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| <p><b>SUBJECT:</b></p> <p style="text-align: center;"><b>Revisions to<br/>Design Manual, Part 1C<br/>Transportation Engineering Procedures<br/>November 2015 Edition, Change No. 4</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                                                                                                                          |
| <p><b>INFORMATION AND SPECIAL INSTRUCTIONS:</b></p> <p>Incorporate the attached revisions into the November 2015 Edition of Publication 10C.</p> <p>These new guidelines should be adopted on all new and existing designs as soon as practical without affecting any letting schedules.</p> <p><b>TABLE OF CONTENTS</b></p> <p>-Updated for consistency with the revisions made as described below and with previously issued changes.</p> <p><b>CHAPTER 1 INTRODUCTION</b></p> <p>*Section 1.0 (Purpose and Objectives)<br/>*Section 1.1.A (Design Manual Series of Documents)</p> <p>-Deleted sentence at end of section with reference to Publication 70M, Guidelines for the Design of Local Roads and Streets.</p> <p><b>CHAPTER 3 PRELIMINARY ENGINEERING PROCEDURES</b></p> <p>*Section 3.5.K (Utility Identification and Verification)</p> <p>-Revised the second paragraph by adding second sentence that identifies information available on the PA One Call website.</p> <p>-Added eighth paragraph with reference to Publication 10, Design Manual 1, Chapter 8, Section 8.6 (Alleged Violation Report).</p> <p>*Section 3.6.D.3 (Plan Deliverables)</p> <p>-Revised subsection d (Typical Sections), first bullet by adding fourth and fifth sentences regarding preliminary pavement designs.</p> |                                  |                                                                                                                          |

## CHAPTER 4 FINAL DESIGN PLAN DEVELOPMENT

### \*General

-Revised Project Schedules, Specifications and Constructability Section to Contract Management Section.

-Deleted metric units.

### \*Section 4.9.H (Roadway Lighting)

-Revised every paragraph in subsection 1 (General Lighting Policies) except the last paragraph.

-Revised first, second, third, sixth, and seventh paragraphs in subsection 2 (Lighting Design Approval Procedures).

-Revised paragraph in subsection 3 (Legal Agreement Review and Preparation Procedures).

-Revised third, sixth, and seventh paragraphs in subsection 4 (Guidelines for Highway Lighting Agreements with Electric Utility Companies).

### \*Section 4.13.J (Addenda)

-Revised section label (was Section 4.13.K).

### \*Section 4.13.K (Disposal of Engineering Drawings)

-Revised section label (was Section 4.13.L).

### \*Section 4.14.C (Contract Management Review)

-Revised eighth paragraph by deleting "up to 10 days" before "prior to bid opening".

Gender neutral language has been updated in all revised pages, i.e., Table of Contents; Chapter 1; Chapter 3; and Chapter 4.

Any comments or questions regarding the above revisions should be directed to the Highway Design and Technology Section, Highway Delivery Division, Bureau of Project Delivery.

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Table of Contents - all pages  
Chapter 1 - all pages  
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# **Publication 10C**

# **Design Manual Part 1C**

## **Transportation Engineering Procedures**

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# DESIGN MANUAL PART 1C

## TRANSPORTATION ENGINEERING PROCEDURES

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# CHAPTER 1

## INTRODUCTION

### 1.0 PURPOSE AND OBJECTIVES

Transportation engineering is a highly complex and time-consuming process that involves a large number of diverse interests, technical disciplines, regulations and review authorities. Because of their large physical size, functional requirements, and long life expectancies, transportation projects can have major fiscal, environmental, and social impacts that must be carefully evaluated during project development. It is in the public interest that licensed and/or trained professionals following established policies and procedures advance these projects in a timely and cost effective manner.

The purpose of this manual is to provide an overview of the engineering procedures required to support the Pennsylvania Department of Transportation's (PennDOT's) Transportation Program Development and Project Delivery Process (Process, See [Figure 1.1](#)). PennDOT developed this manual to serve as a guide for PennDOT employees and consultants, who are responsible for advancing projects through the Process. Familiarity with the procedures described herein will contribute to improved efficiency in the coordination and advancement of projects.

This manual is not intended to be a substitute for experience or sound judgment. Because every project offers different challenges, imaginative application or modification of the procedures described in this manual may be necessary to advance a project and achieve project specific objectives. All transportation projects should be sustainable and provide transportation choices that are place-based and centered on people. A focus on mobility for all users, design of projects that fit the community/project setting, and proper application of the design process' and design criteria's inherent flexibility should always be the goal. The guidance provided in this manual is PennDOT policy for project delivery but not a federal or state regulation. Following this guidance will assist in assuring compliance with relevant state and federal regulations.

For information on the processes associated with developing a local transportation project, see Publication 740, *Local Project Delivery Manual*.

### 1.1 ORGANIZATION

**A. Design Manual Series of Documents.** This manual is Part 1C of a nine-volume series of documents that encompass PennDOT's Design Manual. The Design Manual series of documents includes:

|                 |         |                                                                        |                       |         |
|-----------------|---------|------------------------------------------------------------------------|-----------------------|---------|
| Publication 10  | Part 1  | <i>Transportation Program Development and Project Delivery Process</i> | Design Manual Part 1  | (DM-1)  |
| Publication 10A | Part 1A | <i>Pre-TIP and TIP Program Development Procedures</i>                  | Design Manual Part 1A | (DM-1A) |
| Publication 10B | Part 1B | <i>Post-TIP NEPA Procedures</i>                                        | Design Manual Part 1B | (DM-1B) |
| Publication 10C | Part 1C | <i>Transportation Engineering Procedures</i>                           | Design Manual Part 1C | (DM-1C) |
| Publication 10X | Part 1X | <i>Appendices to Design Manuals 1, 1A, 1B, and 1C</i>                  | Design Manual Part 1X | (DM-1X) |
| Publication 13M | Part 2  | <i>Highway Design</i>                                                  | Design Manual Part 2  | (DM-2)  |
| Publication 14M | Part 3  | <i>Plans Presentation</i>                                              | Design Manual Part 3  | (DM-3)  |
| Publication 15M | Part 4  | <i>Structures</i>                                                      | Design Manual Part 4  | (DM-4)  |
| Publication 16  | Part 5  | <i>Utility Relocation</i>                                              | Design Manual Part 5  | (DM-5)  |

Design Manual Part 2 through Design Manual Part 5 are transportation engineering manuals that provide technical details and further clarify information contained in Design Manual Part 1C.

**B. Contents of Design Manual Part 1C.** Design Manual Part 1C, *Transportation Engineering Procedures*, contains five chapters. This section provides a brief summary of each.

**Chapter 1**, Introduction, describes the purpose of Publication 10C, Design Manual Part 1C, *Transportation Engineering Procedures*, provides an overview of PennDOT's Design Manual family, and summarizes the contents of the subsequent chapters and appendices. This chapter also outlines the proper procedures for implementing modifications and additions to this document.

**Chapter 2**, Pre-TIP and TIP Project Development and Scoping, explains the engineering activities that occur during the Pre-TIP and TIP development phases of the Process (steps 1 through 5 on [Figure 1.1](#)). Chapter 2 also discusses the objectives of the screening field view, the responsibilities of the screening team, and why the decisions made at this stage of the process are critical to a project's delivery. This chapter describes the various activities required for successful project scoping, and identifies a series of engineering, environmental, and public involvement issues that should be evaluated at scoping.

**Chapter 3**, Preliminary Engineering Procedures, describes Preliminary Engineering as a range of engineering activities required to support environmental studies, develop a range of preliminary alternatives, identify a preferred alternative, and prepare a Design Field View Submission.

**Chapter 4**, Final Design Plan Development, focuses on final design plan development. It describes in general terms the steps required to assemble a complete Plans, Specifications, & Estimates (PS&E) package and prepare it for contract letting.

**Chapter 5**, Construction Review Procedures, examines the procedures for construction value engineering and includes a form for contractor's design evaluation. Also included are procedures for processing shop drawing submittals and procedures for preparing "As-built" drawings.

## 1.2 PROCEDURES FOR MODIFICATIONS OR ADDITIONS TO THIS DOCUMENT

This document is published in digital form to facilitate future changes and additions. PennDOT recognizes that the regulations and policies affecting its engineering procedures are continuously changing and that this manual must be a dynamic document to remain current. Whenever modifications or additions are required to improve the present procedures, the following procedure shall be followed:

1. Bureau Directors and District Executives should submit suggestions in the form of revised pages in digital form to the Central Office Bureau of Project Delivery for evaluation and processing. The Bureau of Project Delivery is to evaluate and process the submittals, and coordinate with other Central Office Deputates and Bureaus as necessary concerning any changes and/or additions. The suggestions should include:
  - The title and page number of the existing procedures if applicable,
  - The recommended revised page(s) and the Chapter into which it (they) should be incorporated, and
  - The reasons for recommending modifications or additional procedures.
2. The Director, Bureau of Project Delivery, will review the recommended changes or additional procedures and transmit copies to the various affected Bureau Directors for their comments.
3. The affected Bureau Directors shall provide their comments to the Director, Bureau of Project Delivery, who will take appropriate action.
4. The Director, Bureau of Project Delivery will submit the final version of all changes to FHWA for approval prior to issuing the revised manual.
5. When modifications or additions are made to pages in this manual, a revision date will be indicated below the page number in the upper right-hand or upper left-hand corner, and the revision will be distributed by the Bureau of Project Delivery by Transmittal Letter.

### **1.3 PLAN SHEETS DELIVERY, PRINTING AND PLOTTING ORDER OF PREFERENCE**

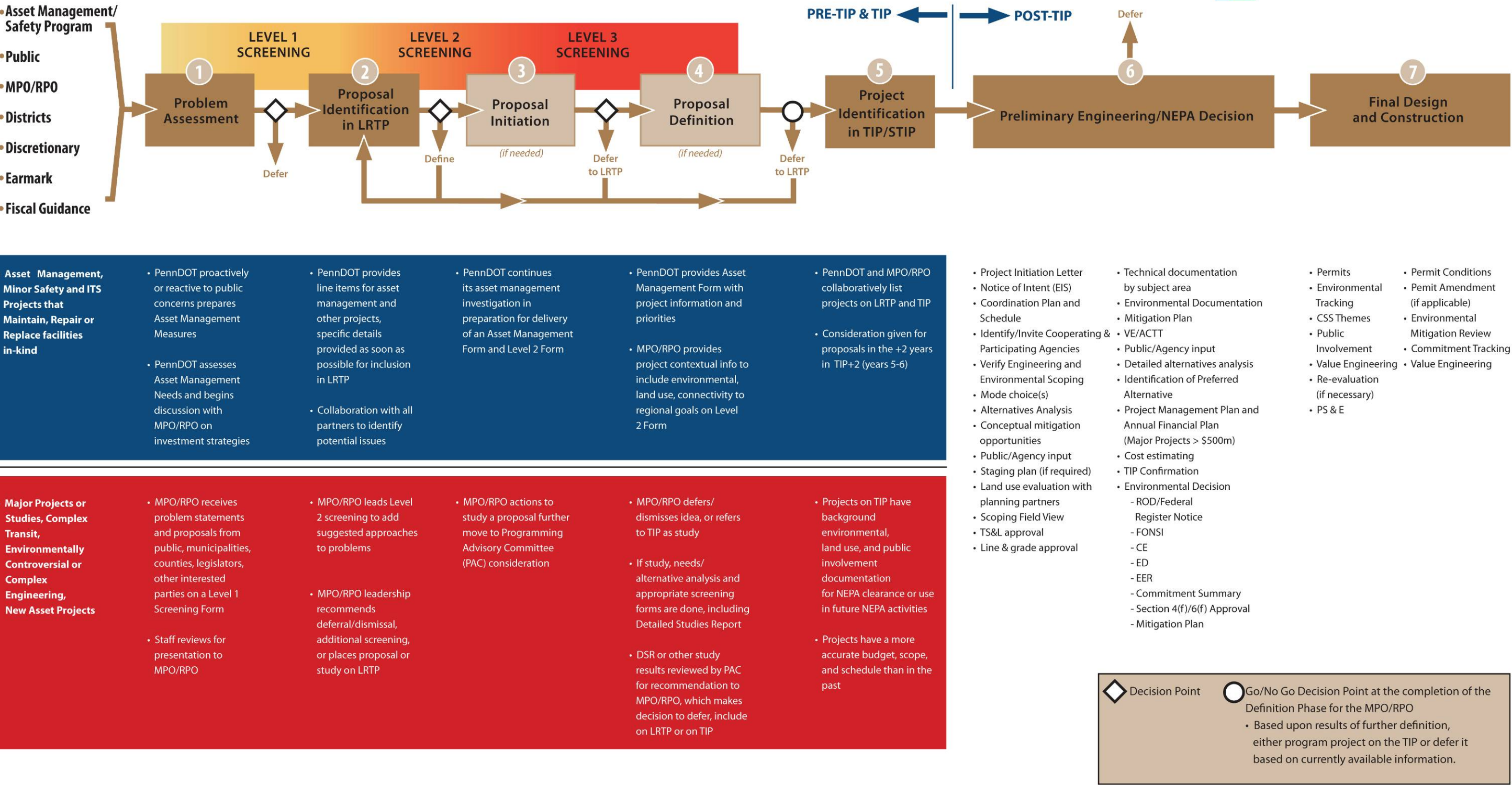
In order to decrease the use of plotters for full-size plan sheets and reduce the consumption of paper, utilize the following order of precedence:

1. Distribute plan sets for either plan review or construction as an electronic file.
2. In circumstances that require a hard-copy set of plans, opt for half-size (11 in × 17 in) printed to laser prints in lieu of plotting a full-size (22 in × 34 in).
3. Provide a full-size plot (22 in × 34 in) only upon request to the District Project Manager.

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# Transportation Program Development and Project Delivery Process



## CHAPTER 2

### PRE-TIP AND TIP PROJECT DEVELOPMENT AND POST-TIP SCOPING

#### 2.0 OVERVIEW OF PRE-TIP AND TIP PROJECT DEVELOPMENT ENGINEERING ACTIVITIES AND POST-TIP SCOPING

During the Pre-Transportation Improvement Plan (TIP) and TIP Project Delivery Phases (see [Figure 2.1](#)), the main responsibilities for identification of potential problems/proposals (possible future design projects) will rest with the Metropolitan and Rural Planning Organizations (MPO/RPO) and the PennDOT District's Planning and Programming Staff utilizing the Long Range Transportation Planning (LRTP) project prioritization process (see Publication 10A, Design Manual Part 1A, *Pre-TIP and TIP Program Development Procedures*). The District's engineering and environmental staff will be involved for technical support, reviews, assessment of purpose and needs, development of conceptual alternatives, development of design and construction cost estimates, and participation during screening field views, as required.

PennDOT recommends that evaluations of conceptual alternatives, including preliminary design and construction (project) cost estimates, and a screening field view, if required, occur during the Proposal Initiation and Definition Steps 3 and 4 (see [Figure 2.1](#)). This is particularly true for more complex or higher NEPA class of action level proposals (see Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*). A screening field view is not required, but can be used to ensure that a full understanding is developed of potential proposals. This will help during proposal prioritization to ensure that the projects being advanced meet PennDOT's Core Principles, as discussed in more detail in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*. Briefly, PennDOT's ten principles are:

1. Money counts/fiscal constraints/scalable projects
2. Choose projects with high value to price ratio/Project Evaluation
3. Enhance the local network
4. Look beyond Level-of-Service/use Context Sensitive Solutions for Transportation Improvements/Sustainability
5. Safety always and maybe safety only
6. Accommodate all modes of travel
7. Leverage and preserve existing investment/Asset Condition
8. Build towns and not sprawl
9. Understand the context; plan and design within the context/scalable projects (see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix B, Glossary)
10. Develop local governments as strong land use partners/coordination with counties, municipal governments, and the public

The intent of these project delivery principles is to ensure that the existing transportation system is being well-maintained and that new transportation projects truly fit the scope and scale of the need, contribute to more livable communities, and provide for alternate modes of travel and transportation choices that benefit all users. The screening field view activities and the entire Pre-TIP Planning Process must result in potential projects that have high benefit to cost ratios (intended to be qualitative assessments generally requiring PennDOT / MPO/RPO staff to consider the overall value of the project in light of its costs; it is not intended to be a quantitative assessment). This starts with developing a thorough and complete understanding of the project area context (or setting) in a Transportation, Community, and Land Use (existing and future) sense and the need for the project or action.

Screening should then focus on scaling proposals to fit the context and need. Additionally, the screening process must evaluate how well the proposed action coordinates with regional and local land use and development planning initiatives, which may require consideration of not only the current project area context, but how the project area may develop and change during the design life of the project/action. Inviting and encouraging participation by all of PennDOT's Planning Partners and internal technical staff is vital to proper project screening and understanding.

For all projects, formal Engineering and Environmental Scoping (hereafter to be referred to as "Scoping") will be completed at the beginning of Step 6. Verification of screening information from the Proposal Definition Step should occur at the beginning of Step 6 and include a formal Scoping Field View involving more technical and resource-oriented staff. In accordance with 23 CFR 771, *Environmental Impact and Related Procedures* the FHWA considers scoping and early coordination activities to be valuable "...in determining the scope of issues to be addressed and in identifying and focusing on the proposed action's important issues. This process normally entails the exchange of information with appropriate Federal, State and local agencies, and the public from inception of the proposed action to preparation of the environmental document or to completion of environmental studies for applicable CEs" (FHWA Technical Advisory T 6640.8A, *Guidance for Preparing and Processing Environmental and Section 4(f) Documents*, October 30, 1987).

The following sections describe in more detail how the engineering activities (Pre-TIP purpose and need, conceptual alternatives analysis, project cost estimate, and screening field view [if held for complex projects]) completed during the first five phases of PennDOT's Process carry into the scoping process during Step 6 (see [Figure 2.1](#)). More details on the Pre-TIP and TIP development phases can be found in Publication 10A, Design Manual Part 1A, *Pre-TIP and TIP Program Development Procedures*, while more details on the Scoping as related to NEPA documentation, can be found in Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*.

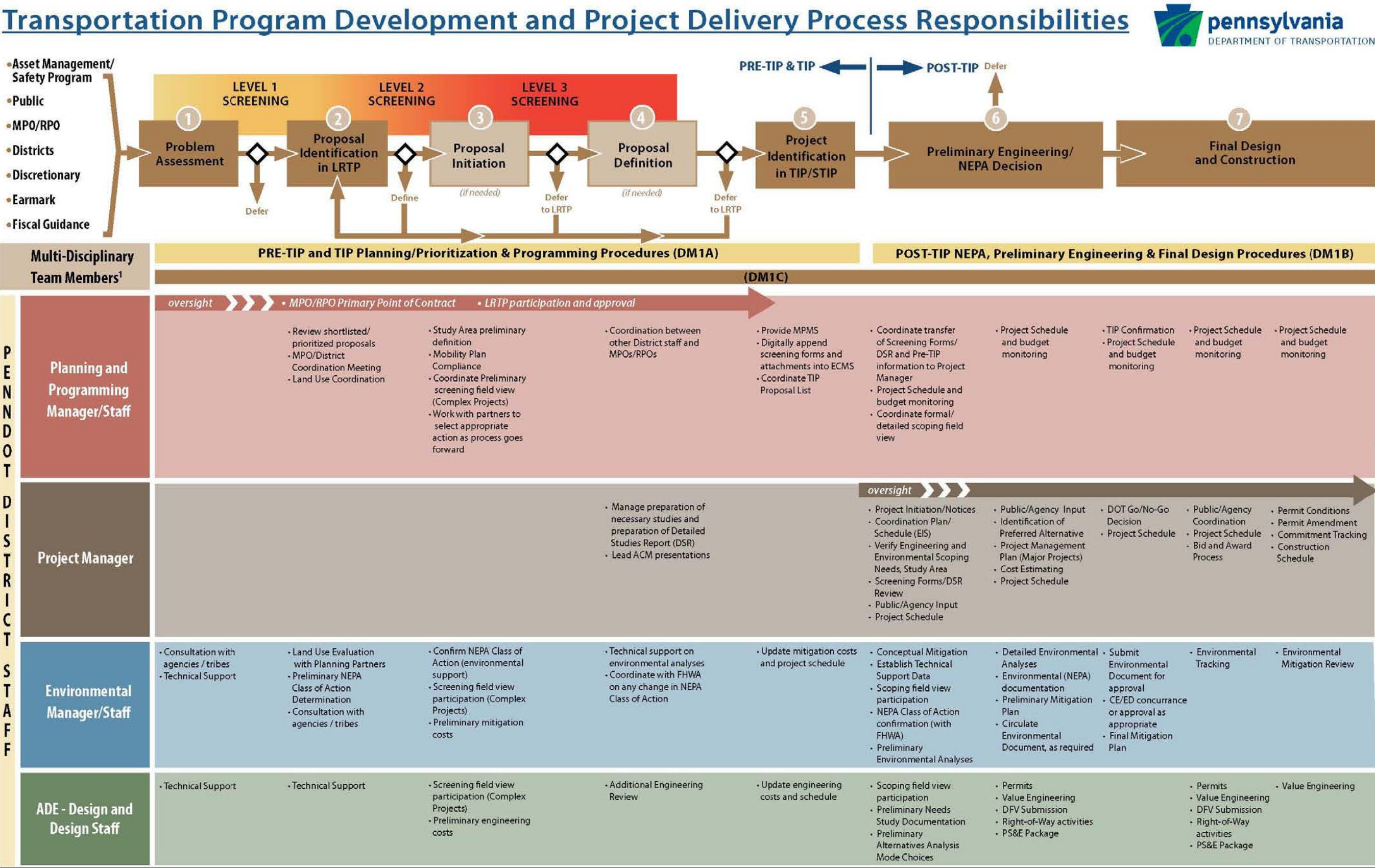
## 2.1 PRE-TIP PROJECT DEVELOPMENT ENGINEERING ACTIVITIES

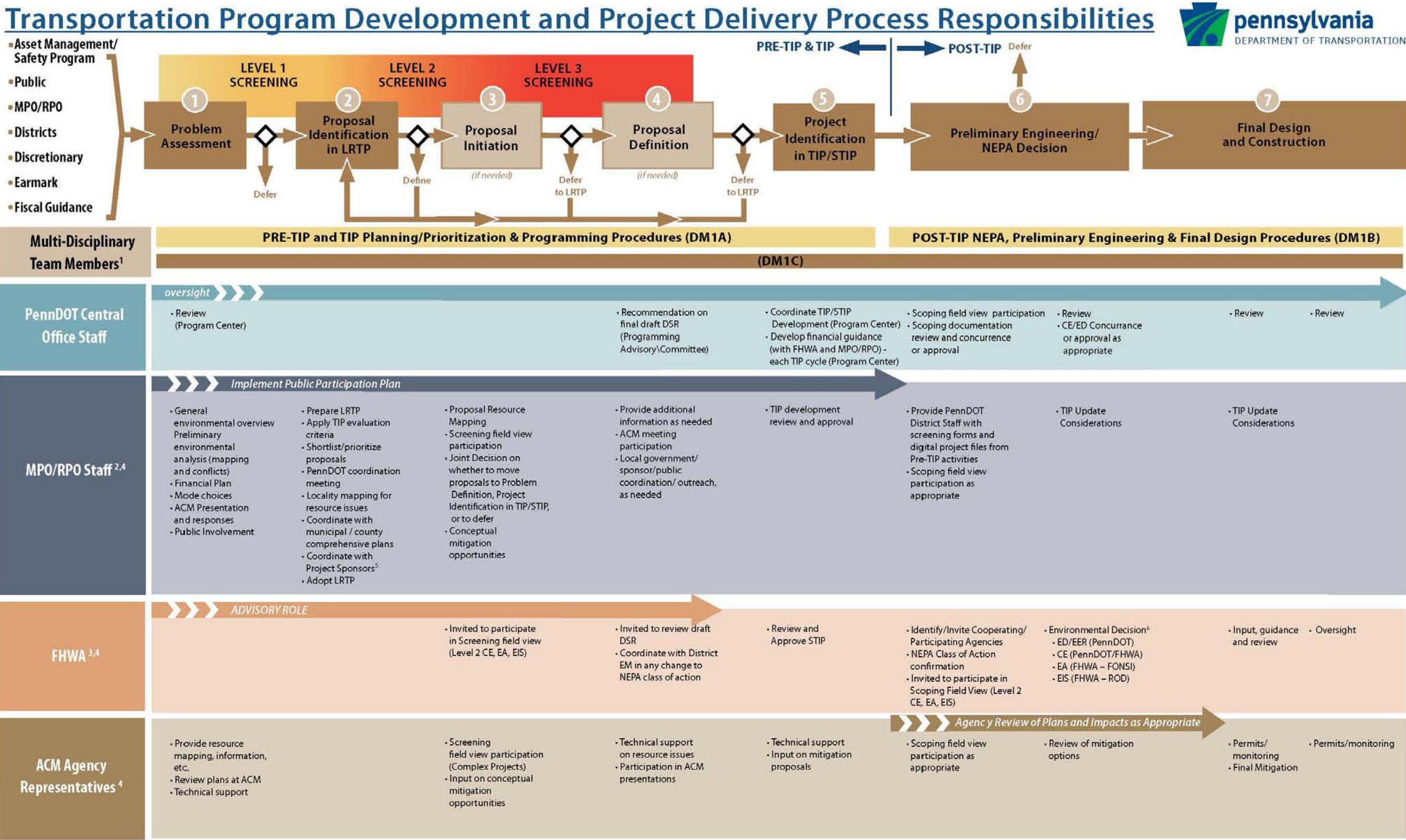
Key engineering activities that occur early in the project development process are Pre-TIP purpose and need, Pre-TIP conceptual alternatives analysis, Pre-TIP project cost estimate, and Pre-TIP screening field view participation, if required.

**A. Pre-TIP Purpose and Needs.** The Pre-TIP phases are vital in defining a preliminary proposal and for ensuring that high value projects are programmed for inclusion in the STIP. Purpose and need is a crucial baseline for future project development activities. A sound understanding of purpose and need leads to balanced solutions that fit the project area and transportation context (see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix B, Glossary) and are fundable. Input into Pre-TIP Purpose and Need from PennDOT's Engineering, Environmental, and Planning staff is vital to developing a thorough understanding of the transportation issues. During the Pre-TIP phases a Purpose and Need analysis should be completed by the MPO/RPO with assistance from PennDOT, particularly for higher Class of NEPA Action projects (EIS, EA, EER, and possibly, depending on the project scope, CE/ED Level 2). Pre-TIP purpose and need information/documentation should be verified and serve as the basis for development of the project during the Post-TIP Preliminary Engineering and NEPA Project Delivery Phases.

Detailed discussion on Purpose and Need follows in [Section 3.5.A](#). Also, see Publication 319, *Needs Study Handbook* for information on preparing and documenting Project Purpose and Need, and the American Association of State Highway and Transportation Officials (AASHTO) Practitioner's Handbook #07, *Defining Purpose and Need and Determining the Range of Alternatives for Transportation Projects*.

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1 Note that Team Member responsibilities designate the traditional lead role for each activity; other team members / disciplines may be involved as necessary with each activity.  
2 MPO/RPO = Metropolitan Planning Organization/Rural Planning Organization  
3 FHWA = Federal Highway Administration; may also be Federal Transit Administration (FTA), Federal Aviation Administration (FAA), or Federal Railroad Administration (FRA).  
4 Activities listed for outside agencies are only those that are directly a part of PennDOT's Transportation Project Development and Project Delivery Process; internal agency activities (i.e. permit approvals, tracking, etc.) are not included.  
5 Sponsor whose proposals are not selected to enter the Proposal Initiation Phase may want to consider developing additional alternate solutions and resubmitting for possible consideration as a TIP amendment.  
6 Review and approval authority varies with the NEPA Class of Action level. Refer to DM1B for detailed information on review requirements and approval authority for the different NEPA Classes of Action.

Figure 2.1 Page 2 of 2

**B. Pre-TIP Conceptual Alternatives Analysis.** During the Pre-TIP phases a conceptual alternative analysis should be completed by the MPO/RPO with assistance from PennDOT, particularly for higher Class of NEPA Action projects (EIS, EA, EER, and possibly, depending on the project scope, CE/ED Level 2). This conceptual alternatives analysis should focus on identifying potential solutions and assessing whether or not they will meet project needs. Both traditional (turning lanes, new travel lanes, new alignment options, etc.) and non-traditional (traffic calming, transit options, transportation system management options, etc.) solutions should be considered, as should use of alternative modes of transportation to meet project needs. Low-cost options should be considered first, with higher cost options only being considered if low-cost options that meet project needs cannot be identified. For more information, refer to the AASHTO Practitioner's Handbook #07, *Defining Purpose and Need and Determining the Range of Alternatives for Transportation Projects*. Additionally, due to the significant safety and operational benefits of roundabouts, they are to be considered for all significant intersection and corridor improvement projects and as required in the Intersection Control Evaluation (ICE) policy in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AI, Intersection Control Evaluation (ICE) Policy. The ICE results should be evaluated in combination with other factors, such as environmental constraints.

Due to asset management considerations, as part of the project development process, an evaluation of the benefits of eliminating a bridge versus upgrading the existing bridge is to be considered. The process to evaluate the elimination of a bridge is contained in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AD, Study Process to Evaluate Bridge Closure and Removal.

A high level of engineering is not required at this stage; however, input from PennDOT engineers should be sought to help identify and conceptually analyze potential solutions. As stated in [Section 3.4.D](#), potential solutions should not only attempt to meet project needs, but fit the scale of the project and the area's context. Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures* contains more information on factors to consider when analyzing solutions (potential alternatives).

Documentation of the Conceptual Alternatives Analysis is very important during the Pre-TIP phases. For the analysis to be useful during the Post-TIP NEPA phases, the documentation must clearly layout:

- What alternatives were evaluated, including the process for selecting alternatives to analyze?
- How the analysis was conducted (methodology).
- The results of the analysis, including:
  - How alternatives meet the needs
  - Preliminary construction cost estimates for each alternative
  - Preliminary environmental impacts for each alternative (based on readily available, existing data from resource agencies and other sources).
  - What alternatives were deferred from consideration and why.
  - What alternatives should be moved forward to the Post-TIP phases and why.

**C. Pre-TIP Cost Estimate.** During the Pre-TIP phases, a preliminary, but justifiable, estimate of project costs should be developed for alternatives recommended to the TIP. This preliminary design and construction cost estimate will become the basis for the project costs funded on the TIP. It will also be the baseline for comparison of future updated construction cost estimates. The Pre-TIP preliminary project cost estimate should include careful consideration of inflation factors. Refer to the latest TIP/STIP Financial Guidance (PennDOT, Office of Planning, Center for Program Development and Management) for more information. Costs should be inflated to the anticipated year of use; in other words preliminary construction costs should be inflated to the estimated construction let date (Year of Expenditure). The importance of this Pre-TIP project cost estimate cannot be overstated. This estimate provides the amount that will be programmed for funding and should accurately reflect the project scope and scale to avoid cost overruns to all extents possible.

Estimating and containing project costs is a key project management responsibility that begins at screening and continues throughout project development and delivery. One of the primary functions of screening is to develop an accurate preliminary project (design and construction) cost estimate of proposal costs, use it as the programmed cost for the TIP, and compare it to the future updated cost estimate. This preliminary project cost should be held as the baseline for the project and revisited throughout project development as the project becomes increasingly well defined.

An effective way of containing project costs is to control project scope at the screening field view, if held during Step 4 and at the Scoping Field View held in Step 6 and throughout project development. It is important that the Scope of Work developed at the Scoping Field View be achievable within the budget that will be approved by the Program Management Committee (PMC). For projects to be constructible, they must be fundable.

The project cost estimate should be based on realistic estimates for the time of expenditure of the following costs:

- Preliminary Engineering (including the need for consultant services)
- Final Design
- Right-of-Way
- Utilities
- Railroad coordination
- Mitigation commitments
- Construction
  - Construction Inspection

PMC action will be required if at any time estimated costs exceed the programmed costs as shown on the TIP by \$1 million or more. The Project Manager is to submit this information, including historical cost information, to the District Planning & Programming Manager for presentation to the MPO or RPO, PennDOT, and FHWA/FTA. Justification for cost increases will focus on project cost and scope, and any cost containment measures that have already been taken. Estimated costs exceeding programmed costs by less than \$1 million, but more than \$500,000, require action by the Center for Program Development and Management. Estimated costs exceeding programmed costs by less than \$500,000 require approval from the District Executive. More information on construction cost estimating for PennDOT projects can be found in Publication 352, *Estimating Manual*.

**D. Pre-TIP Screening Field Views.** During the Pre-TIP phases, a screening field view can be conducted to verify information that is suspect or incomplete, to ensure that other applicable transportation initiatives are being addressed, and gather any additional data deemed necessary to effectively decide if the proposal should be continued into the LRTP and on to TIP/STIP. Screening field views are not required for all projects, but are recommended for complex proposals entering Step 4, Proposal Definition.

Screening field views should be performed by multi-disciplinary teams including MPO/RPO staff; District environmental, engineering, and planning and programming staff and resource agency staff as appropriate. PennDOT Bureau of Project Delivery (BOPD), Highway Design and Technology Section (HDTs) and FHWA staff should be invited for complex projects. Invitations to attend the screening field view come from the Programming Advisory Committee unless otherwise delegated. If a Pre-TIP screening field view is held, PennDOT Engineering and environmental staff should be invited to participate. Participation from PennDOT's Engineering and environmental staff is vital to developing a thorough understanding of the transportation issues.

Topics to be reviewed / discussed at Pre-TIP screening field views are: Pre-TIP purpose and need, Pre-TIP range of reasonable potential solutions to address the needs, and potential environmental resource impacts and mitigation measures. The Pre-TIP screening field view should be documented and included or attached to the Level 3 Screening Form.

If held, Pre-TIP screening field view information/documentation should be verified and serve as the basis for development of the project during the Post-TIP Preliminary Engineering and NEPA Project Delivery Phases. Detailed information on Pre-TIP screening field views is presented in Publication 10A, Design Manual Part 1A, *Pre-TIP and TIP Program Development Procedures*, Chapter 6.

## 2.2 THE SCOPING PROCESS

**A. Purpose.** The Scoping process is a vital part of a project's development. All projects regardless of size, location, complexity, funding, or oversight status are subject to Scoping. The purpose of Scoping is to:

- Discuss engineering issues associated with the project
- Develop a scope of work for preliminary engineering
- Assess the Project Complexity Level (see Tables 2.1, 2.2, and 2.3 in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*)
- Assess the level of environmental studies required to obtain environmental clearance
- Assess the level of effort required to advance the project to PS&E submittal, and to
- Develop an accurate preliminary cost estimate of project construction costs to compare to programmed costs.

A comprehensive scoping accomplishes the following:

- Provides a clear description of the project's objectives and purpose and need.
- Identifies the project limits, study area, including the area's context (i.e., Transportation: Regional or Community Arterial, Community or Neighborhood Collector, or Local Street; Place: Rural, Suburban Neighborhood, Corridor, or Center, Town/Village Neighborhood or Center, or Urban Core, etc.) and logical termini.
- Determines the Project Complexity Level (see Tables 2.1, 2.2, and 2.3 in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*).
- Identifies engineering issues related to the project.
- Identifies the preliminary NEPA Class of Action (see Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*).
- Documents the potential presence or absence of environmental features (cultural, social, and natural) and the potential impact to those features and possible project constraints due to those features (if any).
- Identifies possible design and/or construction techniques to avoid or minimize potential impacts to environmental features.
- Identifies the number of and best fit (See [Section 3.4](#)) alternatives to be studied to meet the project's objectives and purpose and need; particularly if there are environmental resources in the study area that require development of avoidance and minimization alternatives. Any potential alternative/solution should not only meet the project purpose and need, but should fit the area's transportation context (i.e., type of facility - regional or community arterial, community or neighborhood collector, or local street; how it fits within the transportation network, etc.), community context (i.e., rural, suburban neighborhood/corridor/center, town neighborhood/center, or urban core; gateways, recognizable symbol, etc.), and land use context (i.e., residential, commercial, industrial, mixed - existing and future) and contribute to a more livable community and sustainable transportation facility.
- Preliminary considerations shall be given to potential work zone impacts and to what degree those considerations may influence the evaluation and selection of a build alternative. A strategy for developing the Transportation Management Plan shall be developed. Additional studies and information needs shall be identified that will assist in determining whether the project is "significant" and in developing the final Transportation Management/Traffic Control Plan. See Publication 46, *Traffic Engineering Manual*.

- Identifies the project specific deliverables required for project development.
- Documents the evaluation of key issues affecting project development.
- Serves as the basis for a consultant Scope of Work.
- Assists the Project Manager in developing the project schedule.
- Allows documentation of bicycle and pedestrian needs and completion of the Bicycle and Pedestrian Checklist, see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix S.

This section describes the formal scoping process and activities that occur after a project is on the TIP and has received notice to proceed. Particular emphasis is placed on the need to follow a single, consistent process that provides structured flexibility and can be easily adapted to all types of projects. The purpose of this section is to acquaint potential scoping team members with the proper procedures for Scoping Field Views and Scoping Documentation.

Scoping Field View and Scoping Documentation procedures are also provided in Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*, Chapter 3, but that section is focused on the Environmental Manager's role.

## **B. Scoping Activities.**

The Scoping Process includes the following seven steps:

- Obtain and Review Pre-TIP Information Including PennDOT Connects Forms
- Begin to Prepare the Scoping Documentation
- Assemble Multi-Disciplinary Scoping Team
- Gather Information and Data
- Coordinate Scoping Field View
- Conduct Scoping Field View
- Complete Scoping Documentation

**1. Obtain and Review Pre-TIP Information Including PennDOT Connects Forms.** The first activity to be performed in the scoping process entails obtaining and verifying information gathered during the Pre-TIP phases, including PennDOT Connects Forms completed previously during Steps 2, 3, and 4. After obtaining this information, the District's Planning and Programming Manager or Project Manager, if one has been assigned, should verify the accuracy and applicability of the Pre-TIP analysis and documentation, including the PennDOT Connects Forms.

The Scoping Document utilizes information gathered in pre-TIP/STIP phases, contained in the PennDOT Connects form completed (and the Detailed Studies Report (DSR), if prepared). The information and data from the PennDOT Connects form (and the DSR, if prepared) will be used to begin to populate the Scoping Document. Verification of this information must be performed in order to accept this information as the basis for scoping in NEPA.

The following questions need to be considered when verifying data and/or analyses from pre-TIP/STIP process phases:

- How much time has passed since the studies from pre-TIP/STIP phases and corresponding decisions were made?
- Were the future year policy assumptions used in the pre-TIP/STIP phases of the process related to land use, economic development, transportation costs, and network expansion consistent with those to be used in the NEPA process?

- What changes have occurred in the area since the time the pre-TIP/STIP data was gathered and analyses were completed?
- Have resource classifications changed since the time the pre-TIP/STIP data was gathered and analyses were completed?
- Have resource agency requirements changed since the time the pre-TIP/STIP data was gathered and analyses were completed?
- Are the information and analyses still relevant/valid?

Using professional judgment, the District's Planning and Programming Manager works with the District's Functional Unit Managers (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*) and Project Manager, if one has been assigned, to make the final determination of whether the pre-TIP information is still valid and identify what should be examined during the scoping process to update and/or verify project area information. This determination is made based on the above bulleted questions, as well as the complexity of the project.

**2. Begin to Prepare the Scoping Documentation.** Information gathered and analyses performed in pre-TIP process phases form the foundation for scoping in the NEPA process and subsequent analysis for the project. The Scoping Form/Scoping Document (hereafter to be referred to as the "Scoping Document") is one tool that can help bring engineering and environmental considerations together, based upon information already documented and analyses already performed in Pre-TIP phases. The PennDOT Connects form (and DSR, if prepared), as prepared in the Pre-TIP process phases, is the data foundation for the Scoping Document. Scoping will verify this previously gathered and analyzed information and provide updates, clarifications, and/or corrections as appropriate.

PennDOT has developed a Scoping Document that must be completed for all formal Scoping Field Views except for certain Level 1a\* CE/EDs (See Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures* for more information on completing the Scoping Document). The District's Planning and Programming Manager works with the District's Functional Unit Managers (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*) and Project Manager to begin preparation of the Scoping Document. The Scoping Document is designed to aid in collecting all information needed to develop the Preliminary Engineering Scope of Work, facilitate the permitting process, and develop public and agency involvement programs, as necessary.

Fill out as much of the Scoping Document as possible before the Scoping Field View utilizing the information from the pre-TIP process phases contained within the pre-TIP PennDOT Connects form (and DSR, if prepared). Information filled out before the Scoping Field View only needs to be verified during the Scoping Field View.

**NOTE:** Preparation of the Scoping Document should mainly involve transfer of information from the Pre-TIP PennDOT Connects form completed (and DSR, if prepared) into the CE Expert System and updating of that information based on new information/changes that have occurred since the PennDOT Connects form was completed. The Scoping Document will then provide the foundation (can be electronically transferred into) for the CEE. The purposes of the Scoping Document are to identify potential environmental or engineering issues that need to be addressed in project development, and to confirm the appropriate CEE level and/or NEPA class (EA/EIS).

**3. Assemble Multi-Disciplinary Scoping Team.** The Scoping Coordinator will be the District Planning and Programming Manager or Project Manager unless delegated to another party, such as the Environmental Manager, is responsible for assembling the Scoping Team.

The Scoping Coordinator works with the District's Functional Unit Managers (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*) in assembling the scoping team. The scoping team should include appropriate PennDOT District and Central Office staff with FHWA participation for potential CE Level 2, EA, and EIS projects, any Federal Oversight projects and projects with potential impacts to Section 4(f) or Section 6(f) properties (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 3). PennDOT and/or consultant staff from the following disciplines should be included on the scoping team as appropriate for the project: Environmental, Community Relations/Communications, Roadway, Right-of-way, Construction, Geotechnical, Traffic, Contract Management, Bridge, Utilities, and Maintenance. MPO/RPO and Agency Coordination Meeting (ACM) staff should be invited to participate as appropriate.

If cultural resources could be impacted by the project, the District Environmental Manager must consult with and invite a Department CRP to the Scoping Field View and provide the CRP with relevant information ahead of time.

The Scoping Team represents the core of the yet to be assembled, Multi-Disciplinary (Design) Team (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*). The scoping team is a group of people with diverse and complementary skills and backgrounds, committed to working together to achieve the common goal of successfully scoping the proposal. By the definition of a "team," they hold themselves mutually accountable, and are held accountable, as a group, for accurately scoping the project. The diversity of backgrounds, experience, and skills of the team members ensures that all potential issues, modes of transportation, and transportation disciplines are considered.

**4. Gather Information and Data.** Accurate information about relevant aspects of the project is essential to successful scoping. This requires preparation by the entire team. It is very important that the Scoping Coordinator obtain the full commitment of the scoping team to researching the project. Failure to adequately research the project before the Scoping Field View can result in incomplete assessments and unwelcome surprises during subsequent project development phases.

At least two weeks in advance of the Scoping Field View, the scoping team members investigate the relevant PennDOT Connects forms, PennDOT's databases, management systems, and drawing archives for useful project information including, but not limited to the following:

- Pavement history
- Traffic data [internet Traffic Monitoring System (iTMS)]
- Safety - crash reports (CDART system)
- Tort claims history
- Structure conditions - inspection reports
- Environmental features (cultural, social and natural), including wetland and cultural resource mapping, Heritage Geographic Information System (HGIS) data, and Cultural Resources Geographic Information System (CRGIS) data
- Right-of-way
- Utilities
- Railroads
- Maintenance problems
- Project need and objectives
- Roadway and bridge deficiencies
- Programming information
- As-Built information and plans
- Bicycle and Pedestrian transportation needs (use Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix S, Bicycle and Pedestrian Checklist.)
- Public involvement activities
- Bridge Management System (BMS)

- Comprehensive Strategic Highway Safety Improvement Plan
- Congestion Management System (CMS)
- Roadway Management System (RMS) including Systematic Techniques to Analyze and Manage Pennsylvania Pavements (STAMPP) data
- Summary of M-206 Forms (complaints)
- PennDOT Connects form

Supplemental Information Sources include the following:

- Environmental/Regulatory Resource Agencies
- Legislators
- Local officials (township, borough, county)
- Emergency services (police, fire, ambulance)
- School District officials
- Chambers of Commerce
- Bus, rail, air, etc. services
- Planning Commissions
- Tourist bureaus
- Public service agencies
- Realtor organizations
- Adjacent property owners

Refer to Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*, Chapter 3 for additional environmental requirements during the Scoping Field View Process.

**5. Coordinate the Scoping Field View.** The Scoping Coordinator will coordinate/schedule the Scoping Field View. It is recommended that a minimum of two weeks' notice be provided to scoping team members in advance of the Scoping Field View. The invitation to the Scoping Field View can be sent concurrently with the package of background data information gathered about the project as described above.

The District Environmental Manager is responsible to coordinate and schedule the formal Scoping with the CRP, if cultural resources could be impacted by the project. Scoping Field View dates are to be coordinated with the CRP far enough in advance to permit attendance and useful participation by the CRP. In consultation with the Environmental Manager, the CRP may choose to scope the project at a different time than the official Scoping Field View depending on the type of project. The CRP should scope projects where a determination is needed for presence/eligibility of historic or archaeological resources. For these resources, coordination with FHWA may be conducted and their concurrence obtained with regard to Section 4(f) applicability and use (see Publication 349, *Section 4(f) Handbook*).

All Scoping Field Views for construction projects must be coordinated with a BOPD, HDTS Project Development Engineer (PDE), although the PDE may choose not to attend the Scoping Field View.

All Federal actions that involve or may involve any of the following are to be coordinated with the FHWA Environmental Specialist or Transportation Engineer through the HDTS PDE as shown.

- Level 2 CEE or higher environmental action – Environmental Specialist
- Projects with potential Section 4(f) Use including *De minimis* Use – Environmental Specialist
- Other environmental actions that require FHWA review and approval/concurrence – Environmental Specialist
- Federal Oversight/PoDI, as per the Stewardship and Oversight Agreement (Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix C) – Transportation Engineer
- Other non-environmental actions that require FHWA review and approval/concurrence, such as Grant funding & Interstate POAs – Transportation Engineer

The District Pavement Management Engineer/Pavement Manager and the BOPD Pavement Design and Analysis Unit should be invited to Scoping Field Views for proposals/projects involving major pavement rehabilitation or reconstruction.

Public Officials are to be invited to the Scoping Field View unless a separate field view is coordinated under the PennDOT Connects Process provided in Publication 10A, DM-1A, Pre-TIP and TIP Program Development Procedures.

**6. Conduct the Scoping Field View.** The following items should be reviewed, discussed, documented and validated at the Scoping Field View:

**a. Validate Engineering Considerations.** The following are various engineering considerations that should be reviewed, discussed, documented and validated at the Scoping Field View:

- Project classification (minor, moderate, or major)
- Context typology
- Anticipated design criteria (i.e., 3R, 4R, PPG, etc.)
- Right-of-Way requirements
- Utility impacts
- Railroad impacts
- Traffic volumes
- Speed - Posted speed limit, proposed design speed, and desired operating speed
- Roadway characteristics - proposed improvements and existing conditions
- Structure characteristics and design considerations
- Work zone traffic control impacts, including bicycle and pedestrian access needs during construction
- Constructability issues
- Community characteristics (i.e., rural, suburban, town/village, or urban; residential, commercial, industrial or mixed land use; location of community facilities / services, etc.)
- Bicycle and pedestrian facilities
- Costs
- Signing and pavement markings
- Lighting
- Context Sensitive Solutions (CSS)
- Crash histories
- Tort claim histories
- Engineering information from Pre-TIP documentation
- Maintenance considerations
- Drainage and hydraulics considerations
- Impacts to other transportation networks/facilities (e.g., PA Turnpike; municipal roadways; transit; etc.)
- **Anticipated Design Exceptions** - All known substandard conditions requiring a design exception should be identified and discussed at the Scoping Field View. Refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix P, Design Exceptions for a detailed discussion.

**b. Environmental and Agency Considerations.** The following are various environmental and agency involvement considerations that should be reviewed, discussed, documented, and verified at the Scoping Field View:

- Soil erosion and sedimentation potential
- Geologic resources (including DCNR Heritage Geology sites)
- Stream, rivers and watercourses
- Wetlands
- Coastal zones

- Floodplains
- Navigable waterways
- Water trails
- National and State wild and scenic rivers and streams
- Ground water resources
- Federally or State listed T&E species
- National natural landmarks
- Natural and wild areas
- Cultural resources
- Parks and recreational facilities
- Section 6(f), Project 70 and Project 500 properties
- Community facilities and services
- Hazardous, residual, or municipal waste sites
- Unique Cultures & Modes of Transportation (e.g., Plain Sect peoples)
- Noise and air quality issues
- Environmental Justice
- Water quality
- Agricultural resources
- Forest & Game Lands
- Section 4(f) / Section 2002 resources
- Environmental information from Pre-Scoping, if held
- Permitting requirements
- Socioeconomic considerations

A discussion should be initiated at the Scoping Field View to determine how the resource agencies and the public should be involved in the project and documented in the appropriate section of the Scoping Document. Note the recommended number and type of public involvement activities to be conducted. Refer to Publication 295, *Project Level Public Involvement Handbook*, for guidance on public involvement techniques. Public involvement for CEs can vary widely – from very limited activities/efforts for the simplest Level 1a CEs to fairly complex for the larger Level 2 CEs. The public involvement activities should be tailored to the specifics of the particular project.

