TDOT ROADWAY DESIGN GUIDELINES

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PDN

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PDN - CHAPTER 1

GENERAL

CHAPTER 1 GENERAL
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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** – Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the *Roadway Design - TDOT Documents* webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



Stages of Project Delivery Network

0. Planning
1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 – PROJECT INFORMATION

1-100.00 PROJECT RECORDS

It is essential for every Technical Lead to create and maintain a detailed history of the design process for each of their projects. Information in the project records may be used if a problem arises during or after construction of the project. For example, records may be referenced after a flood causes property damage or for other legal claims in court. Examples of records to be kept are described in Chapter 1-102.00 Project Folder.

1-101.00 PROJECT SCOPE AND CHANGES IN SCOPE

As a project develops, the project manager shall contact the Program Development and Scheduling Office (TDOT.PDSO@tn.gov) if the scope of the project as defined in the Concept Report and Project Commitment Document and/or MPO TIP cannot be met. This includes all horizontal and vertical elements that would result in a design exception request, and/or other variations from the original scope such as typical section changes, additional right-of-way needs, project termini, etc. When estimates are submitted (see *Chapter 1-402.00 Submittal of Estimates* and all subsections), a request should be submitted for the monetary value of the estimate from the Bid Analysis and Estimating Office. If the estimate increases by more than 10% from the initial estimate, the Program Development and Administration Division shall be contacted.

1-102.00 PROJECT FOLDER

Each Technical Lead will be required to maintain an up-to-date digital project folder that contains information on the project for all four stages of development (Context/Scoping, Footprint Established, Plan-in-Hand and PS&E). The typical roadway design project folder shall consist of information kept in chronological order by dates and divided into categories. See *Figure 1-1, Example Folder Structure* to see how this folder shall be laid out. The following are the categories and examples of the types of information that may be found in each:

1. Deliverable Requests and Reports:
    - Traffic data request and report
    - Initial Studies request and corresponding letters and reports
    - Additional survey requests
    - Environmental documents
2. Correspondence:
    - Funding letters
    - Departmental emails and correspondence including any notes taken from verbal conversations

- Outside agency emails and correspondence including any notes taken from verbal conversations

3. Field Reviews\Public Meetings:
    - Letters sent for invitations or appointments for field reviews or public meetings
    - Field review reports including attendees list.(Construction Documents), Constructability, (all reviews that are applicable to project)
    - Documentation related to Public Meetings
4. Calculations:
    - Pavement quantities
    - Sight distance
    - Guardrail - length of need
    - Drainage - including any reports exported from approved drainage programs
    - Erosion Control
    - Grading Report (See *Chapter 2-1009.00*, *Grading Report*)
5. Estimated Quantities Excel file

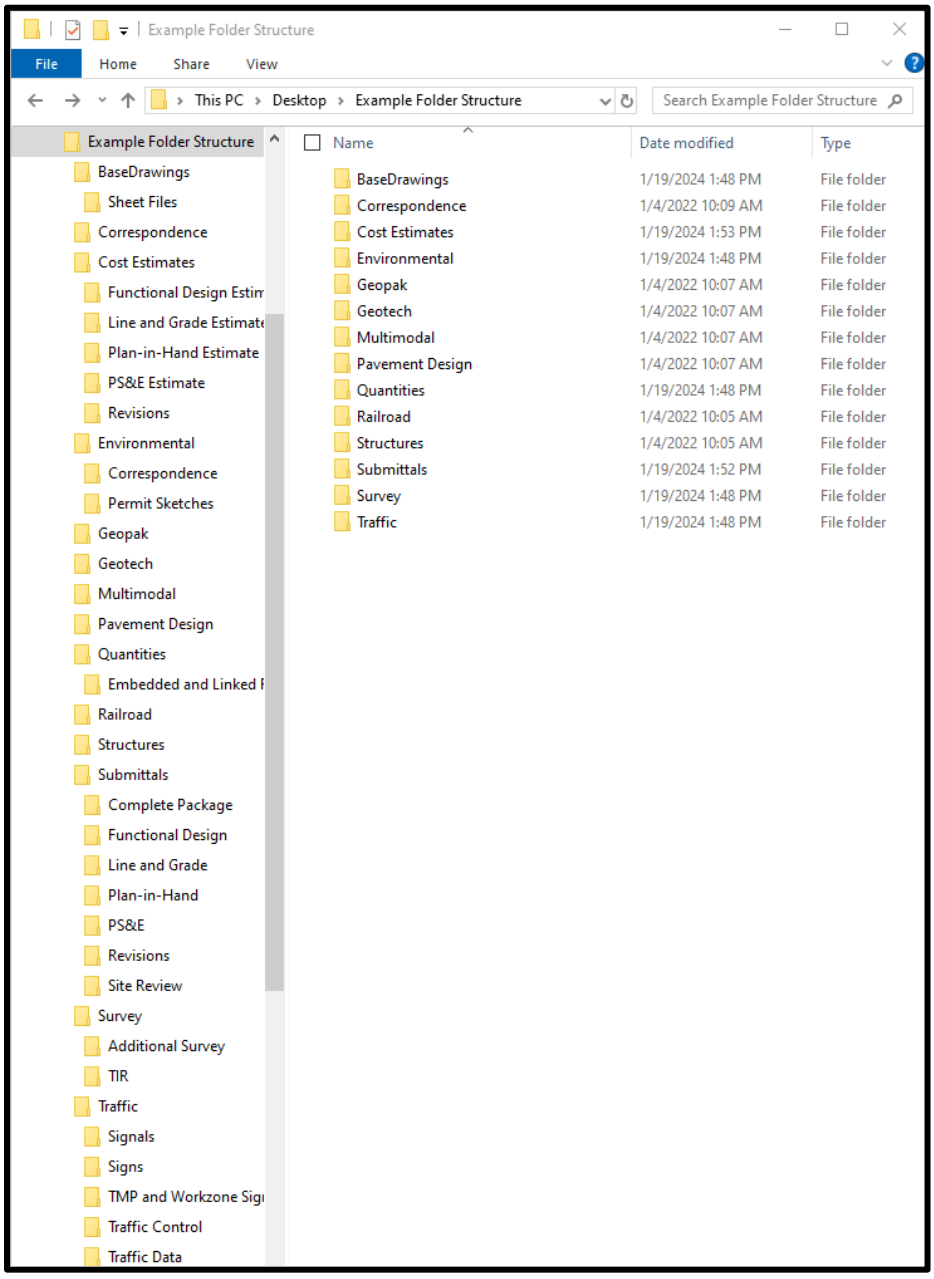


Figure 1-1
Example Project Folder Structure

For each project, a folder shall be made for each of the categories and then placed in an Adobe PDF Portfolio or zip file. At letting turn-in, the Design Lead shall place the Adobe Portfolio or zip file containing the entire project folder onto FileNet with the naming convention: nnnnnn-nn-ProjectFolder.pdf or nnnnnn-nn-ProjectFolder.zip. The nnnnnn-nn-ProjectFolder.pdf/ nnnnnn-nn-ProjectFolder.zip file will become a complete "Design Records" file and a part of the legal documents substantiating the final Construction Plans. It is the responsibility of the Technical

Leads (for Consultant designed projects) to maintain the project folder until the construction project is complete.

Upon receipt of the Notice of Completion from the Regional Operations Office, the Technical Leads shall upload any additional project information pertaining to the project (revisions, requests, correspondence with Operations and/or HQ Construction Division, etc.) that has occurred since the initial letting turn-in with the naming convention nnnnnn-nn-ProjectFolder-Addendum.pdf/nnnnnn-nn-ProjectFolder-Addendum.zip and contact the Design Lead and Project Manager.

1-103.00 CHARGING TIME TO PROJECTS

Refer to Project Delivery Network Section 1PM1 to ensure the correct PE number is utilized for the project stage.

Project Managers and Design Lead are reminded that a task profile ID, which is the TX number for the timesheet, will need to be set up in Edison for the Preliminary Engineering NEPA (PE-N) number and PE-D number at the appropriate stage to ensure that time is charged to the correct funding source. The Design Lead or Project Manager shall request the task profile ID numbers. If there is a child PIN associated with the project, check with the Program Development Scheduling Office to determine what number should be used to charge time.

1-104.00 PDF PLAN SHEET SIZE

PDF plans shall be full-size plans. It is essential that the correct plan size be used when making the PDFs to ensure that printing of the plans will be to scale. Plans Assembly personnel must combine plan sets from several divisions during the Letting phase. Personnel in this group can refuse PDFs that are not the correct size. If approved TDOT sheet borders are used as discussed in *Chapter 1-202.01, Sheet Borders*, the PDFs will be the correct size for 34” X 22”.

