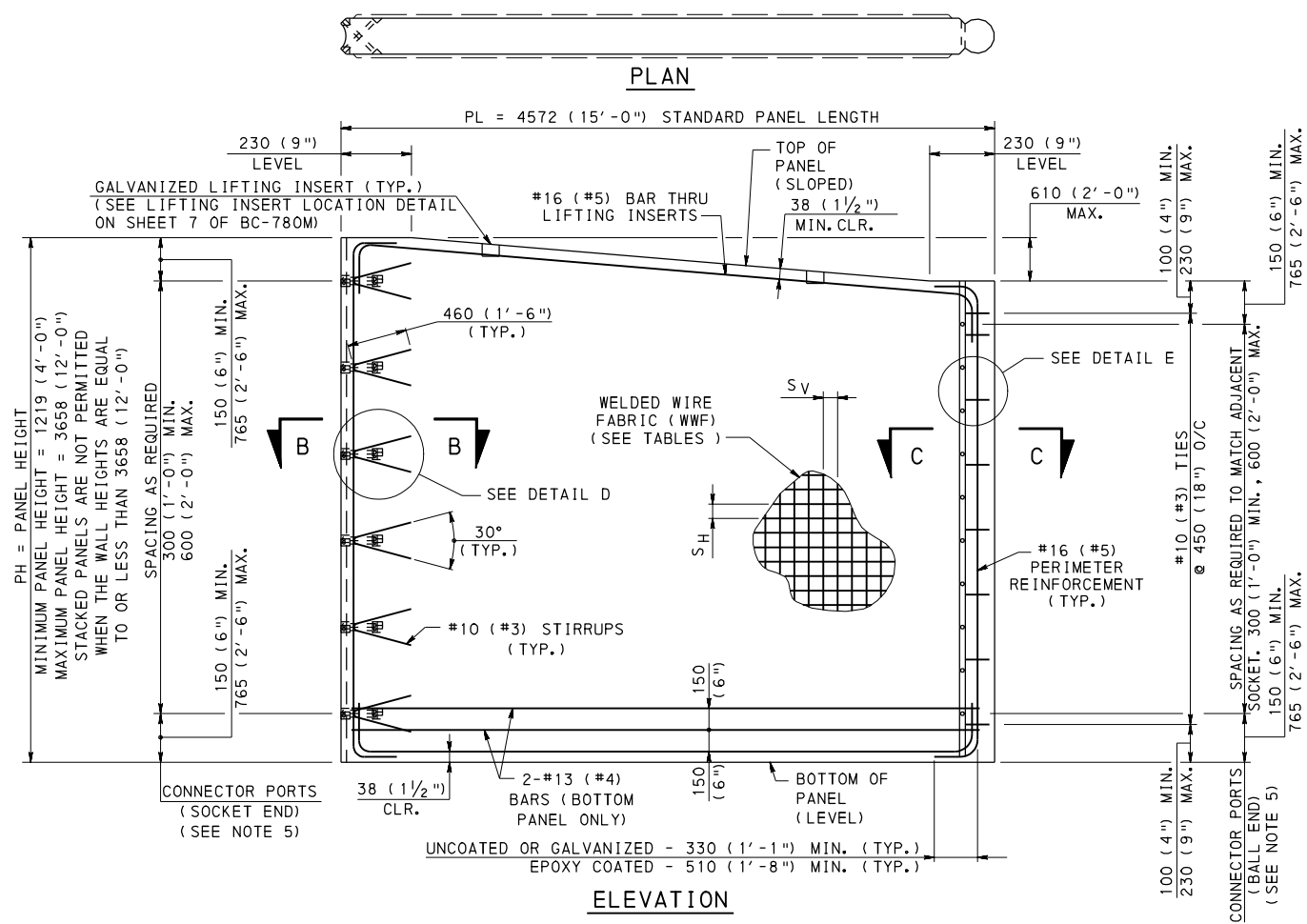
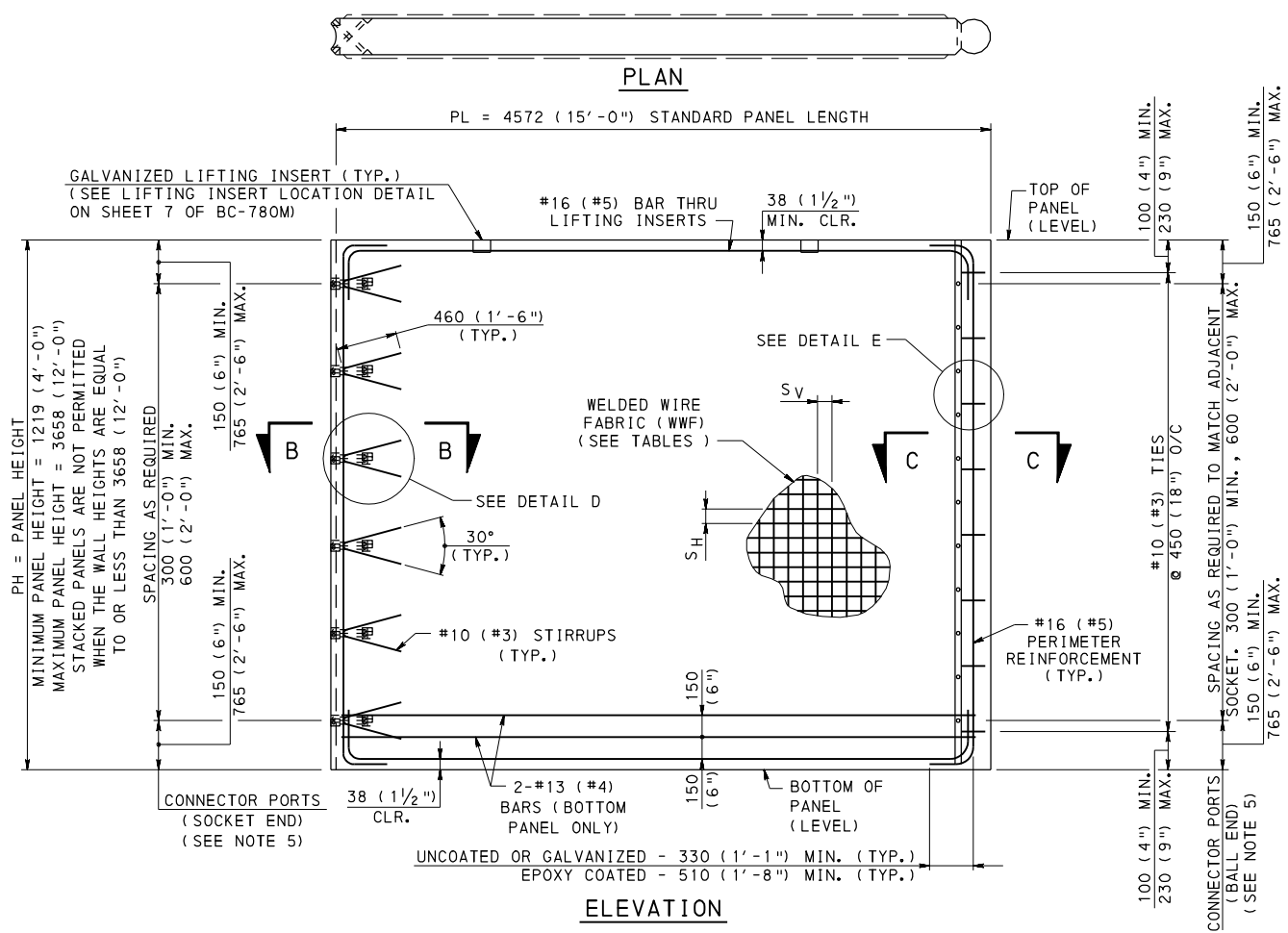
- FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.
- DESIGNER TO SELECT WHICH OPTION IS USED BASED ON ROADWAY GEOMETRICS, RIGHT-OF-WAY REQUIREMENTS AND ALL OTHER CONSTRAINTS. OBTAIN ACCEPTANCE FROM THE DISTRICT BRIDGE ENGINEER. (THE DEPARTMENT PREFERS OPTION 1)