**NOTE:** In addition to NEPA process requirements for public and agency involvement, other laws and regulations include specific requirements for engaging the public and resource agencies. NEPA should be conducted as an "umbrella" process, addressing all regulatory requirements within its framework. As such, it is important to ensure that agency, tribal, and public coordination, as required by these other applicable regulations, is incorporated into the process.

c. **Public Involvement Considerations.** The following are various public involvement considerations that should be documented at the formal Scoping Field View:

- Temporary and/or permanent impacts resulting from lane reductions, closures or changes in travel patterns and accessibility (e.g., detours, lengthy traffic control plans, curb, median barriers) that directly or indirectly lead to substantial motor vehicle re-routing and/or effects to emergency services or school bus routes or that would decrease the safe travel of pedestrians and/or bicycles
- Temporary, and/or changes to permanent traffic control on roads that traverse, intersect or are located near the Pennsylvania Turnpike, whereby highway operations may be affected.
- Construction activities potentially impacting seasonal activities and/or annual special events (e.g., Founders Day celebration, festivals, parades, etc.) or in developed areas and along business and commercial routes (removal of trees within the right-of-way, construction performed in multiple stages, temporary access limitations, etc.)

- Right-of-way acquisition affecting an adjacent property's usage or resulting in the displacement of people or businesses
- Project setting and community context (i.e., is the facility a community gateway or recognizable symbol, is it the main street, what community resources abut or obtain access from the transportation facility, etc.)
- Public controversy; depending on the potential proposal, it may be useful to have some public involvement prior to the Scoping Field View in order to ascertain the level of public interest, issues, and suggestions pertaining to Context Sensitive Solutions (CSS).

**d. Confirmation of NEPA Class of Action.** During the Scoping Field View the anticipated class of NEPA action and required documentation should be verified (Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*).

**e. Determination of Design Submissions.** During scoping the required design submissions should be identified including Line and Grade submission, DFV submission, and FDOM. See [Chapter 3](#) for Line and Grade and DFV Submissions and [Chapter 4](#) for FDOM Submission requirements. Document the identified required design submissions in the scoping document.

**NOTE:** A key issue affecting project development is the type and number of design submissions required to advance the project to Final PS&E. This question should be addressed at the formal Scoping Field View. See [Figure 2.3](#) for a matrix of Post-TIP Engineering Tasks.

**f. Use of Consultant Services.** The decision to use consultant services on a project is generally made by the ADE for Design before the Project Manager is designated. At the Scoping Field View it may be determined that projects that are programmed for internal development contain certain tasks that can be completed more quickly and/or cost effectively using consultant services provided through an open end agreement. These tasks often include certain types of environmental studies. Where consultant services are required, whether for all or only a part of the project scope, the scoping form becomes the basis for the District's Preliminary Engineering Scope of Work, which is a formal part of the consultant agreement. This is an additional reason for the Scoping Document and to identify clearly all required work. The District Environmental Manager and CRP can be instrumental in developing the proposed Scope of Work for environmental and cultural resources, respectively. As such, they may be able to assist in reviewing or writing the scope of services.

**7. Complete the Scoping Documentation.** It is expected that all team members including the CRP, when required, will have scoped the project within two weeks of the official Scoping Field View to ensure that their input can be incorporated into the Scoping Document. It is critical that team members provide all their comments and recommendations concerning the Scoping Document within four weeks of the official Scoping Field View to the Scoping Coordinator, who will be responsible for documenting the formal Scoping Field View utilizing the CE Expert System.

The Scoping Coordinator will verify the anticipated class of environmental documentation and that all necessary scoping information is obtained from all scoping team members including the CRPs within four weeks of the official Scoping Field View and that this information is incorporated into the Scoping Document within six weeks of the official Scoping Field View.

When the Scoping Document is substantially complete, the appropriate HDTs Project Development Engineer (PDE) must be notified to afford the PDE the opportunity for review and comment prior to submission.

Submit the Scoping Document for review/approval through the CE Expert System within six weeks of the official Scoping Field View. All Scoping Documents are to be approved within 12 weeks of the Scoping Field View, regardless of whether or not the project is likely to advance through the project development process in a timely manner due to funding, environmental issues, or any other reasons.

The Scoping Document review and approval process is an automated process that is initiated when the Scoping Document Package is submitted via the CE Expert System. The CE Expert System automatically generates email notifications to required reviewers and the appropriate approval authority as detailed in Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*.

The approval process for Scoping Documents varies by the anticipated project complexity as identified in the Scoping Document as presented in Figure 2.2.

**FIGURE 2.2**  
**SCOPING DOCUMENT APPROVAL PROCESS**

| Federal Funds | Federal Oversight | Complexity <sup>1</sup> | EM Concur | HDTs Concur <sup>2</sup> | FHWA Concur <sup>2</sup> | EM Approve |
|---------------|-------------------|-------------------------|-----------|--------------------------|--------------------------|------------|
| N             | N                 | Minor                   |           |                          |                          | ✓          |
|               |                   | Moderate                | ✓         | ✓                        |                          | ✓          |
|               |                   | Major                   | ✓         | ✓                        |                          | ✓          |
| Y             | N                 | Minor                   |           |                          |                          | ✓          |
|               |                   | Moderate                | ✓         | ✓                        | ✓*                       | ✓          |
|               |                   | Major                   | ✓         | ✓                        | ✓*                       | ✓          |
| Y             | Y                 | Minor                   | ✓         | ✓                        | ✓                        | ✓          |
|               |                   | Moderate                | ✓         | ✓                        | ✓                        | ✓          |
|               |                   | Major                   | ✓         | ✓                        | ✓                        | ✓          |

<sup>1</sup> Refer to the project complexity guidelines in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Section 2.1.

<sup>2</sup> Follow the procedures in Section 2.2.B.5 for coordination with HDTs and FHWA regarding their attendance at scoping field views, and the determination of the appropriate level of environmental documentation.

\*Only Level 2 CE, EA, or EIS

The CE Expert System will generate notifications to each of the participants in the review and approval process sequentially. Each entity will have the opportunity to concur/approve the Package or request revisions. If revisions are requested, they should be made, and the Package Document can then be resubmitted for each appropriate concurrence/approval.

Upon approval, the Scoping Document will be moved to the "Approved Documents" (also referred to as the Archive) database in the CE Expert System and will be available for public viewing.

**NOTE:** For various reasons projects may be delayed or a substantial amount of time lapses between the Scoping Field View approval and the creation of a CEE in the CE Expert System. In those circumstances where three years or more have lapsed, it is advised that the project team field view the area again. If no substantial changes have occurred since the Scoping Field View, the date of the field view is to be documented under "Additional Information" in the BRPA Matrix, Section (B:F) of the CEE or Part C of a 1a, as applicable. If substantial changes have occurred, note those changes under "Additional Information" or initiate a new Scoping Document.

The scoping process is considered complete when:

- The Scoping Coordinator (and Project Manager, if different person) is reasonably certain of the NEPA class of action.
- The engineering issues associated with the project are identified.

- The scope of work for preliminary engineering is understood.
- The complexity level has been determined.
- The environmental studies required to obtain environmental clearance are identified.
- The level of effort required to advance the project to PS&E submittal is understood.
- The Planning and Programming Manager and Project Manager has an accurate preliminary cost estimate of project construction costs to compare to programmed costs.
- The Scoping Document is approved in the CE Expert System (except for certain Level 1a\* CE/EDs that do not require preparation of Scoping Documents).

Please note that environmental and engineering issues need to be identified and well-understood. However, they do not all need to be resolved for formal scoping to be completed.

**NOTE:** For projects that may involve Level 1a CEs, during scoping, the Project Manager should work with the Environmental Unit to evaluate the potential for environmental impacts despite the activity being listed as a Level 1a CE. There are situations when Level 1a activities may involve environmental resources with the potential for some degree (less than significant) of impact. When potential impacts are discovered, the Level of CEE to be completed may change to a Level 1b or a Level 2.

For additional information related to Scoping Field Views and Scoping Documentation refer to Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*, Chapter 3.

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Figure 2.3 Page 1 of 2

**Post-TIP Engineering Tasks Requirements by Project Complexity Levels**

|   |                                    |
|---|------------------------------------|
| X | Required                           |
| Ø | Not Required                       |
| ? | Project specific – may be required |

| Description of Post-TIP Engineering Tasks                                                                                    | Non-Complex<br>(Minor)<br>Projects <sup>1</sup> | Moderately<br>Complex<br>Projects <sup>1</sup> | Most Complex<br>(Major)<br>Projects <sup>1</sup> |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------|--------------------------------------------------|
| <b>Preliminary Engineering Design</b>                                                                                        |                                                 |                                                |                                                  |
| Progress Points for Preliminary Engineering                                                                                  |                                                 |                                                |                                                  |
| Preliminary Engineering Studies                                                                                              | X                                               | X                                              | X                                                |
| Needs Analysis                                                                                                               | X                                               | X                                              | X                                                |
| Alternatives Analysis                                                                                                        | Ø                                               | ?                                              | X                                                |
| Design Field View Submission Review and Approval <sup>4</sup>                                                                | ?                                               | ?                                              | X                                                |
| Design Field View Meeting (actual field view may be included if needed) <i>(required for all federal-oversight projects)</i> | ?                                               | ?                                              | X                                                |
| <b>Final Design</b>                                                                                                          |                                                 |                                                |                                                  |
| Design Development                                                                                                           |                                                 |                                                |                                                  |
| Engineering Requirements                                                                                                     | X                                               | X                                              | X                                                |
| Design Criteria                                                                                                              | X                                               | X                                              | X                                                |
| Geometric Design                                                                                                             | X                                               | X                                              | X                                                |
| Right-of-Way Requirements                                                                                                    | X                                               | X                                              | X                                                |
| Utility Involvements                                                                                                         | ?                                               | ?                                              | X                                                |
| Temporary Traffic Control Considerations                                                                                     | X                                               | X                                              | X                                                |
| Construction Staging Requirements                                                                                            | X                                               | X                                              | X                                                |
| Subsurface Conditions                                                                                                        | ?                                               | ?                                              | ?                                                |
| Structures                                                                                                                   | ?                                               | ?                                              | ?                                                |
| Environmental Mitigation Commitments (include in plans)                                                                      | ?                                               | ?                                              | ?                                                |
| Drainage Design                                                                                                              | ?                                               | X                                              | X                                                |
| Maintenance Considerations                                                                                                   | X                                               | X                                              | X                                                |
| Lighting & Signing                                                                                                           | ?                                               | ?                                              | ?                                                |
| Traffic Signalization & Signing                                                                                              | ?                                               | ?                                              | ?                                                |
| Erosion & Sedimentation Control Measures <sup>3</sup>                                                                        | X                                               | X                                              | X                                                |
| Oversight Status (FHWA) <sup>2</sup>                                                                                         | ?                                               | ?                                              | ?                                                |
| Plans Preparation                                                                                                            |                                                 |                                                |                                                  |
| Highway Construction Plans (including "Also" plans)                                                                          | X                                               | X                                              | X                                                |
| Right-of-Way Plans                                                                                                           | ?                                               | ?                                              | X                                                |
| "Also" Plans                                                                                                                 | X                                               | X                                              | X                                                |
| Traffic Control Plans                                                                                                        | ?                                               | ?                                              | X                                                |
| Soil Profiles                                                                                                                | ?                                               | ?                                              | X                                                |
| Contour Grading & Drainage Plans                                                                                             | Ø                                               | ?                                              | X                                                |
| Erosion & Sediment Pollution Control Plans                                                                                   | X                                               | X                                              | X                                                |
| Landscape Planting Design Plans                                                                                              | Ø                                               | ?                                              | ?                                                |
| Signing & Sign Lighting Plans                                                                                                | ?                                               | ?                                              | ?                                                |
| Structure Plans (including sound barrier plans)                                                                              | ?                                               | ?                                              | ?                                                |

Figure 2.3 Page 2 of 2

**Post-TIP Engineering Tasks Requirements by Project Complexity Levels**

|   |                                    |
|---|------------------------------------|
| X | Required                           |
| ⊖ | Not Required                       |
| ? | Project specific – may be required |

| Description of Post-TIP Engineering Tasks                                                                                                                                                                                                                                                                                                                                                        | Non-Complex<br>(Minor)<br>Projects <sup>1</sup> | Moderately<br>Complex<br>Projects <sup>1</sup> | Most Complex<br>(Major)<br>Projects <sup>1</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------|--------------------------------------------------|
| <i>"Also" Plans Continued</i>                                                                                                                                                                                                                                                                                                                                                                    |                                                 |                                                |                                                  |
| Highway Lighting Plans                                                                                                                                                                                                                                                                                                                                                                           | ?                                               | ?                                              | ?                                                |
| Traffic Signal Plans                                                                                                                                                                                                                                                                                                                                                                             | ?                                               | ?                                              | ?                                                |
| Utility Relocation Plans                                                                                                                                                                                                                                                                                                                                                                         | ?                                               | ?                                              | X                                                |
| Wetland Mitigation Plans                                                                                                                                                                                                                                                                                                                                                                         | ?                                               | ?                                              | ?                                                |
| Wetland Marking Plans                                                                                                                                                                                                                                                                                                                                                                            | ?                                               | ?                                              | ?                                                |
| Cross Sections                                                                                                                                                                                                                                                                                                                                                                                   | ?                                               | X                                              | X                                                |
| <i>The Three Major Final Design Plan Submissions</i>                                                                                                                                                                                                                                                                                                                                             |                                                 |                                                |                                                  |
| Final Roadway Plans & Quantities                                                                                                                                                                                                                                                                                                                                                                 | X                                               | X                                              | X                                                |
| Final Right-of-Way Plans                                                                                                                                                                                                                                                                                                                                                                         | ?                                               | ?                                              | X                                                |
| Final Plans, Specifications & Estimates (PS&E)                                                                                                                                                                                                                                                                                                                                                   | X                                               | X                                              | X                                                |
| Right-of-Way                                                                                                                                                                                                                                                                                                                                                                                     | ?                                               | X                                              | X                                                |
| Utility Coordination                                                                                                                                                                                                                                                                                                                                                                             | ?                                               | X                                              | X                                                |
| <i>Contract Management</i>                                                                                                                                                                                                                                                                                                                                                                       |                                                 |                                                |                                                  |
| Bid Package Preparation                                                                                                                                                                                                                                                                                                                                                                          | X                                               | X                                              | X                                                |
| Proposal, Plans & Construction Cost Estimate & Schedule Preparation                                                                                                                                                                                                                                                                                                                              | X                                               | X                                              | X                                                |
| PS&E Submission Review                                                                                                                                                                                                                                                                                                                                                                           | X                                               | X                                              | X                                                |
| Proposal Review                                                                                                                                                                                                                                                                                                                                                                                  | X                                               | X                                              | X                                                |
| Advertising the Contract                                                                                                                                                                                                                                                                                                                                                                         | X                                               | X                                              | X                                                |
| Bid Package Sales                                                                                                                                                                                                                                                                                                                                                                                | X                                               | X                                              | X                                                |
| Conducting the Pre-Bid Conference                                                                                                                                                                                                                                                                                                                                                                | ?                                               | ?                                              | X                                                |
| Conducting the Bid Letting                                                                                                                                                                                                                                                                                                                                                                       | X                                               | X                                              | X                                                |
| Awarding the Contract                                                                                                                                                                                                                                                                                                                                                                            | X                                               | X                                              | X                                                |
| Collecting & Evaluating Contractors' Bids                                                                                                                                                                                                                                                                                                                                                        | X                                               | X                                              | X                                                |
| Verify DBE/MBE/WBE Requirements                                                                                                                                                                                                                                                                                                                                                                  | X                                               | X                                              | X                                                |
| Providing Concurrence in Award                                                                                                                                                                                                                                                                                                                                                                   | X                                               | X                                              | X                                                |
| Executing the Contract                                                                                                                                                                                                                                                                                                                                                                           | X                                               | X                                              | X                                                |
| Issuing Construction Notice-to-Proceed                                                                                                                                                                                                                                                                                                                                                           | X                                               | X                                              | X                                                |
| <i>Progress Points</i>                                                                                                                                                                                                                                                                                                                                                                           |                                                 |                                                |                                                  |
| Final Design Office Meeting <sup>5</sup>                                                                                                                                                                                                                                                                                                                                                         | ?                                               | ?                                              | X                                                |
| Plan Reviews / Constructability Review                                                                                                                                                                                                                                                                                                                                                           | X                                               | X                                              | X                                                |
| Plans, Specifications & Estimates (PS&E) Submission                                                                                                                                                                                                                                                                                                                                              | X                                               | X                                              | X                                                |
| Contract Letting                                                                                                                                                                                                                                                                                                                                                                                 | X                                               | X                                              | X                                                |
| Construction Notice-to-Proceed                                                                                                                                                                                                                                                                                                                                                                   | X                                               | X                                              | X                                                |
| Pre-Bid Construction Schedule Process                                                                                                                                                                                                                                                                                                                                                            | ?                                               | X                                              | X                                                |
| <sup>1</sup> See Tables 2.1, 2.2 and 2.3 in DM-1.<br><sup>2</sup> Refer to FHWA/PennDOT Stewardship and Oversight Document in DM-1X, Appendix C.<br><sup>3</sup> Can range from a letter to a full plan depending on the project.<br><sup>4</sup> Environmental Clearance is required prior to Design Field View Approval.<br><sup>5</sup> May be waived by BOPD for PennDOT Oversight Projects. |                                                 |                                                |                                                  |

# CHAPTER 3

## PRELIMINARY ENGINEERING PROCEDURES

### 3.0 INTRODUCTION

This chapter establishes PennDOT's Preliminary Engineering procedures, which are completed during Step 6 of the process (see [Figure 2.1](#)) for the support of all classes of environmental review actions. These procedures are required by state and Federal law for both PennDOT Oversight and Federal Oversight Projects. The procedures described herein are organized by engineering activity. Depending on project specific requirements, they may be applied to the development of highway and bridge projects.

### 3.1 PURPOSE OF PRELIMINARY ENGINEERING

The purpose of Preliminary Engineering is to set a highway's preliminary design and to support the activities that will result in environmental clearance. These actions are required for a project to advance to Final Design and right-of-way acquisition.

Preliminary Engineering involves the preparation of engineering studies, designs, analyses, and associated documentation to support the environmental studies (Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*) and to develop a detailed Scope of Work for Final Design. This preparation is required to further refine and/or verify the scope of improvements, as determined during the Scoping Field View, that meet the project purpose and need.

The evaluation of engineering parameters and environmental resources is parallel. Interrelated activities are typically conducted by the same design team. Engineering decisions must be made after identification and consideration of engineering and environmental features, as well as an evaluation of consequences of carrying out these decisions. Without adequate Preliminary Engineering, a thorough evaluation of affected resources cannot be done.

The level of Preliminary Engineering effort for a project is dictated by the level of project complexity. Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 2, Section 2.1 divides PennDOT Transportation Projects into three levels of project complexity:

- Minor Complexity Projects
- Moderate Complexity Projects
- Major Complexity Projects

The anticipated level of environmental documentation for a project is to be made either by the District Environmental Manager or the Assistant Environmental Manager at the Scoping Field View in coordination with the Project Team, including PennDOT Central Office and FHWA as necessary.

Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures* provides details on the preparation and issuance of environmental clearance. For federally funded projects, the following three NEPA Classes of Actions are:

- Categorical Exclusions (CEs)
- Environmental Assessments (EAs)
- Environmental Impact Statements (EISs)

For 100% state funded projects, the following two classes of actions are:

- Environmental Documentations (EDs)
- Environmental Evaluation Reports (EERs)

### 3.2 COMPLETION OF TIP DEVELOPMENT

As identified in [Section 2.0](#), Preliminary Engineering occurs in Step 6 at the completion of TIP Development after the project has been included in the Twelve-Year Program (TYP) and has been approved by the Program Management Committee (PMC) for Design.

Information developed during the Pre-TIP Project Development Phases could include the following:

- PennDOT Connects Forms
- Preliminary Purpose and Need
- Conceptual Alternatives Analysis
- Preliminary Project Cost Estimate
- MPO/RPO Long Range Plan
- Planning Studies
- Local/Municipal Comprehensive Plans

At the end of the TIP Development Phase, the District Planning and Programming Manager should compile this information for inclusion in the project file, which will be transferred to the Project Manager. Prior to development of the formal project Scope of Work and before beginning the Engineering and Environmental Study Phase of the project, the Project Manager should verify the accuracy and applicability of the pre-TIP analysis and documentation. Verification may include additional coordination activities with PennDOT Staff, planning partners, and resource agencies. Refer to Publication 10A, Design Manual Part 1A, *Pre-TIP and TIP Program Development Procedures*.

### 3.3 STEWARDSHIP & OVERSIGHT, FHWA MAJOR PROJECTS AND FEDERALLY FUNDED PROJECTS > \$100 MILLION

**A. FHWA/PennDOT Stewardship & Oversight Agreement.** The FHWA/PennDOT Stewardship & Oversight Agreement presents the current procedures for the administration of the Federal-Aid Highway Program (FAHP) in Pennsylvania. This Agreement provides for a risk-based approach where PennDOT and FHWA agree on how the FAHP will be administered in Pennsylvania, with specific actions to be taken by one or both parties. This Agreement is presented in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix C, FHWA/PennDOT Stewardship & Oversight Agreement.

The intent of this Agreement is to delegate FHWA's approval authority to PennDOT for engineering, construction contract administration, and right-of-way activities on or related to Federal-aid projects, consistent with enabling statutes and regulations, with specified exceptions for special interest project categories. In carrying out their roles and responsibilities, FHWA and PennDOT will perform several project or program oversight activities:

- Project Oversight. Activities performed at a project level by FHWA and PennDOT to ensure that projects are being designed and constructed in accordance with Federal and State Requirements. For PennDOT Oversight projects, PennDOT will act on behalf of the U.S. Secretary of Transportation and FHWA in the development and approval of projects. For Federal Oversight projects, FHWA will retain approval authority for some or all major actions. Regardless of who has project oversight, FHWA continues to retain overall responsibility for all aspects of Federal-aid programs and, as such, shall be granted full access to review any aspect or record of a Federal-aid project at any time.

The Stewardship & Oversight Agreement identifies Projects of Division Interest (PoDIs) for which FHWA retains approval authority. PennDOT refers to PoDIs as Federal Oversight projects in PennDOT's publications, forms, computer programs, etc. All major approvals of a PoDI, as defined in the Stewardship & Oversight Agreement, may have Federal Oversight, or just select portions/approvals for a PoDI may have Federal Oversight as determined at annual meetings between the FHWA Division Office and PennDOT. For example, it could be decided that only the pavement design will be Federal Oversight, but the remainder of the PoDI will be PennDOT Oversight.

- **Program Oversight.** Activities performed at a program level by FHWA and PennDOT to assess the performance of the FAHP to ensure that Federal and State requirements are being followed. Program assessments include, but are not limited to, joint risk assessments, certifications, the Financial Integrity Review and Evaluation (FIRE) Program, self-assessments, Right-of-Way spot check reviews, Compliance Assessment Program (CAP) reviews, and the Independent Oversight Program (IOP). FHWA retains overall oversight responsibility for all aspects of Federal-aid programs.

The four classifications of highway projects are presented below in order of decreasing FHWA involvement and, conversely, with increasing PennDOT authority. It is recognized that the National Highway System (NHS) (which includes the Interstate System) is of primary importance to the FHWA. NHS Federal Oversight projects require the highest level of FHWA review and approval. Off-NHS PennDOT Oversight and 100% state funded projects require the lowest level of FHWA oversight and highest level of PennDOT authority. State funded projects require essentially the same design review procedures as federally aided PennDOT Oversight projects, off-NHS.

- Federal Oversight, on the NHS
- PennDOT Oversight, on the NHS
- PennDOT Oversight, off the NHS
- 100% State Funded

As provided for in Federal legislation, certain categories of Federal-aid projects are delegated to PennDOT for oversight responsibility. On PennDOT Oversight projects, PennDOT will act on behalf of the U.S. Secretary of Transportation and FHWA in the development and approval of projects in accordance with the provisions in the Stewardship & Oversight Agreement and applicable Federal regulations. The expectation is that PennDOT exercises similar judgment based on Federal laws, regulations, and FHWA policies.

Non-Title 23 requirements such as the NEPA, and Section 4(f) apply to both NHS and Non-NHS Federal-aid projects, and FHWA will review and approve the applicable actions for all Federal Oversight and PennDOT Oversight projects, except for those programmatically delegated to PennDOT. The project Oversight Status does not affect FHWA's role in NEPA, including review and approval of the environmental document. For example, if the project requires a Level 2 CE, EA, or EIS, FHWA has oversight for purposes of NEPA and is required to approve the NEPA document.

**B. FHWA Major Project Requirements.** A FHWA Major Project is defined as a federally funded project with a total estimated cost of \$500 million or more. The threshold cost for a FHWA Major Project includes all costs (i.e., Preliminary Engineering, Final Design, Right-of-Way, Utilities, and Construction). FHWA Major Projects typically have more risk associated with the project cost and schedule. Therefore, they typically require additional documentation, including a Financial Plan, Cost Estimate Review, and a Project Management Plan, as described below. These items are developed in the Districts, and when all District comments have been addressed, including Planning and Programming, they are submitted to the Highway Design and Technology Section (HDTS) Project Development Engineer (PDE) for review. The PDE will coordinate with the Central Office Center for Program Development, and with the FHWA.

Financial Plans, Cost Estimate Reviews and Project Management Plans documentation should include the topics per FHWA's website on Major Projects. The website should be consulted for further requirements and processes for FHWA Major Project documentation. The FHWA Major Projects website takes precedence over requirements in this section.

1. **Financial Plans.** A Financial Plan with annual updates is typically required for FHWA Major Projects (including all cost phases). It is typically developed near the end of Preliminary Engineering or early in Final Design.

The initial Financial Plan is submitted to FHWA after the completion of the Cost Estimate Review and prior to authorization of Federal funds for construction. A certification letter addressed to FHWA from the Secretary of Transportation is required.

After the initial Financial Plan has been completed, annual updates to the Financial Plan are typically required until construction is complete. The annual update should be submitted to FHWA for approval at least 90 days prior to a year having passed from the previous Financial Plan being approved.

Refer to Section 3.3.C for Financial Plan requirements for federally funded projects between \$100 million and \$500 million.

**2. Cost Estimate Reviews.** FHWA Major Projects generally have two Cost Estimate Reviews (CER). A CER typically includes a workshop with FHWA that facilitates a risk-based review to verify the accuracy and reasonableness of the cost estimate and schedule to complete the project. The first CER workshop for the preferred alternative should be conducted least 90 days prior to the NEPA decision approval. The second CER workshop should generally be conducted at least 90 days, but no more than 1 year, prior to Initial Financial Plan submittal to FHWA.

Additional CERs may be required to support the Financial Plan annual updates.

**3. Project Management Plans.** A Project Management Plan (PMP) is typically required for all FHWA Major Projects. The initial PMP should be submitted to FHWA at least 90 days prior to authorization of Federal funds for construction.

After the initial PMP has been completed, additional PMPs may be required if significant project changes have occurred prior to completion of construction.

**C. Federally Funded Projects > \$100 Million.** These are projects with a total estimated cost between \$100 million and \$500 million. The total cost includes Preliminary Engineering, Final Design, Right-of-Way, Utilities, and Construction.

Although CERs and PMPs are typically not required for these projects, Financial Plans usually are required.

The Financial Plans are typically developed near the end of Preliminary Engineering or early in Final Design. They are developed in the Districts in coordination with District Planning and Programming. They are then submitted to the HDTs PDE for review and coordination with the Central Office Center for Program Development. These Financial Plans do not require FHWA approval. However, they are transmitted to FHWA for their information and are to be made available to FHWA upon request.

After the initial Financial Plan has been completed, annual updates to the Financial Plan are typically required until construction is complete. The District and Central Office reviews of the annual updates are the same as for the initial Financial Plan and should be completed within a year of the previous Financial Plan. The annual updates are transmitted to FHWA for their information.

### 3.4 PRELIMINARY ENGINEERING CONSIDERATIONS

**A. Engineering Parameters.** The Preliminary Engineering and environmental analysis sets the physical and conceptual limits of the project, which is typically completed concurrently with the analysis of project needs and possibly the Congestion Management System (CMS) evaluation, see Publication 10A, Design Manual Part 1A, *Pre-TIP and TIP Program Development Procedures* where applicable. The analysis establishes engineering design parameters based upon the type and scope of the project and on the project area's context and place. It also confirms existing conditions that may affect the location of the proposed improvements.

A thorough analysis involves extensive gathering and evaluation of information specific to the project. The following is a partial list of engineering factors that should be considered:

- Traffic volumes
- Logical termini

- Independent utility
- Geographic features and landforms
- Existing land use and project setting
- Development plans and trends
- Existing highway system and Levels of Service (LOS)
- Points of interface with other modes of transportation
- Need for regional and through access
- Travel desires, including alternate transportation modes
- Locations of population centers and significant trip generators
- Existing design deficiencies
- Reported safety problem areas (including crash clusters)

Engineering parameters are established to provide a range of acceptable criteria or standards for the project. Examples may include acceptable levels of service, design/operating speeds, and basic geometric design requirements. Figuring out these parameters helps to ensure that projects meet the goals of PennDOT's Core Principles, as discussed in [Section 2.0](#), and that PennDOT projects fit into and enhance the livable community.

Selecting the appropriate engineering parameters carefully cannot be overstated. Establishing these criteria and standards does the following:

- Helps to set the project scope and scale, ensuring the project's fit into the area's place and context
- Helps to control project costs and impacts
- Helps to develop transportation solutions that provide the highest benefits value to cost (intended to be qualitative assessments generally requiring staff from PennDOT, the MPO/RPO, and the FHWA, as applicable to consider the overall value of the project in light of its costs; it is not intended to be a quantitative assessment).

When evaluating and selecting engineering parameters, the flexibility of design guidelines, as discussed in [Section 3.4.C](#), should be thoroughly explored.

**B. Context Sensitive Solutions.** Context Sensitive Solutions is a collaborative, interdisciplinary approach to transportation planning and design that involves project stakeholders, including citizens, agencies and/or other public officials, as part of the design team in developing transportation facilities. Context Sensitive Solutions is defined as "melding the design process for highway, bridge, and other transportation projects with consideration of the community values and environmental resources of the project area." The goal of Context Sensitive Solutions is to "balance safety, mobility, and transportation needs while preserving scenic, aesthetic, historic, cultural, environmental, and community values."

The keys to a successful Context Sensitive Solutions process include having open and continuous public and agency involvement, applying flexibility and objectivity, using a Multi-Disciplinary (Design) Team (see Publication 10, Design Manual Part 1, *Transportation Program Development & Project Delivery Process*), and maintaining continuous communication. Additional information concerning Context Sensitive Solutions as a national initiative can be found on FHWA's website (<http://contextsensitivesolutions.org/>).

**C. Design Flexibility.** Flexibility in design is the application of sound engineering judgment to engineering decisions in the use of design guidelines and criteria. The application of PennDOT's process and Core Principles to achieve project designs that are of the correct scale and are context sensitive, challenges designers to find the flexibility within design guidelines and criteria and, at times, to look beyond the criteria. (Note: The Core Principles are found in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 1.) Designers must properly consider and apply the flexibility in design criteria to meet project needs, promote joint use of all transportation modes, and allow sufficient flexibility to encourage innovative or unique designs for particular situations.

Title 23 of the Code of Federal Regulations (CFR) Part 625, "Design Standards for Highways," designates those standards, policies, and standard specifications that are acceptable to the Federal Highway Administration (FHWA) for application in the geometric and structural design of highways. These regulations designate AASHTO's *A Policy on Geometric Design of Highways and Streets* (AASHTO Green Book) as an acceptable reference. The AASHTO Green Book states that its intent:

*"... is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. It is not intended to be a detailed design manual that could supersede the need for the application of sound principles by the knowledgeable design professional. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations. Minimum values are given or implied by the lower value in a given range of values. The larger values within the ranges will normally be used where the social, economic, and environmental impacts are not critical.*

*... Cost effective design is also emphasized. The traditional procedure of comparing highway-user benefits with costs has been expanded to reflect the needs of non-users and the environment. Although adding complexity to the analysis, this broader approach also takes into account both the need for a given project and the relative priorities among various projects. The results of this approach may need to be modified to meet the needs-versus-funds problems that highway administrators face. The goal of cost-effective design is not merely to give priority to the most beneficial individual projects but to provide the most benefits to the highway system of which each project is a part."*

AASHTO further describes the need for design flexibility in the form of design exceptions in the AASHTO publication *A Guide for Achieving Flexibility in Highway Design* that states:

*"The need for design exceptions is not new and is not inextricably linked to the concept of design flexibility. Designers should understand that design exceptions are an acceptable and indeed useful tool when evaluated and applied properly. Just as design exceptions should not be sought routinely, acceptance of a design exception should not be viewed as an admission of failure. It does not mean that the design criteria are inappropriate or that a resulting design is automatically less safe substantively than a traditional design."*

Publication 13M, Design Manual Part 2, *Highway Design* provides similar design flexibility to the AASHTO Green Book. Where design flexibility is required, and minimum design values of controlling criteria will not be met due to individual project circumstances, a Design Exception Request must be prepared and approved. (See [Section 3.6.C](#); Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1, Section 1.0; and Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix P, Design Exceptions.) Design values may be considered outside the bounds of a given range of values, when necessary and justified, to achieve a balanced design that has considered transportation needs, safety, and the project context.

For additional guidance regarding design flexibility, refer to the FHWA publication, *Flexibility in Highway Design*.

**D. Fitting Project Scope and Scale.** PennDOT's process involves developing a transportation program that considers quality of life concerns, economic development initiatives, fiscal constraints, and other social/environmental criteria. This philosophy should be carried throughout the process. PennDOT's process does not dismiss safety or meeting the project's purpose, needs, and objectives, but rather, helps shape the alternatives/options under consideration. It is an assessment of whether, giving due consideration to all relevant factors, the project's scope is cost-effective and efficient to accomplish.

Developing appropriately scaled alternatives is consistent with Title 23 of the United States Code (USC) Section 109, which requires that Federal-aid projects provide for a facility that will adequately serve the existing and planned future traffic of the highway in a manner that is conducive to safety, durability, and economy of maintenance; and be designed and constructed in accordance with criteria best suited to accomplish these objectives and to conform to the particular needs of each locality.

The following items should be considered during the Scoping Field View relative to this concept of fitting project scope and scale:

- Confirm the project scope and cost estimate.
- Confirm the project funding source and available project budget.
- Provide consistency with existing and planned land use and the project's physical setting. This may involve coordination with local and/or regional planning offices.
- Identify the most urgent transportation-related problems to form the basis for the project needs.
- Evaluate a full range of potential solutions to solve the identified project needs, as well as meeting the project's purpose and objectives. Consider operational improvements to the existing roadway system prior to considering capacity-adding alternatives, if operational improvements meet the project's purpose, needs, and objectives. Consider rehabilitation of existing facilities before reconstruction activities are recommended.
- Establish the appropriate design criteria based on the scope of the project, the project area context (or setting) and source of funding. Evaluate and maximize the design flexibility in Publication 13M, Design Manual Part 2, *Highway Design*, and the AASHTO Green Book. Consider opportunities to incorporate Context Sensitive Solutions.
- Consider Measures of Effectiveness (MOEs) to aid in evaluating when the Core Principles (see [Section 2.0](#)) are being met and when the identified project needs are met. Each Long Range Transportation Plan (LRTP) developed by an MPO/RPO is required to include MOEs (Performance Measures) that relate to sustainability of the transportation system, which relate back to the Core Principles just mentioned.
- Consider and evaluate the appropriate project limits relative to the identified project needs. It may be appropriate to adjust project limits based on existing and projected system conditions, identified project needs, alternatives that solve problems, and available project funding.
- Identify the level of public involvement needed based on the project scope, anticipated impacts to the environment and the traveling public, and potential for controversy on the project.
- Discuss the project schedule and cost estimate relative to the project scope, anticipated environmental impacts, and any commitments made for the project.

During Preliminary Engineering, just prior to NEPA clearance, the items outlined above must be reviewed to ensure the project is developed consistent with decisions made at the Scoping Field View. A field view or rescoping may be necessary as per Publication 10B, DM-1B, Chapter 3.

Confirming the project scope and cost estimate is especially important where additional infrastructure deterioration may have occurred after the Scoping Field View. The project scope and cost estimate are to be analyzed and adjusted accordingly. And, the designated financial resources for the project are to be verified. PMC action may be required as per DM-1, Chapter 3.1.C.

The project scope must be analyzed to ensure the project is appropriately scaled each time the construction cost estimate is evaluated. This should include, but is not limited to, the following milestones:

- At the Scoping Field View.
- Just prior to NEPA Approval.
- At the Design Field View (30% complete), if applicable.

Construction phasing should be assessed to aid in spreading out financial commitments while constructing sections of an overall facility. Funding for all construction phases must be programmed prior to NEPA clearance.

Refer to Section 2.2 for detailed information on the Scoping Process.

**E. Measures of Effectiveness (MOEs).** Projects that include an evaluation of alternatives should include MOEs that represent the project needs, purpose, and objectives, such as transportation for all modes, safety, economic development, community character, and land use. Measures should represent the most important needs and objectives of the project. The intent is not to incorporate all measures on all projects.

Minor Complexity Projects may not include an evaluation of alternatives, such as bridge or roadway preservation projects. These types of Minor Complexity Projects would not typically benefit from an evaluation of MOEs. However, Minor Complexity Projects that involve design exceptions may benefit from the evaluation of MOEs. Measures of effectiveness may be included in the design exception evaluation to support the selection of the proper solution.

Although broad in outlook, MOEs can be simple to calculate from readily available data (for simple projects) and readily reproducible. It is completely acceptable for MOEs to measure different aspects of the same qualities. For example, the "volume to capacity ratio" and "queue length" computations, as defined in the Transportation Research Board's *Highway Capacity Manual* (HCM), are both MOEs about a single quality (traffic service), but each is useful in its own way.

MOEs should be directly related to the accepted project needs and objectives. For objectives relating to vehicular service, measures should be chosen from the standard, widely used measures (e.g., "level of service", "seconds of delay"). For objectives that capture community character, measures should be developed based on the specific concerns of the community. Chosen measures should be transparent and easily conveyed to all stakeholders.

Including MOEs that address community goals as well as traffic performance is critical to reaching a smart transportation solution. For example, traditional traffic-only measures, while accurate for their single goal (moving traffic) are usually devoid of context. Thus, an evaluation measure calling for "attaining peak hour traffic Level of Service C" would gauge success only by that measure. The fact that the roadway may be located within a "Main Street" environment or a suburban neighborhood is not considered (see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix B, Glossary). Using this single measure, any alternative that attains the level is considered satisfactory and any alternative that does not is often dismissed from consideration. Because projects have wide-ranging needs and objectives, no single measure of effectiveness should be used to determine the preferred solution for a problem.

MOEs that address the full set of needs and objectives should be simple and yield a great deal of understanding with a minimum of computation. For example, the measure of pedestrian mobility (a critical element where the context is a "Main Street") is as simple as the number of signalized crossings, the width of pavement to be crossed or the operating speed. All of this information is readily available from project inventories, photographs, GIS files, or field visits.

Public involvement may be one critical consideration in the proper selection of MOEs. Some MOEs will require more public outreach than others. The overall level of public involvement should be evaluated early in the process to ensure that it is cost effective, timely, and commensurate with the scope/complexity of the project and the project context (see Publication 295, *Project Level Public Involvement Handbook*).

The absence of a wide range of evaluation measures in transportation planning is generally not due to the difficulty of computing such measures. Rather, it is because they were not identified as issues earlier in the process. Even if only a few measures are finally selected for project evaluation, consideration of a wide range of measures at the beginning of project planning can help identify important community values that may otherwise be overlooked.

The selection of MOEs should be conducted through coordination with the project team. Responsibilities for the review of the MOEs documentation are consistent with project oversight policies. If the District Office is responsible for the environmental clearance and the Design Field View documentation, the District Office is responsible for the MOEs. If the Bureau of Project Delivery reviews the environmental document or the Design Field View, the MOEs documentation should be included for review. Federal Oversight projects should involve FHWA review of MOEs. Major Complexity Projects that have an executive review committee should involve the committee in the development and review of MOEs. Refer to [Section 3.3](#) for more information on oversight status.

Project MOEs must be documented early in project planning. The format and detail should be commensurate with project complexity. The evaluation of measures may require the development of a formal report or study. Complex alternatives analysis may benefit from a more detailed analysis of measures. Measures should be attached to early project screening documents, and ultimately attached to environmental documents to support the selection of a project alternative. Proper documentation is necessary to ensure that measures are properly evaluated at milestones throughout the project development process. Measures of effectiveness are vital throughout the identification of the proper project alternative, but also through final design to ensure that the measures of effectiveness are adequately addressed in the final construction contract.

MOEs must be selected based on the unique purpose and needs of each project. While not intended to be all-inclusive, [Table 3.1](#) provides examples of measures and how they can be calculated.

Additional information regarding measures may be found in the following publications:

- AASHTO *User and Non-User Benefit Analysis for Highways*, September 2010
- NCHRP Report 618 *Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability*, 2008

Some common characteristics of effective measures include:

- Simple compilation from readily available data (particularly for simple projects).
- Transparent, using a method understandable to the non-technical public.
- Reproducible results (rather than yielding different answers to different analysts for same conditions).
- Objective.
- Yields degrees of success (not just "pass/fail").

The following questions can be asked to determine if this tool was used effectively:

- Have the alternatives been compared using a wide ranging list of measures of success?
- Do all needs and objectives have corresponding measures of effectiveness?

The application of MOEs may simply involve the consideration of all users. For example, the effective use of the existing right-of-way may be evaluated relative to the identified needs of all users. If the existing roadway is two lanes and the right-of-way width is 33 ft, one measure could be best use of the existing right-of-way to accommodate bicyclists and pedestrians. This evaluation should include consideration of lane and shoulder widths, as well as the need for a designated bike lane. This approach to measures of effectiveness would not require a formal study, but simply the consideration of all users in the development of the project solution.

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**TABLE 3.1 - SAMPLE MEASURES OF EFFECTIVENESS****NOTE:** The following is not intended to be an exhaustive listing of potential measures.

| Evaluation Category | Measure of Effectiveness                                                                                                    | Measurement Type(s)                                                                                                                                                                                                                                    | Source of Data                                                                                                                                                                                               |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Traffic             | Peak Hour LOS (intersection)                                                                                                | <ul style="list-style-type: none"> <li>Seconds of delay</li> <li>Queue lengths</li> <li>Daily Profile</li> </ul>                                                                                                                                       | HCS intersection - or SIDRA roundabout runs, existing and design year                                                                                                                                        |
|                     | Screen line capacity (at <i>X</i> segments throughout the corridor)                                                         | <ul style="list-style-type: none"> <li>Peak hour/peak direction vehicles</li> </ul>                                                                                                                                                                    | HCM source flows on planned lane count                                                                                                                                                                       |
|                     | Volume/Capacity (at <i>X</i> segments throughout the corridor)                                                              | <ul style="list-style-type: none"> <li>Peak hour volume/capacity ratio</li> </ul>                                                                                                                                                                      | HCM source flows on planned lane count<br>Traffic Study                                                                                                                                                      |
|                     | Corridor travel times between selected origins and destinations                                                             | <ul style="list-style-type: none"> <li>Minutes</li> </ul>                                                                                                                                                                                              | Simulation such as Synchro, VISSIM, Sim Traffic                                                                                                                                                              |
|                     | Reduction in existing VMT                                                                                                   | <ul style="list-style-type: none"> <li>VMT</li> </ul>                                                                                                                                                                                                  | Simulation such as Synchro, VISSIM, Sim Traffic                                                                                                                                                              |
|                     | Desired travel speeds in Area X, Area Y                                                                                     | <ul style="list-style-type: none"> <li>MPH expected based on roadway design and characteristics</li> </ul>                                                                                                                                             | Publication 13M, Design Manual Part 2/AASHTO Green Book                                                                                                                                                      |
| Safety              | Reduction in number of driveways                                                                                            | <ul style="list-style-type: none"> <li>Number of driveways</li> </ul>                                                                                                                                                                                  | Field Count                                                                                                                                                                                                  |
|                     | Reduction in unprotected left turns                                                                                         | <ul style="list-style-type: none"> <li>Peak hour vehicles</li> </ul>                                                                                                                                                                                   | Signalized intersection analysis and existing turning movements                                                                                                                                              |
|                     | Reduction in predicted/expected crash frequency<br>OR<br>Potential safety improvements at high-crash or high-risk locations | <ul style="list-style-type: none"> <li>Potential for safety improvement</li> <li>Reduction in predicted/expected crash frequency</li> <li>Reduction/Improvement in predicted/expected crash severity</li> </ul>                                        | <ul style="list-style-type: none"> <li>Crash data</li> <li>Safety Impact/Crash Analysis (See Publication 638, <i>District Highway Safety Guidance Manual</i>.)</li> <li>Roadway Safety Assessment</li> </ul> |
| Alternative Modes   | Pedestrian Access                                                                                                           | <ul style="list-style-type: none"> <li>Pedestrian signalized intersections</li> <li>Width of Pavement Crossings</li> <li>Linear feet of new sidewalk</li> <li>Number of well-marked crosswalks, and/or speed and volume of crossing traffic</li> </ul> | Map take-off or GIS                                                                                                                                                                                          |
|                     | Bicycle access                                                                                                              | <ul style="list-style-type: none"> <li>Linear feet of bike lanes, paved shoulders, or wide curb lanes</li> </ul>                                                                                                                                       | Map take-off or GIS                                                                                                                                                                                          |
|                     | Public transportation                                                                                                       | <ul style="list-style-type: none"> <li>Bus stops with safe pedestrian crossings</li> <li>Transit ridership</li> <li>Person throughput</li> </ul>                                                                                                       | Map take-off or GIS                                                                                                                                                                                          |
|                     | Ease of crossing for farm equipment in rural areas and/or horse/buggy use                                                   | <ul style="list-style-type: none"> <li>Crossings</li> <li>Desired speed based on road design</li> </ul>                                                                                                                                                | Map take-off or GIS and Publication 13M, Design Manual Part 2 and AASHTO Green Book                                                                                                                          |

**TABLE 3.1 - SAMPLE MEASURES OF EFFECTIVENESS****NOTE:** The following is not intended to be an exhaustive listing of potential measures.

| <b>Evaluation Category</b> | <b>Measure of Effectiveness</b>                                | <b>Measurement Type(s)</b>                                                                                                                                                                                                                                                                         | <b>Source of Data</b>                          |
|----------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>Community Character</b> | Rural road-front in purchased farm land, conservation easement | ▪ Linear Feet, Acres                                                                                                                                                                                                                                                                               | Map take-off or GIS                            |
|                            | Town streetscape                                               | ▪ Consistency with local and regional plans and policies                                                                                                                                                                                                                                           | Comprehensive Plans or similar documents       |
|                            | Historic resources                                             | ▪ Number of NRHP-Eligible Buildings Impacted/Displaced<br>▪ Number of NRHP-Eligible Districts Impacted                                                                                                                                                                                             | Map take-off or GIS                            |
|                            | Businesses                                                     | ▪ Number Impacted/Displaced                                                                                                                                                                                                                                                                        | Map take-off or GIS                            |
|                            | Residences                                                     | ▪ Number Impacted/Displaced                                                                                                                                                                                                                                                                        | Map take-off or GIS                            |
|                            | Community facilities                                           | ▪ Number Impacted/Displaced                                                                                                                                                                                                                                                                        | Map take-off or GIS                            |
|                            | Land use/growth management                                     | ▪ Consistency with local and regional plans and policies                                                                                                                                                                                                                                           | Comprehensive Plans or similar documents       |
| <b>Environ-mental</b>      | Open space/parklands                                           | ▪ Number Impacted/Displaced                                                                                                                                                                                                                                                                        | Map take-off or GIS                            |
|                            | Wetlands                                                       | ▪ Number Impacted<br>▪ Acreages Impacted<br>▪ Quality                                                                                                                                                                                                                                              | Map take-off or GIS                            |
|                            | Stream crossings                                               | ▪ Number of New Crossings<br>▪ Acreage of New Crossings                                                                                                                                                                                                                                            | Map take-off or GIS                            |
| <b>Financial</b>           | Floodplains                                                    | ▪ Acreages Impacted                                                                                                                                                                                                                                                                                | Map take-off or GIS                            |
|                            | Benefit/Cost Ratio                                             | ▪ Ratio of overall improvements to dollars in Year of Expenditure. A full Benefit/Cost Analysis can be complex, and should only be considered for the most complex projects. See the AASHTO <i>User and Non-User Benefit Analysis for Highways</i> , September 2010.                               | Degree of improvement, Estimated cost          |
|                            | Value to Price Ratio                                           | ▪ Value to Price is a comparison of a Specific Measure (e.g., travel time, delay) to dollars in Year of Expenditure for various alternatives. This evaluation may simply involve a graphical illustration comparing degree of improvement for a specific measure to the cost for each alternative. | Degree of specific improvement, Estimated cost |
|                            | Total project costs                                            | ▪ Dollars in Year of Expenditure                                                                                                                                                                                                                                                                   | Estimated cost                                 |
|                            | Cost per new trip                                              | ▪ Dollars per trip                                                                                                                                                                                                                                                                                 | Estimated cost, new capacity added             |
|                            | Cost per new VMT                                               | ▪ Cents per mile                                                                                                                                                                                                                                                                                   | Estimated cost, new VMT capacity added         |
|                            | Cost per user                                                  | ▪ Dollars per user                                                                                                                                                                                                                                                                                 | Estimated cost, new users                      |

### 3.5 PRELIMINARY ENGINEERING ACTIVITIES

The following Preliminary Engineering activities are commonly involved with developing Preliminary Engineering submissions (see [Section 3.6](#)).