For further guidance, refer to the document Creating PDFs from DGNs.pdf located on the Standard Design CADD Files and Documents webpage.

1-105.00 MAJOR MILESTONE FILENET PROJECT DELIVERABLES

Design Leads are responsible for archiving Roadway Design records for all new construction, reconstruction, and resurfacing projects on the Design folder on the FileNet server utilized by the Department. Unless specified otherwise, when this document refers to FileNet uploads, it is referring to the Design folder. For guidance in creating a composite plan set in the *.pdf format refer to the document Creating PDFs from DGNs.pdf located on the Standard Design CADD Files and Documents webpage.

FileNet archiving shall include all projects with the most recently completed deliverable. See *Table 1-1, Project Deliverable Types* for a summary of each type of file associated within a project deliverable.

Project Deliverable	Format	Additional Notes
Plan Set	.pdf	Include Cross-Sections
Estimates File	.xlsm	As applicable
Approved Design Exception	.pdf	As applicable
Traffic Management Plan	.pdf	As applicable
Project Notebook	.pdf	Included on all ORD projects
Project Design Files	.zip (compressed file) (NOT password protected)	Include all entire project's ORD WorkSet folder

Table 1-1
Project Deliverable Types

To streamline the submittal process, there are email templates for each submittal. When a project reaches a stage completion, an email template is provided for each region and stage. Follow the instructions in the blue text to complete the submittal process. A PDF of each submittal should be saved within the project folder.

Due to process changes, a new solution for each team may be available in the future. At that time, the email submittals will not be needed.

For further guidance, refer to the FileNet Project Deliverables document located on the Roadway Design Guidelines webpage. This document lists the project deliverables and plan sets that shall be loaded on the FileNet server.

1-105.01 LINE AND GRADE PACKAGE FIELD REVIEW SUBMITTAL

Line and Grade (L&G) Package shall include all items listed in the Line and Grade Plans Checklist. See PDN 1RD1 for more information. For the Line and Grade Field Review, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-2, Line and Grade Plans Field Review Package List*. See *Figure 1-2, Line and Grade Plans Field Review Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-LineandGradePlans.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be **nnnnnn-nn-LineandGradePlans.zip.**

A Line and Grade Estimate shall also be submitted by the Project Manager as part of the Line and Grade Package. The naming convention for this estimate shall be **nnnnnn-nn-LineandGradeEstimate.xlsm**. See Chapter 1-402.01 Submittal of the Line and Grade Estimate for more information regarding the estimate submittal.

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the Line and Grade Plans checklist	*nnnnnn-nn*-LineandGradePlans-Roadway.pdf
1	Estimated Roadway Quantities plan sheets – labeled Info Only	*nnnnnn-nn*-RoadwayEstimatedQuantities.pdf
2	Project Notebook	*nnnnnn-nn*-LineandGradePlans-PN.*pdf*
3	Signed Line and Grade Design Plans checklist	*nnnnnn-nn*-LineandGradePlansChecklist.pdf

Table 1-2
Line and Grade Plans Field Review Package List

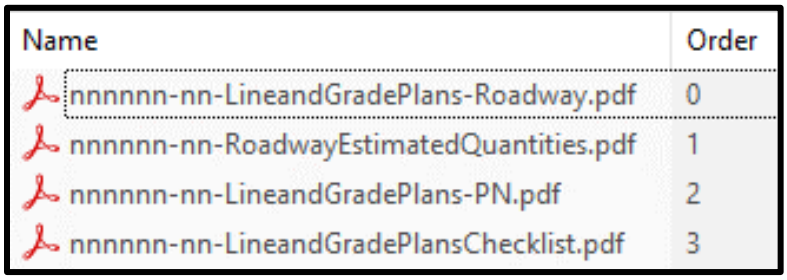


Figure 1-2
Line and Grade Plans Field Review Package Example

1-105.02 FUNCTIONAL DESIGN PLANS FIELD REVIEW FILENET SUBMITTAL PACKAGE

Functional Design Review plans shall include all items listed in the Roadway Design Checklist for Functional Design Plans including, if applicable: the preliminary bridge drawings and retaining walls, Natural Stream Design sheets, ITS sheets, Signal/Lighting sheets, and Geotechnical sheets. These plans shall be uploaded to FileNet by the respective Divisions for use by the Design Lead to include in the submittal packet. Refer to PDN 2RD1 and 2PM5.

For Functional Design Plans Field Review submittal, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added.

The order structure and naming convention is shown in *Table 1-3, Functional Design Plans Field Review Submittal Package List.* See *Figure 1-3, Functional Design Plans Field Review Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-FunctionalDesignPlansFieldReview.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be ***nnnnnn-nn*-FunctionalDesignPlansFieldReview.zip.**

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the Functional Design Plans checklist	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Roadway.pdf
1	Estimated Roadway Quantities plan sheets – labeled Info Only	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Estimate.pdf
2	Traffic Control Strategies and Concepts – labeled Info Only	*nnnnnn-nn*-ConceptualTrafficControl.pdf
3	Bridge, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Bridge.pdf
4	ITS, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-ITS.pdf
5	Lighting, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Lighting.pdf
6	Preliminary Natural Stream Design, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-NaturalStreamDesign.pdf
7	Retaining Wall and Noise Wall Locations, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Wall.pdf
8	Signal, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Signal.pdf
9	Geotechnical, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Geotech.pdf
10	Hydraulic, as applicable	*nnnnnn-nn*-FunctionalDesignPlansFieldReview-Hydraulic.pdf

11	Draft TMP, as applicable	*nnnnnn-nn*-DraftTMP.*pdf*
12	Project Notebook	*nnnnnn-nn*-FunctionalDesignPlans-PN.*pdf*
13	Signed Functional Design Plans checklist	*nnnnnn-nn*-FunctionalDesignPlans-Checklist.pdf

Table 1-3
Functional Design Plans Field Review Submittal Package List

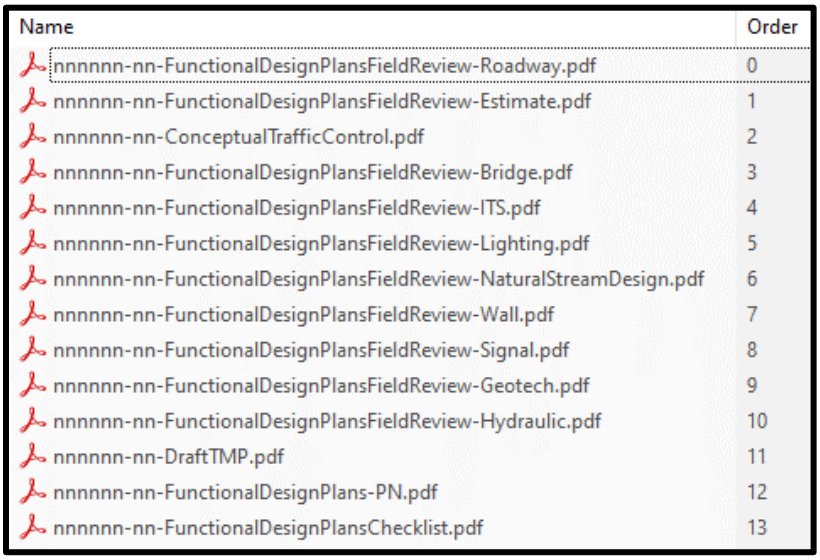


Figure 1-3
Functional Design Plans Field Review Submittal Package Example

1-105.03 FUNCTIONAL DESIGN PLANS SUBMITTAL PACKAGE

Functional Design plans submittal shall include all items listed in the Roadway Design Checklist for Functional Design Plans including, if applicable: the preliminary bridge drawings and retaining walls, Natural Stream Design sheets, ITS sheets and Signal/Lighting sheets. These plans shall be uploaded to FileNet by the respective Divisions for use by the Design Lead to include in the submittal packet. The sealed Functional Title Sheet will additionally be included in the PS&E submittal packages. Refer to PDN 2RD1.

For Functional Design Plans submittal, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-4, Functional Design Plans Submittal*

Package List. See *Figure 1-4, Functional Design Plans Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-FunctionalDesignPlans.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be **nnnnnn-nn-FunctionalDesignPlans.zip.**

A Functional Design Plans Estimate shall also be submitted by the Project Manager as part of the Functional Design Package. The naming convention for this estimate shall be **nnnnnn-nn-FunctionalDesignPlansEstimate.xlsm**. See Chapter 1-402.02 Submittal of Functional Design Plans Estimate for R.O.W. or Utilities Only Funding for more information regarding the estimate submittal.