LEGEND:

DMS = DEGREES, MINUTES, AND SECONDS
▲ - PROVIDE A MINIMUM OF TWO CABLE CONNECTIONS FOR EACH PANEL-TO-PANEL CONNECTION.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
OFFSET SOUND BARRIER WALLS
GEOMETRY AND LAYOUT - 2



LEGEND:

S_H = SPACING OF HORIZONTAL BARS
S_V = 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 CL STRUCTURAL THICKNESS.
- 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).
- IF STACKED PANELS ARE REQUIRED REFER TO DETAIL B ON SHEET 8 OF BC-780M.
- 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.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

PRECAST CONCRETE PANEL REINFORCEMENT FOR STANDARD UPPER PANELS U.S. CUSTOMARY UNITS				
WIND PRESSURE = 28 psf				
PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF A×B-WC×WD	WELDED WIRE STEEL AREA (IN ² /FT.)		MIN. NUMBER OF LIFTING INSERTS
		HORIZONTAL	VERTICAL	
4.0	WWF 6x6-W8×W8	0.16	0.16	2
6.0	WWF 6x6-W8×W8	0.16	0.16	2
8.0	WWF 6x4-W8×W8	0.16	0.24	4
10.0	WWF 6x4-W8×W12	0.16	0.36	4
12.0	WWF 6x4-W8×W20	0.16	0.60	4

PRECAST CONCRETE PANEL REINFORCEMENT FOR STANDARD BOTTOM PANELS U.S. CUSTOMARY UNITS				
WIND PRESSURE = 28 psf				
PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF A×B-WC×WD	WELDED WIRE STEEL AREA (IN ² /FT.)		MIN. NUMBER OF LIFTING INSERTS
		HORIZONTAL	VERTICAL	
4.0	WWF 4x6-W8×W8	0.24	0.16	2
6.0	WWF 4x6-W8×W8	0.24	0.16	2
8.0	WWF 4x4-W8×W8	0.24	0.24	4
10.0	WWF 4x4-W8×W12	0.24	0.36	4
12.0	WWF 4x4-W8×W20	0.24	0.60	4

** WWF A×B-WC×WD (U.S. CUSTOMARY)
WWF A×B-MWC×MWD (METRIC)

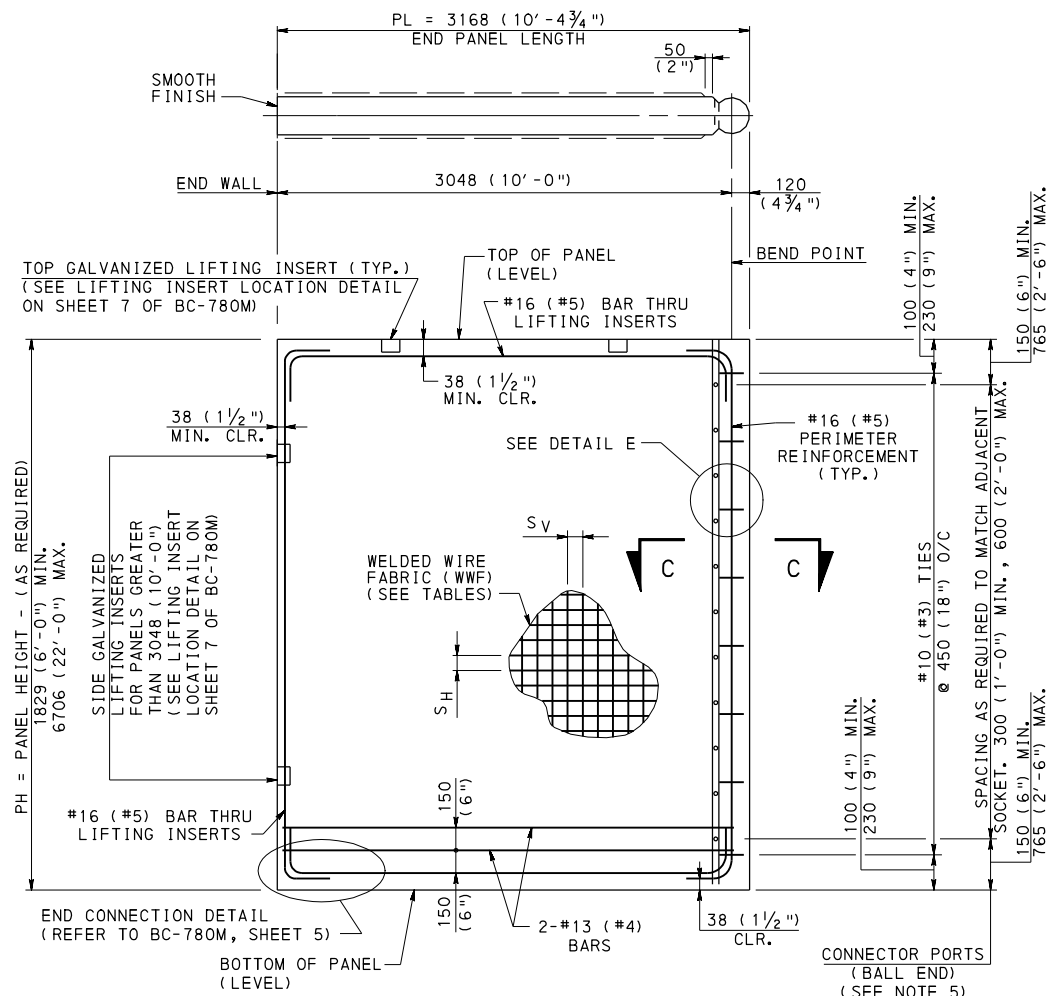
WHERE A = SPACING OF HORIZONTAL BARS (S_H)
B = SPACING OF VERTICAL BARS (S_V)
C = HORIZONTAL WIRE SIZE
D = VERTICAL WIRE SIZE
WWF = WELDED WIRE FABRIC

PRECAST CONCRETE PANEL REINFORCEMENT FOR STANDARD UPPER PANELS METRIC UNITS				
WIND PRESSURE = 1.34 kPa				
PANEL HEIGHT PH (mm)	WELDED WIRE FABRIC ** WWF A×B-MWC×MWD	WELDED WIRE STEEL AREA (mm ² /m)		MIN. NUMBER OF LIFTING INSERTS
		HORIZONTAL	VERTICAL	
1219	WWF 152×152-MW52×MW52	342	342	2
1829	WWF 152×152-MW52×MW52	342	342	2
2438	WWF 152×102-MW52×MW52	342	510	4
3048	WWF 152×102-MW52×MW77	342	755	4
3658	WWF 152×102-MW52×MW130	342	1275	4