**A. Purpose and Need.** All projects require a clearly stated and well documented purpose and needs statement. The only exceptions are those projects that qualify for a Level 1A CE.

The process of determining and documenting the project need is typically started in the Pre-TIP Project Development steps during screening (as discussed previously in [Chapter 2](#)). When sufficient needs information has not been completed during these steps, additional needs-related activities must be conducted during Preliminary Engineering. Many of these activities involve engineering analysis and data collection.

Information about project need is critical to the definition of the purpose, type, size, and location of a proposed highway improvement. During the consideration of project alternatives, the project need statement serves as an important baseline for Preliminary Engineering studies. With a sound understanding of the project purpose and needs and an understanding of how the project fits into the surrounding community and landscape, the Project Team can use the need information to analyze alternatives. The solutions should satisfy the need while balancing the engineering criteria, environmental impacts, costs, and public/agency concerns. The lack of project need information may result in improper decisions concerning the type, size, and location of proposed transportation improvements.

The required level of detail in the statements about purpose and needs varies with project complexity. For a simple bridge replacement project, the need can be summarized in a single problem statement. For example, the statement may concern an undesirable condition caused by structural deterioration and the need to maintain a connection over a natural or constructed feature. For more complicated projects, the need may be more detailed. These projects may require Preliminary Engineering studies to document thoroughly project need and to assess the impacts associated with a range of improvement alternatives.

For guidance regarding documentation of purpose and need during Preliminary Engineering, refer to Publication 319, *Needs Study Handbook*, Chapter 3, Section 3.6 (Step 6 - Preliminary Engineering/NEPA Decision).

Additional guidance regarding purpose and need is found in AASHTO's *Practitioner's Handbook #07*.

**B. Initial Preliminary Engineering Meeting.** This is primarily an internal coordination meeting involving the District and the Design Team. This meeting typically occurs after the Scoping Field View. Depending on project objectives, schedule and the amount of detailed information available from previous or ongoing environmental studies, the meeting agenda may include the following:

- Identify the study area.
- Review project objectives including project purpose and need.
- Identify individual responsibilities.
- Identify the highway system.
- Review any prior conferences held that would be significant to the project.
- For new projects, review any previous studies including planning studies, Linking Planning and NEPA (LPN) data, scoping document, and any available pre-TIP information.
- For dormant projects that are being restarted, review all available environmental and design documentation and studies.
- Review known mitigation commitments [refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix T for a description of the Environmental Commitments and Mitigation Tracking System (ECMTS)].

- Discuss any foreseeable issues associated with the project.
- Discuss the status of other existing transportation facilities affecting the project.
- Determine the availability of existing highway plans.
- Identify design criteria.
- Discuss proposed structures.
- Discuss tentative pavement type.
- Determine plan and profile scales.
- Identify type of access control.
- Discuss mapping and aerial photography requirements.
- Obtain necessary supplies, assignment of survey book numbers, applicable straight-line diagrams of existing highways and the survey letter of intent to enter onto property.
- Discuss Traffic Control.
- Discuss the availability of crash data.
- Discuss the project's anticipated right-of-way requirements.
- Develop and/or review the schedule.

**C. Alternative Analysis.** A primary function of Preliminary Engineering may be to evaluate whether to rehabilitate or upgrade an existing facility, provide new facilities, or modify an existing facility to make it better fit into its surroundings. A thorough understanding of the purpose and need is required to systematically identify, evaluate, and refine a broad range of viable study alternatives.

The environmental and community features within the project study area must be identified and evaluated. The range of alternatives should be based on project purpose and need, and on the project area context and place. Alternatives that were evaluated, dismissed from consideration, and properly documented during the Pre-TIP Project Delivery Phases should be incorporated by reference into the Engineering and Environmental Study Phase Alternatives Analysis. Alternatives dismissed during the Pre-TIP phases should not be reevaluated unless new information is identified that might change the outcome of the Pre-TIP analysis.

EAs and EISs require Alternative Analysis as per Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*.

Evaluation of certain alternatives is required under NEPA for different environmental resources. Although projects with an environmental documentation of Level 2 or lower do not require an Alternative Analysis, some environmental resources may require an Alternative Analysis. For example, for projects requiring a Section 4(f) Analysis, an evaluation of alternatives to avoid and then minimize the use of the Section 4(f) resource must be considered. Where there is Section 4(f) involvement, the Alternatives Analysis must determine that there are no "prudent and feasible" alternative to the use of land from Section 4(f) resources. In addition, in air quality non-attainment areas, which are counties that do not meet National Ambient Air Quality Standards for ozone pollution, specific emission reduction measures must be considered for non-attainment areas. These measures include Transportation Systems Management (TSM), travel demand reduction, operational management strategies, and other nontraditional alternatives for transportation improvements.

The line, grade, and typical sections of the various alternatives must be developed in sufficient detail to determine project impacts and approximate construction costs. The proposed alternatives must satisfy the project purpose and need as well as support a rigorous analysis of all project features and effects related to construction, design, right-of-way requirements, and PennDOT criteria. Alternatives should be evaluated against Measures of Effectiveness which are based on the purpose and need of the project. [Table 3.1](#) provides sample Measures of Effectiveness.

It is important that the alternatives fit the scale of the project (see [Section 3.4.D](#)). In addition, the Conceptual Alternatives Analysis conducted during the Pre-TIP Project Delivery Phases must be used as the baseline for the Post-TIP analyses. The analyses should always first consider low-cost improvements, including non-traditional solutions, and should strive to find the best alternative (from a cost, project need, and project area setting standpoint) with the best cost to benefits value ratio, i.e., the alternative that best balances the benefits provided with the lowest impacts and costs. This can be accomplished using PennDOT's Process ([Figure 2.1](#)) and the ten Core Principles discussed in [Section 2.0](#), along with concepts discussed in [Section 3.4](#). For more details, refer to the AASHTO's *Practitioner's Handbook #07*.

Alternative Analysis may be performed to analyze various engineering solutions such as roundabouts or interchange schematics (see [Section 3.5.D](#) below). For alternative analysis for intersections, use the Intersection Control Evaluation (ICE) policy. Refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AI, Intersection Control Evaluation (ICE) Policy. The ICE results should be evaluated in combination with other factors, such as environmental constraints. These types of Alternative Analysis may not be required for environmental documentation. Review of Alternative Analysis is required as follows:

- Federal Oversight Projects: FHWA, Highway Design and Technology Section (HDTS), and District. FHWA and HDTS can waive their review.
- PennDOT Oversight Major Complexity Projects: HDTS and District.
- PennDOT Oversight Minor and Moderate Complexity Projects: District. The District may request HDTS and FHWA to review an Alternative Analysis.

HDTS and the Environmental Policy and Development Section (EPDS) and FHWA will review Alternative Analysis as required for environmental documentation, which supersedes the above review process.

An Alternative Analysis approval is not required except for when needed for environmental documentation; however, the preferred alternative should be documented in meeting minutes or other documentation.

**D. Alternative Interchange Schematics.** An interchange represents a system of interconnecting roadways with one or more grade separations. An interchange provides for the movement of traffic for two or more roadways on different levels.

An important function of Preliminary Engineering is developing alternate interchange schematics to:

- Determine system continuity.
- Evaluate traffic capacity and operational characteristics.
- Evaluate alternative structure types.
- Evaluate the constructability and safety of various alternatives.
- Develop preliminary construction cost estimates.
- Determine approximate right-of-way requirements.
- Assess environmental impacts.

From the evaluation of these alternate interchange schematics, a preferred interchange layout should be identified and then further refined during final design.

The number of alternate interchange schematics should be based on project-specific considerations. These considerations should include site constraints, system continuity, traffic volumes and composition, safety, constructability and economic factors. For additional information concerning types of interchanges and interchange warrants, refer to Publication 13M, Design Manual Part 2, *Highway Design*. Also, a Point of Access Study may be

required, see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix Q, Points of Access for details.

**E. Notice Of Intent To Enter Property.** Section 309 of the Eminent Domain Code, 26 Pa. C.S. effective September 1, 2006, requires that entry upon any land or improvement prior to condemnation by PennDOT employees or agents, whether for the purpose of conducting studies, surveys, tests, soundings or appraisals, must be preceded by 10 days notice to the owner of the land or the party in whose name the property is assessed. The Notice of Intent to Enter Form is located in Publication 378, *Right-of-Way Manual*.

Accordingly, compliance with the following instructions is required of all persons (including consultants and appraisers) whose work for PennDOT necessitates their entry upon private property prior to condemnation:

- THE NOTICE OF INTENT TO ENTER (Form RW-983) will be mailed by certified mail, return receipt requested, to the property owner in sufficient time to be received by the property owner at least 10 days in advance of the anticipated date of entry. Unless the property owner has been contacted in-person and permission to enter granted, entry onto the property should not commence until a return receipt has been received.
- The format for a normal business letter should be followed. This notice will be sent to the property owner, not to the tenant or mortgage holder. This notice will be sent in a regular business envelope with the return address of the Design Agency sending the notice.
- One notice may cover entry by any number of persons.
- PennDOT will send notices relating entries in which PennDOT personnel will participate, and in such case the return receipts will be kept in the appropriate file.
- If the entry will be made solely by consultant staff, appraiser, or other non-PennDOT personnel, the notice will be sent by them on forms to be supplied by the District. Return receipts will be kept in the former's files. Please note that retention of these receipts is for the protection of non-PennDOT personnel as well as of PennDOT.
- A repeat notice should be sent to the property owner if an extended period of time (6 months) has elapsed since entry was made on the initial notice or after last correspondence. Any Notice of Intent to Enter, after the first notice, will be sent by regular first class mail. Records of the mailing (i.e., a dated photocopy of the notice) should be kept in the project files. In addition, before entry, the entrant should make an effort to contact the property owner personally.
- If entry into buildings is required, it is required to telephone for an appointment to do so, in addition to sending the required notice.
- Copies of NOTICE OF INTENT TO ENTER (Form RW-983) should be reproduced, as needed.
- No changes to NOTICE OF INTENT TO ENTER (Form RW-983) are allowed without the approval of the Chief of Utilities and Right-of-Way Section at the Bureau of Project Delivery. The Chief of Utilities and Right-of-Way Section will coordinate any requested changes with the Office of Chief Counsel.

Entrance to property cannot be made until signed return receipt is received or documented personal contact is made with the property owner. If a property owner refuses entry onto their property, contact the Office of Chief Counsel Real Property Division, as the Department's right to enter is provided by statute, and an enforcement action can be filed in county court.

An AUTHORIZATION TO ENTER, NON-WAIVER OF CLAIM (Form RW-397), or AUTHORIZATION TO ENTER, WAIVER OF CLAIM (Form RW-397A) may be used in emergencies wherein sufficient time is not available to notify a property owner 10 days in advance of entry upon private property. The Form RW-397 and RW-397A, along with instructions for their use, are located in the current version of Publication 378, *Right-of-Way Manual*

(available from the PennDOT District Office). The executed waiver should be retained in the file of the securing party. If a waiver cannot be obtained, entry must be delayed until 10 days notice can be given.

**F. Municipal Notification, Coordination, and Public Involvement.** A proposed construction project often directly or indirectly affects the municipalities in which the project is located and the public who uses the facility. Coordinating directly with groups from these municipalities, including municipal officials and the public, is very important in addressing the specific and perhaps unique concerns and needs of local interests.

During Preliminary Engineering, projects typically require interaction and coordination with municipal officials and the public. This may include public meetings, which are the foundation of the Department's efforts to involve communities in projects that affect them. Throughout Preliminary Engineering, dialogue with municipal officials and the public focuses on:

- Identifying intangible values and tangible resources important to the community.
- Modifying alternatives to minimize impacts to these resources.
- Facilitating compromise, resolving conflict, and building consensus on environmentally sensitive improvements that satisfy identified needs.

During Preliminary Engineering, a Municipal Officials Response Form is one approach used to notify municipal officials of upcoming highway improvement projects and to request information from municipal officials regarding utilities, special events, emergency services and other design considerations. [Figure 3.1](#) presents a sample transmittal letter to municipal officials. [Figure 3.2](#) provides a sample Municipal Officials Response Form.

Public involvement is used to engage citizens in transportation planning and project development. All projects should include some form of public involvement at a level that is commensurate with the project type and size. Publication 295, *Project Level Public Involvement Handbook*, provides detailed guidance on when to engage the public during the Preliminary Engineering and environmental clearance phase, including public outreach checklists and documentation forms.

**G. Base Mapping.** Base mapping (topographic mapping) must show existing conditions with sufficient accuracy and scale to achieve the objectives of Preliminary Engineering. Note that for uncomplicated projects, field surveys may be used in lieu of topographic mapping. Conventional field surveys are widely used to produce mapping on smaller projects. Coverage is confined to a relatively narrow band next to the existing alignment. Aerial mapping supplemented by conventional surveys is generally more cost effective on most projects. This is particularly true where a wide range of alternate alignments is to be investigated.

The accuracy of photogrammetric mapping depends on the flight altitude. Lower flight altitudes produce more accurate mapping but provide a narrower ground coverage width and at a higher cost.

The scope of studies for Preliminary Engineering should dictate the scale, accuracy, and extent of the mapping that is most cost effective. The two most important considerations are width of ground coverage and accuracy. Projects involving roadway reconstruction and minor realignments should normally be mapped at 1 in = 50 ft with a mapping width of up to 1,720 ft with one flight line. Projects involving significant roadway relocation with several alternatives to be studied should normally be mapped at 1 in = 200 ft, since it is highly unlikely that all of the alternatives can be covered within a reasonable width of 1 in = 50 ft mapping. Mapping at 1 in = 200 ft can provide a mapping band of 7,000 ft with one flight line. However, with adequate justification, large-scale mapping for special situations may be requested.

Before starting Preliminary Engineering activities, approval of topographic plans and scales must be obtained from the District Executive. For an in-depth discussion of project mapping, including guidelines for selecting scales, obtaining mapping services and products, and recommended procedures and guidelines for quality assurance/quality control, refer to Publication 122M, *Surveying and Mapping Manual*.

**H. Three Dimensional (3D) Computer Aided Drafting and Design (CADD) Models.**

**1. Introduction.** Three-dimensional (3D) modeling in transportation construction is a mature technology that serves as the building block for the modern digital jobsite. Specifically, 3D Models allow for clash detection (interference between design elements), earthwork quantity computations, stakeless/stringless construction, Automated Machine Guidance (AMG) and for incorporating geospatial subsurface location of cables, conduits and pipes into the design. With 3D modeling software, design and construction teams can develop, test and alter project designs throughout the design and construction phases. This connectivity of design data to construction allows workers in all phases of highway and bridge projects to receive and work with the most accurate models even if mid-cycle design changes are made.

**2. Design.** The Department's standard CADD software and the related civil design applications are 3D modeling applications which automate the annotation of key features (e.g., roadway elevations, pipe inverts, overhead wires) on plan sets, specifically cross-sections and profiles. Additionally, the software can be used to compute earthwork volumes and provide hydraulics information for stormwater systems, thereby decreasing the need for detailed hand calculations. Intricate design features can be viewed geospatially, or in a 3D view, from multiple perspectives, and simulations can be run to detect design flaws before construction begins. Data exported from 3D models can be transferred to Global Positioning System (GPS) machine control that guides and directs construction equipment like bulldozers and excavators.

**3. Determining If a 3D Model Should Be Developed.** Projects defined as Moderately Complex and Most Complex in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Tables 2.2: Moderately Complex and 2.3: Most Complex (Major) will realize the greatest benefits for 3D modeling, but the benefits should be considered for all projects. Specifically, consider 3D modeling when a project includes any of the following conditions:

- A Digital Terrain Model
- Cross sections that will be included in the final plan set
- Reconstruction is proposed within the project limits
  - If the reconstruction is only a component of the overall project (e.g., mill and overlay scope of work with a section of reconstruction), only the reconstruction area should be modeled in 3D
- Major roadway rehabilitation (structural enhancements that both extend the service life of an existing pavement and/or improve its load-carrying capability)
- Complex storm water and drainage (to check for clearances under roadway subbase)
- Intersections
- Subsurface utility information that is located (Quality Level A information)
- Structures with complex bridge deck surface geometry (e.g., curved roadway or slope transitions on structure)
- New structures or culverts
- Major earthwork and/or Class 1 excavation and fill
- High public exposure projects

**I. Traffic Considerations.**

**1. Traffic Studies.** For Preliminary Engineering, traffic studies are typically conducted to support Planning and Needs Studies, complete a capacity/level-of-service analysis, forecast future transportation demand, and evaluate transportation improvement alternatives. A key aspect of needs analysis is evaluating the current transportation system by collecting data on traffic volumes, crashes, and travel patterns. For Minor Complexity Projects, the traffic analysis may be completed with minimal effort.

Reliable traffic data is generally available from a variety of sources. These sources may include the District Traffic Unit, PennDOT's online resources, internet Traffic Monitoring System (iTMS), and the local MPO or RPO. Where sufficient or up-to-date existing data cannot be obtained, new traffic counts may be necessary. Up-to-date traffic data is considered to have been collected within the last 3 years.

Scheduling manual traffic counts should be coordinated in advance with the District Traffic Unit. Avoid conducting traffic counts during unusual events that contribute to extreme traffic volumes, unless the purpose of the traffic counts is specifically related to such events. Depending on the scope and objectives of the project, identification of motorists' origins and destinations, saturation flow rate measurements, speed and delay timings, vehicle classifications, bicycle and pedestrian movements and crash data may be required. Because of the cost and time required to obtain reliable traffic data, the methodology for data collection should be consistent with the objectives for the project. The ITE *Manual of Transportation Engineering Studies* provides useful guidance in the collection and analysis of traffic data.

Safety requirements for work within the highway right-of-way, as indicated in Publication 212, *Official Traffic Control Devices* and Publication 46, *Traffic Engineering Manual*, in conjunction with Publication 213, *Temporary Traffic Control Guidelines*, should be followed. Refer to Publication 319, *Needs Study Handbook* and Publication 13M, *Design Manual Part 2, Highway Design* for additional guidance on traffic characteristics, design considerations and analysis techniques.

**2. Traffic Analysis.** With the determination of existing traffic volumes, a capacity analysis can be completed. Capacity is the measure of how effectively a highway accommodates traffic. Capacity is expressed as a letter grade ranging from Level of Service (LOS) 'A' to 'F'. LOS can be determined for a variety of highway operations including intersections, merge/diverge areas, freeway flow, and bicycle and pedestrian operations. The HCM outlines the criteria, procedures, and guidance for highway capacity analysis. The appropriate software to complete the capacity analysis should be determined through utilization of the FHWA's *Traffic Analysis Toolbox*. An important component to any capacity analysis is model calibration; FHWA's *Traffic Analysis Toolbox* also provides guidance on model calibration.

Once existing conditions are established, the development and evaluation of future traffic conditions can be determined. Future traffic volumes should be projected to the Design Year determined for the project, which is normally 20 years after planned opening to traffic. Design Year traffic volumes can be developed with the assistance of a regional traffic demand model, observed growth rates, development trends or a combination of the sources. Coordination should be completed with the District Traffic Unit to determine the approach for future volume projections. With the development of future traffic volumes, capacity analysis can be completed for future conditions and improvement alternatives. The analysis of future traffic demand not only determines the capacity of various improvement alternatives, but also evaluates the ability of the alternatives to satisfy the purpose and need of the project.

A traffic analysis should also account for multimodal/alternative transportation modes. The needs of pedestrians, bicyclists, transit users, and other users (e.g., horse and buggy traffic) must be considered in designing all roadway projects. Sidewalk networks should be well connected with opportunities for regular, safe street crossings. By encouraging multimodal/alternative transportation, communities can break the pattern of sprawling suburbs with rapidly multiplying vehicular trips and congestion.

It should be acknowledged that there are potential trade-offs between vehicular mobility and pedestrian, bicycle and transit mobility. A balance should be sought in attaining these goals on all projects.

A traffic analysis should also evaluate the impacts on oversize loads, which require hauling permits. The District's Hauling Permit area can provide permit-related maps as a potential tool to identify hauling routes.

**3. Traffic Calming.** The role of physical measures in traffic calming has been emphasized because they are "self-policing". This means that traffic calming measures have the ability to slow motor vehicles in the absence of enforcement. Traffic calming measures involve a combination of primarily physical measures taken to reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users. Examples of traffic calming measures include:

- Roundabouts
- Splitter islands
- Curb extensions/bulb-outs
- Chicanes
- Gateways
- On-street parking
- Raised intersections
- Diagonal diverters
- Right-in/right-out island
- Pedestrian safety enhancement devices

Traffic calming techniques may apply on arterials, collectors, or local streets as necessary to reduce speeds such as in speed transition areas near the urbanized limits of small towns. Transitions from one speed zone to another should be introduced in a manner that gives motorists adequate time to prepare for, and react to, changes in roadway design. In all cases, the designer needs to introduce transition measures that will safely lower the speed of vehicles entering the project area by sending a clear message to the driver that there is a change in context and in roadway typology. Changes in building height and setback, the width and number of travel lanes, and the shoulder treatment are all means of providing visual cues.

Publication 383, *Pennsylvania's Traffic Calming Handbook*, contains information on various traffic calming issues such as legal authority, liability, funding, and impacts on emergency services. This Handbook is intended to provide municipalities with information that can help them establish a traffic calming program for roadways within their jurisdiction.

**J. Railroad/PUC Involvement.** Coordination of all Railroad activities throughout the duration of the project design are to be conducted through the District's Grade Crossing Engineer/Administrator (DGCE/A). An initial meeting with the Railroad should be scheduled as early as possible in the Preliminary Engineering phase. It is recommended that valuation map(s) be obtained from the Railroad early in Preliminary Engineering. Secure a completed D-4279 "Railroad Crossing Data for Design" and D-4279A "Railroad Crossing Data for Contractor" forms from the Railroad through the DGCE/A.

No alteration shall be made to any public highway-railroad crossing, whether crossing a highway at-grade, above-grade, or below-grade, without first obtaining approval from the PA Public Utility Commission (PUC). Based on the scope of the project the DGCE/A and/or Bureau of Project Delivery's Grade Crossing Unit will determine if PUC action is required and if a PUC application will have to be filed. The PUC has no jurisdiction over projects that involve private railroad crossings.

In most cases, the Department must reimburse the Railroad for its Preliminary Engineering (PE) costs through a Railroad reimbursement agreement. Generally, Railroads will not attend any meetings, perform plan reviews, or provide comments, concurrences and/or approvals, until a PE authorization is provided to the Railroad by the Department and/or there is a fully executed Railroad reimbursement Preliminary Engineering agreement with the Department.

Additional guidelines and procedures pertaining to the preliminary Railroad activities listed below can be found in Publication 371, *Grade Crossing Manual*, Chapter 2 "PUC Coordination" and Chapter 4 "Highway and/or Bridge Project Process."

- Authorizations of Preliminary Engineering for Railroad Phase
- Scheduling Initial Meeting with Railroad(s)
- Data for PUC Application (Step 1, 2, and 3 Submission requirements)
- PUC Field Investigation and Conference

- Prepare for a PUC Hearing
- PUC Orders/Secretarial Letters

Additional sources of reference on Railroad and PUC involvement include:

- Title 23, *Code of Federal Regulations, Part 646*
- Publication 371, *Grade Crossing Manual*
- Publication 16, Design Manual Part 5, *Utility Relocation*

**K. Utility Identification and Verification.** All procedures involving the relocation of utility facilities shall conform to the requirements specified in Publication 16, Design Manual Part 5, *Utility Relocation*. Coordinate the tasks needed to complete the utility relocation activities with the District Utility Administrator.

Assure compliance to the criteria outlined in Act 287 of 1974 as amended. Secure information relating to the location of the existing utility facilities and their rights-of-way within the project limits and include this information on the plan. Information regarding PA One Call procedures, designer and locator effectiveness guidelines, responsibilities of the various stakeholders, definition of terms, and the current Pennsylvania One Call legislation is available on the PA One Call Website at [www.pa1call.org/PA811/Public/](http://www.pa1call.org/PA811/Public/).

In accordance with ASCE Publication 38-02, *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data*, the Project Manager is to determine the appropriate Quality Level of Subsurface Utility Engineering (SUE) that will be required for the project, and should use the SUE Utility Impact Form found in Publication 16, Design Manual Part 5, *Utility Relocation*, Appendix A, Figure A-501.

If the Federal Highway Administration is participating in the utility relocation engineering costs, assure the appropriate funding has been programmed for the utility relocation engineering costs that may be reimbursable to the utilities. To avoid jeopardizing Federal funds, an approved Form 4232 (See Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*) must be in place prior to authorizing the utilities to proceed with the engineering. The Project Manager is to notify the District Utility Administrator when the project's utility phase funding has been approved to ensure timely execution of the utility relocation agreement.

Obtaining existing utility data can be difficult and very time consuming; the Design Team should request this information from utility owners at the beginning of Preliminary Engineering. The Design Team shall contact the District or the county Recorder of Deeds to obtain a list of utility owners with facilities in the area. Using this list, the Design Team shall advise each utility owner of the project and shall request information about any facilities in the area of the project.

Publication 16, Design Manual Part 5, *Utility Relocation*, Chapter 3, Section 3.2.F discusses utility verification plans and related activities during Preliminary Engineering. The discussion includes a suggested letter format (Figure A-503) for the Designer to request utility verification of the type, size, and location of existing facilities.

Additional sources of reference on utility identification and verification include:

- Title 23, *Code of Federal Regulations, Part 645*
- Title 67, *Code of Federal Regulations, Chapter 459*
- ASCE Publication 38-02, *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data*.

Refer to Publication 10, Design Manual 1, Chapter 8, Section 8.6, for specific guidance for submitting an Alleged Violation Report for underground utilities that are struck, damaged or previous damage is discovered during design or construction.

**L. Pedestrian and Bicycle Facilities.** Every project must be evaluated to determine pedestrian needs. Pedestrians are a part of the roadway environment, and attention must be paid to their presence in urban as well as rural areas. Pedestrian access, safety and needs must be given full consideration during the Preliminary Engineering phase. When it is determined through a pedestrian study that sidewalk is to be included in the project scope, the municipality will be responsible for future maintenance. A maintenance agreement must be executed or ordinances clarifying maintenance responsibilities must be in place. Sometimes, a pedestrian study is not done, but it may still be determined that a sidewalk is needed. Publication 13M, Design Manual Part 2, *Highway Design*, Chapters 6 and 19 provide design guidelines and considerations for pedestrian facilities and the Americans with Disabilities Act (ADA) requirements.

Provisions of adequate bicycle facilities as part of the overall transportation system enhance and encourage safe bicycle travel as an alternative transportation mode. AASHTO's *Guide for the Development of Bicycle Facilities* and Publication 13M, Design Manual Part 2, *Highway Design*, Chapters 16 and 19 present design guidelines and considerations for the development and design of bikeways and the procedures for the processing of a bikeway project.

During the Preliminary Engineering phase, various design elements for bicycle and pedestrian facilities are to be coordinated with the requirements in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix S, Bicycle and Pedestrian Checklist; specifically, the relevant portions of the checklist should be completed.

**M. Public Transportation.** The needs of transit users must be considered in designing all roadway projects. Transit-friendly design should support a high level of transit activity. Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 19 presents design considerations for providing public transportation, particularly for buses.

**N. Hydrologic and Hydraulic Analysis.** A preliminary hydrologic and hydraulic (H&H) analysis should be performed during the Preliminary Engineering phase of any roadway project that includes a waterway obstruction or floodplain encroachment. The preliminary H&H analysis is used to establish the hydraulic opening size for the Type, Size and Location (TS&L) drawing. The preliminary H&H analysis should be performed in accordance with Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10 and Publication 584, ***PennDOT Drainage Manual***.

**O. Design Value Engineering.** Value Engineering (VE) is defined as:

"The systematic application of recognized techniques by a Multi-Disciplinary Team to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide needed functions to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without sacrificing safety, necessary quality, and environmental attributes of the project."

PennDOT has embraced this concept as a valuable tool for reducing cost without reducing performance and is committed to providing the highest value for each dollar invested.

The potential for savings is greater when VE reviews are conducted early in the design process; however, studies should not be scheduled until sufficient data is available to evaluate the project. The usefulness of the study depends on the availability of information and whether accepted VE recommendations can be implemented without delaying the project schedule. Sufficient data should be available immediately after the Design Field View Submission. When information about the roadway and structures is to become available at different times, it may be cost effective to conduct two separate VE reviews.

The team approach is at the heart of VE's success. Team members must be selected with care and should have expertise in a wide range of disciplines.

See Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix R, Design Value Engineering Review Procedures for a detailed discussion. Appendix R provides practical guidance on:

- Determining if a VE is required;
- When VE reviews should be scheduled to maximize cost savings;
- The requirements of a VE submission;
- How to assemble a VE Team; and
- How to prepare a VE Review Report.

Guidelines are also included in Appendix R for the implementation of VE review recommendations.

### 3.6 PRELIMINARY ENGINEERING SUBMISSIONS

Preliminary Engineering involves the preparation of designs and associated documentation to support the environmental studies (Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*) and to develop a detailed Scope of Work for final design.

The Design Team prepares its designs, along with the related documentation, and submits relevant deliverables at designated points during the Preliminary Engineering phase. Deliverables that are commonly prepared include:

- Line, Grade, and Typical Section ([Section 3.6.A](#))
- Safety Review ([Section 3.6.B](#))
- Design Exception Request ([Section 3.6.C](#))
- Design Field View ([Section 3.6.D](#))

#### A. Line, Grade, and Typical Section.

**1. Determining If a Line, Grade, and Typical Section Submission Is Required.** Whether or not a Line, Grade, and Typical Section submission is required depends on the complexity, type, and location of the project. A Line, Grade, and Typical Section Submission is required for:

- All Major Complexity Projects
- All roadway and bridge replacement Moderate Complexity Projects, unless deemed not necessary by the HDTs Project Development Engineer or the ADE-Design.

Minor Complexity Projects may require a Line, Grade, and Typical Section Submission, as required by the ADE-Design or designee.

For complexity levels, refer to Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 2.

**2. Background.** A Line, Grade, and Typical Section Submission helps to confirm what the purpose and needs are for the project as they were identified during the Scoping Field View and identified/referenced in the Scoping Document. The District may desire to review and approve the Design Criteria prior to the Line, Grade, and Typical Section Submission.

The first step in preparing preliminary line and grade is to evaluate the existing line and grade for geometric design deficiencies, which includes:

- Review crash reports and plot any crash clusters and apparent safety problems.
- Conduct a site visit and interview local residents and law enforcement officials.

- Consider providing a Crash Analysis and Safety Impact Evaluation as defined in Publication 638, *District Highway Safety Guidance Manual*, using the *Highway Safety Manual* methodologies for proposed conditions and applicable existing conditions.

Possible existing design deficiencies may include stopping sight distance (horizontal and/or vertical), ramp acceleration and deceleration lengths, sharp curves, and steep grades. To evaluate the existing conditions, refer to Publication 13M, Design Manual Part 2, *Highway Design*, and AASHTO's *A Policy on Geometric Design of Highways and Streets*.

Where design criteria cannot be met without significant change to the scope and cost of the project, design exceptions may be warranted. See Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix P, Design Exceptions.

The line and grade should be developed to correct identified deficiencies, if warranted, and to coordinate with other Preliminary Engineering activities.

For most Minor Complexity Projects that involve resurfacing, miscellaneous safety improvements or maintenance, line and grade are already established by existing conditions. On these projects, line and grade design activities are generally limited to maintaining or making minor improvements or refinements to the existing line and grade. Interpret, verify (in the field) and convert original design plans or "as built" drawings (if available). These drawings will generally provide the required base design for any subsequent line and grade refinements. For most Minor Complexity Projects, the graphical development of this base will represent the most significant line and grade design activity. Prepare the base design according to Publication 14M, Design Manual Part 3, *Plans Presentation*.

Major Complexity Projects generally involve construction on new location or total reconstruction of an existing facility. Line and grade development is typically the most extensive Preliminary Engineering activity because so many other design and environmental issues are affected by a project's line and grade.

The design of a highway's line and grade is influenced by a wide range of considerations and must be coordinated with environmental studies and other design activities. If applicable to the project, the following issues shall be considered and thoroughly investigated:

- Topography
- Existing utilities
- Structures
- Earthwork balance
- Interchange and intersection locations
- Proposed drainage
- Soil conditions
- Land use
- Roadside Safety
- Americans with Disabilities Act (ADA) curb ramp compliance
- Rail-highway crossings
- Permit requirements

- Right-of-Way requirements
- Airport clearance requirements
- Safety Performance
- Construction and maintenance costs
- Maintenance and protection of traffic
- Constructability
- Public involvement considerations (including aesthetics and noise mitigation)
- Transportation plans (prepared by the local MPO or RPO)
- Any other significant factors (including comments received from the public and regulatory agencies during the project's environmental studies phase)

**3. Plan Deliverables.** Depending on the nature and complexity of the project, the line and grade may be a very minor or extremely significant aspect of Preliminary Engineering.

Plan deliverables should be developed/drafted in accordance with Publication 14M, Design Manual Part 3, *Plans Presentation*. Note that plans should be electronic files or half sizes unless requested otherwise. See [Section 1.3](#), Plan Sheets Delivery, Printing and Plotting Order of Preference. The following should be included in a Line, Grade, and Typical Section Submission:

- a. Title Sheet. The title sheet should include the following information as a minimum:
  - Right-of-Way notes (particularly for limited access roadways)
  - Tabulation of anticipated Supplemental Plans (refer to Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 2, Section 2.1.H)
  - All Design Designation data
  - Project Length
  - Limit of Work Stations
  - Required "S" (structure) numbers

"S" numbers themselves may not be established at the time of the Line, Grade and Typical Section Submission. However, the required number of S's should be indicated reflecting the proposed number of structures.

- b. Location Map. This sheet should either include a map on a plan sheet or 8.5 in × 11 in sheet.

- c. Typical Sections. Typical sections should be developed using critical cross sections as required. The required level of effort to develop typical sections should be commensurate with the type of project.

Obtaining the traffic analysis data and records of pavement history is considered a prerequisite in the development of typical sections. Develop the typical sections according to Publication 13M, Design Manual Part 2, *Highway Design*, and in consideration of the:

- Project setting (rural, suburban neighborhood/corridor/center, town neighborhood/center, or urban core)

- Roadway functional classification and context (regional/community arterials, community/neighborhood collectors, or local road/street)
- Traffic volumes
- Design speed and desired operating speed
- Terrain (level, rolling or mountainous)
- Bicycle and pedestrian accommodations
- Crash data and safety impacts/crash analysis
- Available right-of-way/additional right-of-way needs
- Provisions for on-street parking
- Driveways
- Utilities
- Trees and sidewalks
- Salvageable pavement and curbing

Dimension the following features clearly on the typical sections:

- Lane, shoulder, median, sidewalk, bike lane, and parking lane widths
- Curb-to-curb bridge width (for projects involving a bridge)
- Roadside grading (including cut and fill slopes)
- Swales and adjacent gutters (as applicable)
- Pavement cross slopes (for normal and superelevated sections)
- Profile grade point
- Survey centerline or baseline
- Roadside barriers and curbing
- Approximate station to station limits of tangent and superelevated sections
- Railroads
- Sound barriers
- Retaining walls (if known)

**d. Plans.** Display the proposed design concept. The plan sheets should include the following information as a minimum where applicable:

- Existing topography and contours
- Existing and proposed roadway elements
- Existing and proposed curve data
- Points of curvature and equality stations
- Roadside barriers and curbing
- Legal and required right-of-way and easement lines
- Known property lines with parcel identification and name of owner
- Major and minor drainage features
- Preliminary hydraulic information
- Existing overhead and underground utilities
- Existing and proposed bridge data

e. Profiles. Display the proposed design concept. The profile sheets should include the following information as a minimum where applicable:

- Vertical datum
- Existing and proposed vertical curve data
- Major drainage crossing (existing and proposed)
- Structures with vertical clearances
- Structures with flood water elevations
- Existing overhead and underground utility crossings
- Existing and proposed grades
- Equality stations

**4. Supporting Documentation.** Prepare and submit supporting documentation to explain the line, grade, and typical sections selected for the project.

Include the following applicable information:

- Design Criteria Matrix (see [Section 3.6.A.5](#) below)
- Photographs
- Proposed traffic control methodology (with detour map, if applicable)
- Project Coordination (e.g., utilities, railroads, municipalities)

**5. Design Criteria Matrix.** The Design Criteria Matrix (see [Figure 3.3](#) for sample table) is an electronic spreadsheet that is available in the ECMS File Cabinet in the Project Development Checklist. The Design Criteria Matrix is intended to document the design criteria selected during Preliminary Engineering. The District may add additional fields to the matrix but may not delete any applicable fields. Include this matrix or a matrix with equivalent information, if applicable, as part of a Line, Grade and Typical Section Submission as well as a Safety Review Submission and Design Field View (DFV) Submission. For more detailed information about design criteria, refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1, Section 1.2.

The District may desire to review and approve the design criteria prior to the Line, Grade, and Typical Section Submission.

Instructions to complete the Design Criteria Matrix are as follows:

Section **1** :

Provide information at the top of the page for the MPMS Project Number, State Route (SR), Section Number (SEC), and County.

Section **2** :

Provide a Project Description that reconfirms what the purpose and needs are for the project, as identified during the Scoping Field View and discussed / referenced in the Scoping Document. Vary and/or expand the content in the Project Description based on the project complexity.

Identify whether or not the project is located on the National Highway System (NHS) and/or the Strategic Highway Network (STRAHNET).

Section **3** :

Enter values into the Design Designation section. Except for the State Route (SR), all items have drop-down lists to make a selection.

a. State Route (SR). Specify the SR that the Design Criteria applies (Note: Use a separate sheet for each route). If a local road, use the proper designation (e.g., T-688).

b. Proposed Design Criteria. Design criteria is determined by the type of work proposed. Refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1, Section 1.2 and 1.9.

- New Construction and Reconstruction
- Resurfacing, Restoration and Rehabilitation (3R) for Non-freeways
- Pavement Preservation
- Bridge Projects (New Bridge, Replacement Bridge, Superstructure Replacement, Deck Replacement, or Bridge Preservation)
- Non-Roadway, Non-Bridge Project (e.g., Transportation Enhancement, Pedestrian Facility, Bicycle Facility)

c. Area System (Urban or Rural). Whether a project is located in an urban or rural location is determined in planning and can be found on PennDOT's website through the Bureau of Planning and Research's site for the PennDOT One Map.

PennDOT One Map is a web-based GIS mapping application to support the provision of improvements to state highways and bridges, as well as to aviation, public transit, and rail freight modes of transportation. Users also have access to roadway, bridge, and other asset information sourced from their respective systems of record.

<https://www.dot7.state.pa.us/OneMap>

d. Functional Classification. Functional classification is defined in the AASHTO Green Book and is essentially a Federal definition. Refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1, Figure 1.1 for characteristics of functional classifications. The functional classification is determined in planning and can be found on PennDOT's website through the Bureau of Planning and Research's site for PennDOT One Map.

<https://www.dot7.state.pa.us/OneMap>

- Interstates/Freeways
- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Local Roads

e. Roadway Typology. A roadway typology intends to capture the role of the roadway within the community. It focuses more narrowly on the characteristics of access, mobility, and speed. A roadway typology should be used as a planning and design "overlay" for individual projects, and does not replace the traditional functional classification system.

Roadway typologies are provided in matrices of design values found in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1, Tables 1.3 through 1.8. Roadway typologies are determined at Scoping Field View based on current and planned land use and functional classification. Refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1, Table 1.2 for approximate roadway typology to functional classification equivalents.

- Limited Access Freeway, Rural Interstate
- Limited Access Freeway, Rural Non-Interstate
- Limited Access Freeway, Urban Interstate
- Limited Access Freeway, Urban Non-Interstate
- Regional Arterial, Rural Places
- Regional Arterial, Suburban Neighborhood
- Regional Arterial, Suburban Corridor
- Regional Arterial, Suburban Center
- Regional Arterial, Town/Village Neighborhood
- Regional Arterial, Town Center
- Regional Arterial, Urban Core
- Community Arterial, Rural Places
- Community Arterial, Suburban Neighborhood
- Community Arterial, Suburban Corridor
- Community Arterial, Suburban Center
- Community Arterial, Town/Village Neighborhood
- Community Arterial, Town Center
- Community Arterial, Urban Core
- Community Collector, Rural Places
- Community Collector, Suburban Neighborhood
- Community Collector, Suburban Corridor
- Community Collector, Suburban Center
- Community Collector, Town/Village Neighborhood
- Community Collector, Town Center
- Community Collector, Urban Core
- Neighborhood Collector, Rural Places
- Neighborhood Collector, Suburban Neighborhood
- Neighborhood Collector, Town/Village Neighborhood
- Neighborhood Collector, Town Center
- Neighborhood Collector, Urban Core
- Local Road/Street, Rural Places
- Local Road/Street, Suburban Neighborhood
- Local Road/Street, Town/Village Neighborhood
- Local Road/Street, Town Center
- Local Road/Street, Urban Core

f. Topography. Refer to the AASHTO Green Book. Topography/terrain should be based on the project area, not the roadway grade. Rolling should be applied to most of Pennsylvania.

- Level
- Rolling
- Mountainous

Section **4** :

Enter values into the Traffic Data Section, including:

- Opening Year ADT (Average Daily Traffic) - year that project is open to traffic
- Design Year ADT (Average Daily Traffic) - same as opening year ADT for 3R projects, typically 20 years for new and reconstruction projects
- DHV (Design Hourly Volume)

- D (Directional Distribution)
- T (Truck Percentage)

Note: All of the listed ADTs may not be needed for all types of projects.

Section 5 :

Enter values into the Criteria Section\*, including:

- Location (entire project or by station)
- Existing Value(s) (if applicable)
- Required Value (per design criteria)
- Proposed Value(s)
- Criteria Met? (Yes/No) (This indicates that a design exception may be required)
- Source of Design Criteria (AASHTO or DM-2)
- Remarks (Note any Design Exceptions)

\*Provide appendix upon request, with design calculations and QA/QC verification, for the following:

- Horizontal Alignment Data
- Vertical Alignment Data
- Sight Distances
- Superelevation Transitions (locations and lengths)

Section 6 :

Discuss identified miscellaneous issues, such as:

- Pedestrian and bicycle concerns/needs
- ADA compliance issues
- Transit issues
- Additional design issues

**6. Review and Approval.** The District's Project Manager and appropriate District Unit(s) review the Line, Grade, and Typical Section Submissions. An independent QA review must be performed as per the District's QA/QC plan. Central Office and FHWA may review Line, Grade, and Typical Section Submissions at the District's request. All Line, Grade, and Typical Section Submissions are to be approved by the ADE-Design or the ADE-Design's designated independent reviewer using the memo as shown in [Figure 3.4](#).

**B. Safety Review.** The Safety Review is one of PennDOT's primary review points for quality control on highway design projects. The purpose of Safety Review is to detect and correct safety deficiencies and incorporate necessary safety features into the design as early in the process as possible.

PennDOT's design procedures require that projects be reviewed for safety by a qualified, District Safety Review Committee before contract letting. The ADE-Design is able to waive the Safety Review for certain maintenance type projects (e.g., pavement markings, guide rail repair). Refer to DM-2, Chapter 1 for specific information on maintenance type projects. Additionally, projects that involve traffic signal upgrades/modernization, installation of interconnect systems, and/or the installation of ITS devices only, without any impacts to the existing roadway other than installing conduit and detectors may be granted a waiver. A Safety Review should be considered for all projects, including maintenance projects, for critical traffic control measures. The waiver must be attached to the Program Development Checklist in ECMS.

Safety Review occurs before the Design Field View when there is a Design Field View or at approximately 30% design when there is no Design Field View. Peer review, the team approach, and a dedication to roadway safety are at the heart of the Safety Review process. See Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix O, Safety Review Procedures for a detailed description of Safety Review procedures and a checklist of safety design features.

**C. Design Exception Request.** Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 1 requires that, when minimum design values of controlling criteria cannot be met, a Design Exception Request shall be prepared with full justification provided for the retention, limited improvement, or partial mitigation of these features. The approval of a project design feature not conforming to the minimum controlling criteria should be made only after consideration is given to all project conditions such as service life, safety benefits, compatibility with adjacent sections of unimproved roadways, and the length of time the highway will function under an acceptable level of service.

Design Exceptions should be identified during Preliminary Engineering, and the Requests for those Design Exceptions are to be approved prior to or concurrent to the Design Field View (DFV) Approval (refer to [Section 3.6.C](#)), or 30% design if no DFV submission is prepared. Design Exceptions discovered during Final Design must be submitted and approved prior to the PS&E Submission. Each Design Exception Request must first be reviewed and approved by the District Safety Review Committee.

For further discussion of criteria requiring Design Exceptions, situations not requiring Design Exceptions, review and approval procedures, and documentation of Design Exception Requests, see [Section 3.6.C](#) and Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix P, Design Exceptions.

#### **D. Design Field View.**

**1. Purpose.** The purpose of the Design Field View (DFV) Submission is to:

- Support the project's purpose and need.
- Confirm project impacts as indicated in the NEPA document (includes verifying mitigation commitments and updating the ECMTS report - refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix T, **Environmental Commitments and Mitigation Tracking System (ECMTS) Process**).
- Review and obtain comments on the Preliminary Design prior to final right-of-way and construction plan development.
- Acquaint reviewers with the project site before the actual Design Field View.
- Obtain Design Field View Approval for the project's preferred alternative.

Before a DFV Submission is prepared for a project having multiple alternatives and requiring either an EIS or an EA, the Draft EIS or EA must be circulated and commented on, a public hearing (if required) must be held, and the preferred alternative must be clearly identified. As a rule, a project that qualifies for a CE already has a clearly defined preferred alternative. DFV Submissions are typically made at approximately 30% plan development completion.

The TIP or LRTP must include construction funding prior to NEPA approval; all project phases must be accurately programmed on a fiscally constrained transportation plan (TIP or LRTP) prior to NEPA clearance. Therefore, it is critical at this time to update the previous scoping estimate with the available project information as well as review cost contingencies.

The DFV construction cost estimate is to be compared against the construction cost estimate developed at the Scoping Field View, and if necessary, updates must be made to the construction cost estimate through the District's Planning and Programming process.

DFV Approval follows Environmental Clearance and marks the completion of Preliminary Engineering. Every project must have Environmental Clearance before it can be advanced to Final Design.

**2. Determining If a DFV Submission Is Required.** A DFV Submission is required as follows:

- Federal Oversight Projects - Required unless waived by the FHWA.
- PennDOT Oversight Major Complexity Projects - Required.
- PennDOT Oversight Moderate Complexity Projects - Required, unless waived by the HDTs Project Development Engineer or the ADE-Design.
- PennDOT Oversight Minor Complexity Projects - Not required, unless deemed necessary by the Project Manager or the ADE-Design.

The need for a DFV Submission is to be noted in the Scoping Field View document. If not documented, it is assumed to be required unless it is a Minor Complexity Project or a written waiver is provided in the project file.

A DFV Submission is advisable for all projects with construction cost estimates greater than \$10 million as it will assist in verifying scope and cost containment.

**3. Plan Deliverables.** Refer to [Figure 3.5](#) for a checklist of plan deliverables for DFV Submissions. The District may add additional deliverables but may not delete applicable deliverables. Note that the level of effort and detail in the DFV Submission should be proportionate to the complexity of the project, i.e., a complex project would require more of the items on [Figure 3.5](#) than a Minor Complexity Project. The submitted plans should be electronic files or half sizes unless requested otherwise by the District, Central Office or FHWA. See [Section 1.3](#), Plan Sheets Delivery, Printing and Plotting Order of Preference.

- a. Title Sheet. See [Section 3.6.A.3.a](#) for required information.
- b. Index Sheet. Include the following information as a minimum:
  - Index Map
  - Limit of Work Stations
  - Start and Stop Work Stations
  - Tabulation of Segment Equalities
  - Record of Existing Types of Roadway Pavement, if applicable
  - Sheet Index Block
  - List of Property Owners
- c. Location Map and General Notes. Use as many sheets as necessary to present the following required information:
  - Tabulation of Overall Length and Construction Length
  - List of Stationing Equalities
  - Location Map
  - List of Public Utilities
  - Tabulation of Project Coordinates
  - General Notes
  - List of Segments and Offsets with Corresponding Stationing
  - Earthwork Summary (if known)
- d. Typical Sections. A typical section in the DFV Submission should look closely like a final typical section. In addition to the items listed in [Section 3.6.A.3.c](#) for typical sections on a Line, Grade, and Typical Section Submission, include the following information:

- Approximate pavement and shoulder depths (because the pavement design analysis is typically not completed until Final Design, only approximate pavement depths can be shown). General notes about rounding, seeding, and benching are to be added to each sheet. The approximate pavement structure is to be shown on each section as described in Publication 13M, Design Manual Part 2, *Highway Design*. (Pavement structure descriptions should be the same as in the ECMS Master Items.) For those project pavement designs that are to be submitted to Central Office for review (see Publication 242, *Pavement Policy Manual* Chapter 6.1.B), submit a preliminary pavement design to Bureau of Project Delivery (BOPD), Highway Delivery Division (HDD) prior to DFV approval. A preliminary pavement design may be developed prior to receiving the geotechnical report or soils findings by assuming a resilient modulus.
  - Subsurface and roadside drainage features
  - Subbase drainage treatment
  - Unusual design conditions
  - A standard legend of all proposed materials
  - Roadway identification (by SR and segment).
- e. Special Construction Details. While standard details and construction items generally minimize costs and simplify construction, unusual conditions often require nonstandard design solutions. Identifying unusual construction conditions and developing special construction details during Preliminary Engineering can greatly simplify the Design Field View review process. Proposing special construction details during Preliminary Engineering provides reviewers with additional time to develop alternate solutions and can eliminate unnecessary rework in Final Design.
- f. Plans. The plans for the DFV Submission should clearly display the proposed design concept and identify any conflicts requiring discussion and possible design exceptions. Information required for Design Field View Plan Sheets is shown in [Figure 3.5](#).