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the Functional Design Plans checklist	*nnnnnn-nn*-FunctionalDesignPlans-Roadway.pdf
1	Estimated Roadway Quantities plan sheets – labeled Info Only	*nnnnnn-nn*-FunctionalDesignPlans-Estimate.pdf
2	Traffic Control Strategies and Concepts – labeled Info Only	*nnnnnn-nn*-ConceptualTrafficControl.pdf
3	Draft TMP, as applicable	*nnnnnn-nn*-DraftTMP.*pdf*
4	Original sealed Title Sheet	*nnnnnn-nn*-FunctionalTitleSheet.pdf
5	Bridge, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-Bridge.pdf
6	ITS, as applicable	*nnnnnn-nn*-FunctionaDesignlPlans-ITS.pdf
7	Lighting, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-Lighting.pdf
8	Preliminary Natural Stream Design, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-NaturalStreamDesign.pdf
9	Retaining Wall and Noise Wall Locations, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-Wall.pdf

10	Signal, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-Signal.pdf
11	Geotechnical, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-Geotech.pdf
12	Hydraulic, as applicable	*nnnnnn-nn*-FunctionalDesignPlans-Hydraulic.pdf
13	Project Notebook	*nnnnnn-nn*-FunctionalDesignPlans-PN.*pdf*
14	Signed Functional Design Plans checklist	*nnnnnn-nn*-FunctionalDesignPlans-Checklist.pdf

Table 1-4
Functional Design Plans Submittal Package List

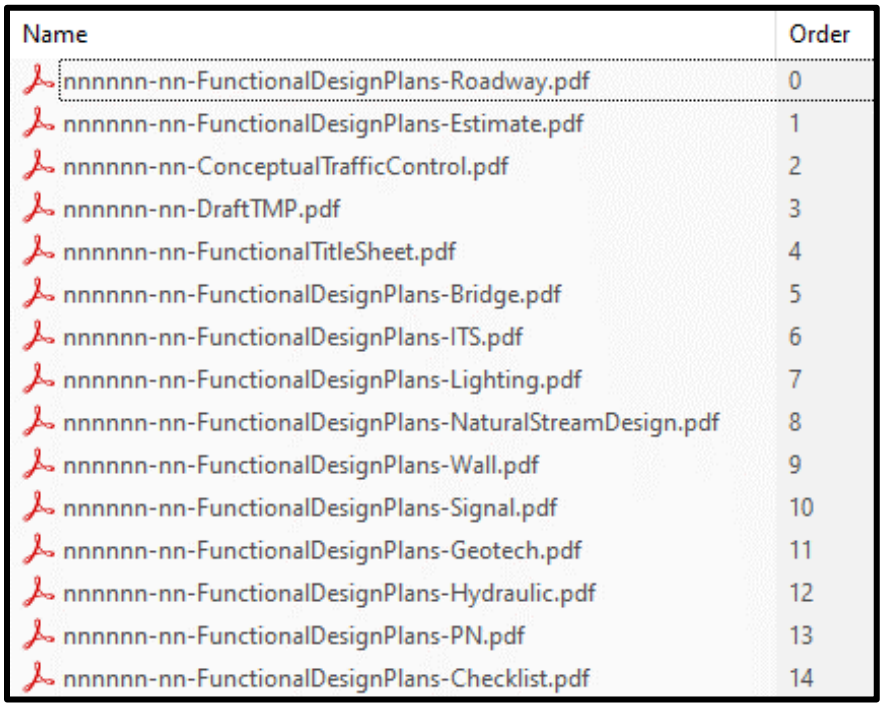


Figure 1-4
Functional Design Plans Submittal Package Example

1-105.04 RIGHT-OF-WAY REVISION FILENET SUBMITTAL PACKAGE

When the Functional Design Plans and the Right-of-Way appraisals and acquisition have been submitted for a project, and a change becomes necessary on the project that changes the

design or footprint of the project, a Right-of-Way Plans revision is required. However, if the revision only includes a property ownership change or update or a subdivision of a property, a R.O.W. Revision would not be needed. This type of change could be reflected in updating the R.O.W. Exhibits. See PDN 3RD1 for more details regarding the R.O.W. Exhibits. All Right-of-Way revisions will be submitted through the Project Manager responsible for the project in an accurate and timely manner. It is not necessary to re-seal the title sheet unless the revision is on the title sheet.

R.O.W. revisions shall include all items listed in the Roadway Design Checklist for R.O.W. including, if applicable: the preliminary bridge drawings and retaining walls, Natural Stream Design sheets, ITS sheets and Signal/Lighting sheets. These plans shall be uploaded to FileNet by the respective Divisions for use by the Design Lead to include in the submittal packet.

For all R.O.W. revisions, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-5, R.O.W. Revision Submittal Package List*. See *Figure 1-5, R.O.W. Revision Submittal Package Example*. The naming convention for the submittal package shall be **nnnnnn-nn-ROW-Rev-mm-dd-yy.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be **nnnnnn-nn-ROW-Rev-mm-dd-yy.zip.**

Portfolio Order #	Item Description	Naming Convention
0	Current R.O.W. Revision Email	*nnnnnn-nn*-ROWRevisionEmail-mm-dd-yy*.pdf*
1	Previous ROW Revision Emails **Folder,** if applicable (This is individuals pdfs of the revision emails dropped into this folder.)	Previous_ROW_Revision_Emails
2	Original Functional Design Submittal Email, PDF	*nnnnnn-nn*-FunctionalDesignSubmittalEmail*.pdf*
3	Draft TMP, as applicable Or Signed TMP, if available	*nnnnnn-nn*-DraftTMP*.pdf* *nnnnnn-nn*-TMP*.pdf*
4	Original sealed Title Sheet	*nnnnnn-nn*-FunctionalDesignTitleSheet.pdf

5	All plan sheets as turned in for Functional Design Submittal with revised sheets	*nnnnnn-nn*-FunctionalDesignPlans-Roadway-Rev-mm-dd-yy.pdf
6	Estimated Roadway Quantities plan sheets – labeled Info Only	*nnnnnn-nn-FunctionalDesignPlans-Estimate.pdf*
7	Traffic Control Strategies and Concepts – labeled Info Only	*nnnnnn-nn-ConceptualTrafficControl.pdf*
8	Bridge, as applicable	*nnnnnn-nn-FunctionalDesignPlans-Bridge.pdf*
9	ITS, as applicable	*nnnnnn-nn-FunctionaDesignlPlans-ITS.pdf*
10	Lighting, as applicable	*nnnnnn-nn-FunctionalDesignPlans-Lighting.pdf*
11	Preliminary Natural Stream Design, as applicable	*nnnnnn-nn-FunctionalDesignPlans-NaturalStreamDesign.pdf*
12	Retaining Wall and Noise Wall Locations, as applicable	*nnnnnn-nn-FunctionalDesignPlans-Wall.pdf*
13	Signal, as applicable	*nnnnnn-nn-FunctionalDesignPlans-Signal.pdf*
14	Geotechnical, as applicable	*nnnnnn-nn-FunctionalDesignPlans-Geotech.pdf*
15	Hydraulic, as applicable	*nnnnnn-nn-FunctionalDesignPlans-Hydraulic.pdf*
16	Project Notebook	*nnnnnn-nn-FunctionalDesignPlans-PN.pdf*
17	Signed Functional Design Plans checklist	*nnnnnn-nn-FunctionalDesignPlans-Checklist.pdf*

Table 1-5
R.O.W. Revision Submittal Package List



Figure 1-5
R.O.W. Revision Submittal Package Example

1-105.05 PUBLIC MEETING FILENET SUBMITTAL PACKAGE

Public Meeting plans shall include all items listed in the Functional Design Plans Checklist and are to be used for public meetings or public hearings. For additional information and documents regarding a public meeting, see the Public Involvement and Communication Office. Refer to PDN 2R2 for more information. For a Public Meeting submittal, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-6, Public Meeting Submittal Package List*. See *Figure 1-6, Public Meeting Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-PublicMeeting.pdf**.