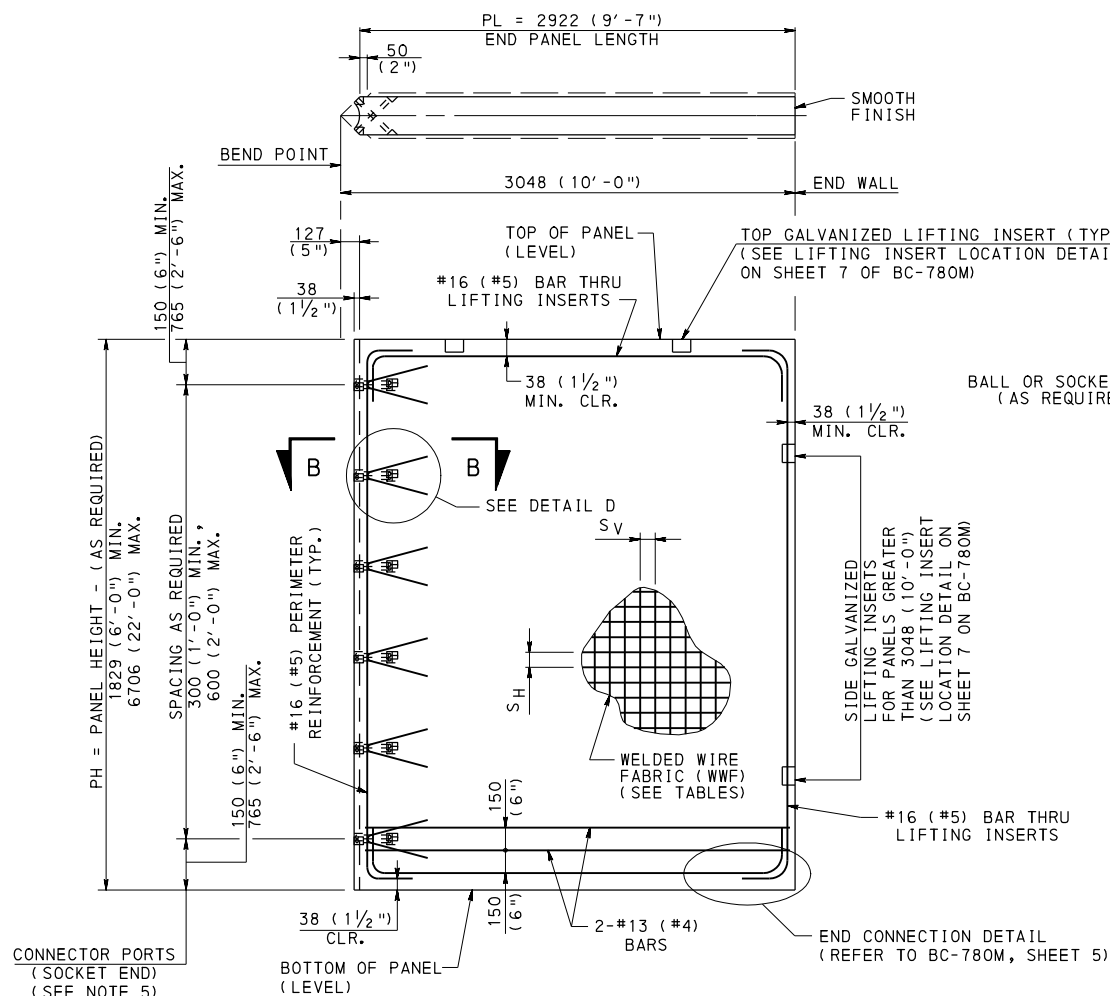
PRECAST CONCRETE PANEL REINFORCEMENT FOR STANDARD BOTTOM PANELS METRIC UNITS				
WIND PRESSURE = 1.34 kPa				
PANEL HEIGHT PH (mm)	WELDED WIRE FABRIC ** WWF A×B-MWC×MWD	WELDED WIRE STEEL AREA (mm ² /m)		MIN. NUMBER OF LIFTING INSERTS
		HORIZONTAL	VERTICAL	
1219	WWF 102×152-MW52×MW52	510	342	2
1829	WWF 102×152-MW52×MW52	510	342	2
2438	WWF 102×102-MW52×MW52	510	510	4
3048	WWF 102×102-MW52×MW77	510	755	4
3658	WWF 102×102-MW52×MW130	510	1275	4

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BUREAU OF DESIGN**

**STANDARD
OFFSET SOUND BARRIER WALLS
PRECAST CONCRETE STANDARD PANEL DETAILS**

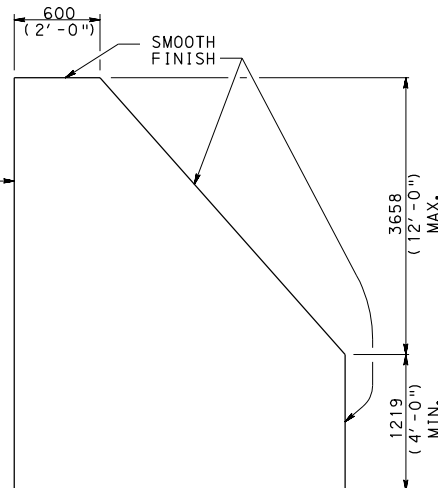


**END PANEL
(FULL HEIGHT)
(BALL END)**



**END PANEL
(FULL HEIGHT)
(SOCKET END)**

NOTE:
FOR INFORMATION NOT SHOWN,
SEE STANDARD PANEL DETAILS
ON SHEET 5.



**ALTERNATE
SLOPED END PANEL**
(FABRICATOR TO LOCATE LIFTING
INSERTS, AS REQUIRED)

LEGEND:

S_H = SPACING OF HORIZONTAL BARS
 S_V = 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 CL 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.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

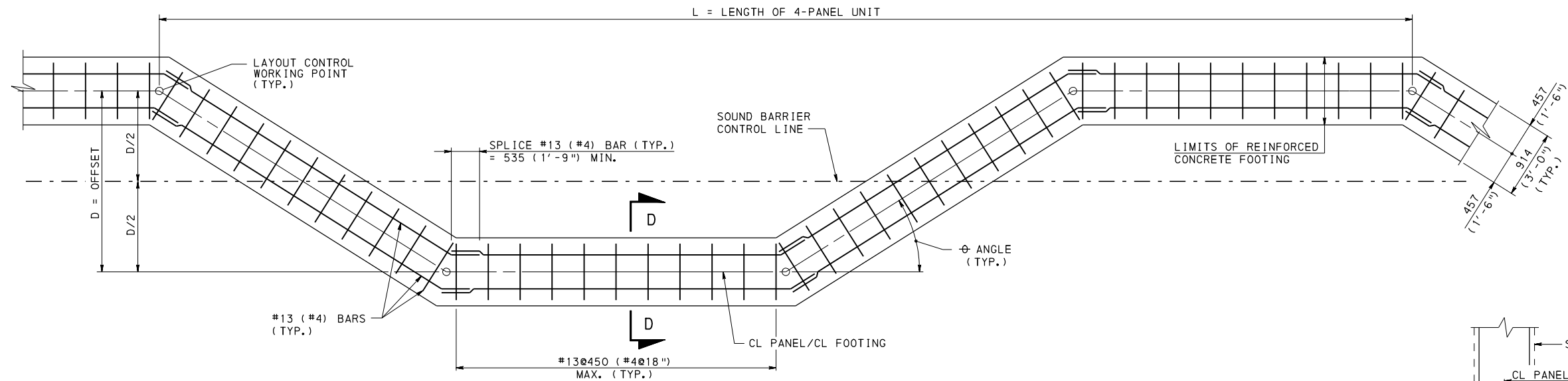
PRECAST CONCRETE PANEL REINFORCEMENT FOR END PANELS U.S. CUSTOMARY UNITS					
WIND PRESSURE = 28 psf					
PANEL HEIGHT PH (FT.)	WELDED WIRE FABRIC ** WWF AxB-WC×WD	WELDED WIRE STEEL AREA (IN ² /FT.)		MIN. NUMBER OF LIFTING INSERTS	
		HORIZONTAL	VERTICAL	TOP OF PANEL	SIDE OF PANEL
6.0	WWF 6x6-W8×W8	0.16	0.16	2	—
8.0	WWF 6x4-W8×W8	0.16	0.24	2	—
10.0	WWF 6x4-W8×W12	0.16	0.36	2	—
12.0	WWF 4x4-W12×W12	0.36	0.36	4	4
14.0	WWF 4x4-W12×W12	0.36	0.36	4	4
16.0	WWF 4x4-W12×W12	0.36	0.36	4	4
18.0	WWF 4x4-W12×W12	0.36	0.36	4	4
20.0	WWF 4x4-W12×W12	0.36	0.36	4	4
22.0	WWF 4x4-W12×W12	0.36	0.36	4	4