(1) Existing and Proposed Geometry. Construction plans for the DFV Submission should clearly depict all identifiable legal and topographic features, including right-of-way lines, easements and both underground and overhead utilities. These features should be presented according to the graphic standards contained in Publication 14M, Design Manual Part 3, *Plans Presentation* and appropriately labeled with specific types and sizes. Any abandoned utilities should be shown and labeled accordingly. Depending on the project type and scope, identifying all pertinent existing features may require doing field surveys to verify and supplement aerial mapping if available.

On projects involving the rehabilitation of an existing roadway, the existing geometry must be established and tied to the project's horizontal and vertical control points. Modern survey equipment and photogrammetry techniques can produce minor variations between the data required to satisfy new survey and photogrammetry and the data considered "as-built." Combining deflection angles obtained from the current survey with radii obtained from "as-built" will generally produce the most satisfactory Design Field View results.

Construction plans for the DFV Submission should clearly depict any topographic features that are critical to the design concept. However, the plans should not be encumbered with secondary final design information that may obscure these features. The purpose of the Design Field View construction plans is to identify critical design issues to be discussed and resolved. Typically, the resolution may require modifications to the proposed line, grade, and typical sections. Until the preferred alignment is approved and thoroughly refined in Final Design, much of this secondary information is indefinite and should not be presented.

This approach is mutually beneficial to both the designer and reviewer. The reviewer can better recognize and address critical features without the clutter of extraneous final design information. The

designer can avoid doing final design calculations prematurely and can therefore devote more attention to the truly critical design issues.

(2) Erosion and Sediment Pollution Control. Detailed Erosion and Sediment (E&S) Pollution Control Plans are not required until after the DFV Submission. However, major E&S features that might determine right-of-way requirements should be considered. Examples of major E&S measures may include sedimentation basins, cofferdams, temporary channels, diversion ditches, and pumped water filter bags. The approximate sizes of these E&S measures should be calculated and presented on the construction plans.

Effective erosion control planning begins during the Preliminary Engineering phase. Control of construction activities and knowledge of the soils encountered are basic to determine measures for preventing erosion and the movement of sediment. Control measures shall be designed to fit the environment, topography, soils, rainfall, land use and construction schedules. A highway location selected with consideration of the problems associated with these basic elements can greatly reduce erosion problems during and after construction. Methods and design criteria are contained in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 13.

(3) Drainage and Stormwater Management. Preliminary drainage design should be completed to the extent of determining the location of major drainage facilities such as inlet and piping systems, culverts, and channels that would affect right-of-way requirements. Drainage calculations should be performed to determine contributing drainage areas and design flows necessary to establish the location and approximate size of the facilities.

Preliminary design of stormwater management facilities should also be completed, including the approximate size of the features if applicable, to determine right-of-way requirements and to evaluate environmental impacts. Examples of stormwater management facilities include vegetated swales, vegetated filter strips, infiltration measures (trenches, basins, berms), permanent detention basins, and constructed wetlands/wet ponds.

Consideration of Best Management Practices (BMPs), which are erosion and sediment pollution control measures, should be given to manage effectively stormwater runoff in accordance with PennDOT's policy on anti-degradation and post-construction stormwater management. The approximate size of these features should be presented on the construction plans for the DFV Submission.

Methods and design criteria for drainage design, stormwater management facilities, and BMP's are contained in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10 and Chapter 13, and Publication 584, *PennDOT Drainage Manual*.

Note that layouts of minor drainage features (inlets, pipes, and stormwater management basins) should be developed using very preliminary calculations and engineering judgment based on previous experience. Detailed calculations are not warranted for these layouts. Major drainage structures (e.g., culverts, stream and river bridges) should include the results of HEC-2 or HEC-RAS program runs on the construction plans as part of the hydraulic data (refer to Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 2).

(4) Railroads. The preliminary construction plans involving Railroad facilities should clearly identify existing Railroad features, including Railroad mileposts, and crossing DOT numbers. On at-grade highway-railroad crossings the existing elevation of each rail and the proposed finished grade of the highway at each rail must be indicated on the construction plans.

(5) Utilities. The Design Team should exert as much effort as necessary to locate utility facilities in critical areas of the project. This may require conducting supplemental field surveys to locate surface features including overhead wires, poles, valves, utility holes, junction boxes, and pipeline markers.

If sufficient data cannot be obtained from the utility owners, reasonable care should be taken to develop a theoretical utility layout that can be verified with test pits. This layout can be very valuable in evaluating the impact of the proposed improvements on existing utilities and estimating construction costs. All utility locations presented on plans for the DFV Submission should be verified with the appropriate utility owners immediately following the Design Field View. See Publication 16, Design Manual Part 5, *Utility Relocation* for more information.

**(6) Lighting Warrant Analysis.** If an analysis suggests that lighting is warranted, a preliminary layout should be prepared to figure out approximate construction costs. For Preliminary Engineering, this layout should be prepared at 1 in = 100 ft or 1 in = 50 ft scale on the Construction Plans. Lighting or electrical calculations are not required and the layout should not show junction boxes or conduits.

For PennDOT's lighting policy and procedures for Final Design, refer to Chapter 4, Final Design Plan Development.

Additional sources of reference on roadway lighting include:

- AASHTO, *Roadway Lighting Design Guide*
- AASHTO, *Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals*
- Publication 72M, *Roadway Construction Standards*
- Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 5
- Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 9

**g. Profiles.** The amount of detail included on profile sheets should be sufficient to show clearly the proposed grade, but should not significantly exceed the minimum requirements shown in [Figure 3.5](#). Providing excess detail for this submission is unwarranted, can be a major cause of unnecessary rework and can detract from the effectiveness of the submission. A measured approach to profile preparation is recommended.

Minor line adjustments during final design should be expected. Because the proposed grade must be specific to the proposed line, any final design refinements to the proposed line will require adjustments to the grade. Profile design is an interactive process, heavily influenced by other design considerations, including geometrics; structures; earthwork analysis; drainage; and right-of-way.

Any existing or proposed features that could be potential vertical control points or otherwise have a significant influence on the profile design (e.g., bridges, culverts, major overhead and underground utilities, flood water elevations, railroads) should be included on the profiles.

Superelevation data can be shown on the profile to help identify problems that may occur with bridges or culverts, substandard transition rates due to reverse or broken-back curves, and rates that exceed the minimum. If not shown on the profiles, this information should be presented in another form.

**h. Critical Cross Sections.** The number of cross sections required depends on the location and complexity of the project. New location projects with few existing constraints generally require only enough cross sections to figure out approximate right-of-way limits and earthwork quantities.

These cross sections are needed to:

- Identify and resolve any potential conflicts.
- Show any major proposed drainage structures.
- Show limits of the slope and any adverse impacts on adjoining property.

Cross sections for the DFV Submission should be sufficiently detailed to relay clearly the proposed template to the existing grade. Providing excess detail is unwarranted and can be a major cause of unnecessary rework.

Specifically, the cross sections should show at least those features shown in [Figure 3.5](#) along with a preliminary earthwork analysis. The latter should be developed on a broader interval than the final cross sections. In areas of potential conflict, cross sections should provide sufficient detail to allow the Design Team and the District to make fully informed decisions. This is particularly true when justification of a design exception is required.

Cross sections may also show:

- Environmentally sensitive areas to be avoided (e.g., cemeteries, wetlands, historic structures)
  - Adjacent roadways, railroads, streams and drainage ditches
  - Stormwater management facilities, including the need for temporary construction easements.
- i. Traffic Control Plan. A Traffic Control Plan (TCP) is a supplemental plan required for projects where traffic flow and control through the work zone needs addressed. Not all projects require a supplemental plan such as a TCP; sometimes a narrative may be used, or Pennsylvania Typical Application (PATA) drawings may be used from Publication 213, *Temporary Traffic Control Guidelines*.

The TCP must conform to the *Manual on Uniform Traffic Control Devices (MUTCD)* and Publication 213, *Temporary Traffic Control Guidelines*. Developing sound TCP concepts should be an integral part of Preliminary Engineering and must be developed in accordance with Publication 46, *Traffic Engineering Manual*, Section 6.3, Work Zone Safety and Mobility and Section 6.14, Traffic Control Plan (TCP) Design Considerations. All available TCP options should be evaluated, public coordination should be performed, and the most appropriate TCP option should be selected and presented in the DFV Submission. Primary considerations in preparing TCP concepts are safety, constructability, cost-effectiveness, and user delay.

TCP concepts must be developed to meet the specific needs of a project. TCP concepts shall be sufficiently detailed to determine the approximate cost, duration, and impacts of the proposed traffic control measures.

Designers should be aware of the impacts that the TCP will have on oversize loads which require a hauling permit. The District's Hauling Permit area can provide permit-related maps as a tool to identify hauling routes.

On Minor and Moderate Complexity Projects, a preliminary TCP may or may not be needed. The submission of standard figures from Publication 213, *Temporary Traffic Control Guidelines*, may sufficiently address the needed traffic control. Otherwise, a project-specific preliminary TCP must be prepared and submitted.

On Major Complexity Projects, a project-specific preliminary TCP shall be prepared. For new location projects, interfaces between traffic and construction may be limited to only a few connections and/or crossings. In these cases, the TCP should be limited to only those affected areas. On complex, roadway reconstruction projects, where traffic must interface with construction throughout the length of the project, a detailed TCP covering the entire project is generally warranted. Logical termini should be established at both ends of the project. For projects that receive Federal or State funds on Interstates, Freeways, and Principal Arterials with intermittent or continuous lane closures at one location for more than 3 days, an analysis of work zone impacts is required. See Publication 46, *Traffic Engineering Manual*, Section 6.3.

A project-specific TCP in Preliminary Engineering shall include a narrative of the proposed construction sequencing and the following:

- Title Sheet
- Index Map (optional) and General Notes
- Tabulation of Traffic Control Devices (without quantities)
- Plan Sheets showing work zones
- Any proposed detours

The preliminary TCP does not need to include signs and device details, temporary pavement markings, channelizing devices, temporary roads, temporary signal plans, or other necessary details.

j. Structure Plans (if applicable). During Preliminary Engineering, the Type, Size & Location (TS&L) studies, as outlined in Publication 15M, Design Manual Part 4, *Structures*, Chapter 1, should be performed to a sufficient level necessary to support the Environmental Documentation and DFV Submission. Although the Final TS&L Submission and approval may not occur until after Design Field View Approval, early coordination of structure issues is required to develop a complete design concept and accurate cost estimate. Structure plans are not required for the DFV Submission, but Type, Size and Location (TS&L) information should be provided with the DFV Submission.

The DFV Submission should include a description and sketches of all proposed structures. The submission should also summarize the assumptions and considerations that led to the selection of the preferred structure type. All bridges shall have alternate bid items unless prior approval for one design is secured at the TS&L stage. It is important to document these design considerations for the reviewers and subsequent design activity.

During Preliminary Engineering, the typically required structure related information includes:

- Span arrangement
- Bridge width (curb-to-curb and out-to-out)
- Superstructure depth
- Bridge skew
- Bridge barrier type
- Substructure types and locations
- Require vertical and lateral clearances
- Required hydraulic opening (for drainage structures)
- Temporary channel obstructions (e.g., temporary shoring, stream diversions, causeways)
- Retaining wall locations
- Sound barrier locations
- Approximate required right-of-way and temporary easements
- Approximate limits of disturbance
- Utility conflicts
- Construction staging requirements
- Preliminary construction cost estimate

Where bridges, culverts, retaining walls, or noise walls (structures) are involved in a project, the structure TS&L becomes important in the development of the design concept in the Preliminary Engineering phase. Structure involvement on projects may include overlays, rehabilitations, widening, replacements, or a new structure on new alignments. However involved, structures will greatly affect the development and decision process for many other Preliminary Engineering activities, including:

- Environmental Evaluation
  - Wetland/stream impacts and avoidance
  - Threatened and Endangered Species impacts and avoidances
  - Section 4(f) involvement impacts and avoidances
  - Hazardous waste, particularly asbestos

- Selection of design criteria
  - Pavement and shoulder widths (curb-to-curb)
  - Pedestrian traffic accommodations
- Development of line and grade
  - Required superstructure depth
  - Horizontal and vertical clearances
  - Sight distance
- Preliminary Drainage Design
  - Roadway inlet locations
  - Parallel ditches and cross pipe locations relative to retaining walls and noise barriers
- Erosion and Sediment Pollution Control/Hydraulic Studies
  - Required hydraulic opening
  - Permits
  - Temporary stream obstructions
  - Post Construction Stormwater Management Controls, if applicable
- Traffic safety features
  - Barrier selection
  - Guide rail connections
- Traffic Control
  - Detours
  - Staged construction
  - Maintenance and Protection of Traffic during construction
- Utilities
  - Conflicts and relocation
  - Attachments to bridges
- Right-of-Way
  - Required right-of-way
  - Temporary construction easements
  - Flowage easements

For drainage structures, the determination of span arrangements and superstructure depth will be an iterative process with the development of the hydraulic and hydrologic analysis, and development of the preliminary line and grade. See Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10 for more details regarding hydraulic studies.

On projects utilizing streamlined TS&L process, a Bridge Pro-Team meeting will be held by the Department during the scoping phase of the project. The Bridge Pro-Team is a group of key personnel who will evaluate the project and provide direction on the structure alternative evaluations. The main purpose of this process is to eliminate the investigation of uneconomical options and expedite the project. Minutes from the meeting will document all the alternatives discussed with reasons behind decisions to pursue or exclude and will be made available at the start of the project.

Although not requiring detailed hydrologic and hydraulic analysis, the approximate openings of bridges over water must be determined before the DFV Submission. Thorough coordination of structural issues is needed to develop a complete design concept and prepare an accurate cost estimate. Bridge skews, span lengths, and substructure arrangements (full height, mid height or stub abutments) determine structure depths that may control the profile design. Retaining wall designs can greatly affect project cost, construction staging, traffic control issues, and the selection of roadway safety appurtenances (e.g., guide rail, barrier).

For Railroad grade separations, the existing, required and proposed (actual) vertical and horizontal clearances must be clearly shown on the TS&L plans for the proposed structure. Refer to Publication 15M, Design Manual Part 4, *Structures*, Volume 1, Part B, Section 2 and latest edition of Publication 371, *Grade Crossing Manual* for additional details pertaining to Railroad horizontal and vertical clearances.

In the development of the TS&L plans for bridge projects over Railroad facilities, early coordination and involvement with the Railroad shall be in accordance with the latest edition of Publication 371, *Grade Crossing Manual*, Chapter 4. This would allow for the Railroad's input to various design parameters being considered. Also refer to Publication 15M, Design Manual Part 4, *Structures*, Volume 1, Chapter 1, Section 1.9.3.

For bridge projects over Railroad facilities the submission of the TS&L shall include a copy of the Railroad's letter of approval in accordance with Publication 15M, Design Manual Part 4, *Structures*, Volume 1, Chapter 1, Section 1.9.3.3.1(e)(13)e.

**k.** Signing and Pavement Marking Plans. Pavement markings may not be needed in Preliminary Engineering and may occur in the Final Design Phase. See [Chapter 4](#), Final Design Plan Development, for more information.

Signing and pavement markings must be designed to guide motorists who have little to no familiarity with the roadway conditions ahead. Procedurally, a preliminary Signing and Pavement Marking Plan can be limited to preparing a conceptual design of major guide signs and of proposed pavement markings. This layout should be prepared at 1 in = 100 ft scale or other appropriate scale on preliminary Construction Plans.

For additional guidance on Preliminary Engineering signing considerations, refer to the *MUTCD*; Publication 46, *Traffic Engineering Manual*, Chapter 2 - Signing and Chapter 3 - Markings; Publication 212, *Official Traffic Control Devices*; Publication 111, *Traffic Control - Pavement Marking and Signing Standards, TC-8600 and TC-8700 Series*; Publication 148, *Traffic Standards - Signals, TC-8800 Series*; and Publication 236, *Handbook of Approved Signs*.

If Sign Lighting is anticipated for the project, design activities for Sign Lighting are generally limited to the Final Design phase after the signing and pavement markings receive DFV approval. See [Chapter 4](#), Final Design Plan Development, for more information.

**l.** Traffic Signal Plans. Traffic Signal Plans include traffic control signals, railroad crossing signals, and pedestrian signals. The planned signal operation for each intersection should be integrated with the design to optimize operational efficiency.

Publication 46, *Traffic Engineering Manual*, Chapter 4 provides the Department's policies, procedures, and further direction relative to the study, design, installation, operation, and maintenance of all types of traffic signals. This chapter also emphasizes the need for local authorities to understand the costs associated with owning a traffic signal.

Publication 149, *Traffic Signal Design Handbook*, Chapter 2 provides guidance for Preliminary Engineering of Traffic Control Signals, including pre-design activities, field view for design, and Preliminary Engineering considerations. Preliminary Engineering of Traffic Control Signals must account for accessibility issues of pedestrian needs and/or design of pedestrian accommodations, including the installation of ADA compliant pedestrian signals and pedestrian push buttons. For further guidance, refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 6 and the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG).

Publication 149, *Traffic Signal Design Handbook*, Chapter 16 provides guidance for the development of Traffic Signal Plans in Pennsylvania. For a DFV Submission, provide a level of detail commensurate with the Preliminary Engineering considerations discussed in Publication 149, *Traffic Signal Design Handbook*, Chapter 2, Section 2.3.

Additional guidelines for the design and operation of traffic signals, including Railroad crossing signals, are contained in the *MUTCD*; Publication 149, *Traffic Signal Design Handbook*; Publication 212, *Official Traffic Control Devices*; Publication 408, *Specifications*; Publication 46, *Traffic Engineering Manual*; Publication 236, *Handbook of Approved Signs*; Publication 148, *Traffic Standards - Signals, TC-8800*

Series; and Publication 111, *Traffic Control - Pavement Markings and Signing Standards, TC-8600 and TC-8700 Series*.

**4. Determining If a DFV Report Is Required.** For Minor and Moderate Complexity Projects, a partial Design Field View (DFV) Report may not be necessary if all significant design assumptions and decisions are readily apparent on the plans; however, a design criteria matrix must still be provided. For Major Complexity Projects, the entire DFV Report checklist must be used. The amount of detail included in the DFV Report should be proportionate to the project complexity and should generally not greatly exceed the minimum requirements listed in [Figure 3.6](#). The District may add additional deliverables but may not delete applicable deliverables.

**5. Report Deliverables.**

**a. DFV Narrative.** Compile the DFV Narrative, using technical support data describing the preferred line and grade alternative. Include the following subjects in the DFV Narrative, as applicable.

- Horizontal and Vertical Alignments - Only discuss unusual conditions that are not clearly discernable in the DFV Plan.
- Superelevation Transitions - Only discuss unusual conditions that are not clearly discernable in the DFV Plan.
- Drainage Requirements - Briefly identify and summarize where relevant information is found in the DFV Plan. Only discuss unusual conditions that are not clearly discernable in the DFV Plan.
- Special Construction Details - Briefly identify and summarize special construction details that are proposed in the DFV Plan.
- Design Exceptions - Identify and list Design Exceptions (if applicable).
- Approximate Structure Information - Identify and list Structures (if applicable).
- Right-of-Way Impacts - Summarize anticipated known temporary and permanent impacts (e.g., number of affected residential and non-residential property owners, total number of takes, number of total takes, number of partial takes).
- Utility Impacts - Summarize anticipated known temporary and permanent impacts (e.g., utility relocation, utility coordination).
- Constructability Issues - Summarize any known constructability issues or concerns that may affect the project. During Preliminary Engineering, consider work zone impacts along with all other impacts in the environmental study. The work zone impacts may affect the selection or elements of the final design alternative and the timing of construction. A detailed Constructability Review is typically completed during the Final Design phase, but for more complicated projects, construction staff involvement should occur in Preliminary Engineering.
- Major Construction Milestones - Present major construction milestones that are anticipated for construction, including:
  - Letting bid date
  - Open to traffic date
  - Construction completion date

A detailed construction schedule is not required for Design Field View, but should be developed during the final design phase.

- Recommended Contracting Method - If requested by the District, identify the contracting method that is recommended to construct the project. The traditional contracting method of Design-Bid-Build is typically utilized. When requested by the Department, alternative methods of project delivery should be investigated. Several of these alternative methods are discussed in Publication 448, *Innovative Building Toolkit*.
- Traffic Signal Warrants - Prepare documentation in accordance with Publication 46, *Traffic Engineering Manual*, Chapter 4, Section 4.3 (Traffic Signal Warrants and Engineering Studies). The warrants themselves do not need to be in the DFV Report, but the report should describe the locations of the traffic signals; should identify whether the traffic signals are to be installed, revised, or removed; and should briefly describe how the traffic signals are to operate.
- Roadway Lighting Warrants - During Preliminary Engineering, lighting activities may be limited to a lighting warrant analysis, prepared according to AASHTO procedures. If the determination of the analysis is negative, the project's lighting design effort is concluded. The warrants themselves do not need to be in the DFV Report, but the report should identify the locations of the roadway lighting; should identify whether the roadway lighting is to be installed, revised, or removed; and should briefly describe how the roadway lighting is to operate.
- Municipal and Other Agreements - Provide a list of required agreements, along with their status, to be obtained with municipalities and other parties. Include a list and status of any agreements reached during Preliminary Engineering. Identify agreements that will need to be completed as part of the Final Design process. These agreements will help to clarify who will be responsible for proposed work and what their responsibilities will be.
- Other - Discuss outstanding issues not covered in other sections of the DFV Report.

Compile and maintain a backup file of technical support data to support the discussion in the DFV Narrative. This backup file may be useful in clarifying assumptions, providing design calculations, defending design decisions, and supporting right-of-way or earthwork requirements.

The backup file of technical support data is **not** to be included in the DFV Report, unless requested.

**b.** Design Criteria Matrix. Briefly identify and summarize the design criteria that are proposed in the DFV Plan. Include a Design Criteria Matrix, similar to the matrix presented in [Figure 3.3](#).

Include Ramp Design Sheets, if applicable, similar to the Ramp Design Sheet presented in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 4, Table 4.1.

**c.** Photographs. Use clear, concise photos as appropriate to convey a large amount of information in a minimum amount of space. Make use of photographs which clearly show roads, community landmarks, and topographic features. Use photographs to display information in a more understandable/readable way. Photographs should supplement the report to illustrate relevant issues in the project area.

**d.** Traffic Control Narrative. The Traffic Control Narrative is to provide a written summary of conceptual sequence of proposed construction activities. This narrative should coincide with the proposed stages or phases of construction depicted in the Traffic Control Plan. Pertinent information should include:

- Route Names (where work is to be performed)
- Station to station limits (for proposed work along routes)
- Potential restrictions (e.g., winter shutdown).

e. Cost Estimate. For the DFV Submission, the cost estimate should be prepared in consideration of all major applicable construction items including:

- Pavement
- Drainage and Stormwater
- Erosion and Sediment Pollution Control
- Structures
- Guide rail and concrete barrier
- Earthwork
- Maintenance and Protection of Traffic
- Utility relocations
- Roadway lighting
- Concrete curbs, curb ramps, and sidewalks
- Demolitions
- Landscaping
- Post Construction Stormwater Management Controls
- Mitigation measures
- Any unusual conditions (e.g., hazardous substance mitigation, mine voids).

The cost of each of these items should be calculated following an analysis of current unit prices and determination of required construction quantities. It is important to provide as comprehensive a listing of items as possible and to document all relevant assumptions. Quantity estimates, cost calculations, assumptions and all other "backup" data should be organized either electronically or in a three-ring binder for future reference. The cost estimate should be prepared on an electronic spreadsheet in the format specified by the District.

Prepare and complete the cost driver analysis for the Design Field View, a key cost estimating milestone. Refer to Publication 352, *Estimating Manual*, for more information regarding how to complete a cost driver analysis.

For additional guidance regarding the preparation of the Design Field View's Construction Cost Estimate, refer to Publication 352, *Estimating Manual*.

Enough information may not be available to prepare detailed quantity computations. In this situation, the cost estimate for the DFV Submission may not enable the District to make important decisions concerning cost, schedule, and project funding. The Project Manager should monitor project costs closely and inform the District Portfolio Manager immediately of any significant cost increases. Many important value engineering decisions are based on preliminary cost estimates.

f. Safety Review Approval Letter. Include a copy of the approval letter from the Safety Review Committee (see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix O, Safety Review Procedures). Comments generated by Safety Review should be presented and addressed in the DFV Submission.

g. Environmental Mitigation Commitments (if applicable). Attach a copy of the environmental commitments from the Environmental Commitments and Mitigation Tracking System Matrix (ECMTS) to the DFV Report. For a sample matrix and required procedures, refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix T, Environmental Commitments and Mitigation Tracking System (ECMTS) Process.

The District Project Manager is to sign/date Part 2 of the Mitigation Tracking System Signature Page and is to include an electronic copy and three paper copies of the ECMTS Report with the DFV Submission.

h. Mass Diagrams (Major Complexity Projects Only). A mass diagram is a very flexible and useful design tool for studying earthwork distributions and optimizing the sequence of grading operations. Mass diagrams should be used on Major Complexity Projects involving large quantities of earthwork and/or

complicated construction staging. These diagrams should be generated as alternate line and grade combinations are investigated. The diagrams should be included in the DFV Submission to support the proposed preliminary line and grade design.

On new corridor location projects, for example, the earthwork distribution that balances cut and fill quantities with minimum haul distances often determines the limits of design and construction sections. Alternatively, highway reconstruction projects that have a net earthwork balance often involve temporary roadways. These roadways require material to be borrowed or wasted because material is temporarily unavailable or in excess supply at various times in the project schedule. A mass diagram can also help determine economical waste disposal and/or borrow site locations for projects that cannot be balanced on site.

A mass diagram is prepared by showing the project stationing on a straight baseline or "zero line" and plotting cubic yards of cumulative cut and fill. Wherever accumulated fill, starting at the project's beginning station exceeds accumulated cut, the mass curve will be below the zero line. If there is an excess of cut, it will be above the line. The mass diagram does not indicate total cubic yards of either cut or fill.

To produce an initial mass diagram, plot cut and fill volumes from cross sections prepared at 150 ft to 300 ft intervals over the entire length of the project. Depending on the relative amount of permanent and temporary earthwork, these quantities may be combined or plotted separately. This initial diagram can provide a reasonably accurate indication of the project's earthwork distribution. By iteratively refining the diagram and adjusting the grade, a designer can determine the optimum earthwork distribution for a given alignment.

## **6. Other Potential DFV Deliverables (Submit If Applicable).**

- a. Design Exception Requests. Refer to [Section 3.6.C](#), Design Exception Request, for discussion.
- b. Draft Transportation Management Plan. A Transportation Management Plan (TMP) lays out a set of coordinated strategies and describes how these strategies will be used to manage the impacts of a project during construction. Publication 46, *Traffic Engineering Manual*, Chapter 6 provides guidance. A TMP includes the following work zone impact management strategies:
  - Traffic Control Plan (TCP) - a supplemental plan currently required for all projects that addresses traffic flow and control through the work zone which must conform to the MUTCD and Publication 213, *Temporary Traffic Control Guidelines*.
  - Transportation Operations Plan (TOP) - a plan that includes Demand Management Strategies, Corridor/Network Management Strategies, Work Zone Safety Management Strategies, and Traffic/Incident Management and Enforcement Strategies.
  - Public Information Plan (PIP) - a plan that informs the public of the impacts on traffic and the general area during or prior to construction.

For "Significant Projects", a draft TMP must be submitted with the DFV Submission. A "Significant Project" is defined as one that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts that are greater than what is considered tolerable based on State policy and/or engineering judgment. The draft TMP is to include a TCP, TOP, and PIP. If a Project is not "Significant", the DFV Submission should still contain a preliminary TCP.

The District may decide to develop a TOP and PIP for non-significant projects (e.g., if there are large existing delays). In this case, the District approves the TOP and PIP for the TMP.

For further detail on how to determine a "Significant Project", along with what elements are to be included in the TMP, refer to Publication 46, *Traffic Engineering Manual*, Chapter 6, Section 6.3 (Work Zone Safety and Mobility).

**7. Design Field View Meeting.** Design Field View (DFV) Meetings are required for:

- Federal Oversight Projects - Required, unless waived by the FHWA.
- PennDOT Oversight Major Complexity Projects – Required, unless waived by the HDTS Project Development Engineer
- PennDOT Oversight Moderate Complexity Projects - Required, unless waived by the HDTS Project Development Engineer or the ADE-Design
- PennDOT Oversight Minor Complexity Projects - Not required, unless deemed necessary by the Project Manager or the ADE-Design.

If a DFV Meeting is held, it is typically held several weeks after the DFV Submission has been provided to the reviewers.

The DFV Meeting is usually held in the District Office, design consultant office, or at the project site. As part of the DFV Meeting, an actual field view of the project is typically needed. The actual field view is considered part of the DFV Meeting and is recommended for all projects greater than \$10 million and for all projects that were scoped more than three years prior to the DFV Submission.

DFV Meetings for Minor and Moderate Complexity PennDOT Oversight Projects should include attendance by appropriate District units, and the District may also request the Project Development Engineer in HDTS to attend. For Major Complexity Projects with PennDOT Oversight and all Federal Oversight projects, the DFV meeting will be attended by the District Office, HDTS, FHWA (if Federal Oversight), and the Design Consultant (if applicable), and other discipline experts as required. The Project Manager is responsible for coordinating the DFV Meeting.

The DFV Meeting is an important opportunity to:

- Meet with the District Units, Central Office, FHWA and affected review agencies (if required)
- Obtain pertinent review comments
- Reach consensus on critical issues
- Identify aspects of the project requiring special attention in Final Design
- Verify scope and construction estimate

The DFV Submission, along with the DFV Meeting, provides the opportunity to review and ensure the project: (1) has been developed consistent with decisions made at the Scoping Field View; and (2) is consistent with the environmental documentation needed to obtain Environmental Clearance (NEPA).

Representatives of the Design Team should be prepared to justify the design, identify any required design exceptions and/or conflict areas, and explain all design assumptions.

DFV Meeting minutes serve as the official record of key decisions reached during the meeting. The District Project Manager is responsible for preparing the DFV Meeting minutes and distributing them to all attendees.

**8. Design Field View Review and Approval.** The Design Field View (DFV) Approval is the approval of the DFV Submission in conjunction with DFV Meeting minutes (if applicable). The DFV Approval indicates that all Preliminary Engineering requirements have been met and the Preferred Alternative is approved for Final Design development. DFV Approval will occur following Environmental Clearance.

Review of the DFV Submission in the District, for Minor and Moderate Complexity PennDOT Oversight Projects, shall include appropriate District units and a geometric review by an independent reviewer. The independent reviewer shall not be on the project team and may consist of:

- District staff
- Another District's staff
- Consultant firm which is not designing the project
- The District may request HDTS staff to perform the independent geometric review

The District DFV Submission QC and QA review shall follow the District's QC and QA plan.

For Major Complexity PennDOT Oversight Projects, the District will provide the DFV Submission to the HDTS.

For Federal Oversight projects, the District will provide the DFV Submission to the HDTS. The HDTS PDE will provide the DFV submission to the FHWA.

DFV Submissions for Federal Oversight projects are approved by FHWA. All Major Complexity PennDOT Oversight Projects are approved by the Highway Delivery Division Chief. Moderate and Minor Complexity Projects are approved by the ADE-Design.

All DFV Submissions which are to be approved by the ADE-Design shall use the "District Design Field View Approval" memo as shown in [Figure 3.7](#). Additional justification may be provided in the memo to justify the design. A copy of the District DFV Approval is to be forwarded to the HDTS within 30 days of DFV approval for moderate complexity PennDOT Oversight projects. The DFV approval is to be attached to the Project Development Checklist in ECMS.

**INTENTIONALLY BLANK**

**FIGURE 3.1**  
**SAMPLE TRANSMITTAL LETTER TO MUNICIPAL OFFICIALS**

Engineering District \_\_-0  
Address  
City, PA Zip Code  
Date

Name  
Address  
City, PA Zip Code

Dear \_\_\_\_\_:

The Pennsylvania Department of Transportation has a highway improvement project scheduled on SR \_\_\_\_, Section \_\_\_\_ (Seg. \_\_\_\_ Off. \_\_\_\_ to Seg. \_\_\_\_ Off. \_\_\_\_), in your municipality. The project \_\_\_\_\_.

The anticipated improvements include \_\_\_\_\_. We propose to maintain and protect traffic by \_\_\_\_\_.

Subject to availability of funding, construction at the earliest is anticipated during the \_\_\_\_ construction season.

The existing signing on SR \_\_\_\_ will be reviewed and updated in accordance with current standards during construction. Signs under your jurisdiction should be reviewed by a municipal representative and consideration given to constructing the signs in accordance with current standards. If you determine that updating of signs is required, please coordinate your signing with the construction phase of the project.

Attached is a Municipal Officials Response Form to be returned to the District Executive. On this form we are requesting information concerning utilities, special events, emergency services, and other design considerations that may be affected by or have an effect on the proposed construction or proposed maintenance and protection of traffic. Please return this form by \_\_\_\_\_, so that your concerns can be given the full consideration they deserve.

If you have any questions, please contact \_\_\_\_\_ at \_\_\_\_ - \_\_\_\_ - \_\_\_\_.

Very truly yours,

\_\_\_\_\_  
District Executive

Attachments: Location Map  
Response Form  
Self-addressed, stamped envelope

cc: Project Manager  
Community Relations Coordinator  
District Traffic Engineer  
Utilities Administrator  
Municipal Services Manager  
Environmental Manager

**FIGURE 3.2  
MUNICIPAL OFFICIALS RESPONSE FORM****MUNICIPAL OFFICIALS RESPONSE FORM**

County: \_\_\_\_\_ Municipality: \_\_\_\_\_ Date: \_\_\_\_\_

SR: \_\_\_\_\_ Section: \_\_\_\_\_

PennDOT Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_

**PLEASE COMPLETE AND RETURN**

1. Contact Person: \_\_\_\_\_ Title: \_\_\_\_\_

Telephone No.: \_\_\_\_\_

Address: \_\_\_\_\_

2. Do you have utilities within the project limits? \_\_\_\_\_ Yes \_\_\_\_\_ No

If yes, type of utility: \_\_\_\_\_ Condition: \_\_\_\_\_

Do any of these facilities need replacement or repair? \_\_\_\_\_ Yes \_\_\_\_\_ No

Description of proposed work: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Do you have plans to install new utility facilities within the project limits in the near future? \_\_\_\_\_ Yes \_\_\_\_\_ No

If yes, target date: \_\_\_\_\_

Description of proposed work: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Do you have any plans to install new curb and/or sidewalk? \_\_\_\_\_ Yes \_\_\_\_\_ No

Do you have curb and/or sidewalk in need of replacement? \_\_\_\_\_ Yes \_\_\_\_\_ No

If yes, will this work be performed before the Department's highway project? \_\_\_\_\_ Yes \_\_\_\_\_ No

Comments: \_\_\_\_\_

\_\_\_\_\_

4. Please list any known special events that may be affected by the proposed project: (i.e., parades, fairs, festivals, etc.)

A. Special Event: \_\_\_\_\_ Date(s): \_\_\_\_\_

Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_

Description and Location: \_\_\_\_\_

Comments/Concerns: \_\_\_\_\_

\_\_\_\_\_

B. Special Event: \_\_\_\_\_ Date(s): \_\_\_\_\_

Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_

Description and Location: \_\_\_\_\_

Comments/Concerns: \_\_\_\_\_

\_\_\_\_\_

(over)

**FIGURE 3.2 (CONTINUED)**  
**MUNICIPAL OFFICIALS RESPONSE FORM**

- C. Special Event: \_\_\_\_\_ Date(s): \_\_\_\_\_  
Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_  
Description and Location: \_\_\_\_\_  
Comments/Concerns: \_\_\_\_\_  
\_\_\_\_\_
5. Please list any emergency services that may be affected by the proposed project:
- A. Emergency Service: \_\_\_\_\_  
Location: \_\_\_\_\_  
Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_  
Comments/Concerns: \_\_\_\_\_  
\_\_\_\_\_
- B. Emergency Service: \_\_\_\_\_  
Location: \_\_\_\_\_  
Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_  
Comments/Concerns: \_\_\_\_\_  
\_\_\_\_\_
6. School District: \_\_\_\_\_  
Contact Person: \_\_\_\_\_ Telephone No.: \_\_\_\_\_  
Comments/Concerns: \_\_\_\_\_  
\_\_\_\_\_
7. Do you know of any design considerations or factors which should be considered by the Department in developing its plans? \_\_\_\_\_
8. Additional Comments/Concerns: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

cc (upon return):  
Community Relations Coordinator  
District Traffic Engineer  
Utilities Administrator  
Municipal Services Manager  
Environmental Manager

Please return to:  
Project Manager  
Engineering District 7-0  
123 Main Street  
Anytown, PA 17101

Distribution Date: \_\_\_\_\_  
Initials: \_\_\_\_\_

Date Received in District: \_\_\_\_\_  
Initials: \_\_\_\_\_

BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
CHK'D BY: \_\_\_\_\_ DATE: \_\_\_\_\_**FIGURE 3.3**  
**DESIGN CRITERIA MATRIX**  
MPMS NO. \_\_\_\_\_

SR \_\_\_\_\_ SEC \_\_\_\_\_, \_\_\_\_\_ COUNTY

**2**

PROJECT DESCRIPTION: \_\_\_\_\_

**3**

NHS? (Y / N) \_\_\_\_\_

STRAHNET? (Y / N) \_\_\_\_\_

**DESIGN DESIGNATION**

SR \_\_\_\_\_  
 DESIGN CRITERIA \_\_\_\_\_  
 AREA SYSTEM (Urban / Rural) \_\_\_\_\_  
 FUNCTIONAL CLASSIFICATION \_\_\_\_\_  
 ROADWAY TYPOLOGY \_\_\_\_\_  
 TOPOGRAPHY \_\_\_\_\_  
 REMARKS \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**4****TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) \_\_\_\_\_

DESIGN YEAR ADT (Average Daily Traffic) \_\_\_\_\_

DESIGN YEAR (for Design Year ADT) \_\_\_\_\_

DHV (Design Hourly Volume) \_\_\_\_\_

D (Directional Distribution) \_\_\_\_\_

T (Truck Percentage) \_\_\_\_\_

| <b>5</b> | <b>CRITERIA</b>                                                          | <b>LOCATION<br/>(ENTIRE PROJECT<br/>OR BY STATION)</b> | <b>EXISTING<br/>VALUE</b> | <b>REQUIRED<br/>VALUE</b> | <b>PROPOSED<br/>VALUE</b> | <b>CRITERIA<br/>MET?</b> | <b>SOURCE OF DESIGN<br/>CRITERIA (AASHTO or<br/>DM-2 Reference)</b> | <b>REMARKS<br/>(NOTE ANY DESIGN EXCEPTIONS)</b> |
|----------|--------------------------------------------------------------------------|--------------------------------------------------------|---------------------------|---------------------------|---------------------------|--------------------------|---------------------------------------------------------------------|-------------------------------------------------|
|          | Design Speed*                                                            |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Lane Width*                                                              |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Shoulder Width*                                                          |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Minimum Horizontal Radius*                                               |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Maximum Superelevation Rate*                                             |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Vertical Grade                                                           | Minimum                                                |                           |                           |                           |                          |                                                                     |                                                 |
|          |                                                                          | Maximum*                                               |                           |                           |                           |                          |                                                                     |                                                 |
|          | Minimum Stopping Sight Distance (SSD*/HLSD)<br>(vertical and horizontal) |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Minimum Intersection Sight Distance (ISD)                                |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Minimum Cross Slope*                                                     |                                                        |                           |                           |                           |                          |                                                                     |                                                 |
|          | Minimum Vertical Clearance*                                              |                                                        |                           |                           |                           |                          |                                                                     |                                                 |

\* Refer to Publication 10X, Design Manual Part 1X, Appendix P for more information on controlling criteria and design exceptions.

**6**

Any pedestrian and bicycle concerns / needs? Explain. \_\_\_\_\_

Any ADA compliance issues? Explain. \_\_\_\_\_

Any transit issues? Explain. \_\_\_\_\_

Any additional design issues? Explain. \_\_\_\_\_

## Figure 3.4

### District Line, Grade & Typical Section Approval

District: \_\_\_\_\_ County: \_\_\_\_\_ S.R. \_\_\_\_\_ Section \_\_\_\_\_

Begin Segment/Offset: \_\_\_\_\_ End Segment/Offset: \_\_\_\_\_

Local Route Number/Name: \_\_\_\_\_ MPMS# \_\_\_\_\_

Complexity Level: Minor/Moderate/MajorDesign Exceptions? Y/N If yes, for which of the 11 controlling criteria? \_\_\_\_\_

Remarks/Conditions: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Name, title and company*Recommended by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Project Manager*Recommended by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Independent Reviewer*Approved by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Assistant District Executive for Design (or designee)*Cc: Project Manager  
HDTs (for Moderate and Major Complexity Projects only)

Attachments: Design Criteria Matrix

**FIGURE 3.5**  
**DFV SUBMISSION PLAN CHECKLIST**  
**PLAN DELIVERABLES**

DISTRICT \_\_\_\_\_ SR \_\_\_\_\_ SECTION \_\_\_\_\_ COUNTY \_\_\_\_\_ MPMS NO. \_\_\_\_\_

| PROJECT TYPE / DESCRIPTION |                                                                                    |                  |             |                          |
|----------------------------|------------------------------------------------------------------------------------|------------------|-------------|--------------------------|
| APPLICABLE DELIVERABLES    |                                                                                    | DM-1C<br>SECTION | APPLICABLE? |                          |
|                            |                                                                                    |                  | YES         | NO<br>IF NO, EXPLAIN WHY |
| a.                         | Title Sheet                                                                        | 3.6.D.3.a        |             |                          |
| b.                         | Index Sheet                                                                        | 3.6.D.3.b        |             |                          |
| c.                         | Location Map and General Notes                                                     | 3.6.D.3.c        |             |                          |
| d.                         | Typical Sections                                                                   | 3.6.D.3.d        |             |                          |
| e.                         | Special Construction Details                                                       | 3.6.D.3.e        |             |                          |
| f.                         | Plans                                                                              | 3.6.D.3.f        |             |                          |
| (1)                        | Existing and Proposed Geometry                                                     | 3.6.D.3.f(1)     |             |                          |
|                            | Existing topography and contours                                                   |                  |             |                          |
|                            | Existing and proposed curve data                                                   |                  |             |                          |
|                            | Points of curvature and equality stations                                          |                  |             |                          |
|                            | Guide rail and end treatment types                                                 |                  |             |                          |
|                            | Existing and required right-of-way and easement                                    |                  |             |                          |
|                            | Property lines (parcel identification & name of owner)                             |                  |             |                          |
|                            | Existing and proposed bridge data                                                  |                  |             |                          |
|                            | Preliminary hydraulic information                                                  |                  |             |                          |
|                            | Protected land uses                                                                |                  |             |                          |
|                            | Pavement details (depth)                                                           |                  |             |                          |
| (2)                        | Erosion and Sediment Pollution Control                                             | 3.6.D.3.f(2)     |             |                          |
| (3)                        | Drainage and Stormwater Management                                                 | 3.6.D.3.f(3)     |             |                          |
|                            | Major and minor drainage features                                                  |                  |             |                          |
|                            | Preliminary hydraulic information                                                  |                  |             |                          |
| (4)                        | Railroads                                                                          | 3.6.D.3.f(4)     |             |                          |
| (5)                        | Utilities                                                                          | 3.6.D.3.f(5)     |             |                          |
|                            | Existing utilities, overhead and underground                                       |                  |             |                          |
|                            | Proposed major utility relocations                                                 |                  |             |                          |
| (6)                        | Lighting Warrant Analysis                                                          | 3.6.D.3.f(6)     |             |                          |
| g.                         | Profiles                                                                           | 3.6.D.3.g        |             |                          |
|                            | Vertical datum                                                                     |                  |             |                          |
|                            | Existing and proposed vertical curve data                                          |                  |             |                          |
|                            | Major drainage crossing (existing and proposed)                                    |                  |             |                          |
|                            | Structures with vertical clearances                                                |                  |             |                          |
|                            | Major utility crossings (existing/proposed, overhead/underground)                  |                  |             |                          |
|                            | Existing and proposed grades                                                       |                  |             |                          |
|                            | Baseline intersections and equalities, including the station and elevation of each |                  |             |                          |
|                            | Existing and proposed grades                                                       |                  |             |                          |
| h.                         | Critical Cross Sections                                                            | 3.6.D.3.h        |             |                          |
|                            | Roadway template including rounding of slopes                                      |                  |             |                          |
|                            | Structures for roadway perspective                                                 |                  |             |                          |
|                            | Structure cross sections                                                           |                  |             |                          |
|                            | Existing right-of-way lines                                                        |                  |             |                          |
|                            | Permanent and temporary easement lines, including                                  |                  |             |                          |
|                            | Anticipated location of parallel ditches                                           |                  |             |                          |
|                            | Major drainage crossings (existing and proposed)                                   |                  |             |                          |
|                            | Major utility crossings (existing and proposed, overhead and underground)          |                  |             |                          |
|                            | Cross Slopes                                                                       |                  |             |                          |
| i.                         | Traffic Control Plan*                                                              | 3.6.D.3.i        |             |                          |
| j.                         | Structure Plans (if applicable)                                                    | 3.6.D.3.j        |             |                          |
| k.                         | Signing and Pavement Marking Plans                                                 | 3.6.D.3.k        |             |                          |
| l.                         | Traffic Signal Plans                                                               | 3.6.D.3.l        |             |                          |

\* For "Significant Projects", a draft Transportation Management Plan must be submitted with the Design Field View Submission.  
See Section 3.6.D.6.b.

**FIGURE 3.6**  
**DFV REPORT CHECKLIST**

DISTRICT \_\_\_\_\_ ROUTE \_\_\_\_\_ SECTION \_\_\_\_\_ COUNTY \_\_\_\_\_

MPMS NO. \_\_\_\_\_

| PROJECT TYPE / DESCRIPTION |                                                                                                     |                  |             |    |                    |
|----------------------------|-----------------------------------------------------------------------------------------------------|------------------|-------------|----|--------------------|
| TABLE OF CONTENTS          |                                                                                                     | DM-1C<br>SECTION | APPLICABLE? |    |                    |
|                            |                                                                                                     |                  | YES         | NO | IF NO, EXPLAIN WHY |
| a.                         | DFV Narrative                                                                                       | 3.6.D.5.a        |             |    |                    |
|                            | Horizontal and Vertical Alignments                                                                  |                  |             |    |                    |
|                            | Superelevation Transitions                                                                          |                  |             |    |                    |
|                            | Drainage Requirements                                                                               |                  |             |    |                    |
|                            | Special Construction Details                                                                        |                  |             |    |                    |
|                            | Design Exceptions                                                                                   |                  |             |    |                    |
|                            | Approximate Structure Information                                                                   |                  |             |    |                    |
|                            | Right-of-Way Impacts                                                                                |                  |             |    |                    |
|                            | Utility Impacts                                                                                     |                  |             |    |                    |
|                            | Constructability Issues                                                                             |                  |             |    |                    |
|                            | Major Construction Milestones                                                                       |                  |             |    |                    |
|                            | Recommended Contracting Method                                                                      |                  |             |    |                    |
|                            | Traffic Signal Warrants                                                                             |                  |             |    |                    |
|                            | Roadway Lighting Warrants                                                                           |                  |             |    |                    |
|                            | Municipal and Other Agreements                                                                      |                  |             |    |                    |
|                            | Other (please specify)                                                                              |                  |             |    |                    |
| b.                         | Design Criteria Matrix                                                                              | 3.6.D.5.b        |             |    |                    |
| c.                         | Photographs                                                                                         | 3.6.D.5.c        |             |    |                    |
| d.                         | Traffic Control Narrative                                                                           | 3.6.D.5.d        |             |    |                    |
| e.                         | Cost Estimate (including completed cost driver form)                                                | 3.6.D.5.e        |             |    |                    |
| f.                         | Safety Review Approval Letter and comments                                                          | 3.6.D.5.f        |             |    |                    |
| g.                         | Environmental Mitigation Commitments (DM-1X, Appendix T) (attach Mitigation Tracking System Matrix) | 3.6.D.5.g        |             |    |                    |
| h.                         | Mass Diagrams (earthwork)                                                                           | 3.6.D.5.h        |             |    |                    |

## Figure 3.7

### District Design Field View Approval

District: \_\_\_\_\_ County: \_\_\_\_\_ S.R. \_\_\_\_\_ Section \_\_\_\_\_

Begin Segment/Offset: \_\_\_\_\_ End Segment/Offset: \_\_\_\_\_

Local Route Number/Name: \_\_\_\_\_ MPMS# \_\_\_\_\_

Complexity Level: Minor/ModerateDesign Exceptions? Y/N If yes, for which of the 11 controlling criteria? \_\_\_\_\_

Environmental Clearance date: \_\_\_\_\_ Safety Review Committee Approval date: \_\_\_\_\_

Remarks/Conditions: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Prepared by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Name, title and company*Recommended by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Project Manager*Recommended by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Independent Reviewer*Approved by: \_\_\_\_\_ Date: \_\_\_\_\_  
*Assistant District Executive for Design*

cc: Project Manager

HDTs (for moderate projects only)

Attachments: Design Criteria Matrix

# CHAPTER 4

## FINAL DESIGN PLAN DEVELOPMENT

### 4.0 INTRODUCTION

This chapter discusses procedures necessary for Final Design Plan Development. It emphasizes procedures, rather than specific design criteria or plans preparation format, and wherever possible, provides references to additional sources with more specific information and guidance.