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the Functional Design Plans checklist	*nnnnnn-nn*-PublicMeetingPlans.pdf
1	Displays files - if there are multiple files used to create displays shown at the meeting, a folder can be used and include a pdf of each of the necessary files	*nnnnnn-nn*-Displays.pdf

Table 1-6
Public Meeting Submittal Package List

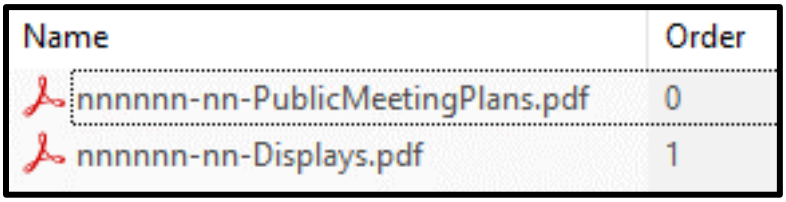


Figure 1-6
Public Meeting Submittal Package Example

1-105.06 PLAN-IN-HAND FIELD REVIEW FILENET SUBMITTAL PACKAGE

Plan-in-Hand (PIH) Field Review plans shall include all items listed in the Roadway Design Checklist for Plan-in-Hand including, if applicable, bridge and retaining walls plans, ITS, signal, and lighting plans, and natural stream design plans. See PDN sections 3EN1-3EN2 for more details regarding environmental permits that will be submitted at this time. These plans shall be uploaded to FileNet by the respective Divisions for use by the Designer to include in the submittal packet. Refer to PDN 3RD1 and 3PM2.

For the Plan-in-Hand Field Review submittal, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-7, Plan-in-Hand Field Review Submittal Package List.* See *Figure 1-7, Plan-in-Hand Field Review Submittal Package Example.* The naming convention for the submittal package shall be ***nnnnnn-nn*-PIHFieldReview.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be **nnnnnn-nn-PIHFieldReview.zip.**

A Plan-in-Hand Field Review Estimate shall also be submitted by the Project Manager as part of the Plan-in-Hand Field Review Package. The naming convention for this estimate shall be **nnnnnn-nn-RoadwayPIHFieldReviewEstimate.xlsm**. See Chapter 1-402.04 Submittal of Plan-in-Hand Estimate for Field Review for more information regarding the estimate submittal.

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the Plan-in-Hand checklist	*nnnnnn-nn*-PIHFieldReview-Roadway.pdf
1	Bridge, as applicable	*nnnnnn-nn*-PIHFieldReview-Bridge.pdf
2	Geotechnical, as applicable	*nnnnnn-nn*-PIHFieldReview-Geotech.pdf
3	ITS, as applicable	*nnnnnn-nn*-PIHFieldReview-ITS.pdf
4	Lighting, as applicable	*nnnnnn-nn*-PIHFieldReview-Lighting.pdf
5	Natural Stream Design, as applicable	*nnnnnn-nn*-PIHFieldReview-NaturalStreamDesign.pdf
6	Retaining Wall and Noise Wall Details, as applicable	*nnnnnn-nn*-PIHFieldReview-Walls.pdf
7	Signal, as applicable	*nnnnnn-nn*-PIHFieldReview-Signal.pdf
8	Utility Rainbow Plans, as applicable	*nnnnnn-nn*-PIHFieldReview-UtilityRainbows.pdf
9	TMP, as applicable	*nnnnnn-nn*-PIH-TMP.pdf
10	Project Notebook	*nnnnnn-nn*-PIH-PN.*pdf*
11	Signed Plan-in-Hand checklist	*nnnnnn-nn*-PIH-Checklist.pdf

Table 1-7
Plan-in-Hand Field Review Submittal Package List

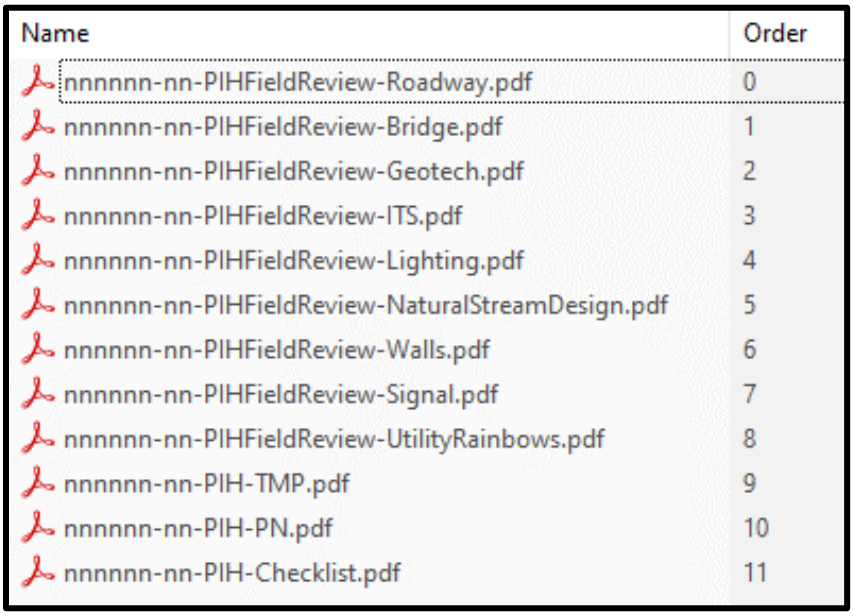


Figure 1-7
Plan-in-Hand Field Review Submittal Package Example

1-105.07 PLAN-IN-HAND FILENET SUBMITTAL PACKAGE

Plan-in-Hand plans submittal shall include all items listed in the Roadway Design Checklist for Plan-in-Hand Plans including, if applicable: the preliminary bridge drawings and retaining walls, Natural Stream Design sheets, ITS sheets and Signal/Lighting sheets. These plans shall be uploaded to FileNet by the respective Divisions for use by the Design Lead to include in the submittal packet. Refer to PDN 3RD1.

For Plan-in-Hand Plans submittal, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-8, Plan-in-Hand Design Plans Submittal Package List.* See *Figure 1-8, Plan-in-Hand Design Plans Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-Plan-in-HandPlans.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be ***nnnnnn-nn*-Plan-in-HandPlans.zip.**

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the Plan-in-Hand Plans checklist	*nnnnnn-nn*-PIH-Roadway.pdf
1	Bridge, as applicable	*nnnnnn-nn*-PIH-Bridge.pdf
2	Geotechnical, as applicable	*nnnnnn-nn*-PIH-Geotech.pdf
3	ITS, as applicable	*nnnnnn-nn*-PIH-ITS.pdf
4	Lighting, as applicable	*nnnnnn-nn*-PIH-Lighting.pdf
5	Preliminary Natural Stream Design, as applicable	*nnnnnn-nn*-PIH-NaturalStreamDesign.pdf
6	Retaining Wall and Noise Wall Locations, as applicable	*nnnnnn-nn*-PIH-Wall.pdf
7	Signal, as applicable	*nnnnnn-nn*-PIH-Signal.pdf
8	Utility Rainbow Plans, as applicable	*nnnnnn-nn*-PIH-UtilityRainbows.pdf
9	Signed TMP, as applicable	*nnnnnn-nn*-TMP.pdf
10	Project Notebook	*nnnnnn-nn*-PIH-PN.*pdf*
11	Signed Plan in Hand checklist	*nnnnnn-nn*-PIH-Checklist.pdf

Table 1-8
Plan-In-Hand Design Plans Submittal Package List

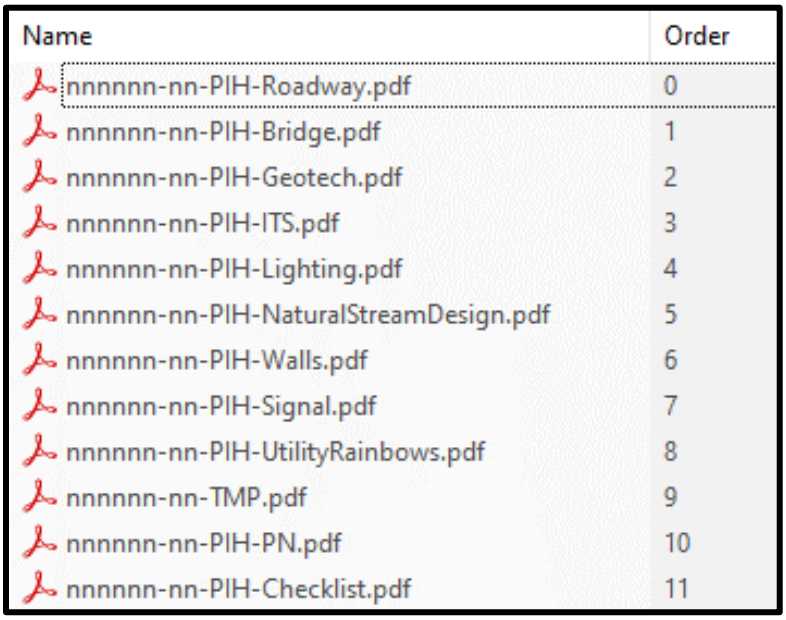


Figure 1-8
Plan-in-Hand Design Plans Submittal Package Example

1-105.08 PLANS, SPECIFICATIONS AND ESTIMATE FIELD REVIEW FILENET SUBMITTAL PACKAGE

Plans, Specifications, and Estimate (PS&E) Field Review plans shall include all items listed in the Roadway Design Checklist for PS&E including, if applicable, bridge and retaining walls plans, ITS, signal and lighting plans, and natural stream design plans. These plans shall be uploaded to FileNet by the respective Divisions for use by the Designer to include in the submittal packet. Refer to PDN 4RD1 and 4PM2.