** WWF AxB-WC×WD (U.S. CUSTOMARY)
WWF AxB-MWC×MWD (METRIC)
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

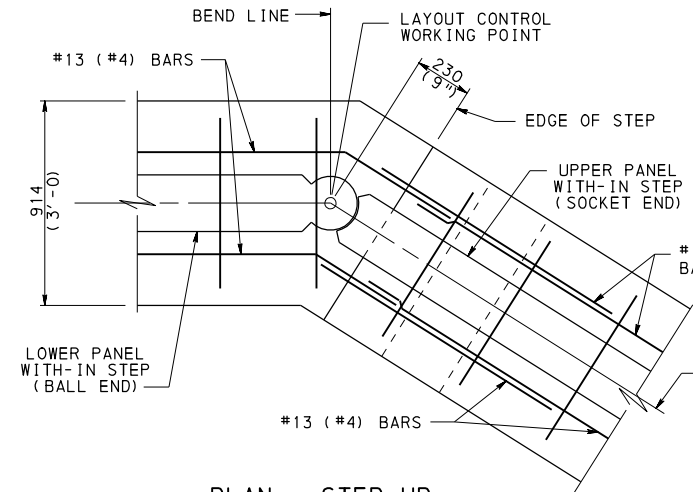
PRECAST CONCRETE PANEL REINFORCEMENT FOR END PANELS METRIC UNITS					
WIND PRESSURE = 1.34 kPa					
PANEL HEIGHT PH (mm)	WELDED WIRE FABRIC ** WWF AxB-MWC×MWD	WELDED WIRE STEEL AREA (mm ² /m)		MIN. NUMBER OF LIFTING INSERTS	
		HORIZONTAL	VERTICAL	TOP OF PANEL	SIDE OF PANEL
1829	WWF 152×152-MW52×MW52	342	342	2	—
2438	WWF 152×102-MW52×MW52	342	510	2	—
3048	WWF 152×102-MW52×MW77	342	755	2	—
3658	WWF 102×102-MW77×MW77	755	755	4	4
4267	WWF 102×102-MW77×MW77	755	755	4	4
4877	WWF 102×102-MW77×MW77	755	755	4	4
5486	WWF 102×102-MW77×MW77	755	755	4	4
6096	WWF 102×102-MW77×MW77	755	755	4	4
6706	WWF 102×102-MW77×MW77	755	755	4	4

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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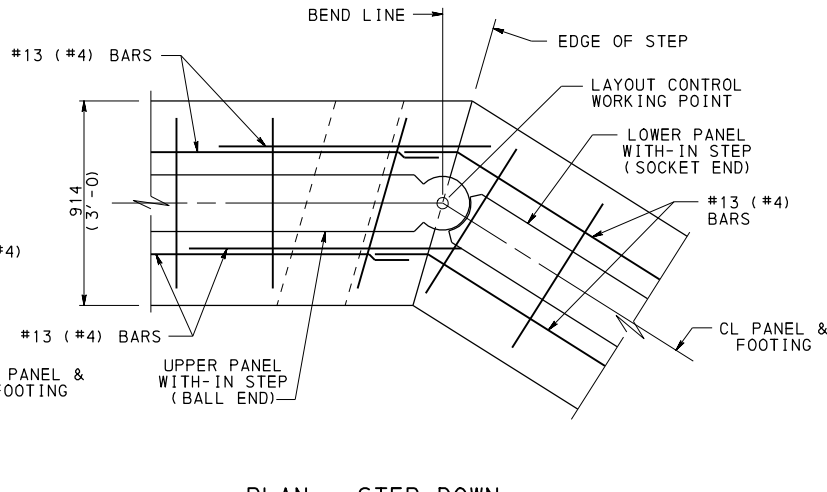
**STANDARD
OFFSET SOUND BARRIER WALLS
PRECAST CONCRETE END PANEL DETAILS**



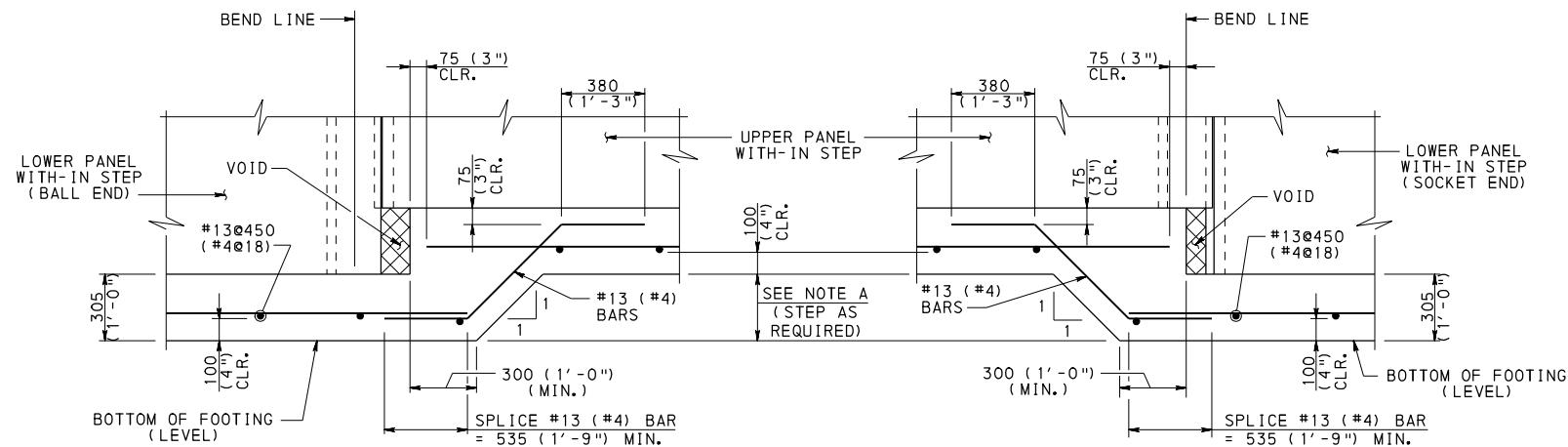
FOOTING REINFORCEMENT LAYOUT FOR STANDARD PANELS



PLAN - STEP UP



PLAN - STEP DOWN

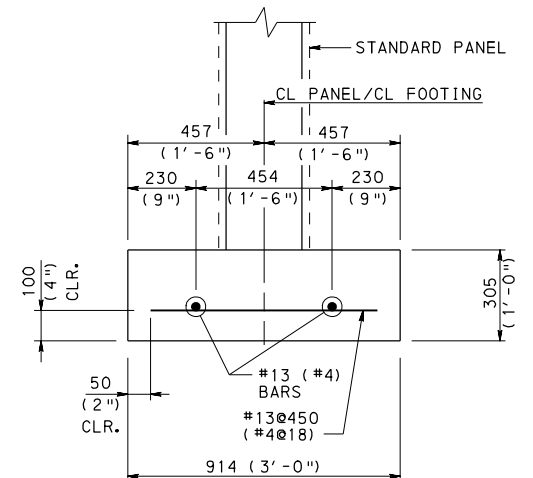


SECTION ALONG CL PANEL

SECTION ALONG CL PANEL

FOOTING STEP DETAILS FOR STANDARD PANELS

NOTE A:
MINIMUM STEP HEIGHT = 150 (6")
MAXIMUM STEP HEIGHT = 600 (2'-0")
MINIMIZE THE NUMBER OF STEPS ALONG LENGTH OF WALL.