Although these procedures are formulated primarily for highway and bridge design projects, they are organized in a logical sequence that is directly applicable to developing Final Design Plans for many other modes of transportation. The basic procedures for right-of-way acquisition, utility coordination, geotechnical investigations, geometric design, structural design, etc., do not change from mode to mode.

Final Design begins at the direction of the District Executive following preliminary engineering and only after approval of the necessary environmental documentation. The Final Design Phase is typically preceded by preliminary engineering. Programming for funding is discussed in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 5, Section 5.5. Refer to Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*, and Publication 448, *Innovative Bidding Toolkit*, for more information on methods of construction, innovative bidding, proprietary items, liquidated damages, and other issues that affect final design.

### 4.1 FINAL DESIGN PLANS

Final Design Plans are binding legal documents. They are prepared to identify project-related improvements, materials, quantities, and activities. The plans must include sufficient detail to inform project stakeholders (designers, reviewers, contractors, suppliers, etc.) of the actions required to advance the project from design through completion of construction.

Final Design Plans must be accurate, concise, and complete. They must contain design data necessary for PennDOT to acquire right-of-way, obtain permits, and satisfy permit conditions. Final Design Plans must also provide reasonable information needed by the contractor to submit a sound, equitable bid and to build the project to PennDOT's standards.

**A. Contents.** A complete set of Final Design Plans will contain Highway Construction Plans (including "Also" plans); Right-of-Way Plans (if required - many 3R projects require no right-of-way acquisition; See Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 2 for a discussion of Highway and Bridge project types); Preliminary Pre-Bid Construction Schedule; Specifications; Special Provisions; and Estimates.

Depending on the scope and specific requirements of the project, the "Also" Plans may include:

- Traffic Control Plan
- Traffic Monitoring Plan
- Signing and Pavement Marking Plan
- Utility Relocation Plan
- Landscaping Plan
- Erosion and Sediment Pollution Control Plan

- Wetland Mitigation Plan
- Highway Lighting Plan
- Railroad Plan
- Contamination and Remediation Plan
- Roadway Test Borings Plan
- Pavement Sensor Plan
- Environmental Mitigation Plan
- Highway Advisory Radio Plan
- Flashing Warning Device Plan
- Sign Structure Plan
- Traffic Signal Plan
- Interconnect Plan
- Weather Monitoring System Plan
- Emergency Detour Plan
- Soil Profile Plan
- Contour Grading and Drainage Plan
- Structure Plans (including sound barrier plans)
- Cross Sections
- Existing Structure Plans
- ECMTS Report (refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix T) - this is an Attachment to the plan, not really an Also Plan
- Intelligent Transportation System (ITS) Plans
- Other

Each of these plans will consist of the specific drawing sheets and features described in detail in:

- Publication 14M, Design Manual Part 3, *Plans Presentation*.
- Publication 15M, Design Manual Part 4, *Structures*.
- Publication 16, Design Manual Part 5, *Utility Relocation*.

**B. Preparation.** Final Design Plans must be prepared in a logical sequence as information is obtained and decisions are made. The plans will be systematically reviewed at specified project milestones by the responsible review agencies, as appropriate, including the District, Bureau of Project Delivery, and the Federal Highway Administration (FHWA). The process assures that the plans conform to approved standards and meet the project objectives. For required project milestones for minor projects designed by consultants, see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AB.

In Final Design, PennDOT may elect to waive the Final Design Office Meeting (FDOM) on PennDOT Oversight projects, depending on project type and complexity. However, a FDOM is expected on all Federal Oversight projects. Beginning at Final Design Authorization, the major Final Design Plan submissions are:

- Final Right-of-Way Plans
- Final Design Office Meeting Submission (if required)
- Final Plans, Specifications and Estimate (PS&E)

## 4.2 COST ESTIMATE UPDATES

Project costs, as estimated during Final Design, are generally more accurate than at any other point in project development because of the increased certainty of the design and the availability of detailed information about the proposed improvements. In most cases, these costs are the result of fundamental decisions made early in the design process, and significant reductions in the project cost are increasingly difficult to achieve without drastic changes to already completed aspects of the design.

In accordance with Publication 352, *Estimating Manual*, construction costs should be monitored on a regular basis to avoid possible cost overruns that might cause cancellation or deferral of the project letting. Construction costs should be determined based on accurate quantity calculations and recent bid prices for similar projects.

Cost of many large quantity items can fluctuate significantly over short periods of time, such as asphalt, concrete, and steel. Field view to verify quantities that may have changed since DFV, such as pavement patching, to minimize cost increases during construction. At a minimum, project costs should be estimated, reviewed, and compared to the programmed cost approved by the Project Management Committee (PMC) at the following milestones during Final Design:

- At Final Design Office Meeting, if applicable (75% complete)
- At preparation of the District Contract Management Estimate (95% complete) - PS&E
- At the bid opening.

PMC action may be required as per DM-1, Chapter 3.1.C.

## 4.3 PUBLIC, PUBLIC OFFICIAL, AND AGENCY COORDINATION

**A. Public, Public Official, and Agency Involvement.** During Final Design, PennDOT will continue to provide information and solicit comments from interested parties. All items that were not resolved during or before the Preliminary Engineering phase must be addressed during the early stages of Final Design.

The District should review the status of the project with respect to the requirements of Pennsylvania Act 120; the National Environmental Policy Act (NEPA); Public Hearing Requirements; Public Use Land Requirements; and requirements of Applicable Memoranda of Understanding Agreements with other agencies.

To determine the necessary work on roads to be abandoned as state highways, any final coordination with the local political subdivisions should be accomplished as early as possible in Final Design.

Depending on project location, PennDOT will coordinate project-related concerns with the MPO/RPO.

PennDOT will also continue to solicit views from federal, state, and local agencies; Citizen Advisory Committees (CACs); local public officials; community groups; and any other parties interested in or affected by the project.

The District is encouraged to maintain project mailing lists for informing interested parties of PennDOT's project-related activities and soliciting input from interested parties on project-related issues. Interested parties should be offered the opportunity to add their names to these lists.

If the project affects another state, input will also be solicited from the appropriate agencies within that state. Continued coordination will be maintained with the appropriate agencies within that state.

Refer to Publication 295, *Project Level Public Involvement Handbook*, for PennDOT's specific procedures for conducting public meetings and other types of outreach programs.

**B. Engineering and Environmental Permits.** During Final Design, the engineering and environmental permits can require extensive coordination. Detailed information on permit application and submission requirements are contained in Publication 13M, Design Manual Part 2, *Highway Design* and in Publication 584, *PennDOT Drainage Manual*.

The District should schedule pre-application meetings with the affected permitting agencies to discuss specific application requirements and review probable special conditions that may affect final design and/or construction. During permit reviews, the District should also respond to requests for additional information.

**C. Pennsylvania Turnpike Commission (PTC) Coordination.** Since PennDOT and PTC transportation facilities create the conveyance backbone for economic development and job creation throughout the Commonwealth, it is imperative that the two systems function effectively as one seamless system. Thus, PennDOT projects that traverse, intersect the turnpike, are in close proximity to PTC facilities, or may affect turnpike operations, or PTC projects which intersect or may affect State roadways must be coordinated between the two agencies. This coordination, as depicted in [Figure 4.1](#), *PennDOT / PA Turnpike Project Coordination Milestones*, is supported by the processes contained in PennDOT's Design Manuals and PTC's Design Operations Manual.

This section defines administrative procedures for coordination of projects between the two agencies including Federal involvement in any phase of a PTC project, any situations where PTC facilities or right-of-way affect or are affected by PennDOT facilities, a PennDOT action is required on a PTC project, or a PennDOT project affects PTC right-of-way or operations. Examples of these situations include but are not limited to:

- Maintenance and Protection of Traffic (MPT) impacts on adjacent facilities.
  - PTC projects where MPT extends onto adjacent state or township roadways.
  - PennDOT projects that traverse or intersect the turnpike, or are in close proximity to the turnpike.
- Coordination of motorist information for both PennDOT and PTC projects.
  - Communication and collaboration between the respective Traffic Management Centers and Community Relations Coordinators regarding media broadcasts and the use of such tools as Dynamic Message Signs, 511PA.com information, Highway Advisory Radio broadcasts, RCRS information, and social media.
- PTC projects that require a Highway Occupancy Permit (HOP).
  - According to the Pa Code, Title 67, Chapter 441, *Access to and Occupancy of Highways by Driveways and Local Roads*, PTC projects that involve system connections or physical work within PennDOT right of way require a HOP.
- PennDOT and PTC projects jointly utilize storm water management facilities, wetland banking, and other potential shared facilities where the opportunity arises.

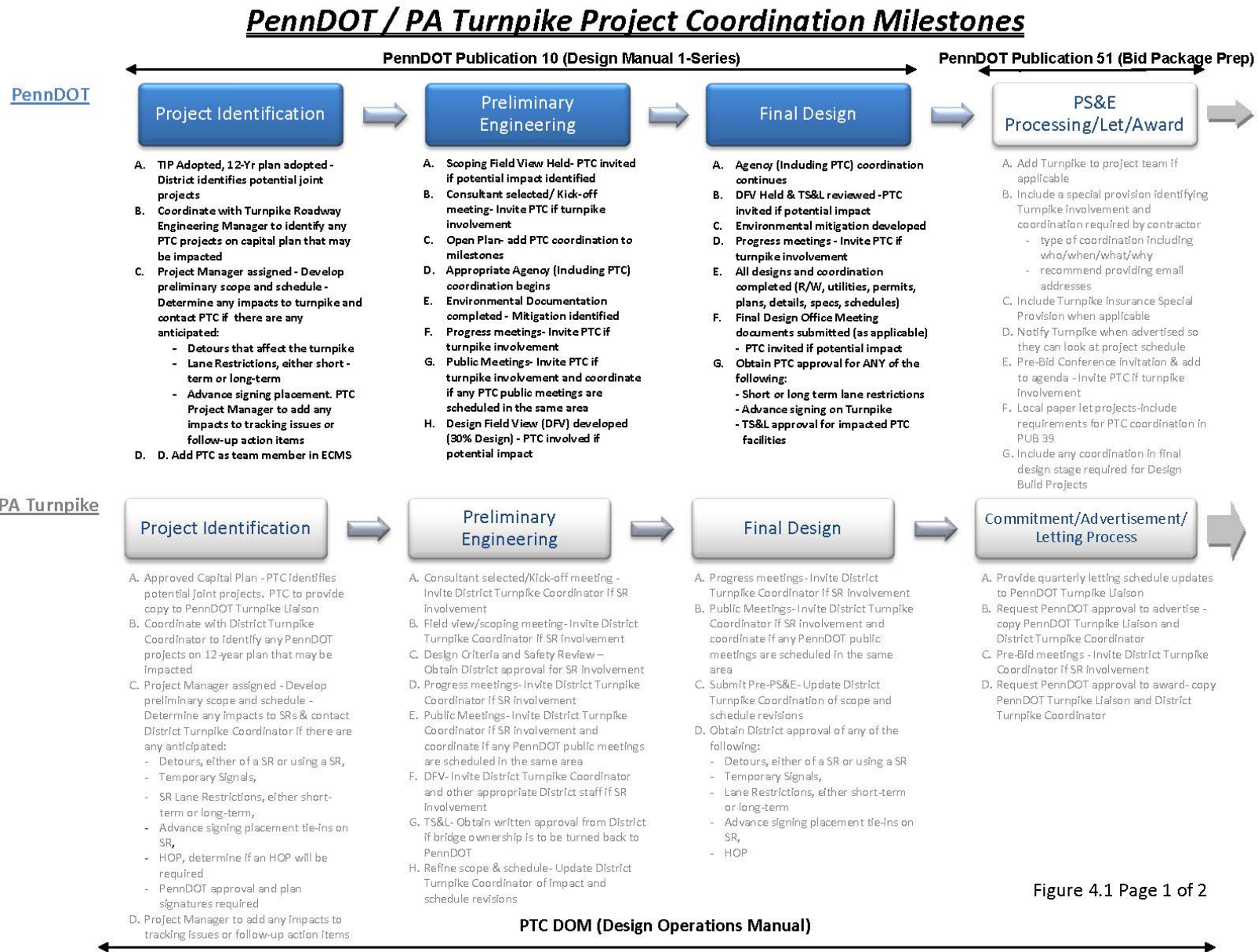


Figure 4.1 Page 1 of 2

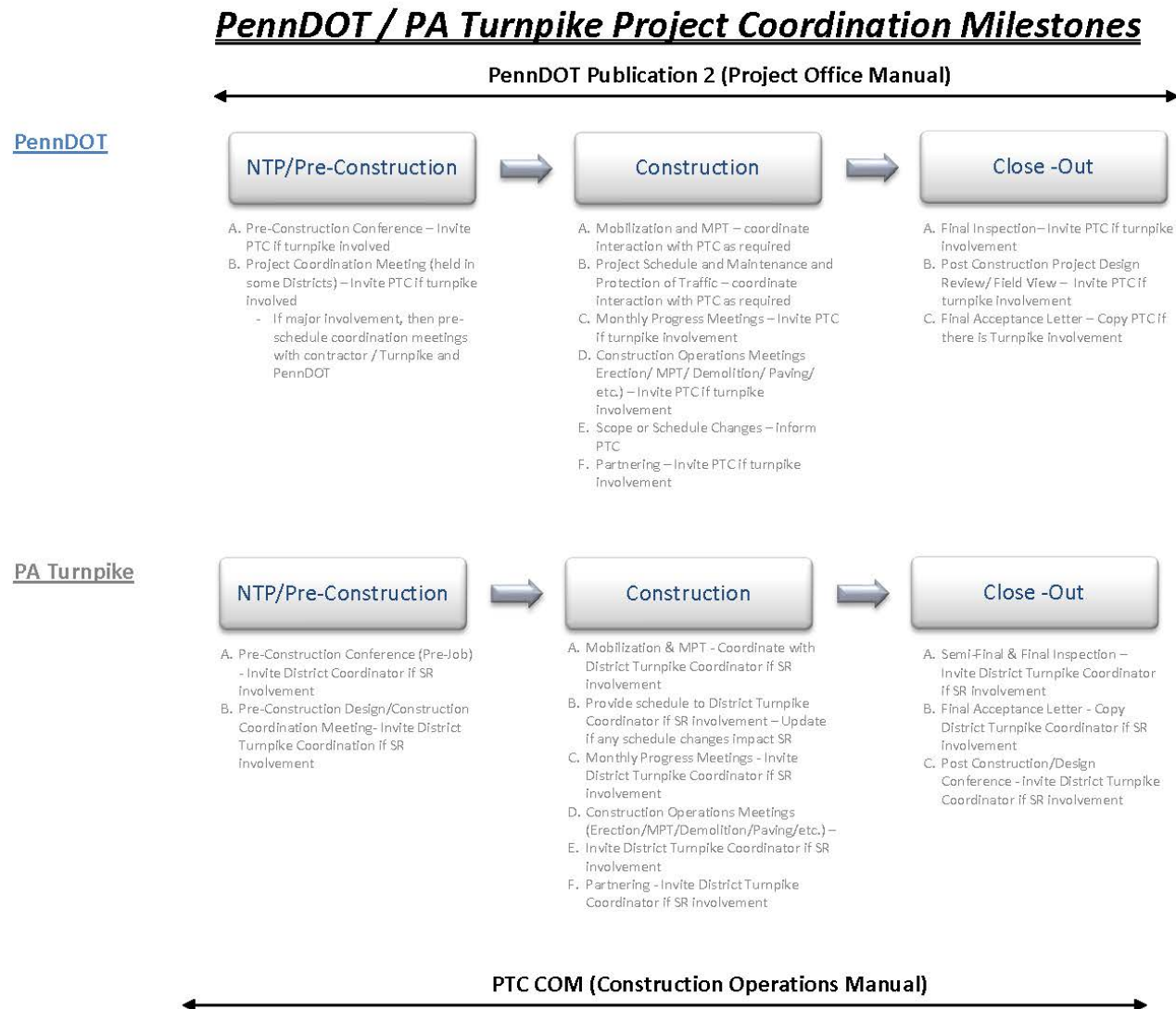


Figure 4.1 Page 2 of 2

To effectively coordinate these procedures, each District shall be represented by its designated District Turnpike Coordinator and the Bureau of Project Delivery shall be represented by its designated Turnpike Liaison Engineer. The District Turnpike Coordinators and the Turnpike Liaison Engineer serve as primary District and Central Office contacts with the PTC. Their responsibilities include administering policy and monitoring projects. For individual projects, the District will assign a Project Manager whose duties are similar to the duties required on a typical PennDOT project.

For Turnpike projects with impacts to PennDOT facilities, regardless of funding, the general flow of submissions will be from the PTC to the District Turnpike Coordinator (or the District Project Manager if one has been assigned and copy the correspondence to the District Turnpike Coordinator), then to the appropriate Central Office Bureau, and to the FHWA if required. For Turnpike projects with no impacts to PennDOT facilities, submissions will be made directly to the Turnpike Liaison Engineer at Central Office.

The PTC's primary contact is its Roadway Engineering Manager. All initial contacts with the Pennsylvania Turnpike Commission will be through:

Pennsylvania Turnpike Commission  
P.O. Box 67676  
Harrisburg, PA 17076-7676  
Attention: Roadway Engineering Manager

For PennDOT projects, the Turnpike will also assign counterpart project managers to oversee specific projects. The initial flow of submissions will be from PennDOT to the PTC Roadway Engineering Manager. Once a Project Manager is assigned, submissions will be to the Project Manager with a copy of the correspondence to the Roadway Engineering Manager.

Submissions to either agency will be acted upon within 15 working days of receipt.

**1. Turnpike Projects with Federal Involvement.** Federal involvement is defined as follows:

- Any Turnpike project affecting a non-turnpike portion of the Interstate System.
- Any Turnpike project using or that may use Federal funds.
- Designated pilot toll projects according to the federal highway legislation.
- Any Turnpike project requiring a Federal action.

For Turnpike projects, where there is Federal involvement, the working relationship between PennDOT and the Turnpike will be consistent with PennDOT's Stewardship and Oversight Agreement Procedures (Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix C). For projects designated as Federal Oversight, PennDOT will make appropriate reviews and recommendations for FHWA's approval and acceptance. This involves administering design procedures according to PennDOT's Design Manuals, including completion of right-of-way activities in accordance with PennDOT's Publication 378, *Right-of-Way Manual*. Construction will be managed according to PTC's procedures for administration of Federal-Aid projects. In addition, all current policy letters will be followed except in the following areas:

- Consultant Engineering Agreements - The Turnpike will utilize its own consultant selection procedures as approved by FHWA.
- Value Engineering - There will be construction value engineering unless specified otherwise in the construction contract.
- Contract Specifications - The Turnpike modified Section 100, General Provisions of Publication 408, *Specifications*, will be used. The modified provisions shall be approved by FHWA before letting the project.

All Federal Involvement PTC projects shall comply with PennDOT's Disadvantaged Business Enterprise (DBE) Program, reimbursement agreement procedure, and quality assurance testing.

**Consultant Selection Procedures.** The PTC will use its own consultant selection procedures for projects which include federal involvement. However, when there is federal involvement, PennDOT and FHWA are included in the process during the following steps:

- PennDOT and FHWA representatives participate in Scoping Field View.
- PennDOT District Office and the Bureau of Project Delivery Chief of the Consultant Agreement Section review draft Scope of Work.
- PennDOT's Turnpike Liaison Engineer reviews consultant technical proposals.
- PennDOT's Turnpike Liaison Engineer participates in consultant short list and selection.
- Bureau of Project Delivery Consultant Agreement Section Chief receives two copies of the technical and price proposals of the selected consultant and one copy of PTC's independent person-hour estimate for design analysis and pre-award evaluation.
- Bureau of Project Delivery Consultant Agreement Section Chief receives four copies of draft agreement.
- Bureau of Project Delivery Consultant Agreement Section Chief receives four copies of final agreement.

**Supplemental Engineering Agreement Procedures.** In preparing supplemental engineering agreements, PennDOT and FHWA will participate in PTC's following course of action:

- Bureau of Project Delivery Consultant Agreement Section Chief receives four copies of draft agreement.
- Bureau of Project Delivery Consultant Agreement Section Chief receives four copies of final agreement.

**Review Submissions.** For all federal involvement projects, the following project milestones will be submitted for PennDOT and FHWA review and/or participation:

- Environmental Document.
- Design Field View submission and meeting.
- Final Design Office Meeting.
- PS&E Submission.

**Highway Occupancy Permit (HOP) Process.** If the PTC project includes work within a state route right-of-way, a Highway Occupancy Permit (HOP) will be required which is issued by the affected District. Initial project coordination should begin at project scoping for projects with federal involvement and at preliminary design on projects with no federal involvement. Coordination between the District and the PTC occurs through the District Turnpike Coordinator or assigned Project Manager. The District Turnpike Coordinator or assigned Project Manager will be involved with the design of the project from Scoping and Preliminary Engineering through Final PS&E. (An HOP is not required for any signing as part of an MPT plan. However, coordination with the District is required.)

Once the PTC design plans are finalized and ready for bidding, the Bureau of Project Delivery is responsible for review and approval of the PTC project (FHWA approval of HOP's for Interstate facilities will be in accordance with the PennDOT/FHWA Stewardship and Oversight Agreement). The Bureau of Project Delivery will verify in writing with the appropriate District Turnpike Coordinator that the project has been coordinated with the District, including the District Permit Manager, and the District is satisfied with the project. The approval will be documented in a letter that includes:

- a. Specific reference to the contract numbers which are being approved.
- b. Information as to whether the Permit must be recorded by the County Recorder of Deeds.
- c. Information as to whether required right-of-way for the project has been acquired. The PTC will provide to the District copies of the right-of-way clearance certificates for the acquired properties.

This approval letter will be addressed to the PTC and copied to the affected District Turnpike Coordinator and the HOP Manager.

Upon receipt of the approval letter, the District Permit Manager shall place the letter in a pending Pennsylvania Turnpike Commission file.

Once the PTC receives the Bureau of Project Delivery approval letter, the PTC will submit a formal application through the e-permitting system or the current submission method requesting a Highway Occupancy Permit for the subject work. Upon receipt of the application, the District Permit Manager will:

- a. Compare the application submitted by the PTC with the approval letter to verify that the contract numbers are identical.
- b. After an administrative review of the plan and recording (if required) of the Permit, issue a free HOP to the PTC.
- c. Perform spot construction inspections of work to verify consistency with Chapters 203/212.

**2. Turnpike Projects - No Federal Involvement.** On Turnpike projects with PennDOT Impacts, the Turnpike Project Manager will coordinate with the appropriate PennDOT District Turnpike Coordinator. This coordination will begin in Preliminary Design and continue through Final Design. PTC plans will be prepared according to standard PTC procedures. The Final PS&E will be reviewed by PennDOT District Office (coordinated by the PennDOT District Turnpike Coordinator) and by the Turnpike Liaison Engineer. All other activities of a routine nature will be the sole responsibility of the PTC.

On Capital Improvement type projects, only major activities that affect a state highway will be reviewed by the District Offices. These activities include:

- Environmental issues
- Design criteria
- Line, grade and typical sections
- Safety review
- Structure Type, Size, and Location (TS&L)
- Special design details
- MPT signing or operational impacts on state highways, and
- Any other items that would affect a state highway.

On Rehabilitation type projects, items affecting a PennDOT facility shall be reviewed. These items include but not limited to:

- Maintenance and Protection of Traffic and/or advance signing extending onto a state route.
- Detours on state route(s).
- Bridge work over a state route.
- Bridge work on a bridge carrying a state route.

Projects without PennDOT Impact - Turnpike Project Manager will submit the Final PS&E to Turnpike Liaison Engineer for review and approval to advertise the project. No District coordination is required.

**Highway Occupancy Permit Process.** See process described in previous section - **Turnpike Projects with Federal Involvement.**

**3. PennDOT Projects - Turnpike Coordination.** For PennDOT projects affecting PTC facilities, the District Project Manager will contact the Turnpike's Roadway Engineering Manager during Preliminary Engineering and involve Turnpike staff in Scoping Field Views and other project activities as design is advanced. Based on the level of Turnpike involvement, the Turnpike will be kept informed of project development, afforded the opportunity to comment on engineering features, and provided copies of pertinent plans and correspondence. The District will provide the Turnpike with a copy of the Design Field View Submission and invite Turnpike staff to the Design Field View meeting, and FDOM if applicable. Adequate review time needs to be considered for the design schedule. After execution, the construction contract must be provided to the Turnpike's Roadway Engineering Manager.

The District must include the special provisions in a project's PS&E package to address PTC requirements. The standard PTC special provisions in ECMS should always be included in project construction documents when working within PTC right-of-way. These Special Provisions include A12201: Pennsylvania Turnpike Commission, C06081: Pennsylvania Turnpike Insurance, and C09012: Arrow Panel, Pennsylvania Turnpike. Turnpike staff will also provide job specific special provisions to the District, such as: entering and exiting the Turnpike, tolls for contractors' equipment, maintenance and protection of traffic on the Turnpike and restricted work hours on the Turnpike.

#### 4.4 TRAFFIC COORDINATION

**A. Supplemental Traffic Analyses.** Supplemental traffic analyses are typically done in Final Design when current traffic data is needed for specific applications having a temporary and limited area of influence. This data may be necessary to complete traffic signal design; Traffic Control Plans; construction staging plans; liquidated damage specifications; sound impact analysis; temporary pavement designs; and off-system improvements.

Traffic data is typically obtained from recent traffic studies, the local MPO/RPO, District Traffic Unit, PennDOT's Roadway Management System (RMS), PennDOT's iTMS, or new traffic counts conducted specifically for the project. For specific procedures concerning traffic analyses, including data collection, see [Chapter 3](#).

In Final Design, traffic volumes are developed for Opening Year conditions. These traffic volumes are generally developed utilizing the same methodology that was used to project the Design Year traffic volumes. [Chapter 3](#) discusses the development of Design Year traffic volumes. Opening Year traffic volumes are utilized to determine Opening Day capacity operations and to develop traffic signal timings and coordination.

**B. Traffic Signal Plans.** Traffic Signal Plans shall conform to the procedures set forth in the following PennDOT publications:

- Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 10, Traffic Signal Plans
- Publication 408, *Specifications*, Section 900, Traffic Accommodation & Control and Section 1104, Traffic Signals
- Publication 149, *Traffic Signal Design Handbook*
- Publication 46, *Traffic Engineering Manual*

Other current publications that may be consulted for additional information are:

- *Manual of Traffic Signal Design*, Institute of Transportation Engineers
- *Highway Capacity Manual*, Transportation Research Board
- *Manual on Uniform Traffic Control Devices*, FHWA
- *A Policy on Geometric Design of Highways and Streets*, AASHTO

During Final Design, Traffic Signal Plans must be submitted to the District Traffic Unit for review and approval. The PS&E Submission must demonstrate that traffic signal locations and intersection geometrics provide for the safe and efficient movement of traffic and maintain or improve roadway capacity and level of service. This submission must also demonstrate that the corresponding signs for motorists and pedestrians provide information clearly. In addition, the final plans will be reviewed for consistency with design parameters, special provisions, and cost estimates.

Temporary Traffic Signal Plans shall comply with Publication 213, *Temporary Traffic Control Guidelines*, and Publication 408, *Specifications*, Section 901 Maintenance and Protection of Traffic During Construction. The Plans should also meet the requirements of the Transportation Management Plan, if required. See Publication 46, *Traffic Engineering Manual*, Chapter 6, for more information regarding Transportation Management Plans.

**C. Signing and Sign Lighting Plans.** The procedure for determining final sign types, locations, messages and lighting requirements follows:

- First, the procedure for preparation of a preliminary Signing Plan shall be fulfilled. See [Chapter 3](#).
- The final signing and sign lighting plan shall indicate:
  - Highway plans indicating precise sign locations and right-of-way boundaries
  - Sign types
  - Precise cross-sections (at overhead and Type A sign locations)
  - Sign messages with all applicable dimensions
  - Recommended sign lighting, if applicable.
- The District Traffic Engineer shall review and approve the Signing Plans. PennDOT Bureau of Maintenance and Operations – Maintenance Technical Leadership Division (BOMO-MTLD) shall review and approve the Sign Lighting Plan.\*
- When sign lighting is included in Consultant and District designed signing plans, a Preliminary Sign Lighting Field View shall be scheduled by the District with the submission of the preliminary plans to BOMO-MTLD.

Simultaneously, the District shall furnish the appropriate electric utility company with a copy of the preliminary plan and request the utility's attendance at the Preliminary Sign Lighting Field View. The Preliminary Sign Lighting Field View shall be conducted by District personnel for the purpose of:

- Informing the utility of PennDOT's sign lighting needs
- Locating power supplies
- Investigating possible right-of-way difficulties involving service pole connections
- Any other coordination required to expedite providing energy to the highway signs.

The District Traffic Engineer will, as necessary, be represented at the Preliminary Sign Lighting Field View. The District Utility Relocation Unit should always be represented to assure conformance to Federal and State utility accommodation policies.

- Submit final sign lighting plans to BOMO-MTLD for approval.\*
- Upon final approval of the sign lighting plan by BOMO-MTLD\*, a reproducible copy of the approved plan shall be forwarded to the electric utility by the District Executive. The District's forwarding letter should request the utility's prompt completion of the necessary engineering and early coordination of the lighting requirements.

Sign structure plans that are Consultant prepared shall be reviewed in the District and approval given by the District Executive.\* Sign structure plans that are District prepared, using Publication 218M, *Bridge Design Standards* or Publication 219M, *Bridge Construction Standards*, should be thoroughly checked in the District and approval given by the District Executive. Sign structure plans that are prepared by the District, and require a special design, should be submitted to the Bureau of Project Delivery, Bridge Design and Technology Division for review and approval. If

sign structures are to be mounted on bridges, the bridge plans shall include the necessary sign structure connections and the bridge design computations must include the effects of the sign structure loads on the bridge. The design must specify the appropriate bridge standards for sign structures.

The District may choose a consultant to review and approve shop drawings for sign structures. The consultant may not have prepared the original design specifications. Fabrication control shall be the responsibility of the Bureau of Project Delivery, Bridge Design and Technology Division.

\*Projects designed using Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AB do not require Department review and approval of consultant submittals in Final Design.

**D. Pavement Marking Plans.** Pavement Marking Plans should generally not be addressed until Final Design. Particular attention should be devoted to interchanges with unusual gore areas, intersections with dual left-turn lanes and other geometrically complex areas. Where possible, pavement markings should be presented on a composite plan with reflectors, delineators, and signing. Depending on the type and complexity of the project, the plans presentation of pavement markings may be limited to major safety items. Other typical markings may be adequately presented by reference to standard details. The required level of detail should be coordinated with the District Traffic Unit.

Where possible, the project base mapping should be used to develop the composite plan at a scale of 1 in = 100 ft to 1 in = 200 ft commensurate with the complexity of the project. The following items should be included in the plan:

- Standard details (gore area striping, continuous striping, etc.)
- Stop bars and approach markings
- Turn lane markings
- Inlaid markings
- Intersections pavement markings
- General notes
- Legend

For additional information, refer to the current editions of the *Manual on Uniform Traffic Control Devices*, TC-7602 (Snowplowable Reflective Pavement Markers), TC-7600 (Pavement Markings), TC-8602 (Reflective Pavement Markers), TC-8709 (Delineators), and RC-57M (Concrete Median Barrier). Pavement Marking Plans should also take into account any requirements spelled out in the Transportation Management Plan (TMP) for a "significant project." Refer to Publication 46, *Traffic Engineering Manual*, Chapter 6, for more information on the requirements of a TMP.

**E. Transportation and Incident Management Plans.** A Transportation Management Plan (TMP) must be developed and provided with the Final Design Office Meeting submission for all Federal Oversight Projects that are determined to be "significant," in accordance with Publication 46, *Traffic Engineering Manual*. For PennDOT Oversight projects that are determined to be "significant" the TMP must be provided for approval with the Final Design Office Meeting submission, when held. When a Final Design Office Meeting is not held the TMP must be provided concurrent with the Final Traffic Control Plan submission. The level of detail included in the TMP will be commensurate with the size and complexity of the project. Typical sections may be necessary. Analysis of construction conditions may be necessary, especially when detours are proposed. A TMP lays out a set of coordinated strategies and describes how these strategies will be used to manage the work zone impacts of a project (within the project area and on other parts of the transportation network, as necessary). The TMP must consist of the following elements:

- Traffic Control Plan (TCP) - A TCP addresses traffic flow and control through the work zone (**required on all projects**).
- Transportation Operations Plan (TOP) - A TOP addresses sustained operations and management of the work zone impact area (including impacts to adjacent roadways in the network and impacts to other traffic movements).

- Public Information Plan (PIP) - A PIP addresses communication with the public and concerned stakeholders.

**Incident management plans** should be considered where appropriate. These plans should be developed in cooperation with local government and law enforcement officials, both during design and construction. Particular emphasis should be placed on projects involving the reconstruction of high-speed roadways.

Incident management plans may include provisions for 24-hour towing services, emergency service arrangements, access/egress to work areas, emergency vehicle routing, detour routes and an incident management handbook. All public awareness materials and programs shall be evaluated to determine if they provide sufficient communication to the traveling public with respect to changing traffic patterns during construction, emergency services, and construction updates.

On "significant" projects, the incident management plan should be incorporated into the Transportation Management Plan (TMP). Refer to Publication 46, *Traffic Engineering Manual*, Chapter 6, for information on TMPs.

#### 4.5 RAILROAD/PUC COORDINATION

The PA Public Utility Commission (PUC) has exclusive jurisdiction over the construction, relocation, suspension and abolition of public highway-railroad crossings. A public highway-railroad crossing can be either at grade, above or below the grade of the tracks of a railroad company. The PUC may order immediate alteration, improvement or suspension to provide for public safety. The appropriation of property for any crossing improvement is exclusively within the PUC's authority. Cost associated with the construction, relocation, alteration or abolition of a crossing may be allocated among the parties as determined by the PUC.

If Railroad property (permanent or temporary) needs to be acquired for a Department project, then the Department shall ask that the PUC appropriate the necessary Railroad property. All private property will be acquired via the eminent domain process.

**D-4279 and D-4279A forms:** Grade crossing activities are coordinated by the District's Grade Crossing Engineer/Administrator (DGCE/A). Assure that a completed and current D-4279A "Railroad Crossing Data for Contractor" form from the Railroad is on file for the project. A copy of the D-4279A form is required to be attached to the Project Development Checklist (PDC) in the ECMS contract for all projects indicating Railroad involvement.

**Early Railroad Coordination and filing of PUC Application:** Railroads are most interested in horizontal and vertical clearances and drainage. Therefore, if it has been determined through early Railroad Coordination that an alteration to the crossing is required and that an Application must be filed with the PUC, it is highly recommended that all major issues with the Railroad be discovered and addressed to the satisfaction of the Department and the Railroad BEFORE the Application is filed with the PUC.

**PUC Field Investigation and Conference, and Hearing Procedures:** Once an Application has been received by the PUC they will hold a PUC Field Investigation and Conference with the affected parties (parties of record). However, outstanding issues are not always resolved at the PUC Field Investigation and Conference. In such cases the PUC will schedule the matter for a formal hearing. When the PUC schedules a hearing it will delay the advancement of the project to a letting by approximately 12 months. Depending upon the unresolved issues, the hearing may be held before or after construction. Once a hearing is scheduled testimony will then be heard by an Administrative Law Judge (ALJ) who will then render a recommended decision to resolve the contested issue(s). The recommended decision is not a final Order.

The PUC will review the evidence, the recommended decision, briefs, exceptions and reply exceptions and will adopt an Order at a public meeting. The Order will be adopted and mailed to the parties after it is entered. Once the Order approving the project is entered and so long as it is not appealed, the Department may proceed with the project.

For additional guidelines and procedures pertaining to PUC Hearings refer to Publication 371, *Grade Crossing Manual*, Chapter 2, Section 2.02 Hearing Procedures.

If applicable, the PUC Secretarial Letter issued for the project will contain ordering paragraphs directing that prior to the start of construction the Department submit to the PUC and to all parties of record for review and approval the complete detailed construction plans and/or right-of-way plans with the related property description for the Railroad property plots needed to be appropriated by the PUC.

**Acquisition and Appropriation of Railroad Right-of-Way, and Right-of-Way Plan Submissions and Coordination with PUC and Railroad(s):** The acquisition of Railroad Right-of-Way shall be accomplished by either amicable settlement or appropriation by the PUC, not both. In either case the Department will need to prepare the appropriate Right-of-Way plans showing each individual Railroad parcel to be acquired along with metes and bounds descriptions (property descriptions) covering all Railroad property to be acquired. The metes and bounds descriptions are to tie into existing Railroad physical features (monuments, tracks, structures, etc.) and describing the property lines in the metes and bounds description, and closure of the boundaries are to be verified. Prior to making a formal Right-of-Way plan submission to the Railroad (acquisition via amicable settlement) or PUC and all parties of record (acquisition via PUC appropriation), appropriate copies of the Right-of-Way plans with metes and bounds descriptions covering all Railroad property to be acquired are to be submitted initially to the Railroad for their concurrence.

If the Department plans to proceed with settling amicably with the Railroad or if no Railroad Right-of-Way is needed for the project, the PUC will proceed with issuing a Secretarial Letter that describes all the arrangements made for the project, to include, but not be limited to, financial and maintenance responsibilities. This document must be on file before the final PS&E submission is made.

If the intent is to have the PUC appropriate Right-of-Way from the Railroad for the highway/bridge construction project, a formal submission must be made to the PUC and to all parties of record for the issuance of an Order appropriating the Railroad Right-of-Way by the PUC. Depending upon the project schedule and arrangements made at the PUC Field Investigation and Conference the PUC may or may not issue a Secretarial Letter addressing matters other than the appropriation of property prior the issuance of the PUC Order that includes the appropriation of the Railroad Right-of-Way.

The Right-of-Way submission to the PUC and all parties of record includes: (1) all applicable plans sheets including title sheet signed by the District Executive, location map, plan, profile, and typical sections, (2) color coded plat sheets showing each individual Railroad parcel of property to be appropriated, and (3) property descriptions covering all Railroad property to be appropriated by the PUC. Prior to making a formal submission to the PUC and all parties of record, submit appropriate copies of the Right-of-Way plans and property descriptions to the Railroad for their review and concurrence.

Upon formal submission made to the PUC and all parties of record, the PUC will not take action until after a 20 day objection period. If there are no objections received from any party of record, the PUC will then process the request and ultimately schedule this matter to be heard at a PUC Public Meeting. Once approved at the Public Meeting an Order will be adopted and the PUC will issue an original certified copy of the Order excerpt appropriating the Railroad property for recording in the County Courthouse. Right-of-Way clearance cannot be issued for the project until such Order is issued by the PUC. Because the PUC can appropriate Right-of-Way, this does not preclude the Right-of-Way Section from making an offer to the Railroad for Right-of-Way and subsequently proceeding with the settling the Right-of-Way claim with the Railroad.

All PUC Secretarial Letters and/or Orders issued for the project are to be attached to the PDC in the ECMS contract.

**Final Highway/Bridge Construction Plan Submissions with PUC and Railroad(s):** Completed construction plans that have at least been signed by the District Executive must be submitted to the PUC for approval and all other parties of record for review. A copy of the Department's letter submitting the construction plans must be attached to the PDC in the ECMS contract. The PUC Secretarial Letter approving the construction plans must be obtained before the project can be let (bids opened). A condition shall be placed in the ECMS contract indicating that bids cannot be opened until PUC's Secretarial Letter approving the plans is issued.

**Railroad Temporary Entry Permit:** Entry onto Railroad right of way may be required for construction activities as well as for inspection, maintenance, survey, soil borings, etc. Should the need arise to gain access to the work site by entering upon the Railroad's right of way, the Railroad's permission shall be obtained prior to the work being started. There are procedural differences between the Railroads in gaining their approval; therefore, early

involvement and coordination with the Railroad and DGCE/A is recommended. A temporary entry permit and/or safety training may be required. Depending upon the proposed construction operations, a Temporary Construction Easement may be needed. A Railroad's temporary entry permit is **not** to be signed by the Department. When this permit is used it is to be signed by the Department's consultant or contractor who is performing the work activities on the Railroad's property. Such activities could include, but are not limited to, engineering studies, inspection, soil borings, surveys, and construction.

**Railroad certifications and documentation for ECMS contract:** For all projects involving Railroad facilities, the District Grade Crossing Engineer/Administrator is required to complete the "Railroad Certification Compliance Check List and then transmit it, along with the state/Railroad construction reimbursement agreement, to the Central Office Grade Crossing Unit at the same time the PS&E package is submitted to the Department's Contract Management Section. Upon the Bureau of Project Delivery's acceptance, the Bureau will issue a Railroad Certification Compliance Letter to the FHWA for Federal Oversight projects or a Railroad Certification memo addressed to the District Executive for all non-Federal Oversight projects at the time of PS&E review. The letter or memo is to be posted in the Project Development Checklist for the project by the District.

Similarly, for all other projects not involving Railroad facilities, the District's Project Manager is required to either prepare a Railroad Certification Compliance Letter to FHWA for Federal Oversight projects or a Railroad Certification memo for all non-Federal Oversight project addressed to the District Executive. The letter and memo are to indicate that the project has no Railroad involvement, with a copy being placed in the Project Development Checklist by the District.

**Railroad Construction Reimbursement Agreements:** In most cases, the Department must reimburse the Railroad for its preliminary engineering costs. Generally, during the engineering phase of the project, the Railroads will not attend meetings, perform plan reviews, provide comments, concurrences and/or approvals, etc. until the Department provides PE authorization to the railroad or there is a fully executed state/Railroad preliminary engineering reimbursement agreement in place with the Department. Similarly, the Department is responsible to reimburse the Railroad for their construction work, construction engineering, construction inspection (if applicable), flagging and protection service costs, and administrative costs during the construction phase as part of the project. Reimbursement of these Railroad costs would be through an executed state/Railroad construction phase reimbursement agreement in accordance with Publication 371, *Grade Crossing Manual*, Chapters 4 and 7, and 23 CFR 646.216 (d)(2). With either the design or the construction reimbursement agreement the Railroad will provide the Department with a "Railroad Force Account Estimate". The preparation and execution of a state/Railroad reimbursement agreement between the Department and the Railroad is handled by and coordinated through the District Grade Crossing Engineer/Administrator. A condition shall be placed in the ECMS contract indicating that Notice To Proceed (NTP) cannot be issued to the Department's contractor until the state/Railroad construction agreement is fully executed.

**Future Maintenance Responsibility:** When maintenance responsibilities of a public crossing have been prescribed by the PUC, only the PUC may change these responsibilities. The PUC will issue either a Secretarial Letter or an Order describing the change(s) in responsibilities.

To determine the maintenance responsibilities of a bridge, the District Bridge Engineer shall:

- Check for PUC actions that assigned maintenance responsibilities in the past and secure a copy of the document(s).
- If no former document(s) could be recovered, provide information to the District Executive so that a request could be made to the Bureau of Project Delivery, Utilities and Right-of-Way Section to determine the current maintenance responsibility. The response from the Bureau of Project Delivery, Utilities and Right-of-Way Section should also advise the District Executive of the responsibilities that will remain in effect until the PUC prescribes the maintenance responsibilities.

Additional guidelines and procedures pertaining to the preliminary Railroad activities listed below can be found in Publication 371, *Grade Crossing Manual*, Chapter 2, "PUC Coordination" and Chapter 4, "Highway and/or Bridge Project Process".

- Early Railroad Coordination
- D-4279A form "Railroad Crossing Data for Contractor"
- Submission of PUC Application
- PUC Field Investigations and Conference
- Hearing Procedures
- Acquisition and Appropriation of Railroad Right-of-Way, and Right-of-Way Plan Submissions and coordination with PUC and Railroad(s)
- Final Highway/Bridge Construction Plan Submissions with PUC and Railroad(s)
- Railroad Temporary Entry Permit
- Railroad Certification Compliance Check List and Letter
- Railroad certifications and Documentation for ECMS contract
- Railroad Construction Reimbursement Agreements

Additional sources of reference on Railroad and PUC coordination include:

- Title 23, *Code of Federal Regulations, Part 646*
- Publication 371, *Grade Crossing Manual*
- Publication 16, Design Manual Part 5, *Utility Relocation*

#### **4.6 UTILITY COORDINATION**

All procedures involving the relocation of utility facilities shall conform to the requirements specified in Publication 16, Design Manual Part 5, *Utility Relocation*. Utility relocation activities are coordinated by the District Utility Administrator.

Assure Subsurface Utility Engineering (SUE) Quality Level A (ASCE Publication 38-02) has been completed (if required). Assure that all available information regarding the location of the existing utilities and their rights-of-way (if applicable) is included on the Right-of-Way and Construction Plans.

If the Federal Highway Administration is participating in the utility relocation costs, assure the appropriate funding has been approved prior to authorizing the utilities to proceed with the engineering of their relocations/adjustments.

Because there are different types of projects that generate different plan requirements, consult with the District Utility Administrator regarding the contents of the Utility Submission (the plans to be sent for the utilities to begin their relocation engineering).

Throughout the design process changes are made to the construction and plans; it is vitally important that these changes be provided to the Utility Relocation Unit for transmittal to the affected utilities. Coordination is greatly improved when all parties are working with the same information.

Where utilities will be permitted to be placed in, on, or through a structure, the District Utility Unit will act as liaison between the utility and the District Bridge Unit. The Bureau of Project Delivery, Bridge Design and Technology Division and Utilities and Right-of-Way Section will provide guidance, if necessary.

No project can be advertised for construction without a Utility Clearance. The Utility Clearance, Form D-419, must be issued by the District as part of the final PS&E package. The Bureau of Project Delivery, Utilities and Right-of-Way Section, is responsible for issuing the Utility Clearance Certification. Utility reimbursement agreements and structure agreements should also be in place prior to the final PS&E submission to the Bureau of Project Delivery.

Additional sources of reference on utility coordination include:

- Title 23, *Code of Federal Regulations, Part 645*
- Title 67, *Code of Federal Regulations, Chapter 459*
- Publication 16, Design Manual Part 5, *Utility Relocation*
- ASCE Publication 38-02

#### 4.7 RIGHT-OF-WAY COORDINATION

**A. Right-of-Way Plan Development.** Right-of-Way Plans result from Preliminary Engineering phase studies. Right-of-Way Plans, including Property Plots, are the basis for determining all property damages that may be involved in the construction of a highway. The District Right-of-Way Unit is available for consultation during plan development; however, the Designer and Professional Land Surveyor are responsible for verifying that the Final Right-of-Way Plan is prepared and reviewed consistent with the applicable standards. The Designer and Professional Land Surveyor will document their verifications by completing and signing the Right-of-Way Plan Review Checklist. This checklist will be submitted along with the Final Right-of-Way Plan. A Final Plan Check of the Right-of-Way Plan shall be conducted to assure compliance with the requirements of Publication 14M, Design Manual Part 3, *Plans Presentation*.

For PennDOT to acquire property, a description or plan thereof shall be prepared, containing the names of the owners or reputed owners, and an indication of the estate or interest to be acquired. Each parcel must be verified in the courthouse to identify the present owner. A copy of the latest deed for each property involved shall be submitted with the Final Right-of-Way Plans. The deed information must include the deed book, page, and other related information. Publication 14M, Design Manual Part 3, *Plans Presentation*, describes how to formulate Right-of-Way Plans and coordinate them with Construction Plans.

Right-of-Way Plans will be developed and reviewed as follows:

The Designer develops the Final Right-of-Way plan with technical guidance from the District Right-of-Way Unit, as needed.

The Designer submits the Final Right-of-Way Plan along with the signed Right-of-Way Plan Review Checklist.

A Final Plan Check will be performed to assure compliance with the requirements of Publication 14M, Design Manual Part 3, *Plans Presentation*.

If during the Final Plan Check, the plan is not consistent with Publication 14M, Design Manual Part 3, *Plans Presentation*, the plan will be returned to the Designer for correction and resubmission, if necessary. If the plan is consistent with Publication 14M, Design Manual Part 3, *Plans Presentation*, the plan will be returned to the Designer to be signed and sealed by the Professional Engineer and a Professional Land Surveyor.

The Final Right-of-Way Plan will be forwarded to the District Project Manager for distribution to the District Right-of-Way Unit.

The District Right-of-Way Unit will begin the right-of-way acquisition process.

If any errors are discovered after the Final Right-of-Way plan has been distributed to the District Right-of-Way Unit, the District Right-of-Way Administrator will notify the District Project Manager. If the plan was developed by a Consultant Designer, the Department Project Manager will initiate the Design Error Process outlined in Publication 93, *Policy and Procedures for the Administration of Consultant Agreements*. Depending upon the current phase of the project, right-of-way plan design errors could result in, but are not limited, to the following:

- Additional survey costs
- Plan revision costs
- Additional appraisal costs
- Additional plan recording costs
- Legal costs
- Construction costs
- Utility relocation costs

The Design Error Process will be pursued when an error on the plan causes additional charges to the Department as noted above. Any approved design changes made during final design that require revisions to the Final Right-of-Way Plan shall not be considered a design error. Note: any design change during final design that would be considered an error or quality issue and also requires revisions to the Final Right-to-Way Plan is subject to the Design Error Process.