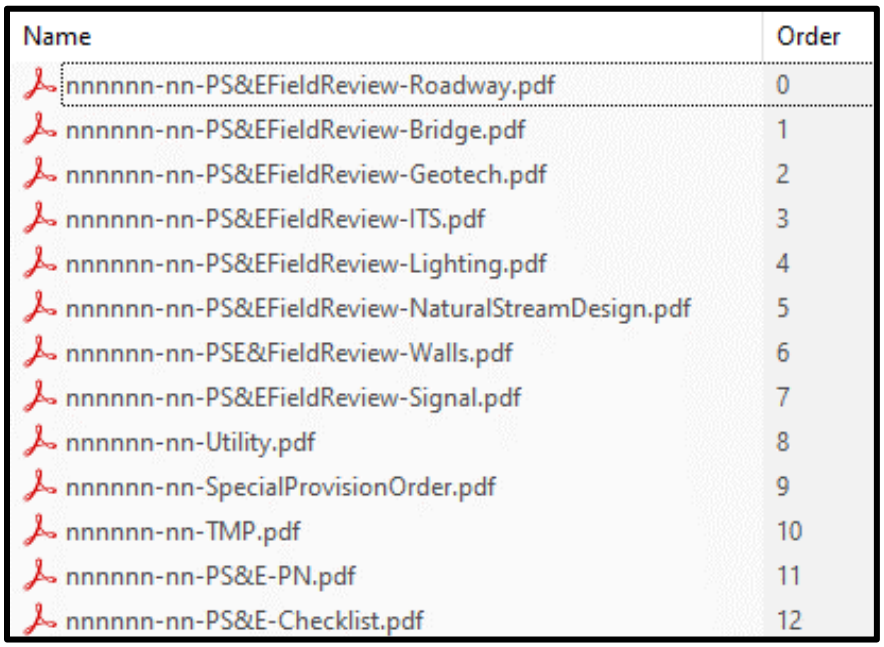
For the PS&E Field Review submittal, the complete project package shall be added to FileNet. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-9, PS&E Field Review Submittal Package List.* See *Figure 1-9, PS&E Field Review Submittal Package Example.* The naming convention for the submittal package shall be ***nnnnnn-nn*-PS&EFieldReview.pdf**.

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be **nnnnnn-nn-PS&EFieldReview.zip.**

A PS&E Field Review Estimate shall also be submitted by the Project Manager as part of the PS&E Field Review Package. The naming convention for this estimate shall be **nnnnnn-nn-RoadwayPS&EEstimate.xlsm**. See Chapter 1-402.05 Submittal of the PS&E Estimate for Field Review for more information regarding the estimate submittal.

Portfolio Order #	Item Description	Naming Convention
0	Roadway Plans - All sheets as designated in the PS&E checklist	*nnnnnn-nn*-PS&EFieldReview-Roadway.pdf
1	Bridge, as applicable	*nnnnnn-nn*-PS&EFieldReview-Bridge.pdf
2	Geotechnical, as applicable	*nnnnnn-nn*-PS&EFieldReview-Geotech.pdf
3	ITS, as applicable	*nnnnnn-nn*-PS&EFieldReview-ITS.pdf
4	Lighting, as applicable	*nnnnnn-nn*-PS&EFieldReview-Lighting.pdf
5	Natural Stream Design, as applicable	*nnnnnn-nn*-PS&EFieldReview-NaturalStreamDesign.pdf
6	Retaining Wall and Noise Wall Details, as applicable	*nnnnnn-nn*-PS&EFieldReview-Walls.pdf
7	Signal, as applicable	*nnnnnn-nn*-PS&EFieldReview-Signal.pdf
8	Utility Plans, as applicable	*nnnnnn-nn*-Utility.pdf
9	Special Provision Order, as applicable	*nnnnnn-nn*-SpecialProvisionOrder.pdf
10	Signed TMP, as applicable	*nnnnnn-nn*-TMP.*pdf*
11	Project Notebook	*nnnnnn-nn*-PS&E-PN.*pdf*
12	Signed PS&E checklist	*nnnnnn-nn*-PS&E-Checklist.pdf

Table 1-9
PS&E Field Review Submittal Package List



Name	Order
nnnnnn-nn-PS&EFieldReview-Roadway.pdf	0
nnnnnn-nn-PS&EFieldReview-Bridge.pdf	1
nnnnnn-nn-PS&EFieldReview-Geotech.pdf	2
nnnnnn-nn-PS&EFieldReview-ITS.pdf	3
nnnnnn-nn-PS&EFieldReview-Lighting.pdf	4
nnnnnn-nn-PS&EFieldReview-NaturalStreamDesign.pdf	5
nnnnnn-nn-PSE&FieldReview-Walls.pdf	6
nnnnnn-nn-PS&EFieldReview-Signal.pdf	7
nnnnnn-nn-Utility.pdf	8
nnnnnn-nn-SpecialProvisionOrder.pdf	9
nnnnnn-nn-TMP.pdf	10
nnnnnn-nn-PS&E-PN.pdf	11
nnnnnn-nn-PS&E-Checklist.pdf	12

Figure 1-9
PS&E Field Review Submittal Package Example

1-105.09 FINAL ROADWAY PS&E FILENET SUBMITTAL PACKAGE

This submittal is only required if there are any modification to the plans from the previous submittal. If there are no modifications to the plans, only the Final PS&E Submittal Package ("Complete Package") is required during PDN Stage 4.

Final Roadway PS&E plans shall include all items listed in the Roadway Design Checklist. The following sealed plans shown in *Table 1-10, Sealed Plans and Divisions* shall be placed on FileNet by the TDOT Division managing those portions of the project:

Sealed Plans	TDOT Division
Structures (Bridge, retaining wall, and noise wall sheets)	Structural Design
Natural Stream Design	Preconstruction - Environmental
SWPPP	Preconstruction - Environmental
Signals	Traffic Design
Lighting	Traffic Design
Geotechnical	Geotechnical Engineering
Utility (Not sealed)	Preconstruction - Utilities

Table 1-10
Sealed Plans and Divisions

Resurfacing plans are not a traditional roadway project design. Their submittal will not require a checklist, as these do not apply to this project type.

For final Roadway PS&E submittal, the complete package submittal shall be added to FileNet. Refer to PDN 3RD1. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-11, Roadway PS&E Submittal Package List*. See *Figure 1-10, Roadway PS&E Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-PS&E-Roadway.pdf.**

As part of the submittal package, a zip file will also be added to FileNet. This folder will be in the form of a compressed zip folder. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the zip folder shall be **nnnnnn-nn-PS&E-Roadway.zip.**

A PS&E Letting Estimate shall also be submitted by the Project Manager as part of the Final Roadway PS&E Package. The naming convention for this estimate shall be **nnnnnn-nn-RoadwayLettingEstimate.xlsm**. See Chapter 1-402.05 Submittal of the PS&E Estimate for Letting Process for more information regarding the estimate submittal.