SECTION D-D

NOTES:

1. FOR ADDITIONAL INFORMATION REFER TO NOTES ON SHEETS 1 AND 2.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

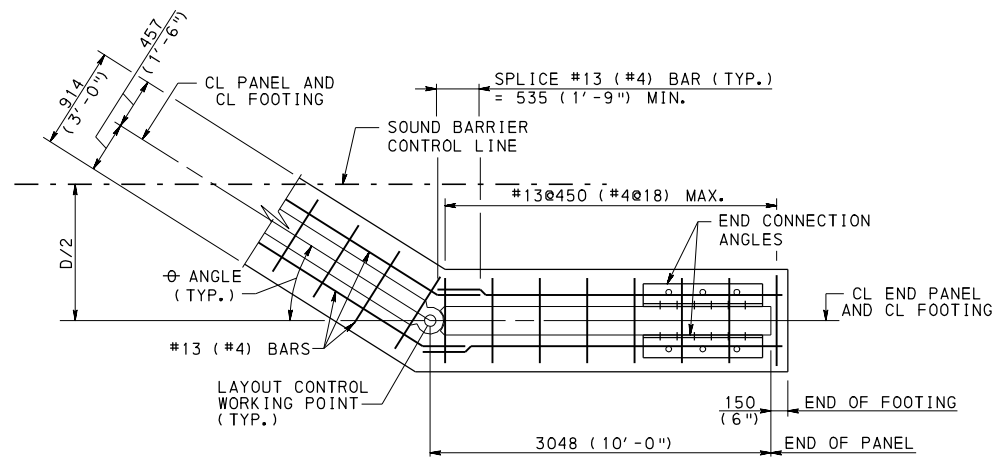
**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
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**STANDARD
OFFSET SOUND BARRIER WALLS
SPREAD FOOTING DETAILS
FOR STANDARD PANELS**

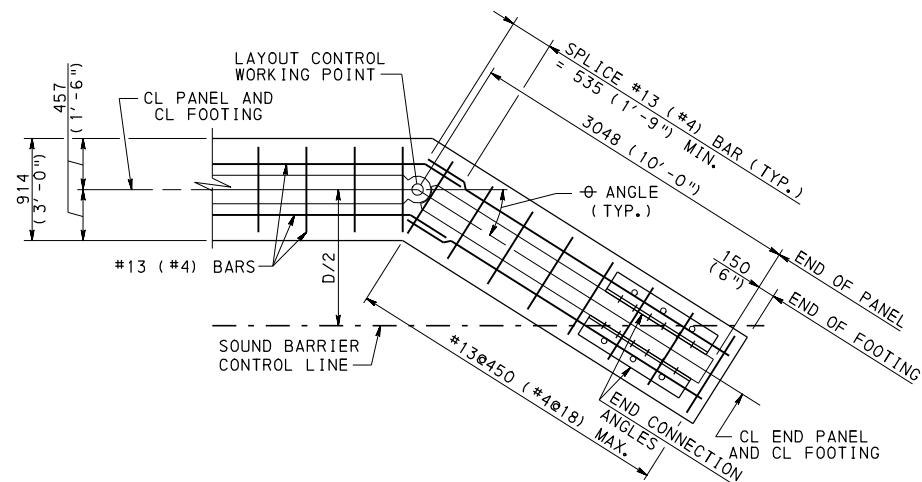
RECOMMENDED SEPT. 20, 2010
Thomas P. Maciore
CHIEF BRIDGE ENGINEER

RECOMMENDED SEPT. 20, 2010
Brenda S. Thompson
DIRECTOR, BUREAU OF DESIGN

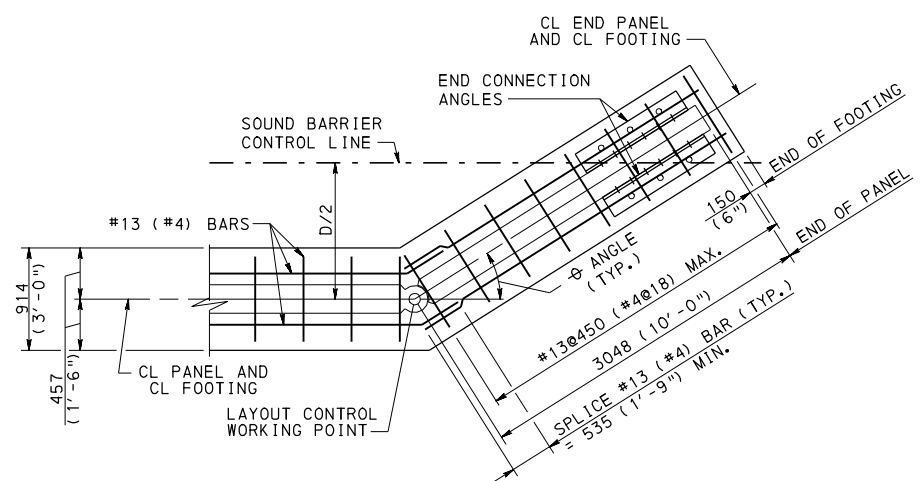
SHEET 7 OF 8
BD-680M



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.

NOTE: EITHER ALL METRIC OR ALL ENGLISH VALUES MUST BE USED ON PLANS. METRIC AND ENGLISH VALUES SHOWN MAY NOT BE MIXED.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
OFFSET SOUND BARRIER WALLS
SPREAD FOOTING DETAILS
FOR END PANELS

CHANGE 2
CHANGE 3

GENERAL NOTES

1. THESE EXAMPLE PLAN SHEETS WERE PREPARED TO ILLUSTRATE THE SIGNIFICANT, BUT NOT NECESSARILY ALL, DRAWINGS NECESSARY FOR A GRS-IBS PROJECT.

2. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH SPECIFICATIONS PUBLICATION 408, AASHTO/AWS D1.5 BRIDGE WELDING CODE AND THE SPECIAL PROVISIONS.

3. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS AS SUPPLEMENTED BY DESIGN MANUAL PART 4, STRUCTURES.

4. USE CLASS A CEMENT CONCRETE FOR CONCRETE MASONRY UNIT FILL AND COPING.

5. 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.

6. REINFORCED SOIL FOUNDATION (RSF) BACKFILL: PENNDOT 2A COARSE AGGREGATE OR DRIVING SURFACE AGGREGATE (LOCAL JURISDICTION BRIDGES ONLY), WITH ALL AGGREGATES TYPE A.

7. REINFORCED BACKFILL GRADATION: AASHTO #8, #57, #67 OR A COMBINATION THEREOF, WITH ALL AGGREGATES TYPE A.

8. INTEGRATED APPROACH BACKFILL: PENNDOT 2A COARSE AGGREGATE OR DRIVING SURFACE AGGREGATE (LOCAL JURISDICTION BRIDGES ONLY), WITH ALL AGGREGATES TYPE C OR BETTER.

9. 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.

10. 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 = 7⅝"x7⅝"x15⅝" - TYPICALLY)

• HEIGHT TOLERANCE ±1⁄16", LENGTH AND WIDTH TOLERANCE ±1⁄8"

• MINIMUM FACE SHELL THICKNESS 1¼" AND MINIMUM WEB THICKNESS ¾"

• SPECIFY SPLIT FACE CMU IF DESIRED FOR AESTHETICS

11. 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.

• 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 100 YEAR WATER VELOCITIES LESS THAN OR EQUAL TO 7 FPS FOR TYPICAL DETAILS SHOWN (SMALL SOLID, HOLLOW AND FILLED CMU).

• LIMIT TO SITES WITH 100 YEAR 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 100 YEAR 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.

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-T-99 AND ±2 PERCENT OPTIMUM MOISTURE CONTENT. IN THE BEARING REINFORCEMENT ZONE, COMPACT TO 100 PERCENT OF THE MAXIMUM DRY DENSITY ACCORDING TO AASHTO-T-99. 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.

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.