**B. Plans Presentation in Highway Occupancy Permit Matters and Public-Private Partnerships.** There are more and more instances where landowners are being required under the Highway Occupancy Permit process to acquire right-of-way for State highway improvements that they must construct due to the development of their land. Sometimes the private landowner solicits the assistance of the local government in acquiring the right-of-way. There are also other circumstances where local governments make improvements to State highways in partnership with PennDOT and right-of-way for those improvements is required. In both of these circumstances, a plan should be generated to maintain PennDOT records documenting the required right-of-way for the State highway. Depending on the circumstances, the plan can also serve other purposes.

The following discussion establishes procedures to be used in generating plans in the instances outlined. It is intended to assist the Districts in these circumstances by establishing a uniform procedure for cooperating in the advancement of the needed highway improvements and properly documenting the required right-of-way. The requirements for plans presentation are incorporated into Publication 14M, Design Manual Part 3, *Plans Presentation*.

**1. Drawings Depicting Right-of-Way to be Deeded for State Highways.** Highway occupancy permittees are sometimes required to make off-site improvements to State highways. Where the width of the highway right-of-way is insufficient to permit construction of the required improvements, the permittee must provide any necessary additional right-of-way to PennDOT [see 67 Pa. Code §441.8(j)(3)]. This additional right-of-way is transferred to PennDOT by deed from the permittee; deed transfer should be used rather than accepting a dedication of the right-of-way through some other means.

Although the deeds are recorded in the county courthouse and provide notice to the world of PennDOT's title to the right-of-way, there is a need to document the extent of the new right-of-way in PennDOT's record keeping system. This can best be done by requiring the permittee to generate a plan depicting the right-of-way that will be deeded to PennDOT. This plan should follow the procedures set forth in Publication 14M, Design Manual Part 3, *Plans Presentation* for generating drawings depicting the right-of-way to be deeded for state highways.

**2. Drawings Authorizing Acquisition by Local Governments on State Highways.** PennDOT policy is not to acquire right-of-way for private permittees. Consequently, such permittees often solicit the assistance of local governments when they are unable to acquire needed right-of-way amicably. In this circumstance, as well as when local governments propose improvements to State highways on their own or in cooperation with PennDOT, a plan should be generated to prove that the local government has PennDOT's permission to acquire, by condemnation if necessary, the needed State right-of-way.

Certain types of municipalities have specific statutory authority to acquire land for State highway purposes. For example, townships of the second class can do so with the approval of PennDOT [53 P.S. §67304(b)]. Other types of municipalities do not have specific authority to do so, but can be granted that authority by virtue of PennDOT's statutory mandate to coordinate its transportation activities and cooperate with other public agencies such as political subdivisions of the Commonwealth [71 P.S. §§512(a)(6) and (7)].

Plans authorizing the acquisition of right-of-way for State highways by local governments should follow the procedures set forth in Publication 14M, Design Manual Part 3, *Plans Presentation* for generating drawings authorizing acquisition by local governments on state highways.

**3. Right-of-Way Acquisition for State Owned Bridges on "Turnback" Local Roads.** There are numerous instances throughout the Commonwealth of State-owned bridges on local roads. These situations arose when local municipalities agreed to accept ownership of a state highway under the Turnback Program but did not accept the bridge(s). Plans authorizing the acquisition of right-of-way for local municipalities for State owned bridges on "Turnback" local roads should follow the procedures set forth in Publication 14M, Design Manual Part 3, *Plans Presentation*.

**C. Right-of-Way Clearance.** The Bureau of Project Delivery, Utilities and Right-of-Way Section, is responsible for determining policies and procedures for right-of-way clearance. These policies and procedures are based upon Federal and state statutes, regulations and guidelines for the administration of the acquisition program, statewide, including such adjuncts as appraisals, relocation assistance to displaced persons, property management, and beautification. When these functions have been performed satisfactorily, the Section Chief can certify to the Federal government that the project has been cleared in coordination with construction schedules and to their satisfaction all regulations have been fulfilled.

The Utilities and Right-of-Way Section, Administration Unit is assigned to provide certification to the Federal government on federally aided projects. The certification must show that the project is now available for construction and all regulations have been complied with, regardless of the type of funding.

Certification (i.e., approval and authorization to advertise and award the contract) is granted when the Federal Highway Administration is satisfied that normal procedures, as required by state and Federal law, were followed in accomplishing right-of-way clearance.

Final Right-of-Way Clearance must be obtained prior to advertisement for contract bids.

- *Final-Notice to Proceed (NTP).* The Final Right-of-Way Clearance Certification authorizes issuance of the notice to proceed to the highway contractor.

Only in exceptional circumstances and with approval of the Chief of the Utilities and Right-of-Way Section should one of the following Conditional Right-of-Way Certificates be obtained (refer to Publication 378, *Right-of-Way Manual* for additional information):

- *Conditional-1 Advertise.* Conditional-1 clearance certification gives authority only to advertise for highway contract bids. Bids shall not be opened until the clearance is upgraded. **Caution:** Clearance level Conditional-1 Advertise should be requested only in exceptional circumstances and full justification must be provided. The District must state that after a careful analysis of all Right-of-Way issues, the Right-of-Way acquisition process will have progressed to meet the anticipated dates to let, award, and issue notice to proceed. Experience indicates this is an area of concern. If the Right-of-Way clearance cannot be upgraded when needed, serious problems are created in the contracting process.
- *Conditional-2 Open Bids.* Conditional-2 clearance certification gives authority to advertise and open bids (project letting), or upgrades a Conditional-1 to a Conditional-2 to open bids. The contract shall not be awarded until the clearance is upgraded.
- *Conditional-3 Award.* Conditional-3 clearance certification gives authority to advertise, open bids, and award the contract, or upgrades a Conditional-2 clearance to award. Notice to proceed shall not be given to the highway contractor until the clearance is upgraded to authorize issuance of the notice to proceed.

- *Conditional-4 Notice to Proceed (NTP).* For contract management purposes, Conditional-4 clearance certification is a final right-of-way clearance certification authorizing issuance of the notice to proceed. In other words, Conditional-4 NTP, when issued, will result in a Final Right-of-Way clearance date displayed in the Milestones section of MPMS.
- Conditional-4 NTP is usually based on a right-of-entry (i.e., an authorization to enter-waiver or non-waiver of claim) signed by a parcel owner that gives PennDOT permission to enter the parcel in emergencies even though payment for the parcel has not been made.
- Conditional-4 NTP clearance certification will be used only in exceptional circumstances. An emergency, such as a slide, damaged bridge or flood damage, are considered exceptional circumstances and adequately justify the case.

**D. Design Build Projects.** Design-Build is an alternative process by which a single entity bids to provide both the design and construction under a single contract between the Department and the design-build contractor. Publication 378, *Right-of-Way Manual*, Chapter 6 (available from the PennDOT Project Manager) and Publication 448, *Innovative Bidding Toolkit*, Appendices E and H provide specifications and illustrate the steps used in the Design-Build right-of-way acquisition process.

**E. Right-of-Way Fence.** Interstate and other limited access highways will be fenced continuously along the right-of-way line as part of the original construction contract. However, judgment may dictate exceptions in areas of precipitous slopes or other natural barriers to access. Using right-of-way fence on limited access facilities should be based on the need to satisfy the following:

- To keep animals off the highway;
- To keep children or pedestrians off the highway; and
- To prevent vehicles and people from entering or leaving the highway at unauthorized locations.

Recent studies and experience has indicated that there is no distinct advantage to the routine use of deer fencing. For this reason, deer fencing will only be specified in exceptional cases where it can be justified. This justification must be maintained with the design file and should show that the fence is being used for a purpose other than as a routine deterrent measure. In general, a Type 2 Right-of-Way Fence will be provided. Type 1 Right-of-Way Fence should only be used in areas of high exposure to the public or residential areas where a Type 2 fence might be considered as objectionable. Refer to Publication 72M, *Roadway Construction Standards*, RC-60M for more information on right-of-way fence types.

## 4.8 GEOMETRIC DESIGN

Although geometry is typically determined during preliminary engineering (see Chapter 3), the geometry may need to be modified during final design. Geometry changes should be reviewed by similar reviewers of the Design Field View submission. Any design exceptions should be submitted for review and approval when they become known.

The plans developed in Preliminary Engineering are further developed in final design. Additional details on the final plans should be provided. For example, plans should indicate the existing and proposed utilities on the plan view and cross sections. The proposed limits of work should also be shown on the plans, with consideration given to the following:

- PUC jurisdictional limits for authorization for Right-of-Way Plans.
- Possible placement of signs beyond the normally considered limits of construction.
- Possible placement of lighting beyond the normally considered limits of construction.

**A. Typical Sections.** Final design typical sections are the continued refinement of the Design Field View typicals. Typical Sections shall be shown for both tangent and superelevated sections. The following data shall be clearly indicated on the typical sections:

- Pavement type, width and cross slope
- Shoulder type, width and cross slope
- Median type, width and cross slope
- Embankment and cut slopes, including rounding
- Swales and contiguous gutters as applicable
- Subbase drainage treatment
- Rate of superelevation
- Unusual design conditions
- Concrete barrier and guide rail
- Retaining walls
- Point of profile grade
- Centerline or baseline
- Seeding and topsoil
- Benching

**B. Interchanges.** For Final Design, interchange geometrics shall be laid out at 1 in = 50 ft scale and indicate the following:

- ADT
- Ramp widths
- Shoulder widths
- Curve data
- Rate of superelevation
- Superelevation transition
- Pavement width transitions
- Lengths of acceleration and deceleration lanes including tapers
- Location of curbs, barrier, and guiderail
- Entrance and exit conditions
- Profiles
- Pavement markings in transition areas and intersections\*
- Pavement joint layouts in complex transitions\*
- Signing layout\*
- Traffic signal requirements and layout\*
- Proposed structure type, size and location (plan and profile views)\*
- Other pertinent information\*

\*These should be in the Also Plans.

The geometric design shall include the contour grading and drainage information and shall meet the requirements specified in Publication 13M, Design Manual Part 2, *Highway Design*.

**C. Intersections.** For Final Design, intersection grading details (sketches) shall be presented at 1 in = 10 ft (preferred) or a reasonable scale to show the necessary details to construct the intersection.

Dependent upon project complexity (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Tables 2.1, 2.2 and 2.3), pavement elevation plans may be developed to describe the necessary horizontal and vertical geometry that cross sections cannot describe. These plans more properly denote elevations at smaller intervals, along curves with smaller radii (e.g., 325 ft or less) and appropriate graphic grades beside the mainline pavement.

Intersection grading details should focus on the pertinent intersection elements that affect the grading and layout. These details can have a lot of hidden existing topography, utilities, and right-of-way data. Items that are required on intersection grading details include:

- Station and applicable offset
- Elevations:
  - Tie into intersecting roadways
  - Low or high points
  - Maximum intervals of (10 ft)
  - Relative to fixed barriers (e.g., curb, islands, etc.)
- Curve data (PC, PT, radii, etc.)
- Pavement edges and lane widths
- Islands
- Concrete curbs and sidewalks
- Curb cut ramps types and elevations
- Final cross walks
- Final signal equipment (e.g., signal post, push buttons, etc.)
- Final drainage features
- Utility poles within the intersection area that are going to remain
- Medians
- Concrete barriers and guiderail
- Pavement tapers and transitions

**D. Roadside Design.** During Final Design, guide rail, barrier and impact attenuating devices and other roadside design features that were initially presented in the project's Safety Review submission (see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix O) are finalized.

Applying a given treatment at a specific site must be tempered by the particular circumstances that exist at that location. Considerations such as risk management, cost, and environmental impact often play a significant role in the final selection process, and may weigh heavily in a decision based at least in part on engineering judgment.

Further guidance and details on roadside design is contained in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 12, and the AASHTO *Roadside Design Guide*.

**E. Airport - Highway Clearances.** The Administrator for the Federal Aviation Administration has established specific clearance requirements and criteria for highways and other structures adjacent to airports that are identified in *Part 77 of the Federal Aviation Regulations - Federal Aviation Administration*. The document is available from the Federal Aviation Administration, Washington, DC, or the Superintendent of Documents, U.S. Government Printing Office, Washington, DC and shall be used as a guide in the preparation of the design of highways adjacent to or near airports to provide adequate clearance between the highways and the navigable airspace. Also see Publication 405, *Airport Sponsor's Guide*.

## 4.9 MISCELLANEOUS DESIGN ISSUES

**A. Drainage and Stormwater Management Design.** Drainage has long been recognized as one of the essentials of highway construction. The cost involved in the adequate removal of surface water justifies a careful and scientific approach for the design of drainage facilities. Waterway design, stormwater management, floodplain management, wetland mitigation, landscaping, and stream encroachment are important aspects of designing and maintaining an adequate drainage facility while minimizing the impact on the environment.

A large percent of PennDOT's highway construction budget (sometimes 25% - 30%) is spent on culverts, bridges, ditches, dikes, channels, erosion control installations, storm drains, and other drainage structures. Project plans of roadway drainage and waterway structures must comply with certain Federal, state and/or local requirements and regulations. Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10 explains the procedures for complying with waterway and floodplain management requirements or regulations.

In Final Design, the scope of drainage design activities can vary greatly with the type and scope of the project. The activities must also comply with waterway and floodplain, as well as stormwater management regulations.

Waterway and floodplain management regulations apply to the detailed hydrologic and hydraulic studies generally performed during the Final Design stage where field survey data are normally used in making these studies. First, projects must be evaluated as to whether they potentially encroach on the 100-year floodplain of the streams. If they do not, then floodplain and waterway management regulations do not apply. The next step is to complete a preliminary risk assessment. If small projects consisting of resurfacing, minor safety improvements or minor maintenance do not involve risk, the floodplain and waterway management regulations are satisfied. On projects that do not meet these criteria, Final Design activities will include extensive coordination and compliance with several regulatory and resource agencies to meet waterway and floodplain management regulations. For these projects, final drainage design activities generally involve the preparation of a Hydrologic and Hydraulic Report.

For a thorough discussion of drainage design procedures, including compliance with waterway and floodplain encroachment regulations, guidelines for preparing hydrologic and hydraulic reports, and procedures for obtaining permits from the PA DEP, U.S. Army Corps of Engineers and U.S. Coast Guard, refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10.

Pennsylvania's Stormwater Management Act (Act 167 of 1978) is applicable for highway improvement projects located within municipalities where there are approved Act 167 Watershed Stormwater Management Plans. In these instances, the District should take necessary action to assure that the projects are consistent with the standards of the individual stormwater management plans. Best Management Practices (BMPs) should be provided for stormwater management in accordance with PennDOT's policy on anti-degradation and post-construction stormwater management, contained in Publication 584, *PennDOT Drainage Manual*, Chapter 14.

**B. Erosion and Sediment Pollution Control Plan.** The purpose of an Erosion and Sediment Pollution (E&S) Control Plan is to limit the ecological and physical damage done to land surfaces and receiving waterways by earth disturbing activities. A detailed description of plan requirements can be found in Publication 584, *PennDOT Drainage Manual*, Chapter 12. Also see Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 13.

**C. Contour Grading and Drainage Plan.** In Final Design, Contour Grading and Drainage Plans may be required with submissions for the following:

- New highway facility
- Interchange geometrics
- Intersection geometrics (optional)
- Safety rest areas
- Service areas
- Tourist sites
- Borrow and waste areas
- Other special areas

The objective of a Contour Grading and Drainage Plan is to relate construction elements with each other and with the topography, to reduce maintenance, to increase safety, and to improve the appearance of the entire area.

The plan shall include the following information:

- Horizontal geometry
- Ramp and shoulder widths
- Rate of superelevation
- Superelevation transitions
- Pavement width transitions
- Length of acceleration and deceleration lanes, including tapers
- Escape lanes, open throats on ramps and type and location of curbs
- Islands and treatment
- Right-of-way lines
- Median widths
- High points and low points for crest and sag curves on pavement\*

- Existing and proposed contours
- Proposed drainage facilities including pipe sizes and all invert and top of grate elevations\*

\*Information requested should be indicated outside the contoured area when feasible and properly flagged.

The plans shall be prepared at a scale of 1 in = 50 ft, be accompanied by the profiles of adjacent roadways and shall have contours at 2 ft intervals. Contours at 1 ft intervals shall be shown on the pavement and shoulders and in gore areas.

Additional requirements for Final Design of Contour Grading and Drainage Plans are provided in Publication 14M, Design Manual Part 3, *Plans Presentation*.

**D. Landscape Planting Plans.** Landscape planting plans are any design/construction plans that effectively depict the placement of plants including trees, shrubs, vines, wildflowers, grasses or other vegetation to be planted or preserved to functionally or aesthetically enhance the view of or from the highway. These plans can be prepared as a part of a construction project or as a separate action meant to enhance the aesthetics of an existing highway. Before beginning development of a Landscape Planting Plan coordinate with PennDOT's Maintenance Unit and the local municipality and the public, including any local shade tree or other landscaping commissions, to ensure that any concerns are addressed in the plan, as applicable. Landscape planting plans are also used to indicate revegetation efforts to mitigate adverse environmental effects of the highway construction; however, these plantings should not be considered as being planted primarily for aesthetic enhancement. Seeding undertaken for erosion control and planting vegetation for screening purposes do not serve an aesthetic enhancement function. Landscape development areas generally include all roadside areas adjacent to the outer edge of the roadway and extend to the limits of the right-of-way. This area also includes any median areas separating directional roadways and interchange infield areas.

Federal-aid Policy Guidelines require landscaping projects that are intended primarily for aesthetic enhancement to include the planting of native wildflower seeds or seedlings, or both, unless a waiver is granted by FHWA. This provision requires the landscaping project to include at least 0.0025 (0.25%) of the funds expended for landscaping to be used for planting wildflowers. Waivers are granted on a project-by-project basis when PennDOT certifies that native wildflowers cannot be satisfactorily grown or that any available planting areas will be used for agricultural purposes, or that there is an overall scarcity of available planting areas. All necessary design work required to implement this requirement will be handled by the Bureau of Project Delivery, Highway Design and Technology Section. For design consultants whose Scope of Work includes preparing landscape planting plans in their entirety, the District Office shall contact the Bureau of Project Delivery, Highway Design and Technology Section for design guidance on wildflower locations, species selection and planting specifications.

Each District Office is responsible for properly coding all landscape items on Form D-4232 (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*) so that the appropriate amount of funds expended on wildflowers can be recorded. Two separate line items on Form D-4232 under Code 0031 Landscaping and Other Scenic Beautification will be necessary to assess the wildflower provision. The first line total under 0031 will record all normal roadside development/landscape construction items **excluding the 0808 or 9808 materials used for aesthetic enhancement**. These first line items may include:

**Item Number Series**

|             |                                                       |
|-------------|-------------------------------------------------------|
| 0802 - 0803 | - Topsoil Items                                       |
| 0804        | - Seeding, Mowing or Herbicide Application Items      |
| 0805        | - Mulching Materials                                  |
| 0806        | - Water Course and Slope Erosion Protection Materials |
| 0809        | - Sodding                                             |
| 0810        | - Selective Tree Removal and Trimming                 |

|             |                                                          |
|-------------|----------------------------------------------------------|
| 0811        | - Temporary Protective Fence for Existing Plant Material |
| 0820        | - Roadside Clean-Up                                      |
| 0845 - 0865 | - Erosion and Sedimentation Pollution Control Items      |

The second line total under 0031 will include items for trees and shrubs ***planted primarily for aesthetic enhancement*** of the highway. These items will include most construction item numbers found under Series 0807 and 0808 listed below:

|      |                                            |
|------|--------------------------------------------|
| 0807 | - Tree Wall Items                          |
| 0808 | - Plants, Planting and Transplanting Items |

A current listing of all master construction items may be found on the ECMS Homepage by selecting "Master Items Maint" under "Design Admin."

Special plant material construction items in series 0808 or 9808 used for any environmental mitigation areas such as wetland replacements, wildlife habitat replacement areas, or junkyard screening ***may be excluded from this total***. The wildflower expenditure will be at least 0.0025 (or 0.25%) of this second line total. Code 0031 has been established to record the project costs related to the planting of the wildflowers and should also be recorded on Form D-4232.

Wildflower related materials will be assigned special construction item numbers in the 9800 series on a project-by-project basis due to the nature of using non-standard type seeding mixtures. In all cases, however, the word "wildflower" will appear in the item description to segregate this item for tabulation under Code 0031. If a waiver of the wildflower requirement has been granted, the full amount of the landscaping costs can be reported on a single line under Code 0031.

The procedure for designing the landscape planting portions of various construction projects shall be as follows (note that whether the landscaping is consultant or in-house design, the project schedule must account for landscaping and assure the landscaping is completed during the appropriate season, especially for any late season work):

- 1. Consultant Design.** When the engineering agreement Scope of Work includes the provision for design as well as the preparation of Landscape Planting Plan drawings, the following procedures shall be followed:

Landscape planting design is a specialized field requiring personnel skilled and experienced in the practice of Landscape Architecture. The consultant shall obtain the services of a qualified registered professional Landscape Architect if their staff does not have the appropriate skill or experience in landscape design work.

The Consultant shall prepare the landscape planting design on approved final contour grading and drainage plans when applicable or on standard Roadway Plan sheets for areas not normally designated to have contour grading plans prepared.

The Landscape Planting Plans shall be prepared according to Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 7. Also, see Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 8.

The Consultant shall coordinate the preparation of typical sections showing proposed seeding formulas and other erosion control materials, if applicable, with the District Roadside Specialist or other appropriate District personnel.

Periodic reviews of the design plans will be made prior to final plan preparation. For all review submissions, the Consultant shall submit the Landscape Planting Plans and applicable Typical Section sheets along with any necessary special provision specifications or special planting details necessary to supplement the design to the District Office. If the District concurs with the design, plans and specifications may be sent directly to the Bureau of Project Delivery, Highway Design and Technology Section. In accordance with [Section 1.3](#), Plan

Sheets Delivery, Printing and Plotting Order of Preference, send plans electronically, half-size if hardcopy is required, or full-size only upon request to the District Project Manager.

The District Roadside Specialist should review the plans and specifications and forward the plans and specifications to the Bureau of Project Delivery, Highway Design and Technology Section for their review and comment. Any District review comments shall also be forwarded along with the Central Office submission.

Upon completion of the Bureau of Project Delivery's review, the reviewed plans and specifications will be returned to the District for forwarding to the Consultant.

The Consultant shall make any required revisions and resubmit the plans for approval prior to additional design work or final plan preparation.

Office plan reviews between the Consultant, District, and Bureau of Project Delivery, Highway Design and Technology Section personnel will be conducted as required.

The final Landscape Planting Plans and appropriate specifications will be accepted upon the approval of the designated District and Bureau of Project Delivery review personnel.

**2. In-House Design.** The procedures outlined below should be followed for Landscaping Plans designed by PennDOT:

Following approval of the contour grading and drainage plans pertaining to the proposed area, the District should prepare one set of reproducible type drawings of all applicable contour grading and drainage sheets, any applicable typical section sheets and any other pertinent sheets requiring planting design considerations.

The District shall further provide any other pertinent information necessary for design considerations such as any unusual soil or moisture conditions, scenic views, existing vegetation in general locale and any environmental mitigation commitments that may affect plant selections or planting locations. The District Roadside Specialist should be consulted and should indicate the standard seeding formulas proposed for use on the typical section sheets.

The District shall then forward all appropriate plans and all recommendations and pertinent information to the Bureau of Project Delivery, Highway Design and Technology Section for the preparation of the planting design. In accordance with [Section 1.3](#), Plan Sheets Delivery, Printing and Plotting Order of Preference, send plans electronically, half-size if hardcopy is required, or full-size only upon request to the District Project Manager.

The Bureau of Project Delivery, Highway Design and Technology Section, shall design the landscape planting requirements and prepare any appropriate special provision specifications to supplement the design.

The Bureau of Project Delivery, Highway Design and Technology Section, shall return the appropriate plan sheets on which the proposed planting design has been indicated and any accompanying specifications to the District for forwarding to the Consultant, if applicable.

The District will forward the landscape planting design plans and specifications to the Consultant. The Consultant shall then prepare the final Landscape Planting Plan drawings according to Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 7.

After completion of the final drawings and the appropriate quantity tabulations, the Consultant shall forward at least two complete sets of prints and specifications of the Landscape Planting Plans to the District for review.

The District shall be responsible for the initial review of the final Landscape Planting Plans and specifications for format, clarity and design intent, quantity accuracy and any other pertinent information. Consultation with the District Roadside Specialist for future maintenance considerations required by the design is encouraged.

The District shall then forward one set of prints of the complete final Landscape Planting Plans and specifications to the Bureau of Project Delivery, Highway Design and Technology Section for their review and comment. Any District review comments shall also be forwarded along with the Central Office submission.

Any required revisions shall be returned to the District for the appropriate drawing revisions.

The plans will be accepted upon approval of the designated District and Central Office review personnel.

**E. Stream Encroachment Plan.** Stream encroachment rules and regulations are discussed in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10. A significant encroachment is a highway encroachment that would involve one or more of the following construction or flood-related impacts:

- A significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route;
- A significant risk;
- A significant adverse impact on natural and beneficial floodplain values; or
- A significant conflict with likely base floodplain development.

Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10, provides a detailed explanation of how Stream Encroachment Plans must accompany permit applications. Under delegation of authority, the PA DEP takes the lead role in the approval process, working jointly with the appropriate regional office of the Pennsylvania Fish and Boat Commission, U.S. Coast Guard, U.S. Army Corps of Engineers, and/or other agencies as required, to provide all necessary regulatory permits or approvals.

**F. Designated Borrow and Waste Areas.** PennDOT does not generally advocate designating borrow and waste areas. The objective of grading design, ideally, is to balance the earthwork quantities (i.e., cut and fill) and minimize or eliminate the need for designating borrow and waste areas. Rarely, it may be desirable to designate these areas where:

- They would not cause erosion and pollute the stream;
- Sources of borrow or areas to waste are limited;
- There is only one area available for specified material;
- Significant fuel conservation may be realized.

In addition to environmental reasons, waste areas are sometimes designated on adjacent projects for other reasons.

Before designating borrow or waste areas, state law, state legal opinions, and Federal requirements must be considered. The Office of Chief Counsel has determined that:

- Act 100 permits PennDOT to acquire borrow areas and waste areas either by amicable means or by condemnation. This applies to areas both contiguous and noncontiguous to the highway right-of-way. However, the necessity to condemn borrow areas should be avoided whenever possible, and
- If appropriate, bid proposals will inform bidders that borrow must be obtained or waste must be deposited at one or more locations previously selected by PennDOT at predetermined prices negotiated by PennDOT. After the contract has been awarded, it is not sufficient for PennDOT to direct the contractor to acquire a borrow or deposit waste at a particular location and leave it to the contractor to work out a price with the landowner. Such an arrangement would put the contractor at a severe disadvantage negotiating face-to-face with the landowner.
- A separate bid item, with one price, would be required for the excavating, hauling and placing of the borrow, and restoration of the borrow area according to Publication 408, *Specifications*, Section 105.14. The price for depositing waste and restoring the waste area according to Publication 408, *Specifications*, Section 105.14 would be included in the price for Class 1 excavation.

The Federal requirements for designating borrow areas are indicated in the Federal Aid Policy Guide (FAPG). The FAPG states that borrow areas may be designated where there is a definite finding by the State with concurrence from FHWA that it is in the public interest to require the contractor to use material furnished by the State or from sources designated by the State. Environmental reasons, conservation of fuel and areas where it is difficult to obtain borrow could be construed as meeting these requirements. All requests to designate borrow areas must be submitted to the Bureau of Project Delivery for review and forwarding for FHWA's approval. The Federal Aid Policy Guide indicates conditions under which waste areas may be designated.

FHWA has also expressed concern for the control of access for borrow and waste areas. Specifically, these areas must not be used for parking, roadside rests, storing maintenance materials, or any other purpose that might detract from the safety or environmental quality of the project.

Designating borrow and waste areas may require the use of State or local roads as haul roads. Use of local roads requires coordination with the municipality. If these roads are damaged, Federal funds may be available for their restoration. The work would be classified as incidental construction costs and require prior approval of the FHWA.

Using designated borrow and waste areas should not be overlooked on projects traversing publicly owned land. In cases of this type, it will be necessary to negotiate an agreement with the involved agency.

When designating borrow or waste areas, there are several items that must be considered. PennDOT's responsibilities include acquiring any necessary permits from the PA DEP. PennDOT also provides its soil and core-boring data to the contractor to define the character and extent of the material at the designated borrow or waste area. Should the designated borrow or waste area scope fall outside the requirements for NPDES Stormwater Discharges Associated with Construction Activities (i.e., less than the minimum earth disturbance acreage), the project plans and proposal must include an Erosion and Sediment Pollution Control Plan and a plan for restoring the involved area taking drainage and soil erosion into account. The contractor's responsibilities include site preparation and final site restoration as included in the project plans and proposal.

Designated borrow areas need not be acquired as right-of-way where they are contiguous to the highway right-of-way. This item may be handled by legal agreement with ownership being retained by the original property owner.

**G. Miscellaneous Environmental Mitigation Measures.** During Final Design, particular attention must be devoted to monitoring of environmental mitigation commitments and avoiding or minimizing further environmental impacts where practical, feasible, and appropriate. The environmental mitigation commitments contained in the final environmental document and related Mitigation Report or Special Conditions of Permits must be identified and systematically tracked to determine if they have been adequately addressed and incorporated into the plans and specifications. Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix T, Environmental Commitments and Mitigation Tracking System (ECMTS) Process, provides detailed procedures for tracking a project's environmental commitments and mitigation. Also included, are the requirements for preparing and updating a project ECMTS Report. Refer to AASHTO's Practitioner's Handbook #04 for more information on tracking environmental commitments.

Environmental commitments made in the NEPA document may not be modified or deleted during Final Design and Construction without FHWA's prior concurrence. Failure to implement environmental commitments contained in the NEPA document without written concurrence from FHWA places PennDOT in violation of the Federal-Aid Project Agreement General Provision No. 20 and will jeopardize federal participation in the project.

The Mitigation Report serves as a contract of mitigation commitments. The Final Design consultant or PennDOT must use the Mitigation Report, with design measures and special provisions, to ensure every mitigation commitment is addressed in the construction bid package. The construction project engineer must be knowledgeable about the mitigation commitments and guarantee that they will be fully implemented in the field as presented in the bid package.

During its normal field supervision during construction, the District should monitor work to ensure that all mitigation measures are effectively implemented. Following construction, these measures can be further evaluated to determine their effectiveness in fulfilling their intended purposes.

It is not enough to simply maintain an index of mitigation efforts that are planned or underway. It is necessary to supervise the design and construction to ensure that PennDOT's consultants and contractors adhere to commitments made in the Mitigation Report. The District should institute a Quality Assurance Reporting system by which project personnel can evaluate the progress and effectiveness of environmental mitigation. Construction and maintenance staff should be required to submit regular reports regarding mitigation measures. Project Team technical supervisors should periodically inform Central Office of any developments during Construction.

Projects in some sensitive areas will require the implementation of sophisticated mitigation techniques such as wetlands replacement. Consultants serving as environmental monitors may be assigned to these projects to ensure that mitigation efforts accomplish their anticipated objectives. These independent monitors will report to PennDOT and the FHWA on the effectiveness of committed mitigation measures.

The following are several frequently required environmental impact avoidance, minimization, and mitigation measures that should be considered:

**1. Preblast Surveys.** Depending on project location, alignment, and soil conditions, extensive blasting for rock excavations may be required. If not properly performed, blasting could adversely affect adjacent dwellings and facilities, resulting in damage claims from property owners, particularly if there is a historic house in the area. To obtain baseline data for properties that could be affected by blasting, preblast surveys should be conducted immediately prior to blasting activities. Preblast surveys allow PennDOT to distinguish between valid and frivolous claims.

Surveys are typically completed immediately prior to blasting and, consequently, are more representative of current structural conditions. Other situations to consider are:

- Establishing general criteria for determining which properties should be monitored, based on scaled distances and peak particle velocities from blasting operations.
- Reviewing the properties designated for preblast surveys.
- Providing a special provision for pre-blast surveys requiring video camera recording of each property.

**2. Residential Water Supplies.** Blasting in rock excavations can adversely affect both water quality and quantity in adjacent water wells and springs. These concerns are greatest on projects located in limestone terrain and where colluvium and alluvium are present. Because of these concerns, preconstruction monitoring of wells and springs adjacent to the proposed alignment should be performed to obtain baseline data.

During water testing operations, the District Right-of-Way Section must be kept informed on the status of each property. This format facilitates tracking of well and spring monitoring operations and is a useful tool for evaluating suspected impacts during the construction phase.

**3. Farming Operations Impacts.** Where applicable, the District is encouraged to continue coordination with farm operators within the project area. Developing high-speed roadways and interchanges may limit a farmer's ability to move farm equipment across the proposed right-of-way.

The District is also encouraged to review designs for implementing mitigation commitments made during the preliminary engineering phase, possibly as a result of the Agricultural Lands Condemnation Approval Board (ALCAB) Hearings. These mitigation measures could include:

- Setting the alignment to follow property lines;
- Adjusting typical sections and bridge span lengths; and
- Maintaining access by providing an overpass or underpass for bisected parcels.

ALCAB meetings must be coordinated in accordance with the guidelines established in Publication 324, *Agricultural Resources Evaluation Handbook*.

**4. Stream Impact Mitigation, Enhancements, and Modifications.** Measures to avoid or minimize direct impacts to streams should be incorporated wherever possible. These measures may include:

- Spanning with structures, rather than crossing with culverts;
- Using depressed or low flow culverts;
- Minimizing stream relocation;
- Minimizing the length of stream involvement;
- Incorporating in-stream and streamside enhancements; and
- Use of baffling in culverts.

**5. Stormwater Management Plan Conformity.** In addition to avoiding downstream flooding, stormwater management design objectives may include collection, filtration, and deposition of normal roadway pollutants from roadway runoff to prevent groundwater pollution. If such commitments were made during the Preliminary Engineering and environmental studies phase, the details for Final Design must comply with the watershed's Stormwater Management Plan.

For additional information regarding the Anti-degradation and Post-Construction Stormwater Management Policy see Publication 13M, Design Manual Part 2, *Highway Design*, Section 13.7; Publication 584, *PennDOT Drainage Manual*, Chapter 12; and Publication 72M, *Roadway Construction Standards*, Standard Drawings RC-70M through RC-77M.

**6. FEMA Map Revisions.** Floodway Maps may be revised for streams included in previous Flood Insurance studies and where the project would adversely affect the limits or extent of the 100-year flood boundaries. The two key steps in this process are:

- Obtaining written municipal approval/concurrence to the change
- Submitting a Letter of Map Revision (LOMR) or Conditional Letter of Map Revision (CLOMR) to FEMA.

**7. Temporary Stream Crossings.** This is an extremely important and often overlooked aspect of large or expedited projects. Failure to design for temporary stream crossings can significantly delay executing a construction contract. Permitting agencies typically prefer to address temporary stream crossings during the design phase to limit their involvement during construction. Due to the frequent need for staged construction and the potential for intercontract coordination and access problems, temporary stream crossings should be identified as early as possible in the design process and incorporated in the Joint Permit Application (Chapter 105 permit from PA DEP). See Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10 for more details on permit requirements.

**8. Wetland Habitat and Vegetation Protection.** Wetlands and vegetated areas requiring special protection should be identified on the Final Design Plans and in special provisions. Protective measures may include using protective fencing to restrict access by contractors during construction. Where temporary construction access through wetland areas is required, measures to minimize impacts such as using mats should be provided. These details must also comply with Chapter 105 and Section 404 permit conditions. In addition, reference the mitigation section of the NEPA document applicable to the project. Wetland mitigation efforts should follow guidelines established in Publication 325, *Wetland Resources Handbook*.

**9. Municipal, Industrial, and Hazardous Waste.** Regulated waste within a project area demands special attention during the Final Design. To determine the severity of a problem, a site assessment is performed. Such studies range in scope from gathering historical information (Phase I) to collecting samples (Phase II and Phase III). Publication 281, *Waste Site Evaluation Procedures Handbook*, provides guidelines for site assessments performed for PennDOT.

PennDOT's most common waste management issues involve worker's health and safety, and waste material handling. PennDOT's cleanup responsibility on most projects is limited to the proper management of contaminated materials encountered during construction, such as drums, waste piles, soil, and water. However,

it is important to recognize exceptional situations where PennDOT could be held liable for more extensive remediation, beyond the immediate work area.

Procedures to address waste management concerns on a particular project should be added to the construction specifications. Where minor soil contamination occurs, a special provision could be as simple as requiring that excavated soil be incorporated into an embankment. Where the degree of contamination is greater, special provisions are likely to be more complicated, and may require disposing soil off-site, controlling dust, and treating water prior to discharging to a stream.

**10. Habitat Mitigation.** Depending on project location and extent of wildlife habitat disturbance, preparation of a plan for habitat mitigation may be required based on coordination with the District Environmental Manager. The project landscape design should be developed to include plantings (native to Pennsylvania) that maximize wildlife habitat value. In some cases, acquiring additional property to be added as State Managed Habitat Reserves may be a suitable mitigation measure. Roadside plantings should be sensitive to existing landscape settings. In addition, roadside plantings with wildlife habitat value should consider safety issues in regard to attracting wildlife at or near roadways.

**11. Cultural Resource Preservations.** During Final Design, particular attention must be devoted to monitoring of cultural resources mitigation commitments associated with avoiding or minimizing effects where practical, feasible, and appropriate. Where there may be changes to a commitment, coordination with the appropriate agencies should be initiated. Mitigation commitments for cultural resources would be contained in the Mitigation Report and/or the Memorandum of Agreement. Appropriate measures to provide special protection for historic or archaeological sites during construction should be considered and incorporated into the special provisions. For example, archaeological sites may exist along the alignment that should be protected by restricting construction access with protective fencing. Vegetative screening also may be considered as a permanent means to minimize visual impacts to historic sites.

**12. Noise Abatement Measures.** Noise analyses conducted during Final Design shall address the mitigation of noise impacts identified during the Preliminary Engineering/Environmental Clearance phase of the project. For noise analyses conducted during Preliminary Engineering/Environmental Clearance phase, reference Publication 24, *Project Level Highway Traffic Noise Handbook*. The goal of Final Design noise Analysis is to re-evaluate design year noise levels under the selected alternative and to consider noise abatement options were deemed warranted, feasible and reasonable based on PennDOT's current noise policy. Precise barrier locations and design options are defined at this stage and coordinated with affected communities.

Proposed noise mitigation is evaluated during Final Design and must meet all the criteria identified in Publication 24, *Project Level Highway Traffic Noise Handbook* to be recommended for construction as part of the project. The PennDOT Noise Abatement Criteria specifically deals with warrants, feasibility criteria, and reasonableness considerations. A detailed explanation of the Noise Abatement Criteria can be referenced in Publication 24, *Project Level Highway Traffic Noise Handbook*. The most current version of Publication 24, *Project Level Highway Traffic Noise Handbook* should be referenced in order to determine the appropriate cost factors used for reasonableness calculations.

All recommended noise mitigation identified in Final Design should be reviewed by the sponsoring agency before coordination with the public is initiated, which is part of the final reasonableness determination. Once the affected public is presented information specific to their area, their desires related to the proposed abatement methods shall be recorded. It is important to note that at any time during final design, the public has the right to refuse the abatement, at which time the decision is documented. Should the community accept the final noise abatement proposal, noise abatement will proceed into the Plans, Specifications and Estimates (PS&E) and construction.

## **H. Roadway Lighting.**

**1. General Lighting Policies.** Any exceptions or waivers to the general lighting policies must be approved by the Deputy Secretary for Highway Administration. To obtain these approvals, Districts are requested to submit the approval request with justification to the Director, Bureau of Maintenance and Operations for coordination with the Deputy Secretary for Highway Administration or the FHWA. Districts should not send the approval request directly to the Deputy Secretary for Highway Administration or directly to the FHWA.

The implementation of lighting should be based on Publication 13M, Design Manual Part 2 (DM-2), *Highway Design*, Chapter 5, Lighting guidance and/or the AASHTO Roadway Lighting Design Guide (RLDG) which provides warrants and/or recommendations for the following locations:

- Certain Interchange and Controlled Access Facilities
- Major Arterials in Urban Areas
- Certain High Crash Locations

For locations where neither Publication 13M, DM-2 nor the AASHTO RLDG provides warrants and/or recommendations, PennDOT may still provide lighting systems, such as for interchanges, intersections, bridges, and other locations at the discretion of the District Executive. The cost of the installation will be financed by appropriate State, Federal and Local funds unless privately funded.

Other locations generally include enhancement projects (streets, walkways, and bicycle lanes, and consistent with funding source requirements), temporary roadways, roadside rest areas, tunnels, park-and-ride areas, truck weigh stations, truck escape ramps, and traffic signal mounted lighting.

The Commonwealth will retain ownership of all highway lighting systems installed by PennDOT on Interstate Routes and on interchanges formed by two Appalachian Development Highway Systems (ADHS) highways that have not yet been constructed and pay for the total cost of energy and maintenance.

For highway lighting systems installed on interchanges where applicable AASHTO RLDG warrants are met, other than Interstate Route interchanges, and closed ADHS interchanges that have not yet been completed, the local government must assume in writing the obligation of ownership and also pay half of the annual energy and maintenance charges. The other half is to be paid by the State. PennDOT, by agreement, will turn over the ownership of the complete system to the local government under the conditions of the agreement, including the following:

- Maintenance will be performed in a manner and on a schedule satisfactory to PennDOT.
- Any agreement entered into with a local electric utility company will contain a clause prohibiting use of the lighting facilities for any purpose other than the lighting of highways or signs.
- When a replacement lighting system is required, it will be subject to PennDOT approval.

On an interchange where the applicable AASHTO RLDG warrants are not met, but the local government requests lighting and agrees in writing to assume the total cost of installation as well as the annual energy and maintenance costs, the AASHTO RLDG warrant requirement may be waived and permission given for the installation subject to the approval of the Deputy Secretary for Highway Administration.

Provisions for other lighting will be handled as follows:

- On new or reconstructed bridges, PennDOT will install, at its expense, lighting standards - providing the local government agrees in writing to assume the ownership and the costs of energy and maintenance.
- On existing bridges, the updating or installation of lighting systems shall meet PennDOT's standards and be approved by BOMO-MTLD. The local government must agree in writing to assume the ownership and the costs of construction, energy, and maintenance.
- On intersections, such as roundabouts where PennDOT guidance recommends lighting, PennDOT will install, at its expense, lighting standards - providing the local government agrees in writing to assume the ownership and the costs for energy and maintenance or as stipulated in the maintenance agreement.

When local governments do not agree to the payment of the energy and maintenance costs, the District Executive or the Deputy Secretary for Highway Administration may consider one of the following:

- Apply cost sharing.
- Have PennDOT cover the energy and maintenance costs.
- Install provisions for future lighting, in which case, PennDOT will typically provide the following:
  - o Interchanges and Intersections. Conduit, in accordance with Publication 408, *Specifications*, shall be provided under pavements at all anticipated electric cable distribution crossings. These locations shall be identified on the plans by a Station plus number.
  - o Bridges. As determined by the District Executive.

Conversion of existing lighting systems from High Pressure Sodium (HPS) to Light Emitting Diode (LED) is acceptable when a life cycle cost analysis shows the conversion to be economical. There may be an advantage both in terms of energy and maintenance. Refer to Publication 13M, DM-2, Chapter 5 for more information.

**2. Lighting Design Approval Procedures.** During the early stages of Final Design, the District shall obtain comments from BOMO-MTLD relative to the installation of lighting. Recommendations shall be based on the District Executive's knowledge of the local situation and shall stipulate to install lighting now; specify provisions for future lighting; or specify no provisions for lighting now or in the future.

If other than Interstate or closed ADHS interchange, the District Executive or qualified representative (not the Consultant) must obtain from the local government a letter of intent to initiate the design and a signed agreement meeting the General Lighting Policies discussed previously, if the local government will be maintaining the lighting.

The District will arrange for a pre-design meeting for the proposed lighting with BOMO-MTLD during the early stages of Final Design. The purpose of this meeting is to review requirements and establish design parameters including the following:

- a. Purpose of lighting, limits of work, funding source(s).
- b. Current design manuals, standards and criteria
- c. Luminaire and pole selections.
- d. Mounting heights
- e. Light Loss Factor (LLF) to be applied to photometric calculations.
- f. Minimum average maintained illumination at End of Rated Life (ERL).
- g. Maximum uniformity ratio (average/minimum).
- h. Maximum veiling luminance (glare) ratio.
- i. Coordination of proposed lighting with adjacent roadways.

All designs must conform with Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 5; Publication 14M, Design Manual Part 3, *Plans Presentation*; Publication 408, *Specifications*; Standard Drawings; AASHTO; pre-design meeting items; and other pertinent specifications and/or drawings.

The District (or its designated consultant) will prepare and distribute the minutes of the meeting to all attendees.

The preliminary lighting plans and calculations shall be transmitted electronically by the District to BOMO-MTLD for approval. All information for the lighting system shall be shown on a 1 in = 100 ft or 1 in = 50 ft scale plan.

Justification for the proposed lighting shall be furnished to BOMO-MTLD with the initial design submission. The plans must show the applicable AASHTO warrants listed in AASHTO's *Roadway Lighting Design Guide* and should state the conditions. When the warrant is based on ADT (estimated ADT when the facility will be opened for traffic), show the ADT on the mainline, crossroads and ramps. If the ADT is below that required by AASHTO warrants, supporting justification for the present lighting shall be given on the plans. Note that the applicable AASHTO warrants and ADTs are not to be shown on the final lighting plans.

Refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 5 for specific information about the requirements for the Preliminary Lighting plans, calculations, and report.

BOMO-MTLD will review the preliminary plans and calculations and submit comments and/or approval to the District.

The location of all lighting pole anchorages on bridges shall be shown on the bridge drawings (for appropriate locations of lighting poles on bridges to minimize maintenance and vibrations, refer to Publication 15M, Design Manual Part 4, *Structures*).

Final lighting plans, special provisions and wire size calculations will be prepared and transmitted electronically to BOMO-MTLD for approval prior to release of the final plans to the District Office for PS&E development (refer to Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 9; pre-design meeting items; and Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 5 for additional final design requirements).

The District Executive must approve items involving structural considerations that are not fully covered by the Standard Drawings or Specifications for highway lighting prior to the final lighting plans submission to BOMO-MTLD. A copy of the letter of approval from the District Executive for the items shall be included with the final lighting plans submission to BOMO-MTLD. Items that require approval from the District Executive are special foundations, special lighting poles, special supports or mountings, etc.

**3. Legal Agreement Review and Preparation Procedures.** If the agreement between PennDOT and the local government is prepared at the District level, the District Executive shall submit the draft to the Office of Chief Counsel (OCC) for review, together with one set of final lighting plans for review (several revision cycles may be necessary). OCC's Lighting Agreement template or a combined Agreement template which includes Lighting should be used. The agreement shall include the following general information:

- Names of the county, State Route, section and required highway station numbers of the section of the State highway involved.
- Full names of parties, specifying whether corporate, partnership or individual, together with their place of business addresses.
- Short statement of purposes to be served by the agreement.
- Complete description and drawing or plot plan of the area affected by the terms of the agreement.
- Statement of the work or obligations to be performed by each of the parties of the agreement, including amounts, times and portions thereof.
- The total costs and allocations of the costs of the work to be performed, including the terms, times and proportions of payments for the work.
- Responsibilities for future maintenance of the completed work.
- Any special provisions or requirements that should be made a part of the agreement.

**4. Guidelines for Highway Lighting Agreements with Electric Utility Companies.** These agreements are prepared by the Electric Utility Companies and initiated during construction by the District Executive for the supply of electricity. The cost of the provisions to supply the electricity, such as line extension and/or facility charges, is a proper project construction charge. The cost of electricity used to energize the system is a proper maintenance charge.

When a lighting agreement with the electric utility company is required for systems owned by the Commonwealth, it should be initiated during construction by the District Executive. The electric utility

company will bill the District Office/County for the energy usage. Billing by the local electric utility company shall be for metered service unless PennDOT approved un-metered energy only rate is available.

When an existing HPS lighting system is retrofitted to LED, the District shall contact the electric utility company to coordinate the adjustment of the electricity rate structure.

The electric service locations shown on the plans should be confirmed in writing by the electric utility company, and line extension charges, if any, determined at the time. Charges by the electric utility company for line extension or facilities are to be paid as one-time, lump sum, project construction cost. Such charges are never to be deferred or included in the periodic billing for energy. The one-time, lump sum payment to the electric utility company for line extension and/or facility costs may be procured through a Service Purchase Contract. Payment shall be encumbered with an SAP-7 against the project and paid through SAP transaction code FB60 when the work is completed. The amount of these charges by the electric utility company is based on their cost to provide the service facilities required with relation to the energy usage anticipated.

When processing agreements, as many copies of the agreement as there are parties to the same (usually two) must be hand-signed by the proper official of the local electric utility company and sent to the District Office. The electric utility company must include a resolution or other delegation of signature authority if the agreement is executed by someone other than the president or a vice president and attested by someone other than the secretary, assistant secretary, treasurer, or assistant treasurer. Under certain circumstances, in order to save time, the Commonwealth will execute the electric utility company's prepared forms in the first instance before signing by the proper officials of the electric utility company, but this practice should be discouraged as contrary to customary procedure. The agreement should be checked for accuracy and conformity with the Commonwealth policy by the District Office and such objectionable terms that would require the Commonwealth to indemnify and save harmless the electric utility company shall be eliminated since this cannot be done legally without legislative authority. In addition, such agreement should provide for a definite termination date either by passage of a certain period or by notice of intention to terminate.