Portfolio Order #	Item Description	Naming Convention
0	Original sealed Title Sheet	*nnnnnn-nn*-FunctionalDesignTitleSheet.pdf
1	Signed Traffic Management Plan	*nnnnnn-nn*-TMP*.pdf*
2	Roadway Plans - All sheets as designated in the PS&E checklist	*nnnnnn-nn*-PS&E-RoadwayPlans.pdf
3	Grading Report	*nnnnnn-nn*-GradingReport.pdf
4	Special Provision Order	*nnnnnn-nn*-SpecialProvisionOrder.pdf
5	Project Notebook	*nnnnnn-nn*-PS&E-PN.pdf
6	Signed PS&E checklist	*nnnnnn-nn*-PS&E-Checklist.pdf

Table 1-11
Roadway PS&E Submittal Package List

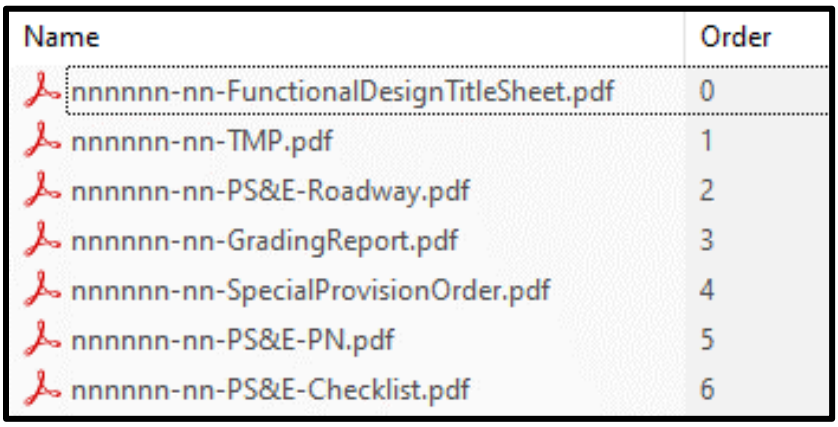


Figure 1-10
Roadway PS&E Submittal Package Example

1-105.10 FINAL PS&E DOCUMENTS "COMPLETE PACKAGE"

The Final PS&E Package or "Complete Package" shall be submitted for letting purposes. It shall be uploaded to FileNet prior to the turn-in date once all files listed below have been compiled. This zip file will contain all the digitally signed divisional plans combined into one master portfolio, all divisional plans combined into one flattened pdf, a .zip file of all divisional estimates, a .zip of design files, the special provision order sheet, final TMP, grading sheets, bridge reference drawings, utility provisions, reports (Geotech, asbestos, etc.), and pre-construction ride excel (rideability projects only). Each individual file is described below as it should be included in the submittal package. See 4RD1. The order structure and naming convention is shown in *Figure 1-14 Zipped "Complete Package" PS&E Example.* The naming convention for the submittal package shall be ***nnnnnn-nn*-FinalPS&EPackage.zip.**

For the Design Files submittal, the zipped folder of design files submittals shall be added to the zipped Final PS&E Submittal Package. This is in the form of a zipped folder with individual files added. This folder will contain the project's entire WorkSet folder, acquisition table excel file, quantities excel file, etc. The naming convention for the submittal package shall be ***nnnnnn-nn*-DesignFiles.zip**

For Final PS&E Estimates submittal, the zipped folder of estimate submittals shall be added to the Zipped Final PS&E Submittal Package. This is in the form of a zipped folder with individual files added. See Chapter 1-402.05 Submittal of the PS&E Estimate for Letting Process for more information regarding the estimate submittal. The order structure and naming convention is shown in *Figure 1-11, Zipped Estimates PS&E Submittal Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-Estimates.zip**

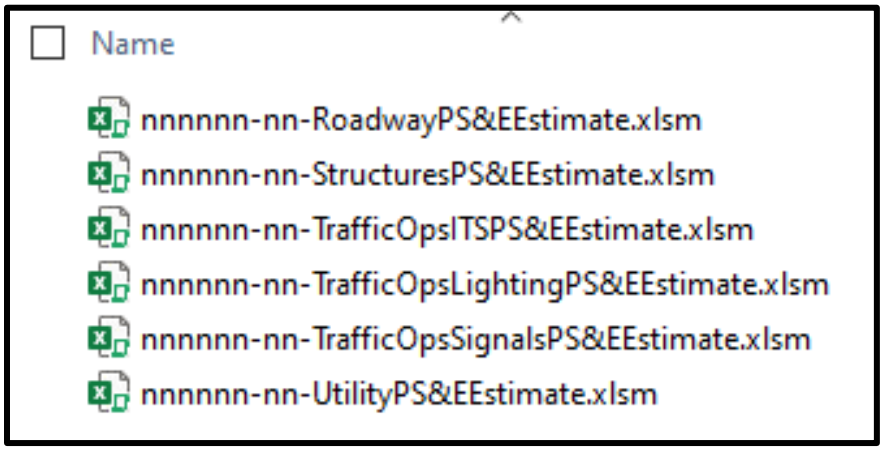


Figure 1-11

Zipped Estimates PS&E Submittal Example

The Final PS&E plans shall include all items listed in the Roadway Design Checklist for PS&E document turn-in, including, if applicable, bridge and retaining wall plans; geotechnical plans; ITS, signal and lighting plans; natural stream design and SWPPP plans; and utility plans. These plans shall be uploaded to FileNet by the respective Divisions for use by the Design Lead to include in the submittal packet.

For Final PS&E Plans submittal, the plan files shall be added to the zipped Final PS&E Submittal Package. This is in the form of an Adobe Portfolio PDF with individual files added. The order structure and naming convention is shown in *Table 1-12, Final PS&E Plans Submittal Package List*. See *Figure 1-12, Final PS&E Plans Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-FinalPS&E.pdf.**

Portfolio Order #	Item Description	Naming Convention
0	Original sealed Functional Design Title Sheet	*nnnnnn-nn-FunctionalDesignTitleSheet.pdf*
1	Signed Traffic Management Plan	*nnnnnn-nn*-TMP*.pdf*
2	Complete sealed set of Roadway Plans as turned in for final PS&E	*nnnnnn-nn*-PS&E-Roadway.pdf
3	Bridge, as applicable	*nnnnnn-nn*-PS&E-Bridge.pdf
4	Bridge Reference Documents, as applicable	*nnnnnn-nn*-PS&E-BridgeReferenceDoc.pdf
5	Geotechnical, as applicable	*nnnnnn-nn*-PS&E-Geotech.pdf

6	ITS, as applicable	*nnnnnn-nn*-PS&E-ITS.pdf
7	Lighting, as applicable	*nnnnnn-nn*-PS&E-Lighting.pdf
8	Natural Stream Design, as applicable	*nnnnnn-nn*-PS&E-NaturalStreamDesign.pdf
9	Retaining Wall and Noise Wall Details, as applicable	*nnnnnn-nn*-PS&E-Walls.pdf
10	Signal, as applicable	*nnnnnn-nn*-PS&E-Signal.pdf
11	SWPPP, as applicable	*nnnnnn-nn*-PS&E-SWPPP.pdf
12	Utility Plans, as applicable	*nnnnnn-nn*-PS&E-Utility.pdf
13	Project Notebook	*nnnnnn-nn-PS&E-PN.pdf*
14	Signed PS&E Turn-in checklist	*nnnnnn-nn*-PS&E-Checklist.pdf

Table 1-12
Final PS&E Plans Submittal Package List

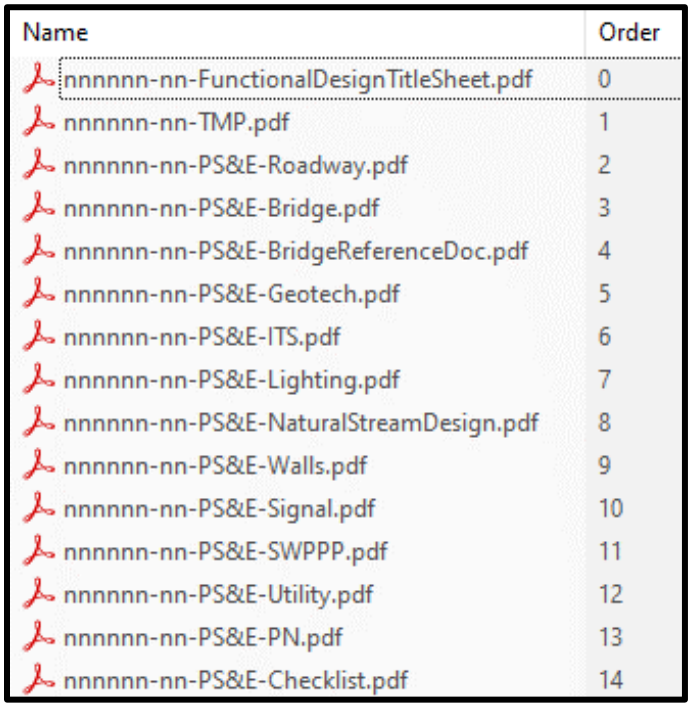


Figure 1-12
Final PS&E Plans Submittal Package Example

For the flattened Final PS&E Plans document, create a flattened PDF with all divisional plans combined into one PDF. Follow this guide when Creating the Flattened Plan Set. The order structure and naming convention is shown in *Table 1-13,Flattened Plan Set List*. See *Figure 1-13, Flattened Plan Set Example*. The naming convention for the submittal document shall be ***nnnnnn-nn*-FinalPS&E-Flattened.pdf.**