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_b = 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_b = WIDTH OF THE BRIDGE

b_{block} = WIDTH OF CMU

b_r = LENGTH OF BEARING BED REINFORCEMENT; LENGTH = 2q + b

B_{RSF} = WIDTH OF RSF

B_{total} = TOTAL WIDTH AT BASE OF GRS ABUTMENT INCLUDING THE WALL FACING

CMU = CONCRETE MASONRY UNIT

d_a = 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_{max} = MAXIMUM PARTICLE DIAMETER IN REINFORCED BACKFILL

D_{RSF} = DEPTH OF RSF BELOW BOTTOM OF WALL ELEVATION; 0.25 × B_{total} MINIMUM

GRS = GEOSYNTHETIC REINFORCED SOIL

H = WALL HEIGHT MEASURED FROM TOP OF RSF TO TOP OF BEAM SEAT

H_{block} = HEIGHT OF CMU

h_{rb} = HEIGHT OF ROAD BASE (EQUALS HEIGHT OF SUPERSTRUCTURE AND PAVEMENT THICKNESS)

IBS = INTEGRATED BRIDGE SYSTEM

L = LENGTH OF GEOSYNTHETIC REINFORCEMENT

L_{abut} = ABUTMENT WIDTH

L_{block} = LENGTH OF CMU

L_{ww} = WINGWALL LENGTH

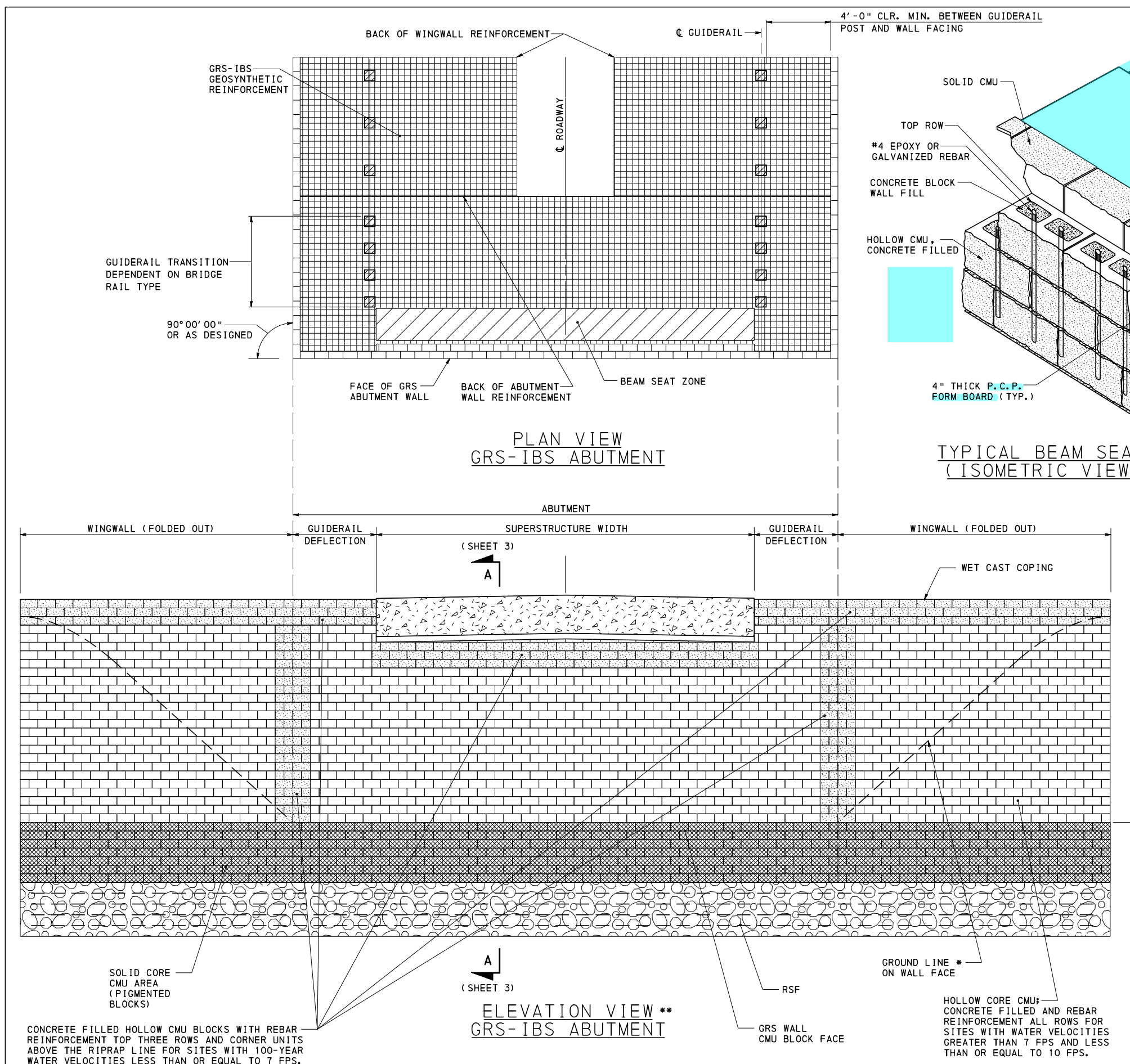
RSF = REINFORCED SOIL FOUNDATION

X_{RSF} = LENGTH OF RSF IN FRONT OF THE ABUTMENT WALL FACE; 0.25 × B_{total} MINIMUM

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STANDARD
GEOSYNTHETIC REINFORCED SOIL
INTEGRATED BRIDGE SYSTEM
NOTES

RECOMMENDED NOV. 21, 2014 Thomas P. Maciore CHIEF BRIDGE ENGINEER	RECOMMENDED NOV. 21, 2014 Brenda Stroman ACTING DIR, BUR. OF PROJECT DELIVERY	SHEET 1 OF 4 BD-697M
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NOTES

1. INSERT #4 REBARS INTO THE TOP 3 ROWS OF CMU'S AND ALL ROWS OF CORNER CMU'S ABOVE THE RIPRAP LINE AND FILL WITH CONCRETE.
2. SUPERSTRUCTURE CROWN OR SUPERELEVATION CAN BE PROVIDED BY GRADING THE REINFORCED FILL, PROVIDING REINFORCING FOR FILL THICKNESS GREATER THAN 4 INCH THICKNESS, COVERING TOP OF GRADED FILL WITH GEOSYNTHETIC, AND INDIVIDUALLY STEPPING OR CUTTING BLOCKS TO MATCH GRADE USING A CONCRETE CUT-OFF OR CIRCULAR SAW.
3. ADJUST LENGTH AND ANGLE OF WINGWALLS FOR SITE SPECIFIC CONDITIONS. WINGWALL LENGTH CONSIDERATION SHOULD INCLUDE PREVENTING EROSION OF GRS ABUTMENT FILL FROM STREAM FLOW INCLUDING THE EFFECTS OF ESTIMATED CHANNEL MIGRATION.
4. IF RSF IS NOT USED BENEATH THE WINGWALLS, THEN ADDITIONAL INDEPENDENT RETAINING WALL CALCULATIONS SHOULD BE PERFORMED TO DETERMINE THE STABILITY OF THE WINGWALLS.
5. SOLID CORE CMU'S SHALL BE PLACED UP TO THE RIPRAP HEIGHT.
6. CMU BLOCKS ARE STAGGERED, INCLUDING CORNERS, SO THERE ARE NO VERTICAL JOINTS GREATER THAN 1 CMU BLOCK HEIGHT.
7. GUIDERAIL TYPE AND LOCATION TO BE DESIGNED BY OTHERS IN ACCORDANCE WITH REQUIRED SAFETY STANDARDS.
8. WHEN NECESSARY, GRADE A DRAINAGE CHANNEL OFFSET FROM THE BACK OF THE WINGWALLS AND LINED WITH GEOTEXTILE AND CHANNEL ROCK. GRADE IN COMPACTED SOIL AGAINST THE WINGWALLS WITH A SLOPE LEADING TO THE CHANNEL.