After all copies of the agreement have been signed by the local electric utility company and approved by the District Office as indicated above, they should be forwarded by the District Office to the Bureau of Project Delivery, Utility & Right-of-Way Section to check for compliance with PennDOT's policy directives. In the forwarding letter to Bureau of Project Delivery, the District must indicate the proper method of funding of the costs involved in carrying out the agreement. Upon approval, the Bureau of Project Delivery will forward the copies of the agreement to the Office of Chief Counsel for final processing and subsequent distribution.

In the final processing procedure conducted by the Office of Chief Counsel, the required copies of the agreement are transmitted to the Bureau of Fiscal Management for budget purposes. Then they are transmitted to the Deputy Secretary for Highway Administration for signature. When these procedures have been completed, the copies of the agreement are returned to the Office of Chief Counsel for approval as to form and legality, the Office of General Counsel (if necessary) and the Office of Attorney General and thereafter to the Comptroller for fiscal approval. Only after approval by the Comptroller does the agreement become a legal obligation of the Commonwealth. The Comptroller retains either a hand signed or signature stamped copy of the fully executed agreement for its files and the Office of Chief Counsel returns the remaining hand signed or stamped copies to the District. The District then distributes copies of the executed agreement as follows:

- Bureau of Project Delivery - one copy.
- State Treasurer - one copy.
- District Office - one hand signed copy for each party to the agreement.

#### 4.10 GEOTECHNICAL ENGINEERING

Geotechnical Engineering encompasses a wide range of issues critical to the design and construction of highways, bridges, and other types of transportation structures. Publication 293, *Geotechnical Engineering Manual*, provides a comprehensive guide to these issues.

#### 4.11 STRUCTURE DESIGN COORDINATION

Structures include all bridges, retaining walls, and noise barrier walls required to support the highway and its appurtenances. The term structure also includes culverts draining watersheds larger than 0.5 mi<sup>2</sup>.

The Final Design of structures shall be sufficient to select and justify Type, Size and Location (TS&L) based on the available information. To support the investigations, data on reconnaissance soils and geologic engineering should be reviewed.

Preliminary cost comparisons should be made to support TS&L recommendations. Data necessary to prepare hydraulic calculations for structures draining areas greater than 0.5 mi<sup>2</sup> shall be collected for use in calculating bridge or structure waterway openings. Refer to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10.

For railroad structures, information required to complete Form D-4279, "Railroad Crossing Data for Bridge Engineer," shall be collected for use in Final Design.

**A. Type, Size, and Location (TS&L) Plans.** Publication 15M, Design Manual Part 4, *Structures*, Chapter 1 provides guidance for determining review and approval responsibility for each bridge submission. For TS&L Submissions, Publication 15M, Design Manual Part 4, *Structures* also specifies the responsibilities of the District and Bureau of Project Delivery, Bridge Design and Technology Division.

**B. Approved Test Boring Contractor List.** The Bureau of Project Delivery, Innovation and Support Services Division, Geotechnical Section will maintain a list of Approved Test Boring Contractors. Reference Publication 222, *Geotechnical Investigation Manual*, Chapter 1 for information regarding the approved test boring contractor list.

**C. Approval of Structural Foundations.** Publication 15M, Design Manual Part 4, *Structures*, Chapter 1 outlines foundation exploration and report preparation details. Publication 15M, Design Manual Part 4, *Structures*, specifies the review and approval responsibilities for the District and Bureau of Project Delivery, Bridge Design and Technology Division. Submission requirements, special considerations, and foundation approvals are also noted. The request for approval of structural foundations shall be transmitted to the Bureau of Project Delivery, Bridge Design and Technology Division by the District Executive.

**D. Clearance of Track Where Railroads Are Overpassed by a Highway.** Prior to development of a preliminary bridge plan, the Consultant and/or District Executive shall know what position the railroad will take regarding clearances. The position should be supported in writing from the railroad with its reasons for requesting the clearances. The railroad shall be provided, by the Consultant or District Executive, at the earliest possible time, a letter of intent to construct a crossing above the railroad grade, with the following pertinent information provided:

- A plan indicating the typical roadway section, the approximate alignment and profile of the proposed highway, and railroad cross sections 500 ft each side of the highway centerline.
- A statement pertaining to existing drainage conditions.
- A statement that PennDOT proposes to provide 12.5 ft lateral clearance, measured from the centerline of track, on both sides, and overhead clearance of 23 ft (25 ft over electrified tracks) measured from the top of rail. These clearances meet the PUC's minimum requirements.
- A statement informing the railroad that a 18 ft maximum lateral clearance will be provided for off track equipment on one side, if presently required or contemplated in the future.
- Three copies of Form D-4279, "Railroad Crossing Data for Bridge Engineer," and a request that the Railroad return two completed forms.

If the Railroad is in agreement with the above-stipulated clearances, the Preliminary Bridge Plan shall be prepared accordingly. If the Railroad requests clearances in excess of those mentioned above, complete justification of this request must be provided. Class 1 Railroads may require lateral clearances in excess of the above, depending upon the need for drainage ditches and roadway for off-track equipment. If the District considers the justification to be

adequate, the proposed clearances, together with complete justification, shall be incorporated into the TS&L submission to the Bureau of Project Delivery, Bridge Design and Technology Division for approval. If the District does not consider the Railroad's justification to be adequate, the procedures described below shall be followed.

If the Railroad requests additional lateral clearances for the purpose of adding an additional track in the future, the District shall request the Railroad to provide PennDOT with a letter of intent to construct additional trackage at the location and the approximate date scheduled for the construction of the additional track. The Railroad shall be informed that whether or not the Railroad provides this letter of intent, the only way PennDOT can agree to provide the clearances requested is if the Railroad will agree to reimburse PennDOT for the additional costs incurred if the Railroad does not construct the additional track within a specified period of time (5 years). This must be in the form of a written agreement and must be executed by both parties prior to continuance of design and for any proceedings before the PUC.

If the Railroad will not provide the letter of intent and will not enter into an agreement as outlined above, and still requests excess clearances, as outlined, or if the District does not accept the Railroad's justification of clearances greater than provided for in the above bullets, the procedure shall be as follows:

- If a Cooperation Agreement has been executed with a Railroad, the Dispute Resolution paragraphs must be complied with in the Agreement.
- The District Executive shall transmit to the Chief Bridge Engineer (with one copy of all data to the Bureau of Project Delivery, Utilities and Right-of-Way Section) the following:
  - All correspondence and minutes of meetings pertaining to the lateral clearance.
  - Two sets of plans indicating the typical roadway section, approximate alignment and profile, and cross sections of the Railroad 500 ft each side of the intersection point with the highway alignment. The plan shall identify PennDOT clearances proposed and the Railroad clearances requested.
  - The transmittal letter forwarding this data shall contain a District statement as to why the District disagrees with the Railroad's position and an estimate of the additional cost incurred to provide the clearances requested by the Railroad. This estimate may be based on an area of structure calculation.
- The Chief Bridge Engineer and the Bureau of Project Delivery, Utilities and Right-of-Way Section will jointly review the pertinent data and proceed to approve the design as originally proposed (without the excess clearances requested by the Railroad) and request a PUC hearing to resolve the issues.

If the excess clearances are ordered by the PUC and Federal-aid funds are involved, PennDOT shall prepare the Preliminary Bridge Plan accordingly and transmit it to the Federal Highway Administration for approval, together with the Railroad's justification for the excess clearances, and a copy of the PUC order.

**E. Hydrologic and Hydraulic Reports.** The hydraulic design of structures will be according to the procedures outlined in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10. The Bureau of Project Delivery will forward a copy of the report to the FHWA for review and approval according to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10.

**F. Structure Foundation Submission.** Publication 15M, Design Manual Part 4, *Structures* summarizes the review and approval responsibility for foundation approval for all Projects. Categories include foundations on bedrock, soils, pedestals, caissons, and piles. Sound barriers and sign structures are also included. Publication 15M, Design Manual Part 4, *Structures* also outlines:

- Responsibilities of District
- Responsibilities of Bureau of Project Delivery, Bridge Design and Technology Division
- Submission Requirements
- Special Considerations
- Foundation Approval.

**G. Final Bridge Plan Submission.** Publication 15M, Design Manual Part 4, *Structures* summarizes the review and approval responsibilities for Federal Oversight and PennDOT Oversight projects. Publication 15M, Design Manual Part 4, *Structures* also outlines:

- Responsibilities of District Bridge Engineer
- Responsibilities of Bureau of Project Delivery, Bridge Design and Technology Division
- Plan Presentation
- Signing of Bridge Plans

#### 4.12 SPECIAL PURPOSE PROJECT PLAN COORDINATION

**A. Transportation Enhancements Projects.** Federal legislation encourages the public and private sector to cooperatively plan and develop intermodal transportation enhancements projects that are tailored to their specific needs. This program provides a means of stimulating additional activities that go beyond the normal elements of a transportation improvement project.

Transportation enhancement activities must have a direct relationship to the intermodal transportation system. An intermodal transportation system is one in which various forms of transportation (or modes, such as motor vehicles, transit, rail freight or bicycles) are integrated and interconnected. The intent of the Transportation Enhancements Program is to integrate more creatively various transportation facilities into their surrounding communities and the natural environment.

Eligible transportation enhancement activities must fall into one or more of the ten approved categories included in the Federal legislation. See Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 2, for more information about PennDOT Transportation Enhancements projects. These projects follow the same general process as other PennDOT projects. Refer to Chapter 3 for Preliminary Engineering requirements and this chapter for Final Design requirements.

**B. Safety Rest Area and Welcome Center Plan.** Four general stages of design development shall be followed for safety rest area and welcome center plans. These stages are to assure continuity in receiving the appropriate design approvals and preparing the plans necessary to develop a Safety Rest Area or Welcome Center. The design stages are as follows:

- Site Selection
- Conceptual Design Scheme Development
- Preliminary Engineering
- Final Design

**1. Site Selection.** Site investigations will normally deal with two types of potential site locations, including new location where no previous development or right-of-way acquisition has been completed and previously designated areas where right-of-way has been acquired for Safety Rest Area/Welcome Center development. Features such as ramps and parking areas may have previously been constructed.

The following topics shall be investigated and appropriate data shall be included in the preparation of the Site Selection Report:

- a. Location and Topographic Considerations.** Consider proximity to other Safety Rest Areas/Welcome Centers, interchanges, highway structures, residential or other development, prime tourist attraction areas, and state borders.

Assess the natural characteristics of the site such as woods, openness, constant or intermittent watercourses, wetlands, farmland, land slope, adjacent land use, site aesthetics, etc.

Assess the relationship of the site to the highway in terms of elevation. Is the site above, below, or at the same elevation as the highway?

Assess the ease of developing access ramps, parking areas, other site development facilities, and potential for future expansion. Assess the extent of earthwork modifications necessary to develop the site and how this will affect the proposed site.

Assess the scenic quality of the site and the view from the site.

**b. Environmental Considerations.** Provide a preliminary environmental overview of each site by investigating the following concerns:

- Regional and community growth
- Conservation and preservation
- Public facilities and services
- Community cohesion
- Displacement of people, businesses and farms
- Air quality
- Noise
- Water pollution
- Hazardous waste site
- Aesthetics

**c. Right-of-Way Consideration.** Assess the amount of land acquisition necessary to provide all required site development facilities. Determine existing property parcel(s) ownership (private, public, corporate, etc.). Prepare a preliminary cost estimate for any proposed right-of-way acquisition.

**d. Utility Availability Consideration.** The Design Agency shall coordinate with all applicable utility companies to determine the location of any existing facilities within the study area. This coordination is according to PA Act 287 of 1974 as amended by Act 187 of 1996 and Act 181 of 2006. The Design Agency shall verify telephone and electric power service availability, power requirements, service termination locations, service runs and any utility relocation if necessary. Document all utility company correspondence. Assess the availability and type of the following utilities:

- Electric power
- Telephone
- Municipal water supply system (present or planned)
- Municipal wastewater (sewage) treatment facilities (present or planned)

Assess any other existing utility type features on site that may be affected by the site development such as gas lines, oil/gas wells, high voltage transmission lines, cable transmission lines, etc.

**e. Water Supply Availability.** Assess the availability of any nearby municipal water supply lines and provide a preliminary cost estimate necessary to extend the municipal water supply to the site.

Assess the feasibility of drilling an on-site water well. Include information on anticipated well depth, existing groundwater, quantity of supply and quality of water. Consult the Pennsylvania State Geologist for assistance in determining well feasibilities. If an on-site water supply well is required, the Design Agency shall prepare and let a well drilling contract. The contract will allow an adequate supply of potable water to be located if an existing well is not available. In developing a new well, the water capacity shall be determined during drilling operations before a fully cased and capped well is completed. The proposed location of any well(s) shall avoid conflict with other proposed facilities to be developed on the site.

Upon completion of an approved well, the Design Agency shall conduct the required biological, chemical, and radiological water quality and quantity pumping tests, test results shall be provided by a certified testing laboratory. If no water treatment or only disinfection treatment is required as determined by the well tests, the Design Agency shall file a noncommunity water supply Brief Description Form and apply for a Public Water Supply Identification number through PA DEP. If the well water requires more intensive treatment beyond disinfection, then the Design Agency must obtain a Public Water Supply Permit from PA DEP.

**f. Wastewater (Sewage) Discharge.** Assess the availability of any nearby existing or planned municipal sewage treatment plants and provide a preliminary cost estimate necessary to extend service to the site.

Assess the feasibility of on-site sewage disposal before considering an on-site treatment plant as a final solution for treatment of on-site generated wastewater. This requires coordination with the local sewage enforcement officer.

Assess potential discharge areas on site for treated wastewater effluent associated with an on-site treatment plant. Contact PA DEP and obtain the initial sewage discharge limits to approve an on-site treatment plant. Mandatory connection to an existing treatment plant in the area may be required. The Design Agency shall investigate an appropriate area on the site where the sewage treatment system can be located. The treatment plant location should avoid conflict with other proposed facilities to be developed on the site.

**g. Soil and Geological Factors.** Assess the following:

- Soil type(s) and associations
- Engineering and classifications, uses and limitations
- Water table information
- Depth to bedrock
- Wetland boundary determinations

**h. Schematic Site Development.** Develop Preliminary Engineering schematic drawings indicating the proposed site development components. These components may include access ramps, parking areas, building location, well location, wastewater treatment facility, picnic areas, etc.

Provide scale drawings on topographic maps at a minimum scale of 1 in = 200 ft. Show proposed right-of-way acquisition limits. Provide a preliminary cost estimate to develop the site based on the design schematic.

**i. Site Selection Report.** Compile all data and provide documentation of all factors that affect the site location determination in the Site Selection Report. List advantages and disadvantages of developing each potential site. Recommend the most desirable site for further study based on an analysis of the compiled data. The Design Agency shall submit at least two copies of the Site Selection Report to the District Office and three copies to the Bureau of Project Delivery for review and approval. The Design Agency shall schedule appropriate field views and office review meetings as necessary. The Design Agency will invite participation by all appropriate parties. The Design Agency shall revise the Site Selection Report as necessary to incorporate applicable review comments as determined by PennDOT. PennDOT will issue a Site Selection Report acceptance letter to the Design Agency. The letter will be based upon the successful completion of the document and upon receiving the appropriate approvals and/or concurrences.

Upon acceptance of the Site Selection Report, one of the proposed sites will be selected by PennDOT for further study. The site determination will be based on evaluating the information presented in the Site Selection Report and in conjunction with a field view of the sites that will be scheduled by the District Office. Field view participants should include appropriate personnel from the Design Agency, District, Bureau of Project Delivery, FHWA, and other Central Office Bureaus or Offices as necessary. The Design Agency shall be responsible for compiling appropriate minutes of the field view. The agency shall forward copies promptly to all participants except FHWA. The Bureau of Project Delivery shall forward the field view minutes to FHWA for their review and concurrence.

**2. Conceptual Design Scheme Development.** When the proposed site has been determined, the Design Agency is authorized to begin preparing Conceptual Design Schemes for site development. PennDOT will issue a site approval letter indicating the site to be developed. The District Office will issue appropriate letters of intent to enter property. The entry may be necessary to initiate any field surveys, soil boring investigation, percolation tests or exploratory well drilling as necessary for future design considerations.

The Design Agency shall develop an appropriate topographic contour base map (scale 1 in = 50 ft) of the approved site. The map should be sufficient in area to encompass the proposed right-of-way acquisition and proposed construction. The base map shall be developed indicating contour intervals of 1 ft. Use recent photogrammetric mapping and supplement with appropriate field surveys as required. The topographic map shall include the following information where applicable:

- Extend topographic plot at least 100 ft beyond the proposed property right-of-way.
- Include all boundaries of wooded areas, structures, paved areas, rock outcrops, streams or other watercourses, wetlands, drainage structures with appropriate elevation information, utility lines, poles, fences and any other physical features that may affect the design or construction.

The District Office will identify the required scope of any engineering studies and the corresponding environmental documentation, which will be completed in accordance with Publication 10B, Design Manual Part 1B, *Post-TIP NEPA Procedures*.

The Design Agency shall prepare design development schemes. The schemes will include the proposed access ramps, parking lot configuration, locations of the anticipated water supply and sewage treatment facilities, building location, electric power supply and telephone line routing, preliminary contour grading limits and associated drainage systems. The purpose of the conceptual design schemes is to develop graphic plans based on function, safety, and aesthetic awareness. Schemes should be developed with consideration of the following factors:

- Accommodation of design year traffic volumes. See Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 9.
- Adaptation of the proposed Safety Rest Area/Welcome Center building and other facilities to the site conditions.
- Preservation of existing desirable site features such as vegetation or other visual enhancement areas.
- Construction costs.
- Safe vehicular and pedestrian circulation.
- Future maintenance considerations such as snow removal, trash storage, mowing, picnic areas, pet walk areas, etc.

The Design Agency shall submit two copies of all conceptual site design schemes to the District for review. The Design Agency shall also submit three copies of all schemes to the Bureau of Project Delivery.

The Design Agency shall be responsible for scheduling field views with PennDOT and FHWA personnel to analyze and select the best design scheme for further engineering development. The Design Agency shall be responsible for compiling appropriate minutes of all field views and forwarding copies to all attendees except FHWA. The Bureau of Project Delivery shall be responsible for coordinating all reviews, approvals, or concurrences with FHWA.

The Design Agency shall coordinate all review comments and refine any design modifications to the selected design scheme. Revised design schemes shall be resubmitted for review and approval as indicated for the

initial submission. The Preliminary Engineering stage will not commence until a conceptual scheme is approved and all environmental clearances are received.

If requested by the District, the Design Agency shall be responsible for scheduling a Public Plans Display. The display should acquaint local government leaders and citizens of how the project may affect the general area and solicit their input on site development.

**3. Preliminary Engineering.** Preliminary Engineering may include compiling engineering studies, securing appropriate approvals or permits and preparing preliminary engineering drawings for the following items:

- Conduct appropriate surveys to establish baselines, benchmarks, etc.
- Perform soil borings and compile data as required to complete any roadway or structural design work.
- Prepare site development plans including roadway geometrics, profiles, typical sections, parking lot configurations, siting of building, contour grading and drainage, sidewalks, landscape planting, pavement markings, roadway and area lighting, erosion and sedimentation pollution control, roadway and site signing, etc.
- Pavement design
- Utility service(s) verification
- Sewage Treatment System. Includes submission of an NPDES (National Pollution Discharge Elimination System) Application - Part I to PA DEP to receive an NPDES Permit. The NPDES Permit approval may require up to 12 months duration.
- Water supply system
- Right-of-way plan (if applicable)
- Cost estimates
- Specifications

Follow appropriate design criteria for roadway items as described in Publication 13M, Design Manual Part 2, *Highway Design*. Follow appropriate plans presentation formats as described in Publication 14M, Design Manual Part 3, *Plans Presentation*.

Preliminary engineering plan and submission requirements for Safety Rest Areas and Welcome Centers include:

- a.** Contour Grading and Drainage Plans. The Design Agency shall submit two copies of the contour grading and drainage plans to the District and two copies to the Bureau of Project Delivery for review. The Bureau of Project Delivery will forward their review to the District for coordination with the Design Agency. Contour grading and drainage plans are necessary due to the unusual nature of the site usage associated with these areas. Sidewalk locations, picnic areas, areas to be mowed and other designated use areas require grading coordination beyond that which can be normally associated with grading depicted by cross sections alone.

Upon receiving approval of the contour grading and drainage plans, the Design Agency will further develop the grading near the Safety Rest Area/Welcome Center building. If designated, the Design Agency will further develop the grading around the sewage treatment plant. The contour grading depicted around the Safety Rest Area/Welcome Center building should be developed as a scale of 1 in = 25 ft. It should also show any proposed development around the building. Sidewalks, building roof drainage provisions, flagpole location, outdoor telephone provision, water/jug filler location, light poles, curb ramp

provisions, bench pads, etc. should be indicated. Indicate pavement spot elevations and proposed building floor elevation. The contour interval should be 1 ft. Submit the building area grading plan for review following the same procedure stated for the general site contour grading and drainage plans.

**b. Water Supply System Plans.** The Design Agency shall submit two copies of all water supply system plans and associated specifications to the Bureau of Maintenance and Operations, Maintenance Technical Leadership Division, Strategic Environmental Management Program Section for review and approval. In the event that connection to a public water supply company is proposed, approval of the connection and the costs of this service must be secured from the utility company.

**c. Sewage Treatment System Plans.** The Design Agency shall submit two copies of all sewage treatment system plans and associated specifications to the Bureau of Maintenance and Operations, Maintenance Technical Leadership Division, Strategic Environmental Management Program Section for review and approval. In the event that connection to a public sewage treatment plant is proposed, approval of the connection and the costs of this service must be secured from the utility company local sewage enforcement officer.

**d. Roadway and Area Lighting Plans.** The Design Agency shall meet with the Bureau of Project Delivery to ascertain the roadway and area lighting requirements. Coordinate all lighting plan submissions and approvals through the Highway Design and Technology Section. Follow Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 5 for lighting design criteria and procedures.

**e. Pavement Design Approval and Plans.** The use of the Safety Rest Area/Welcome Center sites by all types of vehicular traffic will generally require the use of Portland cement concrete pavement for the truck parking areas. The increased pavement width of the parking lots will require the preparation of an appropriate pavement joint plan for all concrete pavements. Follow Publication 13M, Design Manual Part 2, *Highway Design*, and Publication 242, *Pavement Policy Manual*, for pavement design criteria.

**f. Landscape Planting Plans.** The Bureau of Project Delivery, Highway Design and Technology Section may prepare the preliminary landscape planting design for the general site and building area. The Design Agency will provide appropriate reproducible drawings of the approved contour grading and drainage plans and building area contour grading and drainage plans for this purpose. The Bureau of Project Delivery may also designate the location of picnic table pads, flagpole, benches, planters, etc. as desired. The Bureau of Project Delivery will return the preliminary landscape-planting plan to the Design Agency for incorporation into the Final Plans. In the event the Highway Design and Technology Section is not performing the landscape planting design, the Design Agency will submit two copies of the preliminary landscape planting to the Highway Design and Technology Section for their review and approval. The Design Agency will revise the preliminary plans as necessary to incorporate review comments.

**g. Design Field View Submission.** The Design Agency shall submit appropriate sets of plans to the District and the Bureau of Project Delivery for review and comment. The Bureau of Project Delivery will coordinate plans review with FHWA. The District should perform a plan review prior to scheduling a Design Field View. The District will schedule a Design Field View to review the plans at the site. All appropriate offices shall be notified of the field view. The Design Agency will prepare appropriate minutes of the field view and forward copies to the appropriate offices. The Design Agency shall revise the preliminary plans as indicated at the Design Field View and resubmit the plans as indicated above. Upon receiving approval of the preliminary plans, the Design Agency shall commence with the Final Design Stage.

**4. Final Design.** Final Design will include the finalization of the contract construction drawings, specifications and all contract documents. The Design Agency shall be responsible for obtaining all approvals necessary for final plans submission. The sewage treatment system will require submission of a NPDES Application Part II to PA DEP (See Publication 13M, Design Manual Part 2, *Highway Design*). This submission is necessary to obtain the permit for construction and operation of the sewage facility.

The Bureau of Project Delivery will (when applicable) supply the Safety Rest Area/Welcome Center building drawings and technical specifications to the Design Agency. These items shall be incorporated into the final

drawings and contract documents. The Design Agency shall be responsible for submitting and secure a building occupancy permit from the Pennsylvania Department of Labor and Industry.

Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 9 outlines the design criteria for safety rest areas and welcome centers. They must be according to current PennDOT and AASHTO design standards. Wastewater disposal systems and drinking water supply systems shall be according to PA DEP regulations. All pedestrian accessibility provisions must be according to Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 6, and the Americans with Disabilities Act (ADA).

**C. Bikeways.** With an increase in the use of bicycles for commuting, for recreation and for other travel purposes, PennDOT recognizes the need to provide bicycle-related projects and programs. Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 16 outlines the guidelines for the development and design of bikeways. The chapter also provides the procedures for the processing of a bikeway construction project after the Planning, Prioritization, and Programming phases through the Final Design phase. Other sections include information on the operation and maintenance of bicycle facilities, bikeway funding procedures, procedures for processing bikeway construction projects, obtaining bikeway occupancy permits, and procedures for signing, signalization, and marking.

For additional guidance on bikeway design considerations refer to PennDOT's *Statewide Bicycle and Pedestrian Master Plan, Bicycle Guidelines*; AASHTO's *Guide for the Development of Bicycle Facilities*; and Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix S.

**D. Pedestrian Facilities.** The FHWA's regulations require, in part, that full consideration be given to accommodate safely pedestrian traffic on all Federal-aid highway projects.

Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 6 provides criteria for the design and construction of pedestrian facilities. The criteria conform to the Americans with Disabilities Act (ADA), and state guidelines for pedestrian accessibility routes. For additional guidance, see PennDOT's *Statewide Bicycle and Pedestrian Master Plan, Pedestrian Guidelines*.

PennDOT (i.e., District design staff) must coordinate its efforts with the public, schools, businesses, recreational areas, and municipalities to identify the need and location for pedestrian facilities. PennDOT shall not acquire additional right-of-way for the construction of sidewalks by a municipality. The municipality is responsible for the acquisition of a sidewalk easement or obtaining permission for such construction.

The issuance of an occupancy permit for curbs and sidewalks shall include the following conditions:

- Construction of curbs, drainage facilities, curb ramps or any other associated work shall be according to PennDOT's construction standards and specifications, or other details approved by PennDOT.
- The municipality shall agree to provide any necessary maintenance of the curb, sidewalk or curb ramp.

General guidelines, practices and justification for the construction of pedestrian facilities may also be found in the following: AASHTO's *A Policy on Geometric Design of Highways and Streets* and Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix S.

**E. Park-and-Ride Facilities.** Park-and-ride lots are fringe-area-parking facilities that can provide a relatively inexpensive contribution to air quality and mobility improvements. The following guidelines address issues affecting the design of park-and-ride facilities. The following factors should be considered during park-and ride lot site selection:

- Proximity to existing informal park-and-ride activity sites, such as parking on shoulders or on leveled areas.
- Access to primary arterials or freeways serving the corridor. Certain interchanges may provide space for park-and-ride lots.
- Security and potential to minimize vandalism and theft.

- Location relative to residential areas and major activity centers that generate a significant number of trips and can provide auxiliary services such as dining, ticket service, etc.
- Ability to alleviate congestion because of location relative to major activity centers and traffic bottlenecks.
- Ability to serve as an intermodal transfer point because of location relative to existing transit service and major activity centers.
- Accessibility and circulation potential of the site for entering and exiting transit vehicles.
- Future expansion potential of the site.

The following criteria should be used to evaluate the suitability of various potential sites.

- Facility development policy
- Development and operating costs
- Transit service availability
- Accessibility to high occupancy vehicle facilities
- Staged construction potential
- Environmentally sensitivity of the site
- Site Availability
- Site Visibility
- Projected Demand
- Site Accessibility
- Available User Benefits

Park-and-ride facilities should be designed for safety and efficiency. The design should be developed in cooperation with local agencies including transit-operating authorities (if applicable). All design features should comply with PennDOT's design standards and specifications. Operating policies and local requirements and zoning regulations should be investigated and incorporated as appropriate. All applicable Federal regulations, including Americans with Disabilities Act (ADA) requirements, must be incorporated as required. Many issues affecting the design of a park-and-ride facility also apply directly to the design of safety rest areas and welcome centers.

For more information on park-and-ride facilities, including design, maintenance and operations procedures, refer to the current version of AASHTO's *Guide for the Design of Park-and-Ride Facilities*; Publication 13M, Design Manual Part 2, *Highway Design*; and Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*.

#### **F. Memorandum of Understanding Between PennDOT and DCNR on Footpaths Crossing State Routes.**

The Highway Occupancy Agreement (HOA) process was developed to establish the responsibilities of PennDOT and recreational trail facility sponsors when a recreational trail crosses a state highway. This process applies to trails that are sponsored by a private entity or by a political subdivision. The process does not differentiate between types of trails. When dealing with other state agencies, a Memorandum of Understanding rather than the HOA process is applicable.

The Department of Conservation and Natural Resources (DCNR) has numerous pedestrian-only hiking paths, commonly referred to as footpaths, on lands that they own or control. Many of these "footpaths" cross state highways. To address these unique crossings, PennDOT entered into a Memorandum of Understanding (MOU) with DCNR regarding footpath crossings on April 14, 2005. The original MOU covered any crossing where a footpath on DCNR owned or controlled land crossed a state highway. An Amendment to the MOU was signed on September 26, 2005, to include crossings of State Forest Hiking Trails and state highways. There are 18 hiking trails in the State Forest Hiking Trail System, with a total length of nearly 1,000 miles. Almost 800 miles traverse State Forest land with the remainder crossing State Game lands and some private property.

The MOU was created cooperatively with DCNR and addresses concerns regarding the scope and application of the HOA process to at-grade pedestrian-only trails. The HOA process does not apply to recreational trail crossings

falling under the MOU. The procedures outlined in the MOU will apply to these crossings. For the convenience of the reader, Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AF, Memorandum of Understanding (Footpaths on DCNR Lands Crossing State Highways), presents a "merged" copy of the MOU as amended, which merges the original MOU and the amendments into a single document. Copies of the original MOU and Amendment are available upon request from the Bureau of Project Delivery, Highway Delivery Division, Environmental Policy and Development Section.

Also attached in Appendix AF for use by the District Highway/Trail Coordinators are excerpts, explanations and procedures applicable to the implementation of the MOU with DCNR on footpath crossings.

This agreement commits PennDOT to perform 10 traffic studies, if needed, per year.

**G. Department Force Box Culverts.** The Department provides direction in Publication 23, *Maintenance Manual*, Section 16.9 regarding the use of ECMS to bid the precast reinforced concrete box culverts and appropriate precast concrete products when Department Forces are used for installation (Department Force Box Culvert project). Department Force Box Culverts are those projects where Department Force prepares the site, the box culvert is delivered and placed through a construction contract, and Department Force finalizes the work. For additional guidance, refer to the following publications:

- Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AE.
- Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*
- Publication 615, *Scheduling Manual*

#### 4.13 GENERAL DESIGN COORDINATION

**A. Constructability Review.** The purpose of a constructability review is to refine a project's design and help the District plan project construction. An important product of a constructability review is a realistic Pre-Bid Schedule. Increased constructability and accurate Pre-Bid Schedules reduce the need for change orders and the possibility of cost overruns. Constructability reviews also help avoid disputes and delays. Constructability reviews should be conducted at various points throughout design development by constructability teams assembled by the District Executive and Project Manager. Members of constructability teams should have a wide range of experience, including construction, design, contract management, traffic control, permitting and scheduling.

The extent to which the District Executive and Project Manager use the constructability review team depends on the complexity of the individual projects. The team could be required to be involved only at several points for Minor projects or continually throughout the development of Major projects. The District Executive and Project Manager must determine the level of review effort required for individual projects.

For specific constructability review procedures see Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix N, Constructability Reviews. Appendix N discusses constructability review teams and tasks, and provides guidelines for using open-end agreements for consultant constructability review services. Also included is a useful checklist of issues to be considered in constructability, biddability, and cost estimate reviews.

**B. Plan Review.** The Bureau of Project Delivery, Field Liaison Engineers (FLE) or the Certified District Plan Reviewer (CDPR) may hold three specific types of plan reviews: Final Right-of-Way Plan, Final Construction Plans including "Also" plans, and Plan Revisions. These plan reviews may be conducted with periodic visits to Consultants and Districts (see [Section 4.13.D](#)).

The time when a plan review should be scheduled will be determined by the Field Liaison Engineer at the periodic visits or by the request of the District Executive or designee. In all cases, the time of the review will be coordinated with the District. Refer to Publication 14M, Design Manual Part 3, *Plans Presentation*, for information on plan presentation requirements.

All new construction, reconstruction, and rehabilitation projects require plan reviews at different stages or at least a final one on all sets of plans. All Right-of-Way Plans, including HOP Right-of-Way Plans, require Plan Reviews and preparation of a Plan Review Report by a Plan Reviewer (Refer to Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 7).

**C. Plan Review Delegation and Acceptance of Final Plans.** The final plan review is performed by the Bureau of Project Delivery, Field Liaison Engineer or designee, CDPR, and consultant.

The duties and responsibilities of the representatives in authority of the final plan review are as follows:

Field Liaison Engineer:

- Has the authority of the Bureau of Project Delivery, Highway Design and Technology Section Chief.
- Is in charge of the final plan review of PennDOT Oversight (PO) Major Complexity and Federal Oversight (FO) projects. FLE will conduct plan reviews of PO Minor and Moderately Complex projects if requested by the District Executive or designee (See Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Tables 2.1, 2.2 and 2.3 for information on Project Complexity Levels), except for projects following the procedures in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AB.
- Is to prepare a Plan Review Report on any items that are not correct at the time of the final plan review. Completed copies must be submitted to the District Executive and the Bureau of Project Delivery, Contract Management Section, Chief.
- Is in charge of verifying the assigned District personnel as a Certified District Plan Reviewer (CDPR) for Plan Reviews of PO Minor and Moderately Complex projects, formal Plan revisions, and conducting Quality Assurance reviews of the plan reviews done by CDPR.

The District shall:

- Provide qualified personnel to perform all required design review. These reviews shall include checking alignment and grade, length of project, safety, hydraulics, structures, traffic, quantities, etc. The District Executive will be responsible for the accuracy of the work performed by these personnel.
- Provide qualified personnel to complete Plan Reviews (a CDPR for plan reviews of PO Minor and Moderately Complex projects), except for projects following the procedures in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AB. The CDPR will complete the details specified in the Plan Review Report, including descriptions of any design exceptions or special design(s) requiring environmental mitigation.
- Prepare the Preliminary Estimate, including bridge and roadway quantities, supporting data and a list of Structural Special Provisions. The District will review or forward the above-mentioned forms and a complete set of bridge plans to the Bureau of Project Delivery, Bridge Design and Technology Division for a review of structure plans. This information must be available prior to completion of the final plan review.
- Notify the Field Liaison Engineer (if required) when the plans will be ready for the final plan review. This notification need not be by letter but should be made at least 3 weeks in advance of the desired date to allow for scheduling the plan review 2 weeks in advance.
- Prepare an evaluation report indicating the completeness and accuracy of consultant's work, if applicable. These evaluation reports will be used to determine future assignment of work to the consultant.
- Verify conducting the final plans review and completing the Plan Review Report for all projects not requiring Field Liaison Engineer participation.

- Verify that the Plan Review Report is attached to the Project Development Checklist in ECMS or included with the PS&E package.

Consultant:

- Is required to have the plans and related documents adequately reviewed prior to the final plan review to eliminate any delay in checking the project.
- Will have the Project Engineer, together with adequate design personnel, make any required corrections, and be involved in the final plan review. It is expected that all required corrections will be made by the consultant in a timely manner.
- Will provide sufficient sets of prints at the final plan review.
- Will conduct final Plan Review for projects following the procedures in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix AB.

Refer to Publication 14M, Design Manual Part 3, *Plans Presentation*, for information on plan presentation requirements.

**1. Plan Review Procedures and Certification Process.** A plan review may be conducted at the time of Design Field View (DFV) submission (approximately 30% plan development stage) for projects having Right-of-Way involvement. A final plan review shall be conducted at the time of Final Design Office Meeting (FDOM) submission (approximately at 90% plan development stage) for FO projects and Major Complexity PO projects.

Final Plan Reviews of PO Minor and Moderately Complex projects will be conducted at approximately 90% of plan development stage to provide enough time to address review comments.

A Final Plan Review Report with acceptance signature must be attached to the Project Development Checklist in ECMS or with the PS&E package before advertising the project.

In advance of the plan review, the plan preparer must complete a thorough Quality Control review and incorporate revisions before a Plan Review is conducted. At least 3 weeks advance notice should be given to the Plan Reviewer.

1. A complete set of plans shall be submitted to the Plan Reviewer for the review.
2. The Designer and the Plan Reviewer may elect to meet and conduct a Plan Review Meeting.
3. The Plan Reviewer will recommend acceptance of plans (with or without comments) using the "Plan Review Report" form based on sound engineering principles and conformance to the Design Manuals.
4. The Plan Review Report with acceptance signature will be attached to the Project Development Checklist in ECMS or included with the PS&E package.

All Plan Review Comments must be adequately addressed before the next submission or the project advertisement.

Plan reviews completed by the CDPR will be randomly reviewed as per the Quality Assurance Policy for conformance and for evaluating the certification. In the absence of a CDPR, the CO FLE or designee will conduct Plan Reviews for the District including PO projects, FO projects, HOP plans, and formal Plan Revisions.

- a. **Plan Review Policy.** The purpose of the Plan Review QA Review is to assure compliance with the following Manuals for Plans Presentation:

- Publication 14M, Design Manual Part 3, *Plans Presentation*.
- Other Design Manuals as appropriate.

When a recommended District Plan Reviewer is verified as a CDPR, the District accepts plan reviews of PO Minor and Moderately Complex projects locally without submission to Central Office for review or concurrence. The delegation granted to the District is based on the premise that all acceptances conform to the requirements of the Design Manuals as appropriate.

Each QA review is an audit of the PO Minor and Moderately Complex projects Plan Review process and the documentation procedures used in the District during a one year period. The QA review is an opportunity to assess the District's performance during the year to identify areas for improvement.

The QA review assures the District's ability to maintain the proper records throughout the year as part of day to day business practices. An audit provides a good indication of how well the District has followed policies, procedures and guidelines and how these items have been incorporated into daily routine.

The following actions are recommended:

- Develop and implement an internal QA/QC process.
- Include the CDPR in the CO QA review of the Plan Reviews
- CDPR will maintain a spreadsheet and Plan Review Report of plans reviewed on a monthly basis. Include date of Plans Review and date of letting. This will be used to randomly select Plan Reviews for the QA review by CO FLE.
- Plan Review Reports (and marked up plans if cross referenced) along with final version of the plans should be kept in an orderly fashion for accessing and for QA review selection.

**b. Quality Assurance and Certification Process.** A CO FLE from the Highway Design and Technology Section (HDTs) will perform a QA review of each District's Plan Reviews annually based on a calendar year. Adequate notice of the date of the QA review will be provided to the District.

The District will provide all requested Plan Review Reports (and marked up plans if cross referenced) and final version of the plans. The District will provide an adequate area for review with a networked computer for the CO FLE. The CDPR will be available to answer questions during the review.

A total of three sets of plans will be checked at each QA review. The three plans will be selected from a list of projects that were reviewed by the CDPR after the previous annual QA. This includes all Plan Reviews that resulted in the development of Final Right-of-Way plans, Final Construction Plans, Plan Revisions and combination thereof.

The CO FLE will provide an exit briefing to the Assistant District Executive (ADE) for Design or designee before departure.

A memo of the findings for each review will be issued from the Chief of Highway Delivery Division to the District Executive. Annually, the QA team will produce and distribute a report of the findings from the QA reviews for that calendar year. It is intended that this report be used by the Districts to compare and examine their processes and to investigate the review items that have had the most deviations and work to improve those items.

If the District requires improvements, corrective actions will be prescribed during the exit briefing and in the memo including a follow-up QA that will be scheduled within 6 months of the annual QA. The procedures for the follow-up QA will be the same as the procedures for the annual QA.

**D. Periodic Visits to Consultants and Districts.** The purpose of this visit will be to check on the status of all highway projects being designed by the Consultant or District; to determine problems that are causing or could cause delay in the progress of projects; and to assure that the consultant's activities are coordinated for all Districts.

This visit by the Bureau of Project Delivery Field Liaison Engineer and Project Development Engineer is intended to supplement the visits by District Liaison personnel.

Should any District Executive desire to have a representative attend a periodic visit in the consultant's office, contact should be made with the Bureau of Project Delivery. The Central Office Field Liaison Engineer shall set a mutually agreeable date for this periodic visit. The District Executive will be notified, in writing, concerning follow-up action needed to resolve any special problems discovered during the visit. It is anticipated that the periodic visit will be combined with the Preliminary Plan Reviews when possible.

**E. Final Design Office Meeting.** The Final Design Office Meeting is conducted prior to the Final Plan Check and final submission of the Plans, Specifications, and Estimate (PS&E) package to the District Contract Development and Award Section. The meeting is typically conducted at approximately the 90% plans completion point. The purpose of this meeting is to provide an opportunity for the Highway Delivery Division (HDD) and FHWA, if applicable, to review and comment on the final design. A FDOM is required for all major complexity PennDOT Oversight projects and for all Federal Oversight project unless waived by HDD or FHWA as applicable. As determined by the District, some moderate complexity projects may need a FDOM. The FDOM is typically attended by the District Project Manager, the appropriate District Units, the HDD Project Development Engineer, the FHWA Transportation Engineer (if applicable), and the design consultant as deemed appropriate.

The District is responsible for coordinating the FDOM with the HDD and providing the FDOM submission to the reviewers typically at least 4 weeks prior to the FDOM. The HDD will coordinate the FDOM with the FHWA.

Prior to the FDOM the following are to be completed as applicable (note that this is not an all-inclusive list and does not include many activities that occur during Preliminary Engineering.):

- Design Field View Approval
- District Safety Review Committee Approval
- Structure Type, Size & Location (TS&L) Approval
- Design Exception Approval
- Pavement Design Approval
- Design Value Engineering Approval
- Constructability Review
- Service Road Justification
- Erosion and Sediment Pollution Control Plan
- Hydraulic Computations - Applicable for pipes with a drainage area less than 0.5 mi<sup>2</sup>.
- Hydraulic Design of Structures - Follow the procedures outlined in Publication 13M, Design Manual Part 2, *Highway Design*, Chapter 10.
- Soils and Geological Engineering Report Addenda (if required)
- Traffic Control Plan (TCP)
- Transportation Management Plan (TMP) - Applicable if the project is determined to be "significant." Refer to Publication 46, *Traffic Engineering Manual*, Chapter 6.

- Lighting Plans - Preliminary Approval. Coordinate submission and approval directly with the Bureau of Maintenance and Operations. The District Office is also responsible for any necessary coordination with local officials.
- Traffic Signal Plans
- Signing Plans
- Utility Relocations - Planning and coordination of major utility relocations as defined in Publication 16, Design Manual Part 5, *Utility Relocation*.
- Special Provisions - All major special provisions anticipated for the project are to be prepared before the FDOM. The special provisions do not need to be in their final format, but they should describe their intended purpose. Additionally, for non-standard special provisions the Non-Standard Special Provisions Worksheet is to be completed as per Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*, Appendix II.B.
- Updated Cost Estimate
- RULDs
- Environmental Commitments Mitigation Tracking spreadsheet
- Environmental Permits
- Environmental Clearance and re-evaluations, if necessary
- Railroad Agreements
- ADA Technically Infeasible Forms
- Construction Schedule

The District must also pursue any necessary agreements with municipalities or other local political subdivisions. A report on the status of these agreements is required for the FDOM.

The District Project Manager is responsible for preparing the FDOM minutes and distributing them to attendees. The District Office will request HDD approval (or coordination of approval by FHWA as applicable) of the FDOM Submission and the associated minutes. The approved transmittal is to be posted in the Project Development Checklist in ECMS.

**F. Letters of Transmittal.** Letters of Transmittal from the District Executive to the Bureau of Project Delivery, Contract Management Section shall accompany completed right-of-way, construction and/or also plans. The plans are recommended by the District Executive and must be signed and sealed by the ADE Design. When preparing the letter of transmittal, and the proposal preparation to accompany it, include statements, if applicable, about the following:

- Describe briefly the type of work involved. For construction plans, this will be similar to the description in the proposal. Also, a tabulation of drawings, forms and other pertinent data being submitted for SR \_\_\_\_, Section \_\_\_\_ from Station \_\_\_\_ (Segment \_\_\_\_, Offset \_\_\_\_ ) to Station \_\_\_\_ (Segment \_\_\_\_, Offset \_\_\_\_).
- Where separate right-of-way and construction plans are prepared, state that the right-of-way and construction plans were cross-checked and that there is complete agreement in horizontal geometry, parcel numbers and other pertinent information common to both plans. When the right-of-way plan is submitted, indicate whether or not all right-of-way can be acquired within one year.

- The District Right-of-Way Administrator must confirm in writing that the District Right-of-Way Administrator has inspected the project in the field, has reviewed the plans, and is convinced that the plans considered anticipated right-of-way problems. Provide a status of the right-of-way at this time with anticipated clearance dates for all parcels not yet acquired. In cases of extreme urgency in letting a project for which right-of-way is not cleared, include a draft letter of public interest in accordance with the Federal-Aid Policy Guide.
- For non-capital budget projects, indicate the program that controls the project. If the project is an emergency type project, show by whose authority the project is being advanced to letting and how it will be funded, by indicating:
  - Multi-Modal Project Management System (MPMS) Number
  - Engineering and Construction Management System (ECMS) Number
  - State Project Number (Design)
  - State Project Number (Construction)
- Show the funding breakdown by percentage for Federal, state, local, and utility.
- State the position of the officials of the political subdivision involved. If the subdivision is a borough or city, indicate whether it will or will not share in the construction costs and whether the local council will ordain the plans. The District Executive should recommend the course of action to be followed by PennDOT pursuant to the position taken by the political subdivision.
- If agreements or ordinances between PennDOT and any other agency (i.e., signal plan agreements, lighting agreements, detours on local roads, etc.) are not available at this time, state their present status. Provide copies of completed ordinances or agreements as necessary.
- Describe the proposed Traffic Control Plan (TCP) for the maintenance and protection of traffic during construction. The Assistant District Executive-Construction and the District Traffic Engineer must confirm that they reviewed the proposed TCP and are convinced that it is compatible with the proposed construction and traffic operations.
- Indicate that the Safety Review Committee reviewed and approved the plans.
- State that the Assistant District Executive-Construction has reviewed and approved the special provisions and is satisfied with the constructability aspects of the design as proposed.
- State that all items discussed at the Final Plan Check are resolved and incorporated into the PS&E.
- Indicate that the appropriate field view(s) were conducted.
- For 100% state projects, state the need for wage rate information.
- Indicate the need for construction engineering services by a consultant for checking shop drawings of bridge and sign structures. Include the name of the consultant and engineering agreement number, if any.
- Provide information regarding the preparation of the Federal-aid Preliminary Estimate for Federal Oversight Projects and the Project Agreement Estimate without prices for PennDOT Oversight Projects. Indicate unique items of work or special areas or types of proposed construction that are ineligible for Federal participation, or where Federal participation is limited. Identify items affected and show the FHWA percentage.
- List the Federal Project Numbers and type of work involved for any previous Federal authorizations on the project. If the requested phase is not yet approved, indicate the date the Form D-4232 (see Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 5) was submitted to the Center for Program Development and Management.

**G. Special Provision Development.** Special Provisions, as part of the contract documents, must be written with extreme care. The language used must be clear, exact, in agreement with the plans, and in sufficient detail for proper interpretation. If the contractor cannot understand what is wanted, the work cannot be performed correctly. Instructions should be in sufficient detail to enable the contractor to determine who will be required to do what. Keep in mind that the Special Provisions are legal documents; and each word, sentence, and punctuation mark may come under the scrutiny of a court of law or an arbitration board of claims.

All contracts are governed by Publication 408, *Specifications*, unless approval is obtained from the Bureau of Project Delivery for specific local government specifications. Supplemental specifications shall be approved through the clearance transmittal process specified in Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*. For preparation of special provisions, refer to Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*.

**H. PS&E Submission Project Information and Check List.** The Project Development Checklist in ECMS provides a concise list of project information to be included in a PS&E submission and a quality control checklist in preparation for Letting. Once the bid package is drafted in ECMS, it will be forwarded to the Bureau of Project Delivery, Highway Delivery Division, Contract Management Section.

In addition to the Project Development Checklist in ECMS, the PS&E Submittal Review Certification List in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix U is used as a Quality Assurance tool by the Central Office PS&E Reviewers to verify completeness of the PS&E package for Federal Oversight projects. The certification list, which will be completed by Central Office PS&E Reviewers, is included in the formal PS&E transmittal to FHWA for their review and authorization of the PS&E. Note that FHWA review time for a PS&E package is 3 weeks.

**I. Revisions to Plans Subsequent to the Original Right-of-Way or Construction Plan.** A revision is defined as a change in the original Right-of-Way or Construction Plan. Right-of-Way Plan revisions are applicable for plans that have been signed by the Secretary of Transportation on behalf of the Governor as well as himself or herself. For more information concerning Right-of-Way Plan revisions, see Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 3.