Order #	Item Description	Naming Convention
1	Complete sealed set of Roadway Plans as turned in for final PS&E	*nnnnnn-nn*-PS&E-Roadway-Flattened.pdf
2	Bridge, as applicable	*nnnnnn-nn*-PS&E-Bridge-Flattened.pdf
3	Bridge Reference Documents, as applicable	*nnnnnn-nn*-PS&E-BridgeReferenceDoc-Flattened.pdf
4	Geotechnical, as applicable	*nnnnnn-nn*-PS&E-Geotech-Flattened.pdf
5	ITS, as applicable	*nnnnnn-nn*-PS&E-ITS-Flattened.pdf
6	Lighting, as applicable	*nnnnnn-nn*-PS&E-Lighting-Flattened.pdf
7	Natural Stream Design, as applicable	*nnnnnn-nn*-PS&E-NaturalStreamDesign-Flattened.pdf
8	Retaining Wall and Noise Wall Details, as applicable	*nnnnnn-nn*-PS&E-Walls-Flattened.pdf
9	Signal, as applicable	*nnnnnn-nn*-PS&E-Signal-Flattened.pdf
10	SWPPP, as applicable	*nnnnnn-nn*-PS&E-SWPPP-Flattened.pdf
11	Utility Plans, as applicable	*nnnnnn-nn*-PS&E-Utility-Flattened.pdf

Table 1-12
Flattened Plan Set List

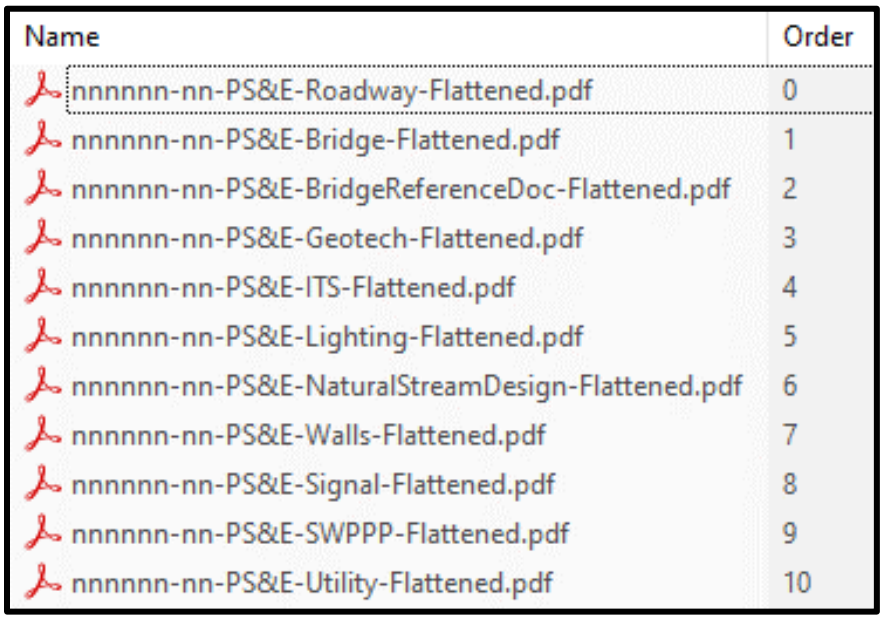


Figure 1-13
Flattened Plan Set Example

For Final PS&E Reports submittal, the zipped folder of all reports that are required for the project shall be added to the zipped Final PS&E Submittal Package. This is in the form of a zipped folder with individual files added. The reports that may be included shall be the Special provisions order, a grading report, the asbestos report, geotech report, etc. Addition reports may be added to this zip folder as needed. The naming convention for the submittal package shall be ***nnnnnn-nn*-Reports.zip**

For the Structures Bridge Reference document, see section 4ST1 in the PDN Manual. The naming convention for the submittal document shall be ***nnnnnn-nn*-StructuresBridgeReference.pdf.**

For Utility Specifications, see section 3UT3 in the PDN Manual. The naming convention for the submittal document shall be ***nnnnnn-nn*-UtilitySpecs.pdf.**

The Final PS&E Package shall include all items, if applicable, listed in the PS&E Roadway Design Checklist. For Final PS&E Package submittal, the complete package submittal shall be added to FileNet. This is in the form of a zipped folder with individual files added. The order structure and naming convention is shown in *Figure 1-14, Zipped "Complete Package" Final PS&E Submittal Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-FinalPS&EPackage.zip.**

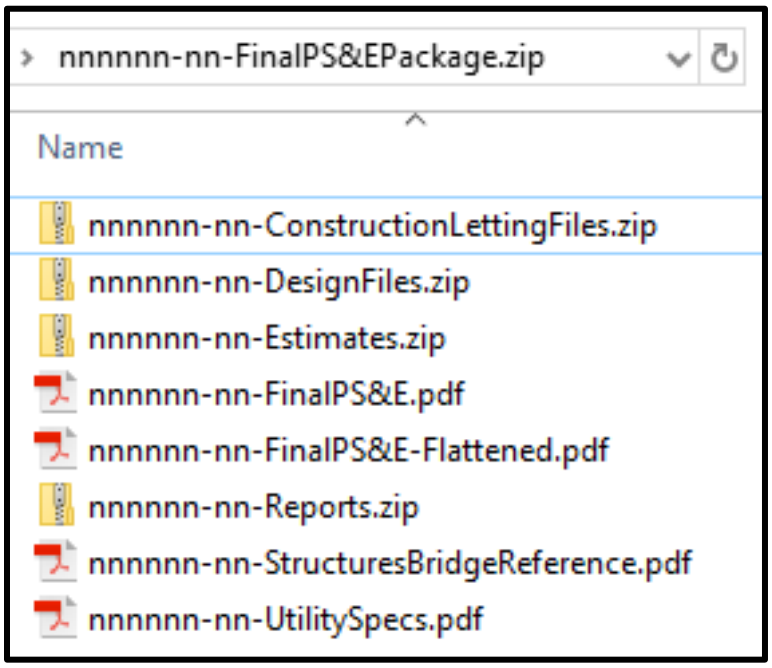


Figure 1-14
Zipped "Complete Package" Final PS&E Submittal Package Example

1-105.10.01 CONSTRUCTION LETTING ZIPPED FOLDER

The Construction Letting Zip Folder should include all files listed on table 1-16 and the file naming convention for Construction Letting Zip Folder shall be **nnnnnn-nn-Constructon LettingFiles.zip** to clearly designate they are the final file and intended to be posted on the website. The Construction Letting Zip Folder shall be included in the Final PS&E Submittal Package as shown in Figure 1-14.

Order #	Item Description	File Format	Remark
1	Estimate Quantities (all disciplines)		Shall be sent to tdot.construction.estimates@tn.gov
2	Compiled full set of plans (all disciplines and reference drawings as applicable)		Flattened 34" X 22" (should be all files listed under flattened plan set table 1-12)
3	Utility Spec		No portfolios

4	Environmental Permits		Or notice that No permit required
5	RR Agreement (SP 105C)		
6	ROW Availability (SP 107C)		
7	ITS Provisions (SP 725)		
8	Geotech Report		
9	Asbestos Report		
10	Grading Quantities		
11	Mainline & Side Road Cross-Sections and Terrain File	.DGN & .TIN	The files are extracted from the larger Design Files.zip file. The files must be placed in another zip folder before being included in the Construction Letting Files Zipped Folder. If your project is being designed in MicroStation, this package will contain electronic files of the mainline and side road cross sections (*.dgn and *.sht) and the Geopak digital terrain (*.tin) files. If your project is being designed in ORD, this package will contain electronic files of the mainline and side road cross sections and the terrain file (*.dgn).
12	Pre-rides (from regional Materials & Tests)		
13	Special Provision Order Sheet		

14	General Notes, Special Notes and/or Construction Notes as applicable		(i.e., miscellaneous safety contracts, maintenance contracts, salt bin contracts, etc.)
15	Bridge Inspection Reports as Applicable		

Table 1-16
Construction Letting Files Zipped Folder List

Any changes made to files listed above after Final Turn-in will require a letting revision to ensure that all changes to original plans/files are captured and posted for bidders. Revisions will be submitted to the locations listed above.

Files submitted after 4 pm CST the Tuesday before Advertisement will be processed by HQ Construction the week after advertisement as a letting addendum. Any deviations to this schedule must be approved by the Director of Construction or the Construction Contract Admin Manager.