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STANDARD
GEOSYNTHETIC REINFORCED SOIL
INTEGRATED BRIDGE SYSTEM
PLAN AND ELEVATION

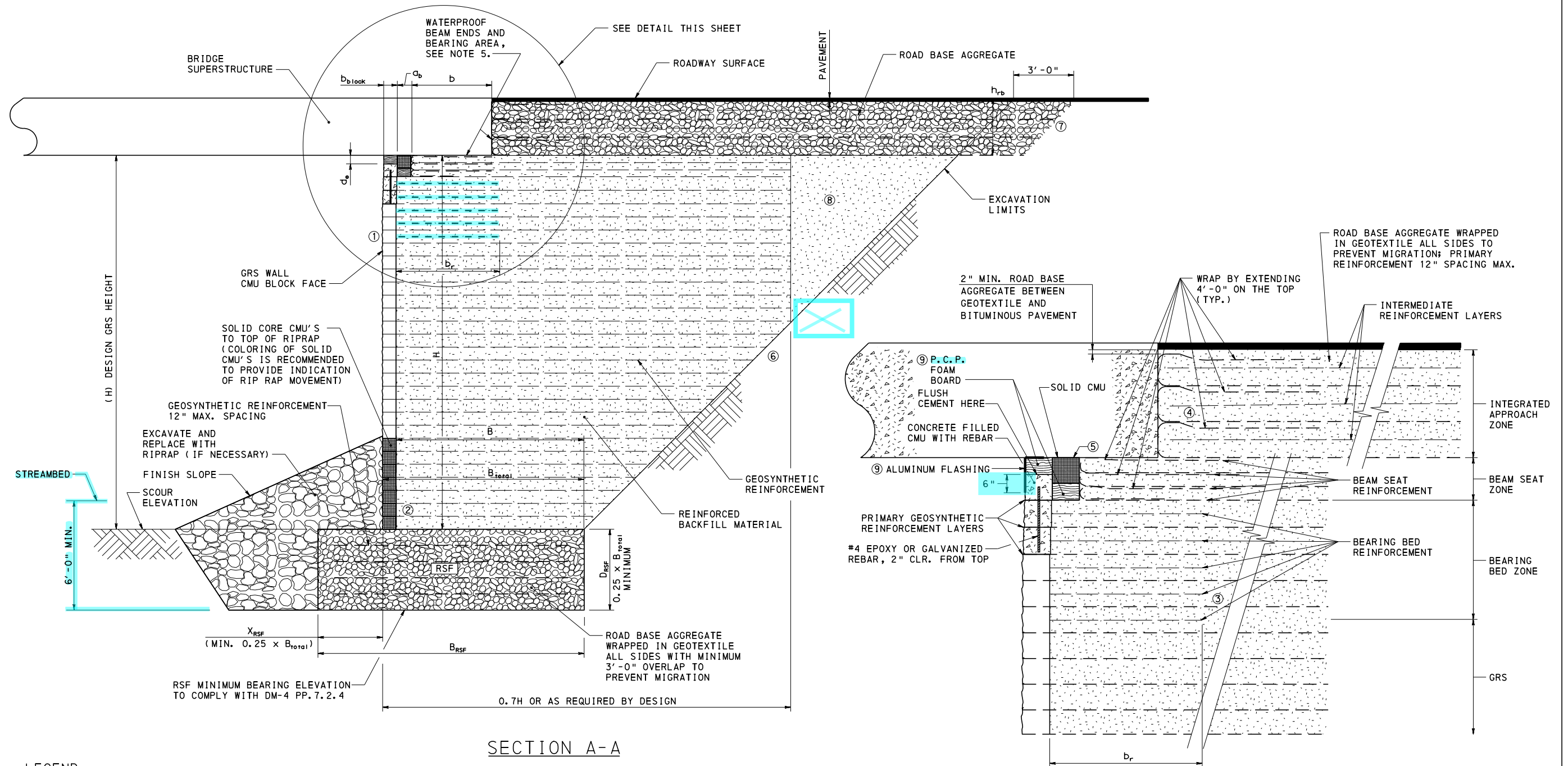
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Thomas P. Maciore
CHIEF BRIDGE ENGINEER

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Brian S. Thompson
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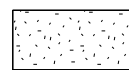
SHEET 2 OF 4
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* BENCH WINGWALL AS NECESSARY.

** WINGWALLS FOLDED OUT FOR ELEVATION VIEW.



LEGEND



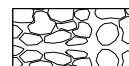
REINFORCED BACKFILL MATERIAL



ROAD BASE AGGREGATE



PAVEMENT



RIPRAP



HOLLOW CONCRETE MASONRY UNIT (CMU)



PIGMENTED SOLID CONCRETE MASONRY UNIT (CMU)



CONCRETE FILLED CONCRETE MASONRY UNIT (CMU)

NOTES

1. INSERT #4 REBARS INTO THE TOP 3 ROWS OF CMU'S AND ALL ROWS OF CORNER CMU'S ABOVE THE RIPRAP LINE AND FILL WITH CONCRETE.
2. FINISH CMU CONCRETE FILL AT TOP OF CMU'S UNDER BRIDGE GIRDERS SLOPED TO DRAIN.
3. ON TOP ROW OF CMU'S CREATE A MORTAR CAPPING APPROXIMATELY 1 1/2" THICK. SEE COPING DETAIL ON SHEET 4.
4. THE SOLID CMU IN BEAM SEAT MUST ENGAGE THE UPPER-MOST CONCRETE FILLED CMU FACING BY 1/3 OF THE BLOCK HEIGHT.
5. WATERPROOFING METHODS ARE DEPENDANT ON THE SUPERSTRUCTURE TYPE, BUT CAN INCLUDE ROYSTON OR BITUMEN WATERPROOFING, 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. PIGMENTED CMU'S ARE RECOMMENDED.
- ③ DEPTH DESIGNED TO SATISFY INTERNAL STABILITY WITH MINIMUM OF 5 LAYERS OF BEARING BED REINFORCEMENT; LENGTH MIN. $2a \geq b$
- 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.
- ⑨ ALUMINUM FLASHING AND P.C.P. FOAM BOARD ON TOP OF CMU FACING IS OPTIONAL.

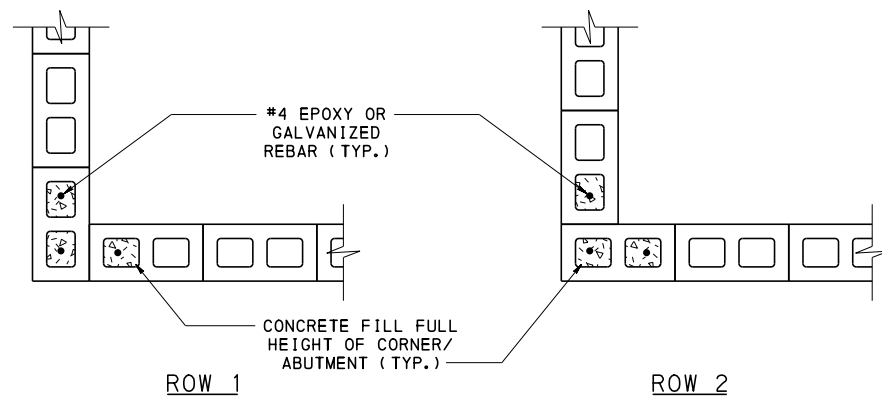
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STANDARD GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM DETAILS

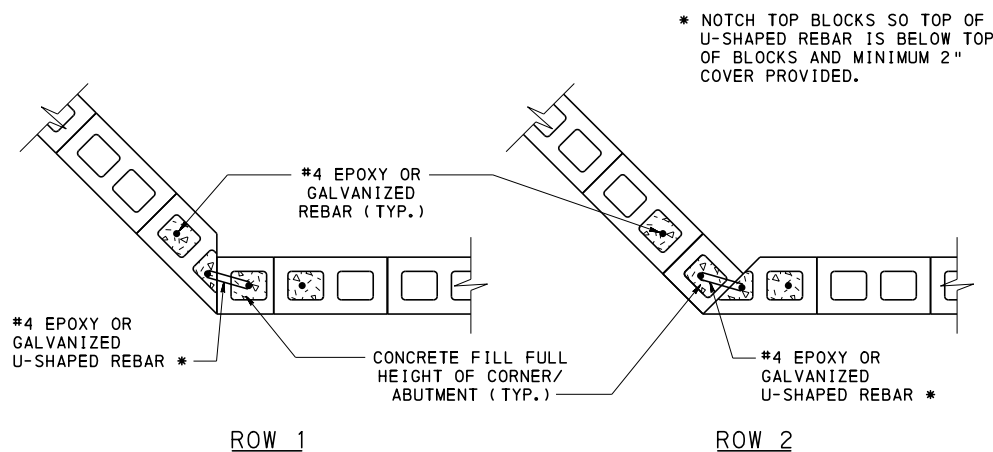
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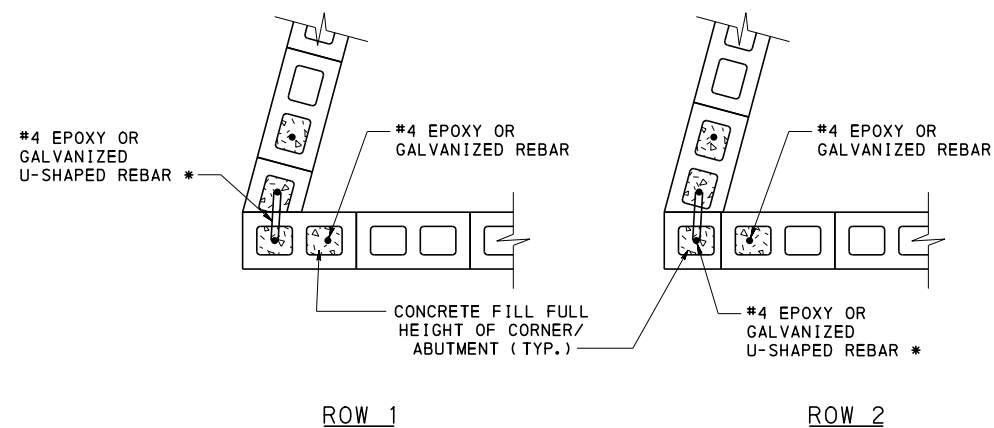