Construction Plan revisions are applicable for plans that require construction plan changes. Changes made to a Construction Plan prior to the plan being made available to prospective bidders (i.e., prior to advertisement) will not be listed as revisions. Construction Plan revisions made after the plan has been made available to prospective bidders will be submitted as plan revisions. After plans have been made available to prospective bidders and before the plans have reached bid opening, contractors will be notified of any revisions to the plan by an Addendum. The plans will be revised as per the Addendum and delivered to the successful bidder after award of the project. For more information concerning Construction Plan revisions, see Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 2.

Construction Plan changes in the form of Alternate Bridge designs will require a new set of design plans. For more information concerning alternate bridge design changes, see Publication 15M, Design Manual Part 4, *Structures*. Combination plan revisions will follow the respective procedures herein for Right-of-Way Plan revisions and Construction Plan revisions.

The following procedures are to be followed when revisions are necessary:

**1. Definition of Major and Minor Changes.**

**a. Right-of-Way:**

- Major Change. Longitudinal change to Limits of Access or the relinquishment, vacation, or abandonment of acquired right-of-way. These plans will be submitted as revisions.
- Minor Change. Additional topography, temporary easements, utility corridors, change in ownership, (PUC jurisdiction not involved), change in plots or plot areas, small shifts in required right-of-way, etc. These changes will be submitted as revisions. Change in ownership of an unaffected parcel normally does not require a Right-of-Way plan revision.

- Special Case Changes. In special circumstances, changes may be justified for conversion of Limited Access Right-of-Way to Legal Right-of-Way; and change in location or extent of control of access.
- b. Construction:
- Major Change. Substantial change in limits of work, alignment, grade, typical section, drainage, or quantities. These changes will be submitted as revisions.
  - Minor Change. Changes that do not affect the right-of-way and changes normally placed on the "As-Built" plans including changes in location of pipes, inlets, underdrains, etc. These changes will not be submitted as revisions.

Construction Plan revisions that require changes to the Right-of-Way Plan should also follow the procedures presented under Right-of-Way above.

For applicability and procedures concerning the above items, the Bureau of Project Delivery, Highway Delivery Division, Highway Design and Technology Section should be contacted on a case-by-case basis. For Federal-aid projects, changes made after construction PS&E approval (Federal Oversight) or after final acceptance (PennDOT Oversight) must be coordinated with the FHWA.

## 2. District Procedures for Processing Revisions.

a. Right-of-Way Revisions. The District will highlight all proposed revisions on prints of the latest or most recent official plan sheets and Title Sheet of record. As indicated in Publication 14M, Design Manual Part 3, *Plans Presentation*, the print of the Title Sheet of the Right-of-Way plan shall contain a signature approval block for the District Executive, the District Right-of-Way Administrator, the District Chief-of-Surveys, and the District Plans Engineer. In the upper portion of the block, a general description of all proposed changes, affected parcel numbers and the sheets on which they occur shall be provided. The District shall also include the notary seal block and the recorder of deeds block to have the revised plan re-recorded in the office for the recording of deeds. It is not necessary to provide detailed information, such as stationing, in the description. The District shall include the note for reauthorization in the revision block for all projects.

For reauthorizations without revisions, the District should make a request for the reauthorization to the Bureau of Project Delivery, Plans Reproduction Unit. The Plans Reproduction Unit shall place the reauthorization block and proceed to obtain the required signatures.

Arrangements should be made with the Bureau of Project Delivery, Field Liaison Engineer for a plan review of the revisions in the absence of a CDPR (refer to Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 7).

After a critical review of the proposed revisions from the engineering and legal standpoint, and after any issues have been resolved, the print of the Title Sheet will be signed and dated as indicated in above.

b. Construction Plan Revisions (For roadway, right-of-way, and related plans, refer to Publication 14M, Design Manual Part 3, *Plans Presentation*. For bridge/structure plans, refer to Publication 15M, Design Manual Part 4, *Structures*).

The District will highlight all proposed revisions on prints of the latest or most recent official plan sheets and Title Sheet of record. The print of the Title Sheet of the Construction Plan shall contain a signature approval block as per Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 2. In the upper portion of the block, a general description of all proposed changes, affected parcel numbers and the sheets on which they occur shall be provided. It is not necessary to provide detailed information, such as stationing, in the description.

Arrangements should be made with the Bureau of Project Delivery, Field Liaison Engineer for a plan review of the revisions in the absence of a CDPR (refer to Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 7).

After a critical review of the proposed revisions from the engineering and legal standpoint, and after any issues have been resolved, the print of the Title Sheet will be signed and dated as indicated in above.

When a project is advertised in ECMS and addendum are necessary, the District may attach an unofficial plan revision to the addendum if the advertisement period or let date is to remain as advertised. A copy of the formal plan revision should be added to the ECMS file when complete and provided to the successful bidder.

c. Project Coordination. On PennDOT Oversight projects, the approved check prints require additional coordination only as per the special cases listed below.

For Federal Oversight projects, the District shall submit two copies of the approved prints with the changes highlighted to the Bureau of Project Delivery, Highway Design and Technology Section for coordination with FHWA. The Highway Design and Technology Section will notify the District when the FHWA approval has been received and the plan revision process will continue with the District request letter to the Bureau of Project Delivery as presented below under "District Submission to the Central Office".

The following *special cases* also require additional coordination of the check prints:

- When a revision involves a utility relocation, the District shall submit a set of prints to the Bureau of Project Delivery, Highway Delivery Division, Utilities and Right-of-Way Section who will review the changes for conformance to PennDOT policies. The Utilities and Right-of-Way Section will show concurrence by initialing the check prints.
- On railroad-highway crossing projects under jurisdiction of the PUC, any changes to the Right-of-Way plan or Construction plan will require approval of the PUC when a hearing before the PUC has been conducted and the plan was submitted into evidence by PennDOT as an exhibit and/or an order has been issued by the PUC approving the plan.

If the change involves a Right-of-Way plan, and either of the above applies, then property descriptions for property appropriated by the PUC must be revised to incorporate the changes in the Right-of-Way plan. In addition to the aforementioned procedures for plan revisions, the following additional steps shall be followed concurrently with the plan revisions:

Step 1: A copy of the transmittal letter with a set of check prints and revised property descriptions shall be sent to the Bureau of Project Delivery, Grade Crossing Engineer by the District for preparation of a petition to modify the PUC order.

Step 2: After the revised plans have been signed by the Secretary of Transportation, the District will notify the Grade Crossing Engineer. A petition to modify the PUC Order will then be submitted.

Step 3: The Grade Crossing Engineer will notify all concerned of the PUC action on the petition when such action is taken, after which the necessary recording prints will be returned to the District for re-recording.

### 3. District Submission to the Central Office.

a. Right-of-Way and Construction Plan Revisions. After the prints have received the necessary signatures, the District shall submit a request letter to the Bureau of Project Delivery, Office Management and Procurement Section, Plans Reproduction Unit, requesting original right-of-way plans or original construction plans if the project has reached bid opening and has not been awarded. Original construction plans are filed in the District after bid opening and the project has been awarded. For this case, the request letter will accompany the revised originals to the Plans Reproduction Unit.

For all projects, both Federal Oversight and PennDOT Oversight, the District will be responsible for filing the check prints. For PennDOT Oversight projects, the check prints need not accompany the request letter after necessary coordination as described in 2c Project Coordination, above. Similarly, for Federal Oversight projects, after the prints have been coordinated with the FHWA through the Bureau of Project Delivery, Highway Delivery Division, Highway Design and Technology Section as per 2c Project Coordination, above, the prints need not be submitted to the Bureau of Project Delivery.

The following items shall be contained in the request letter:

- Statement that the check prints have been approved including the date of approval.
- Federal-aid project number.
- A detailed explanation of the revisions and why they are necessary. If a vacation or abandonment of right-of-way is involved, this information should be included.
- Cost analysis, if right-of-way versus construction item comparison is relevant, or an estimate of additional right-of-way cost.
- Statement indicating how right-of-way and construction will be funded.
- If the Right-of-Way Plan only has been signed by the Secretary of Transportation, give the status of the Construction Plan.

**b.** Right-of-Way Transmittal Form. In addition, each Right-of-Way plan must be accompanied by a form containing Project Status Information for Title Sheet Signature. This form need not be typed. If a project does involve significant public issues, they must be listed and described in detail on a separate sheet.

#### **4. Central Office Procedures for Processing Revisions.**

**a.** Right-of-Way Plan Revisions. Upon receipt of the transmittal letter as discussed above the Bureau of Project Delivery, Plans Reproduction Unit will send the requested original sheets to the District. The District will complete the revisions to the original sheets as per the previously approved prints. Upon completion of the revisions, the original sheets will be forwarded to the Engineering Support Section who will obtain the necessary signatures required to execute the Title sheet of the revised plan.

The Plans Reproduction Unit will obtain the necessary signatures, notarize the plan, and add the re-recording stamp. One set of prints or microfilms of the revised plan and the original Title Sheet will be returned to the District. After re-recording the plan with the County Recorder, the District will return the original Title Sheet to the Engineering Support Section. The Plans Reproduction Unit will then make a set of microfilm for their files, for the District files, and an extra microfilm of the Title Sheet for the Courthouse (if recording with microfilm).

**b.** Construction Plan Revisions. Upon receipt of the transmittal letter from the District as discussed above the Bureau of Project Delivery, Plans Reproduction Unit will send the requested original sheets to the District. The District will complete the revisions to the original sheets as per the previously approved prints. Upon completion of the revisions, the original sheets will be forwarded to the Plans Reproduction Unit to obtain the necessary signatures required to execute the Title Sheet of the revised plan. For those projects that have reached bid opening and have been awarded, the transmittal letter along with the revised originals will be directed to the Plans Reproduction Unit, who will proceed accordingly.

The Plans Reproduction Unit will obtain the necessary signatures and make a set of microfilm for their files and for those Districts who use microfilm. The original plans are returned to the District after the project has reached bid opening and has been awarded.

It should be noted that proper work orders shall be prepared in accordance with Publication 2, *Project Office Manual*.

For Federal-Aid projects, if the change involves a change in Scope of Work as included in the approved Form D-4232 (for example, change in limit of work, pavement type, typical sections or change in number of structures), the Work Order will not be approved until a revised Form D-4232 has been approved.

For bridge plan revisions, see Publication 15M, Design Manual Part 4, *Structures*.

**J. Addenda.** Addenda are necessary to make changes to the contract documents, after the bidders have secured plans and proposals. Every effort should be made during the contract development process to reduce, if not eliminate, the need for addenda through careful preparation, coordination and review of contract plans and proposals prior to advertisement. Addenda should be considered the exception and never the rule. Experience has proven that a little more time and care in the preparation of the initial contract package can substantially reduce the need for addenda as a result of deficiencies such as:

- Lack of information in special provisions and drawings;
- Mistakes in quantity computations;
- Unclear plans or special provisions;
- Inconsistencies between standard specifications and special provisions;
- Discrepancies between the schedule of prices and the special provisions or between plans and proposal.

The issuance of an addendum often places bidders in the unfair position of having to speculate and make contract adjustments in a very short time frame. This perpetuates uncertainty and could result in irregular or unbalanced bidding. For preparation of contract addenda requests, refer to Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*. The District Contract Management Engineer/Supervisor shall submit all requests for addenda to contract proposals in accordance with Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*, Chapter I.16, Addenda.

**K. Disposal of Engineering Drawings.** The PennDOT Office of Chief Counsel advises that original tracings and as-built tracings may be microfilmed and the tracings destroyed. Further, a duplicate reproduced from microfilm will be acceptable in court. Therefore, in order to keep plans, file space and equipment to a minimum, the following procedure shall be followed in destroying original tracings and other reproducible of original tracings. Sepias, Vandyke's, or other reproducible of original tracings shall be destroyed as soon as the District receives the original tracings back from the microfilm unit. All other working copies will be destroyed upon completion of construction.

Tracings, or acceptable prints of the tracings, which have been corrected to as-built plans while the project was under construction, will be returned to the Bureau of Project Delivery, Plans Reproduction Unit, after the auditing time requirement has been fulfilled. Acceptable prints shall be defined as those prints with sufficient clarity of linework and printing to meet the requirements for microfilming as set forth in Publication 14M, Design Manual Part 3, *Plans Presentation*, Chapter 13. They will be refilmed and returned to the District for destruction unless desired by respective County Commissioners. A deck of copy filmcards of as-builts will be sent to the Districts to be added to the original deck of filmcards when tracings are returned to the Districts.

Cross sections will not routinely be microfilmed since they are seldom used after completion of the project construction. Filing and maintenance of original cross sections are the responsibilities of each District. Special requests for microfilmed cross sections will be considered by the Bureau of Project Delivery, Plans Reproduction Unit. When right-of-way plans and revisions, as well as combination plans, are microfilmed, a deck of copy filmcards and the original right-of-way tracings including revision tracings, etc. will be sent to the Districts.

**4.14 CONSTRUCTION COORDINATION**

**A. Oversize and Overweight Equipment.** There are instances when traffic is to be maintained on a project, where it is desirable to permit the use of oversize and overweight equipment. Under the provisions of Section 905(e) of the Vehicle Code, no permit is required for the use of oversize equipment upon, across, or along the highway if the contract so provides. Therefore, each individual project should be analyzed for economical and safety reasons whenever traffic is maintained to determine if a special provision is required in the proposal to allow the operation of unlicensed, oversize and overweight vehicles. Consultation with the State Police prior to the preparation of the contract and at the Pre-Construction meeting is advisable for projects where a special provision is proposed in the contract for unlicensed, oversize, and overweight vehicles. The District should analyze these related factors and prepare the contract provisions accordingly.

**B. Open Pit Burning and Land Fill Disposal.** In keeping with the present day concern to avoid and/or reduce air pollution, the problem of disposal of dried stumps, roots (free of dirt), and brush during the clearing and grubbing operation becomes paramount in importance.

For projects located entirely or partially within a specifically controlled air basin where burning is anticipated, the District Executive must obtain, during the later stages of Final Design, an Open Pit Burning Approval for that area of the project within the air basin. Initial contact should be made with the PA DEP Regional Air Pollution Control Engineer who may suggest a field view to walk the line and indicate an acceptable location for the burning operation (contact PA DEP for a listing of Regional Air Pollution Control Engineers). Application for approval shall be made to PA DEP, Bureau of Air Quality Control. Burning, in most cases, is permitted outside the limits of a controlled air basin.

When burning is not permitted within or outside a controlled air basin, the District Executive shall, in the later stages of Final Design, contact the Regional Sanitarian in the PA DEP, Bureau of Air and Waste Management, to indicate the District's intent to make application for a Permit to bury the stumps, roots, and brush. The Regional Sanitarian (contact PA DEP for a current listing) should receive copies of the soil maps from the District Executive in order that the Regional Sanitarian may suggest some probable areas where burying may be permitted outside the 1V:2H slope limits of the roadway section. It may be necessary to arrange a field view with the Regional Sanitarian to walk the line, if locations are not apparent from the maps. Applications for a Land Fill Disposal Permit shall be made through the Regional Sanitarian. If burying the material cannot be done, possibly the Regional Sanitarian may suggest other methods of disposal of the stumps and brush.

**C. Contract Management Review.** The District Office, Project Manager should coordinate the preparation of the project construction Plans, Specifications, and Estimate (PS&E). The Project Manager then transmits the PS&E package for review and publishing (advertisement). The purpose of the contract management review is to ensure that the PS&E package is complete, understandable, biddable, and constructable. This ensures that competitive bids will be received from the contracting community.

District Review and Publish (Advertisement) Responsibilities include:

- Projects designated in Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Table 2.1 as Non-Complex (Minor) Projects can be published (advertised) by the District.
- The District can request Central Office (Contract Management Section) review be completed by checking the ECMS "Contract Management QA Review" box.

Central Office Review and Publish (Advertisement)

- Projects not designated as minor.
- Projects with following parameters require Central Office Review and Publish
  - Federal Oversight projects
  - Projects with innovative bidding (excluding Road Users Liquidated Damages)
  - Projects with an experimental item(s)

The District Contract Management Unit reviews and finalizes the bid package using the Engineering and Construction Management System (ECMS) in accordance with Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*. In order to obtain competitive bids the recommended advertisement and review times are shown in [Table 4.1](#), Project Publish (Advertisement).

For some projects, the Municipality or Local Agency may advertise and let the project after approval from the Project Scheduling, Specifications, and Constructability Section. For more information about Municipal Projects, refer to Publication 39, *Procedures for the Administration of Locally Sponsored Projects*.

**TABLE 4.1**  
**PROJECT PUBLISH (ADVERTISEMENT)\***

| Description of project                                                                                                              | District Publish            | Central Office Publish                                         |                             |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------|-----------------------------|
|                                                                                                                                     | Actual Advertisement Period | Deadline for submittal of project to Central Office for review | Actual Advertisement Period |
| Non-Complex                                                                                                                         | 5 Weeks prior to Let Date   | 7 Weeks prior to Let Date                                      | 5 Weeks                     |
| Moderately Complex                                                                                                                  | N/A                         | 8 Weeks prior to Let Date                                      | 6 Weeks                     |
| Most Complex and Federal Oversight                                                                                                  | N/A                         | 12 Weeks prior to Let Date                                     | 7 Weeks                     |
| Design Build                                                                                                                        | N/A                         | 15 Weeks prior to Let Date                                     | 12 Weeks                    |
| *Coordinate with the Chief of Project Scheduling, Specifications, and Constructability Section for shorter advertisement durations. |                             |                                                                |                             |

For concerns that may affect all bidders, *addenda* can be published at least 7 days prior to the bid opening. If in the case of an emergency, addenda can be published 3 days prior to bid opening. If problems occur within 3 days of the bid opening, the only options are to delay the bid opening or to let the project as it is. Addenda published less than one week from the Bid Opening, require Central Office review, approval, and publish.

An addendum for a Federal Oversight project requires review and approval by FHWA. Allot additional time (typically 2 to 3 working days) for FHWA review. Federal Oversight projects must be submitted by the Bureau of Project Delivery to the Federal Highway Administration for approval.

Addenda are required for Federal-aid projects, when modifications to Federal Wage Rates are received (revised) prior to bid opening.

*Bid openings* are held approximately twice a month (generally every other Thursday) in accordance with a predetermined schedule. At the bid opening, ECMS bid results are publicly read and an apparent low bidder is announced. After verification of the bids, the apparent low bidder becomes a verified low bidder.

The Contract Management Section awards contracts by processing a *Concurrence to Award* (or reject). The Concurrence to Award is supported by cost justification and analysis, as required. To award the contract, DBE goals or MBE/WBE participation levels must be approved. Similarly, Right-of-Way clearance to award must be received. As per the specifications, projects must be awarded within 60 days from the bid opening. For Local Municipality let contracts, the respective Local Municipality awards the contracts upon concurrence and with assistance through the District Office and Contract Management Section.

The Contract Management Section *executes the contract*. As per the specifications, projects must be executed and a Notice to Proceed issued within 30 days of the award of the project. In addition to the signature of the contractor and the Bureau of Project Delivery Director, executions require the signatures of the Office of Chief Counsel and the Comptroller. Municipal contracts do not require signatures from PennDOT. For Local Municipality let contracts, the

respective Local Municipality executes the contracts upon concurrence and with assistance through the District Office and Contract Management Section.

The actual *Notice to Proceed* is issued by the District Construction Unit. For those projects that have environmental mitigation commitments, the Construction Unit should review these commitments, along with the project ECMTS Report (refer to Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix T), with the contractor at a start-up meeting.

**D. Selective Post-Construction Project Design Reviews.** Before project construction closeout, the Design Project Manager and key members of the design team, including FHWA for all Federal Oversight projects, shall conduct a project design review or field view to evaluate how effective the constructed design is in achieving project objectives. The purpose of this review or field view is to provide design personnel with a valuable learning experience and foster continuous improvement of the overall design process.

At these reviews, designers have an opportunity to judge the accuracy of their design assumptions and determine how well their design solutions were implemented under field conditions. These reviews allow designers to strengthen the link between the cognitive design development process, actual field conditions under which the completed product functions, and the construction that took place.

These reviews should be performed for all designs, but they are particularly beneficial in situations involving a high degree of uncertainty such as projects involving unusual problems or unique situations for which no time honored, standard solution currently exists. These design reviews are classified as training and professional development activities, and should be scheduled by the Project Manager in coordination with regular design activities.

The Design Project Manager is responsible for leading the design review/field view. These responsibilities include:

- Coordinating selection of the design review team with the District Portfolio Manager.
- Preparing for the design review by developing an agenda, and obtaining the appropriate design plans, notes, etc.
- Scheduling the review/field view.
- Reporting the review/field view findings and results to the ADE-Design and ADE-Construction.
- Gaining input from the Resident Engineer and Assistant Construction Engineer (ACE).

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## CHAPTER 5

### CONSTRUCTION CONTRACTING AND REVIEW PROCEDURES

#### 5.0 INTRODUCTION

Key construction decisions concerning the most appropriate contracting procedure, project scheduling and constructability must be addressed during the **Design Phase**. This chapter describes these **Design Phase issues** and PennDOT's procedures for reviewing and modifying a project design during the **Construction Phase**. Refer to Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*, and Publication 448, *Innovative Bidding Toolkit*, for more information on methods of construction, innovative bidding, proprietary items, liquidated damages, milestone dates, and other issues that affect final design.

#### 5.1 CONSTRUCTION

Construction begins at the completion of Final Design after PennDOT has awarded a construction contract and issued the Construction Notice to Proceed. The purpose of Construction is to execute the design as specified in the contract documents. The key participants in the construction phase are PennDOT, the contractor, the construction manager, the FHWA, and the designer. The construction manager and designer typically serve as agents of PennDOT. Often, the construction manager is the District Construction Unit.

#### 5.2 CONSTRUCTION VALUE ENGINEERING PROCEDURES

**A. Introduction.** The purpose of construction Value Engineering (VE) is to eliminate or modify any contract provision that adds cost to a project but is not required for the proper function of the finished product. Construction VE provides an opportunity for contractors to improve the cost effectiveness of a design by submitting cost reduction proposals and applying cost saving techniques. Construction VE can produce substantial benefits to PennDOT. This section describes PennDOT's procedures for evaluating and implementing VE proposals submitted by construction contractors. This section supplements the Construction VE procedures contained in Publication 408, *Specifications*, Section 104 (Scope of Work/Value Engineering).

**B. VE Concept Proposals.** PennDOT's construction VE procedure is initiated by the contractor with the submission of a Construction VE Concept Proposal to the District. The District Executive is responsible for the evaluation and decision to proceed with the VE Concept Proposal. The contractor will submit the Concept Proposal to the District Construction Unit. The District Construction Unit will immediately notify the District Value Engineering Coordinator and the Bureau of Project Delivery, Innovation and Support Services Division, Construction QA Section of the Concept Proposal. On Federal Oversight projects, the District Construction Unit will also notify the FHWA Transportation Engineer of the Concept Proposal. The submission should also be provided to the Engineering/Designer (in-house or consultant) for consideration/review.

The level of detail provided in the Concept Proposal must be commensurate with the scope of the proposed design change and must be sufficient for the District to conduct a thorough evaluation of the proposed concept. Detailed design specifics are generally not required until after the Concept Proposal is approved.

The District Construction Unit shall notify the contractor immediately upon Concept Proposal acceptance so the contractor may proceed with preparation of the actual Construction VE Proposal (VE Proposal). Acceptance of the Concept Proposal authorizes the contractor to proceed with preparation of the VE Proposal but does not obligate PennDOT to accept the VE proposal. If the VE Proposal is wholly or partially acceptable, its acceptance will be by a contract work order. The work order will incorporate the necessary changes in the plans and specifications to permit the value engineering proposal or any accepted part of it to be implemented.

**C. VE Proposals.** Publication 408, *Specifications*, spells out the minimum information that must be submitted with each proposal. Publication 408, *Specifications*, also specifies the amount of time that must be allotted for PennDOT investigation and implementation without interference with project schedules.

All Construction Value Engineering Proposals (VE Proposals), for both PennDOT Oversight and Federal Oversight projects, must be submitted simultaneously with or after District Construction Unit approval to the Director, Bureau of Project Delivery for concurrence. Federal Oversight projects require the additional concurrence and approval of the FHWA. The Director, Bureau of Project Delivery shall coordinate the VE Proposal with the FHWA to obtain their concurrence and approval. VE Proposals may be rejected by the District Executive without the approval of the Director, Bureau of Project Delivery. Proposal rejections do not require any action by the Director, Bureau of Project Delivery.

The Contractor shall submit a written VE Proposal according to the procedures outlined in Publication 408, *Specifications*, Section 104.04. The contractor may request the opportunity to make an oral presentation to supplement the written VE Proposal. The contractor shall submit one original and six copies of the VE Proposal to the District Construction Unit. The District VE Coordinator shall be notified immediately upon receipt of the VE Proposal.

The District VE Coordinator and VE team, if authorized by the District Executive, are responsible for reviewing the VE Proposal and providing final recommendations to the District Executive. After review and approval by the District Executive, the District VE Coordinator will submit the VE Proposal to the Director, Bureau of Project Delivery with five copies attached.

The Director, Bureau of Project Delivery will transmit copies of the Construction VE Proposal to the appropriate Central Office Bureaus and FHWA for Federal Oversight Projects. The Director, Bureau of Project Delivery will also review the VE Proposal and provide comments and his/her decision on concurrence or rejection to the District Executive via the District VE Coordinator and District Construction Unit. After receiving the Director, Bureau of Project Delivery's recommendations for either rejection or concurrence, the District Construction Unit will notify the contractor of the decision. If rejected, the District Executive's notification to the contractor must include the reasons for rejection. If the Director, Bureau of Project Delivery concurs with the VE Proposal, the District Construction Unit will prepare and submit copies of the necessary work orders to the Director, Bureau of Project Delivery.

**D. General Requirements.** Both Concept and VE Proposals should be processed as quickly as possible. Payment will be according to Publication 408, *Specifications*, Section 110.07 (Payment/Value Engineering).

PennDOT is not required to consider any cost reduction proposal that is submitted. PennDOT will not be liable for failure to accept or act upon a proposal submitted, nor for any delays to the work due to the submitted proposal, if such a proposal is similar to a change in the plans or specifications for the project already under consideration by PennDOT at the time the proposal is submitted.

If such a proposal is based upon, or similar to, standard specifications, standard special provisions, or standard drawings adopted by PennDOT after the advertisement for the contract, PennDOT reserves the right to make the changes without compensation, under the provisions of this section.

PennDOT will judge the acceptability of a VE proposal and the estimated net savings from the adoption of all or any part of the proposal. In determining the estimated net savings, PennDOT may disregard the contract bid prices if, in the judgment of PennDOT, such prices do not represent a fair measure of the value of the work to be performed or to be deleted.

If the proposal is accepted in whole or in part, such acceptance will be by a contract work order. The work order will incorporate the necessary changes in the plans and specifications to permit the VE Proposal, or any part of the proposal that is determined to be acceptable, to be put into effect. If the approval of PennDOT is conditional, the order will note the conditions.

The work will continue to be performed according to the requirements of the contract until PennDOT issues a work order incorporating the value engineering proposal, in whole or in part. Acceptance and/or preparation of the value engineering proposal and performance of the work will not extend the contract completion time unless the work order provides an extension. PennDOT reserves the right to adopt a value engineering proposal for general use on other contracts.

Value engineering proposals, either identical or similar to previously submitted proposals, will be eligible for consideration and compensation under the provisions of this section if the previously submitted proposals were not adopted for general application to other contracts administered by PennDOT. Except as specified, PennDOT, or any other public agency, will have the right to use all or any part of any submitted value engineering proposal, without obligation or compensation of any kind.

**E. Alternate Bridge Design Submission During Construction.** Alternate bridge designs that are prepared by the contractor and use of alternate material types are allowed for all bridge types at Type, Size and Location (TS&L) stage after approval is obtained from the Director, Bureau of Project Delivery. The Director, Bureau of Project Delivery, may limit the number of alternate designs to one at the TS&L stage. Any exception to this policy can only be granted by the Deputy Secretary for Highway Administration.

PennDOT realizes that due consideration must be given to citizens groups or other interest groups which, during Preliminary Engineering, may demand restricting a structure to only one material type. In these instances, the project manager must offer industry representatives the opportunity to develop and present alternate material concepts to the public for consideration. Any constraint requirements must be included in the "Alternate Bridge" Special Provision. See Publication 15M, Design Manual Part 4, *Structures*, Chapter 1 for a complete description of the alternate bridge design review and approval process.

### 5.3 CONTRACTOR'S DESIGN EVALUATION PROCEDURES

The purpose of the Construction Contractor's Design Evaluation Report is to give contractors an opportunity to evaluate design plans and special provisions prepared by, or for, PennDOT. These remarks enable PennDOT to identify problem areas, take corrective action, and generally improve the quality of its designs. The contractor is requested to critique the design plans and special provisions with objective comments. [Figure 5.1](#) presents a sample design evaluation report. The contractor should prepare this evaluation report at the time of the Final Inspection and submit one copy to the Director, Bureau of Project Delivery and, one copy to the appropriate District Executive. Some items on the form may not apply to all contracts. The evaluation form was designed to incorporate most types of contracts.

### 5.4 SHOP DRAWINGS

The contract documents prepared by the designer are adequate for bidding and general construction purposes. However, the contract documents are typically not detailed enough for the fabrication and production of many project-specific products and materials. The fabrication process requires detailed shop drawings developed in consideration of the fabricator's specific location, capabilities and techniques. Shop drawings are necessary supplements to the original contract documents.

Procedurally, the fabricator prepares the shop drawings according to the requirements of the design drawings, PennDOT standards, contract special provisions and Publication 408, *Specifications*. Shop drawings are reviewed and approved before construction begins on that particular component/item.

A typical highway project may require shop drawings for a variety of products. These products may include bridge members, retaining wall components, noise barrier panels, sign structure elements, temporary shoring, special inlets, and light poles. Every nonstandard item that is fabricated away from the construction site requires some type of shop drawing or catalog cut submission.

The Engineer/Designer and/or Contractor should prepare a list of items requiring shop drawings. This list can be prepared by reviewing submission requirements that are set forth in the specifications and special provisions. The list should be reviewed and agreed upon by the Contractor and the Inspector-in-Charge. This list can then be used as a guide to properly plan activities and assign manpower.

**FIGURE 5.1 Page 1 of 2**  
**DESIGN EVALUATION REPORT**  
 CONSTRUCTION CONTRACTOR'S  
 DESIGN EVALUATION REPORT

DESIGNER: \_\_\_\_\_ SR: \_\_\_\_\_ SECTION: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_ COUNTY: \_\_\_\_\_

CONTRACT NO.: \_\_\_\_\_

REPORT DATE: \_\_\_\_\_ DISTRICT: \_\_\_\_\_  
 CONTRACTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_  
 \_\_\_\_\_

NOTE: Prepare this report at the time of the final inspection and submit one copy to the Director, Bureau of Project Delivery and one copy to the appropriate District Executive.

Report Submitted by: \_\_\_\_\_ (Name)  
 \_\_\_\_\_ (Title)  
 \_\_\_\_\_ (Date)

The evaluation must be signed by a duly authorized official of the Construction Contractor who has been delegated the authority to administrate the Construction Contract indicated above.

**A. Plans, Special Provisions and Standard Specifications**

1. Conformity between plans, standards specifications and special provisions, including clarity of the special provisions.

Comments: \_\_\_\_\_  
 \_\_\_\_\_

2. Overall clarity and practicality of the design.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

3. Provisions for traffic control sufficient and cohesive.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

4. Adequacy and accuracy of quantities.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

5. Adequacy and accuracy of drainage information.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

6. Adequacy and accuracy of utilities information.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

7. Adequacy and accuracy of erosion control information.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

8. Adequacy and accuracy of environmental commitments and mitigation tracking information.

Comments: \_\_\_\_\_  
 \_\_\_\_\_

**FIGURE 5.1 Page 2 of 2**  
**DESIGN EVALUATION REPORT**

- 9.** Overall clarity, adequacy and appropriateness of general construction information.  
Comments:
- 10.** Appropriateness of Design prepared construction schedule.  
Comments:
- 11.** Constructability.  
Comments:
- B.** What was the most serious plan/proposal deficiency experienced on this contract?  
Explain:
- C.** Additional comments and/or Evaluation Summary, including comments on the Designer's role during construction - i.e., shop drawings, requests for information, turnaround time, etc. (Comments).

Product suppliers prepare shop drawings and submit them to the contractor for distribution to all interested parties, including PennDOT, the designer, and the construction manager (if applicable). The designer reviews the drawings for consistency with the intent of the original design. They must be approved before the start of product fabrication. See Publication 15M, Design Manual Part 4, *Structures*, Chapter 1 for a complete description of the Shop Drawing submittal, review, approval, and distribution process.

## 5.5 INNOVATIVE BIDDING TECHNIQUES AND PROCEDURES

Various innovative construction procedures have been successfully applied by PennDOT and other public agencies. It is important to note that these innovative methods are not recommended for all projects. Project guidance for selecting projects that may be good candidates for innovative bidding type provisions, discussion regarding potential problems that should be avoided, the associated Benefits/Risks, implementation procedures, and detailed guidelines can be found in Publication 448, *Innovative Bidding Toolkit*, for the following innovating contracting procedures:

- Incentive/Disincentive Clause Applications
- Cost Plus Time Method (A + Bx Concept)
- Lane Rental Method
- Design-Build One-Step, Low Bid Process
- Design-Build Best Value

Refer to Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*, and Publication 448, *Innovative Bidding Toolkit*, for more information.

## 5.6 KEY CONSTRUCTION MANAGEMENT TECHNIQUES

**A. Alternate Design by Contractor.** As indicated in [Section 5.2](#), Construction Value Engineering Procedures, PennDOT has been using this method in bidding structure projects. Contractors have the opportunity to bid alternate structures in most bridge projects. Approximately five percent of structures may have been constructed as alternate designs.

**B. Use of Warranties.** The purpose of warranties is to produce a better quality product that will result in reduced maintenance costs. This is a way of having the contractor take full responsibility for the quality of his work. Selection Criteria - Project Profile and/or Project Need.

- Ideal for high traffic and restricted access highways.
- High congestion area where closing a road for repairs has a large impact.
- Need for positive public perception of road quality.
- Reduces risk to owner associated with testing a new or innovative product.
- Significantly reduces owner inspection costs.
- Projects where risks can be accurately defined.
- Not good for urban projects due to excessive impacts by other parties.
- Bridge decks, HMA pavement, bridge painting, bridge expansion dams and traffic line painting.
- Contractor can provide some design input - contractor can choose the optimal design or best materials.
- Project has well defined limitations on work phasing.
- Specifications clearly define "performance" measurement techniques or failure thresholds.

- Changes in project parameters not under contractor control that would negate warranty provisions are well defined.
- Factors impacting successful implementation:
  - Existing project conditions are not well defined.
  - Some Contractor design input (should be there).
  - Supplier/contractor relationship.
- Exposure - weather/traffic.
  - Owner's maintenance practices.
  - Current condition of project.

FHWA's rules allow the use of warranties in NHS construction contracts in accordance with the following:

- Warranty provisions shall be for a specific construction product or feature. Items of maintenance not eligible for Federal participation shall not be covered.
- All warranty requirements and subsequent revisions shall be submitted to the FHWA Division Administrator for advance approval.
- No warranty requirement shall be approved, which in the judgment of the FHWA Division Administrator, may place an undue obligation on the contractor for items over which the contractor has no control.
- PennDOT may allow its own procedures regarding the inclusion of warranty provisions in Non-NHS, Federal-aid contracts.

**C. Use of Critical Path Method (CPM) Scheduling.** Any construction project where major traffic disruptions are anticipated need to have a CPM schedule so that the disruptions can be analyzed and strategies developed to minimize the disruption. Any projects involving incentive/disincentive provisions or innovative bidding or high public visibility should have CPM requirements. Such projects should be Completion Date Projects. Major rehabilitation projects are ideal candidates for CPM application.

Adequate time must be provided in the early design phase to develop a proper CPM. The District Design and Construction personnel must conduct the constructability review with the consultant. The consultant should provide PennDOT with a network logic diagram with charts of activities derived from Welcom Open Plan project scheduling software. This software should be capable of producing CPM network schedules and time scale diagrams, and indicating the cash flow by activities. Time scale diagrams are useful for evaluating project constructability. See Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, Appendix N, Constructability Reviews, for Constructability Review procedures. Refer to Publication 352, *Estimating Manual*, Chapter 7, for discussion on construction scheduling, including scheduling terminology and CPM.

**D. Road User Costs Determination.** Road User Costs are the basis for determining the Road User Liquidated Damages (RULDs) or incentive amounts to be used in the contracts involving Innovative Bidding Techniques. Refer to Publication 448, *Innovative Bidding Toolkit*, and Publication 51, *Plans, Specifications and Estimate Package Delivery Process Policies and Preparation Manual*, for information on determining RULDs.

## 5.7 AS-BUILT PLANS

**A. General.** "As-Built" plans are a set of construction drawings prepared to show the facility as actually built, including all field construction changes. The purpose of As-Built plans is to record the actual dimensions of the finished product. As-Built plans reflect changes made through addendums, change orders, field adjustments, or corrections.

As-Built drawings are a valuable source of information for the District Maintenance Unit and designers involved with the reconstruction or rehabilitation of an existing facility. They may also be helpful in protecting PennDOT against possible tort liability related to changes to such items as drainage or guiderail.

In accordance with Publication 2, *Project Office Manual*, a set of "As-Built" drawings shall be maintained for every project that has construction plans. The Bureau of Project Delivery assigns responsibility for the preparation of the As-Built plans to the Districts. The Bureau's policy gives the Districts flexibility in the preparation of these plans. Depending on available resources, the District may assign this responsibility to its construction inspectors, in-house design staff, or consultants.

"As-Built" plans should indicate all major changes, including types of materials, geometry, design, and limits of work. "As-Built" plans may be prepared using a variety of media, including Computer Aided Drafting and Design (CADD), tracings, and prints. Regardless of how these drawings are prepared, all As-Built plans shall conform to the following minimum requirements:

- All drawings shall be legible and of a quality acceptable for archiving.
- No erasure of original information is permitted.
- Changes should be indicated by adding the correct data and crossing out the incorrect data.
- These drawings should not include quantity changes.

**B. Plan Revisions (Other than Structure Plans).** The "As-Built" drawings shall be prepared per plan presentation procedures stated in Publication 14M, Design Manual Part 3, *Plans Presentation*, and should include the following:

- A full size construction plan shall be used.
- On the Title Sheet upper left-hand corner, list the following project data:
  - Contractor's name and address
  - District Executive
  - Assistant District Executive for Construction
  - Assistant Construction Engineer
  - Inspector-in-Charge
  - Calendar Days Allowed
  - Calendar Days Used
  - Pertinent Dates - Starting, Completion and Final Inspection
  - Sources of Materials
- Mark "Final" on all Limits of Work:
- When the location and/or length of pipe, underdrain and other drainage structures change including inlets, manholes and sections, etc., draw the new locations on the "As-Built" plans. Drainage facilities, including pavement base drains and underdrains with outlets, should be plotted even if they are constructed to plan stations.
- Indicate any structure changes (footing elevations, rebar, piling, or average pile tip elevation) for each substructure unit, etc. on Structure Drawings.
- Since no erasure of original information is permitted, changes for minor revision should be made by adding the new information and crossing out the incorrect data.
- It is not necessary to revise the quantities on the Summary of Quantities Sheets, Tabulation of Quantities Sheets, or the Bridge Summary of Quantities Sheets to match the final quantities in the estimate books. However, the following note shall be placed on the Quantities Sheets:

"THE QUANTITIES LISTED ON THIS SHEET MAY NOT MATCH THE QUANTITIES FOR  
THE AS-BUILT PLAN REVISIONS."

- Use black ink or No. 2 pencil to make changes.

The final "As-Built" Drawings shall be completed on the original construction plan. Field changes noted on the "As-Built" prints should be transferred to the original construction plans. The District shall submit the "As-Built" drawings to the Bureau of Project Delivery, Plans Reproduction Unit, for archiving, immediately upon completion. Upon completion of the archiving, the Plans Reproduction Unit will return the original plans to the District. See Publication 15M, Design Manual Part 4, *Structures*, Chapter 1 for a complete description of the structure plan revision process.

## 5.8 CONSTRUCTION PROJECT SCHEDULING PROCESS

**A. Introduction.** A key measure of the success of a construction project is on-time completion. The construction project scheduling process consists of two parts developing an accurate Pre-Bid Construction Schedule during Design to plan the project and monitoring the Contractor's schedule during Construction to manage the project effectively. This section describes the second part of the process, monitoring construction. See Publication 10, Design Manual Part 1, *Transportation Program Development and Project Delivery Process*, Chapter 7, Section 7.2 for procedures on preparing Pre-Bid schedules and scheduling special provisions.

**B. Monitor Construction.** Monitoring of the Contractor's schedule begins at Construction Notice-to-Proceed and continues to Construction Closeout. Monitoring actual progress and comparing it to the Contractor's Baseline Schedule prepares PennDOT's Inspector-in-Charge and/or Assistant Construction Engineer (ACE) to:

- Communicate and resolve project issues with the Contractor and PennDOT management.
- Properly assess and measure impacts of changes to the schedule.
- Make decisions concerning corrective actions.

**C. Process.** The Monitoring in Construction ([Figure 5.2](#)) process recognizes that events will occur that can delay or otherwise impact construction schedules. This process provides a formal and systematic approach to taking corrective actions when necessary. The process uses the schedule as an effective communications tool for PennDOT and the Contractor. It identifies key decision points in project construction and the responses required of PennDOT staff and the Contractor.

This process promotes teamwork between PennDOT's Design and Construction staff, while assigning responsibility for construction scheduling to the Contractor. The Contractor is required to provide PennDOT with a realistic schedule based on available resources.

## 5.9 CONSTRUCTION PROJECT TRAFFIC BARRIER PRE-INSTALLATION REVIEW GUIDELINES

**A. Introduction.** The purpose of a pre-installation review of traffic barriers is to ensure that proposed traffic barriers meet the needs of the roadside environment. By conducting pre-installation reviews, appropriate modifications can be identified that may be necessary before the traffic barrier is installed. Note that a Standard Special Provision is available and must be included in the construction documents to notify the contractor that this review is required.

The term traffic barrier as used in these guidelines refers to all types of permanent barrier including, but not limited to, W-beam guide rail, concrete median barrier, cable barrier, and end treatments/impact attenuating devices.

**B. Process.** Use the following process as a guide to implement the reviews.

Implement pre-installation reviews on the following projects that involve traffic barrier:

- All federal oversight construction projects that involve traffic barrier as part of the project scope-of-work.
- All Interstate and Expressway construction projects (whether Federal oversight projects or not) that involve traffic barrier as part of the project scope-of-work.

Notify the contractor at the Pre-Construction Conference and Partnering Session that a traffic barrier pre-installation review will take place **before** any **permanent traffic barrier** is installed on the project. The prime contractor will be asked to coordinate with any subcontractors involved with this work, as the prime contractor deems appropriate. The contractor should be made aware this review is incidental to the traffic barrier items.

Prior to the review, the contractor will be asked to place temporary markers (i.e., paint markings, stakes, or flags, etc.) indicating planned locations of all permanent traffic barrier and end treatments/impact attenuators that are to be installed as part of the project.

When the temporary markers are in place, the PennDOT Inspector-in-Charge, or their representative, will notify the District Guiderail Mentor, and the FHWA Transportation Engineer on Federal Oversight projects, to schedule the pre-installation review. The review should take place to allow sufficient time to make any necessary changes before the contractor begins the actual traffic barrier work to ensure that the contractor is not delayed.

Reviews will look at the following items:

- Barrier Length of Need:
  - Does the proposed barrier layout adequately shield the field hazards?
  - Does the proposed barrier layout end in the best possible field location?
- End Terminal/Crash Cushion Selection:
  - Is the appropriate choice of end terminal "Type" proposed for the actual field conditions? (an example being the use of a tangent system (Type III) versus a flared system (Type II))
  - Do proposed backslope anchors (Type I) have the proper layout in accordance with RC-54M so that they are not incorrectly and/or prematurely tied into the cut slope?
- Slopes & Grading:
  - Does the proposed barrier layout include adequate slopes in front of the barrier?
  - Does the proposed end terminal layout include adequate grading around the terminal?
  - Does the barrier have the proper backup behind it? Are long posts necessary?
- Miscellaneous Other:
  - Is there any existing or proposed traffic barrier within the project limits that is not warranted and should be removed?
  - Are there any obvious traffic barrier locations within the project limits that need addressed but were missed by the project scope-of-work?
  - Are there any areas within the project limits that barrier can be reduced or eliminated by slope flattening from excess excavation or waste?

Review participants should include (as a minimum):

- Construction Project Inspector-in-Charge or qualified Representative.
- District Guiderail Mentor, or qualified Representative.
- FHWA Transportation Engineer (on Federal Oversight projects).
- Contractor's Representative.
- District Construction Unit representative (encouraged).
- District Design Unit representative (encouraged).

These reviews should cover all of the proposed traffic barrier installation sites on the reviewed project. However, if this is not feasible, enough locations should be reviewed until the review team is confident that the remaining traffic barrier installations will be installed correctly.

All review findings must be documented in writing by the Inspector-in-Charge and signed by all members of the review team. Any proposed revisions will then be processed through existing PennDOT procedures with the eventual result being traffic barrier installed as part of the construction project that best meets the needs of the roadside environment.

Review findings are to be communicated with appropriate District Design staff so they can be turned into lessons learned for future project designs.

By the end of the calendar year, each Guiderail Mentor will submit to the Central Office Roadside Safety Committee (RSC), c/o Highway Design and Technology Section, Bureau of Project Delivery, a summary of results from their District's pre-installation reviews. The RSC will evaluate the statewide results from these pre-installation reviews. The RSC will work with the District Guiderail Mentors on the details of this evaluation effort.

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# MONITORING IN CONSTRUCTION PROCESS

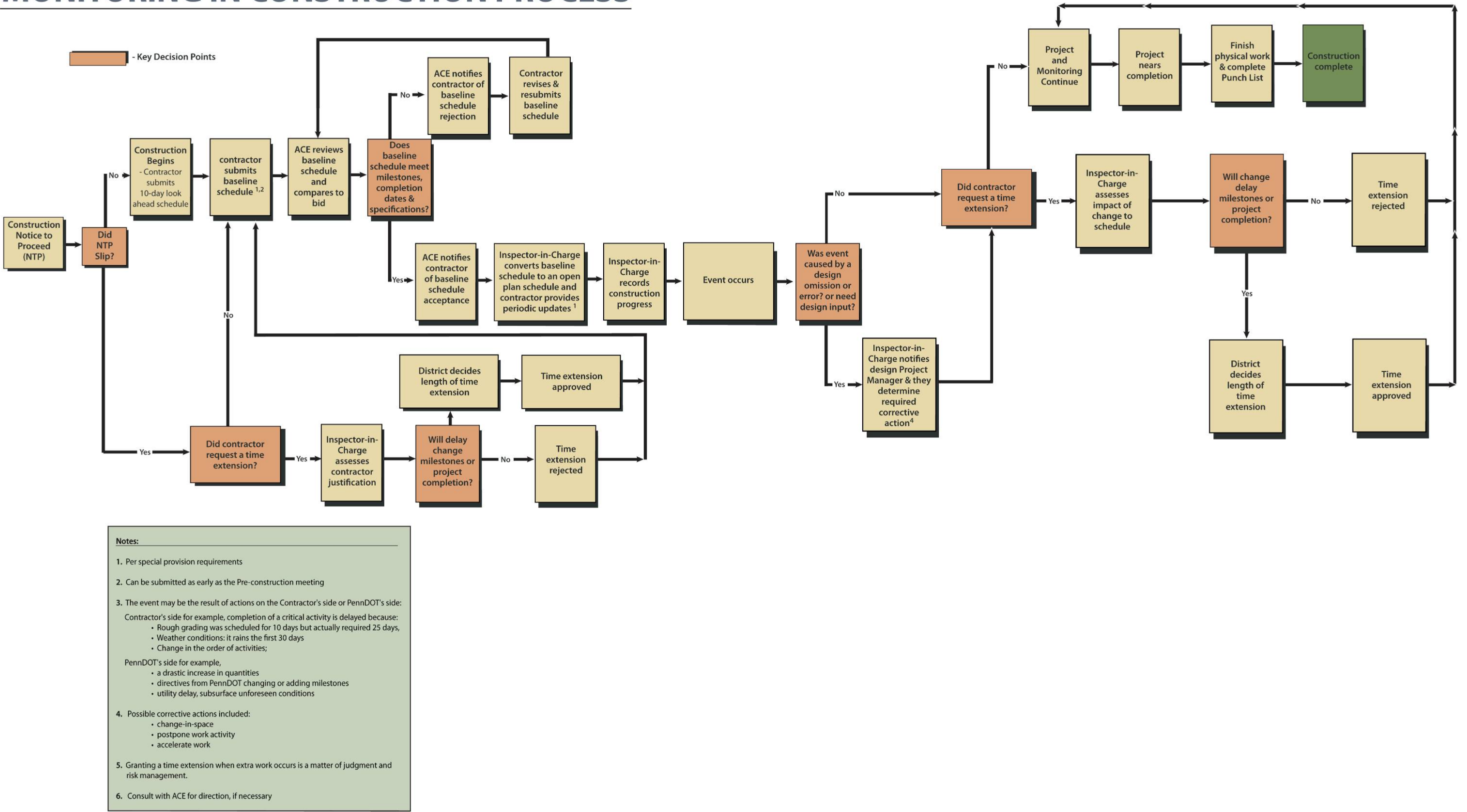


Figure 5.2