CORNER DETAIL (90°)



CORNER DETAIL (> 90°)

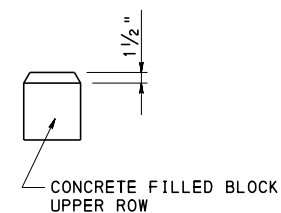
NOTE: MANUFACTURED ANGLED CORNER UNITS ARE ALSO POSSIBLE. CHECK AVAILABILITY BEFORE SPECIFYING.



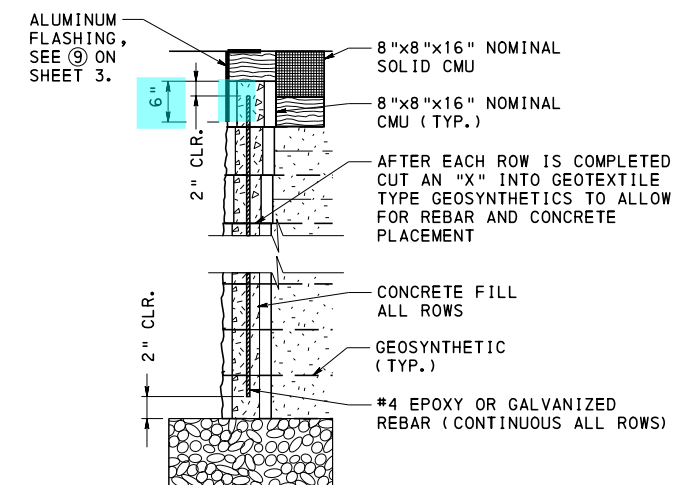
CORNER DETAIL (< 90°)

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.

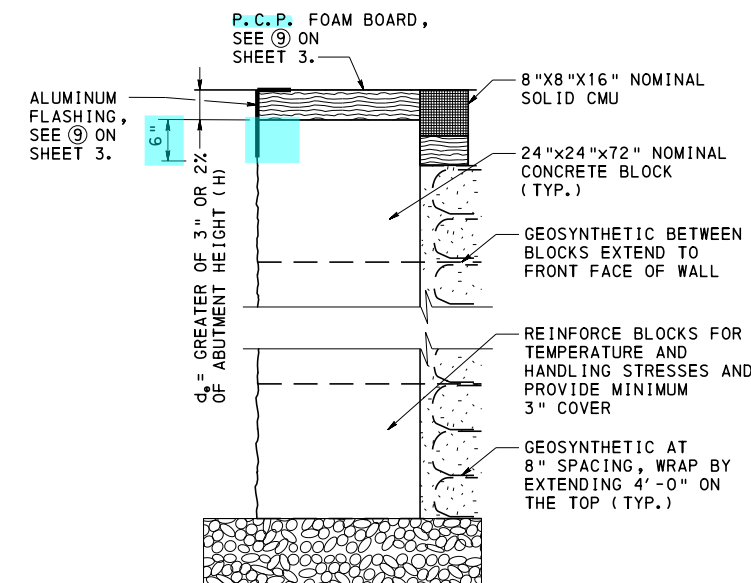


COPING DETAIL



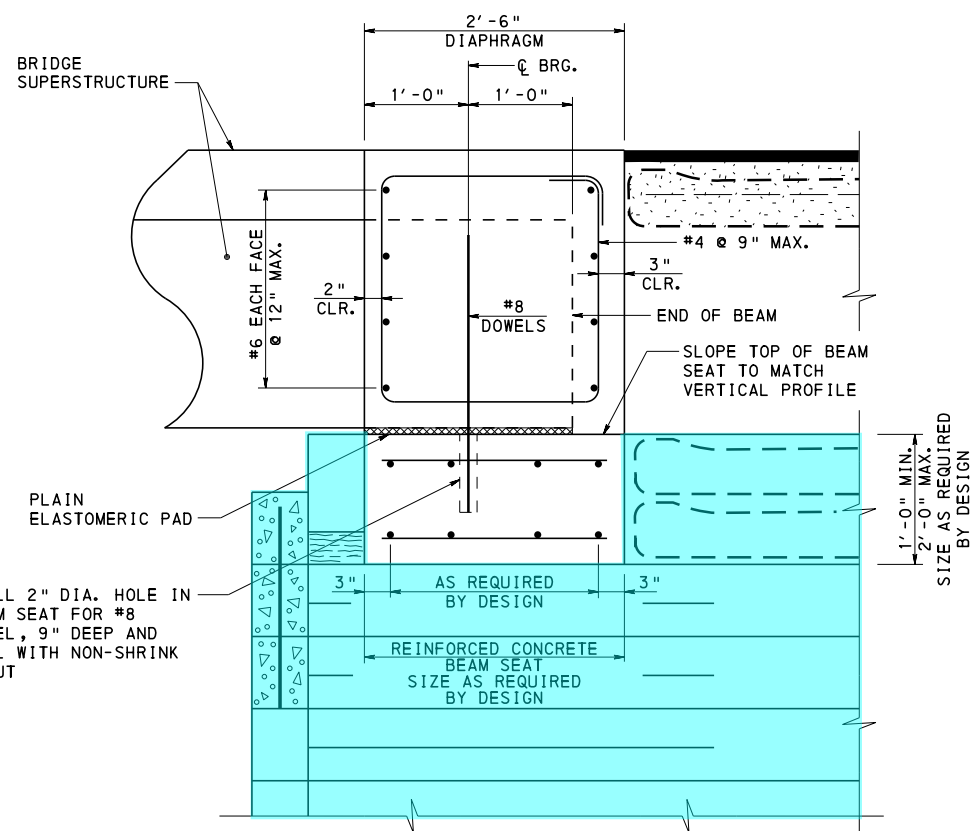
NOTE: FOR SITES WITH 100-YEAR WATER VELOCITIES LESS THAN OR EQUAL TO 7 FPS, ONLY TOP 3 ROWS AND ALL CORNER UNITS MUST CONTAIN REBAR AND BE CONCRETE FILLED.

8"x8"x16" NOMINAL CMU ALL ROWS CONCRETE FILLED
(SITES WITH 100 YEAR WATER VELOCITIES GREATER THAN 7 FPS AND LESS THAN OR EQUAL TO 10 FPS)



24"x24"x72" NOMINAL SOLID BLOCK
(SITES WITH 100 YEAR WATER VELOCITIES GREATER THAN 10 FPS AND LESS THAN OR EQUAL TO 12 FPS)

FACING REQUIREMENTS & DETAILS



CONCRETE BEAM SEAT DETAIL

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**STANDARD
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