After Advertisement, it is imperative that changes made to bid files and bid documents be processed and submitted to HQ Construction as completed and not held until just prior to the letting. All revisions (includes any HQ Construction requested changes due to Bidder RFI's) must be submitted by 4 pm CST the Wednesday before the Letting to allow processing and notification to all Bidders prior to bid opening. Any deviations to this schedule must be approved by the Director of Construction or the Construction Contract Admin Manager.

1-105.11 LETTING REVISION FILENET SUBMITTAL PACKAGE

Revisions made to plans between when the plans are initially submitted for construction letting and the day that projects are let to contract are called Letting Revisions. For Letting revision submittals, the complete package shall be resubmitted to FileNet with the updated information which includes the Letting Revision zip folder. The Letting Revision zip folder is in the form of an zipped folder with individual files added. The naming convention and description of the files are shown in *Table 1-13, Letting Revision Zipped Folder List*. See *Figure 1-15, Letting Revision Zipped Folder Example*. The naming convention for the Letting Revision zipped folder shall be ***nnnnnn-nn*-LettingRev-Emails-mm-dd-yy.zip.** This zipped folder is then added to the updated Complete Package zip folder.

Item Description	Naming Convention
Current Letting Revision Email	*nnnnnn-nn*-LettingRevisionEmail-mm-dd-yy.*pdf*

Previous Letting Revision Email **Folder**, if applicable (This folder contains individual pdfs of the revision emails dropped into this folder.)	Previous_Letting_Revision_Emails
Original Roadway PS&E Submittal Email	*nnnnnn-nn*-PS&E-RoadwaySubmittalEmail.pdf

Table 1-13
Letting Revision Zipped Folder List

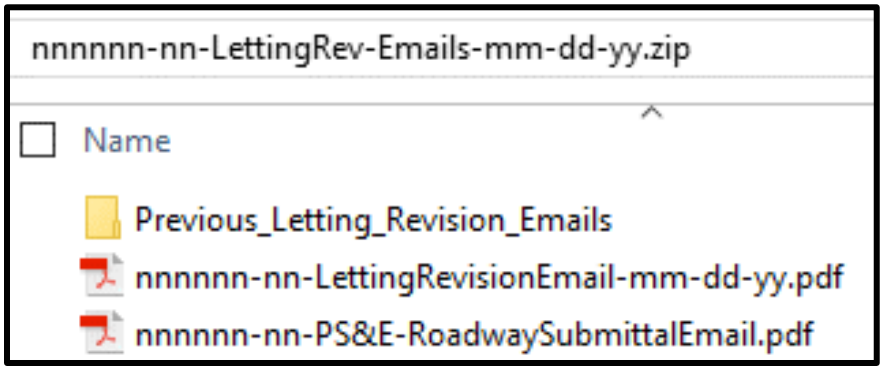


Figure 1-15
Letting Revision Zipped Folder Example

The Final PS&E Package – Letting Revision shall include all items, if applicable, listed in the PS&E Roadway Design Checklist. For Final PS&E Package – Letting Revision submittal, the complete package submittal shall be added to FileNet. This is in the form of a zipped folder with individual files added. The order structure and naming convention is shown in *Figure 1-16, Complete Package Letting Revision Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-FinalPS&EPackage-LettingRev-mm-dd-yy.zip.** Note that if a file within the Complete Package zip folder is not a part of the Letting Revision, the "-LettingRev-mm-dd-yy" tag does not have to be included in the file name. Only include that tag with items that are being updated with the Letting Revision.

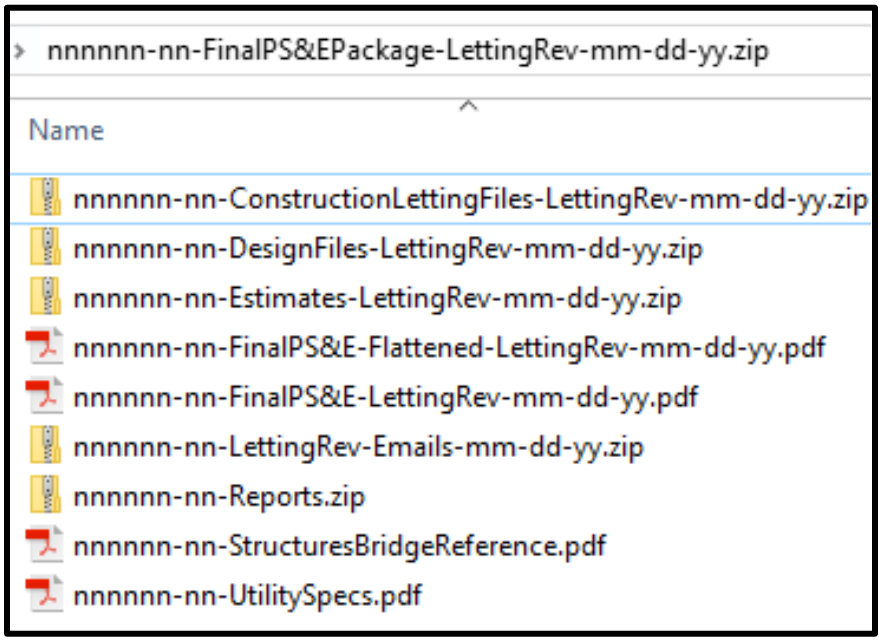


Figure 1-16

"Complete Package" Letting Revision Package Example

This Complete Package will be uploaded to FileNet and an email notification will be sent out using the Letting Revision Submittal Template. This email notification will include an attachment of the revised sheets and an Estimate Revision Request (ERR), if applicable.

1-105.12 PS&E REVISION FILENET SUBMITTAL PACKAGE

Revisions made to plans after the day that projects are let to contract are called PS&E Revisions. For PS&E revision submittals, the complete package shall be resubmitted to FileNet with the updated information along with the PS&E Revision zipped folder. The PS&E Revision zipped folder is in the form of a zipped folder with individual files added. The naming convention and description of the files are shown in *Table 1-14, PS&E Revision Zipped Folder List*. See *Figure 1-17, PS&E Revision Zipped Folder Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-PS&ERev-Emails-mm-dd-yy.zip**. This zipped folder is then added to the updated Complete Package zip folder.

Item Description	Naming Convention
Current PS&E Revision Email	*nnnnnn-nn-PS&E-RevisionEmail-mm-dd-yy.pdf*
Previous PS&E Revision Emails **Folder**, if applicable (This folder contains individual pdfs of the revision emails dropped into this folder.)	Previous_PS&E_Revision_Emails
Original Roadway PS&E Submittal Email	*nnnnnn-nn*-PS&E-RoadwaySubmittalEmail.pdf

Table 1-14
PS&E Revision Zipped Folder List

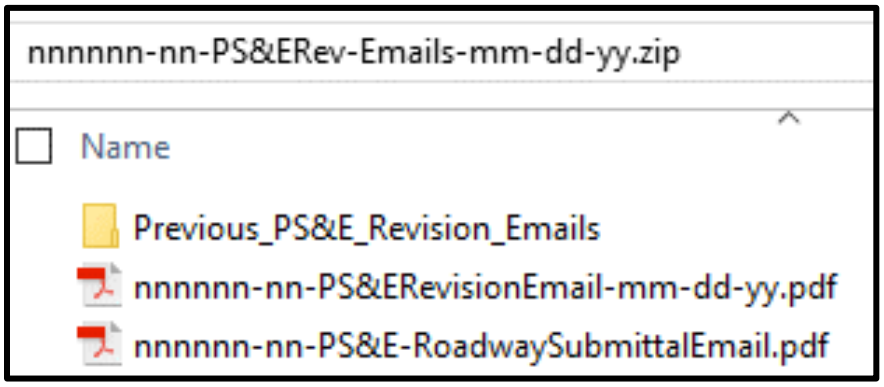


Figure 1-17
PS&E Revision Zipped Folder Example

The Final PS&E Package – PS&E Revision shall include all items, if applicable, listed in the PS&E Roadway Design Checklist. For Final PS&E Package – PS&E Revision submittal, the complete package submittal shall be added to FileNet. This is in the form of a zipped folder with individual files added. The order structure and naming convention is shown in *Figure 1-18, Complete Package PS&E Revision Package Example*. The naming convention for the submittal package shall be ***nnnnnn-nn*-FinalPS&EPackage-PS&ERev-mm-dd-yy.zip.** Note that if a file within the Complete Package zip folder is not a part of the PS&E Revision, the "-PS&ERev-mm-dd-yy" tag does not have to be included in the file name. Only include that tag with items that are being updated with the PS&E Revision.

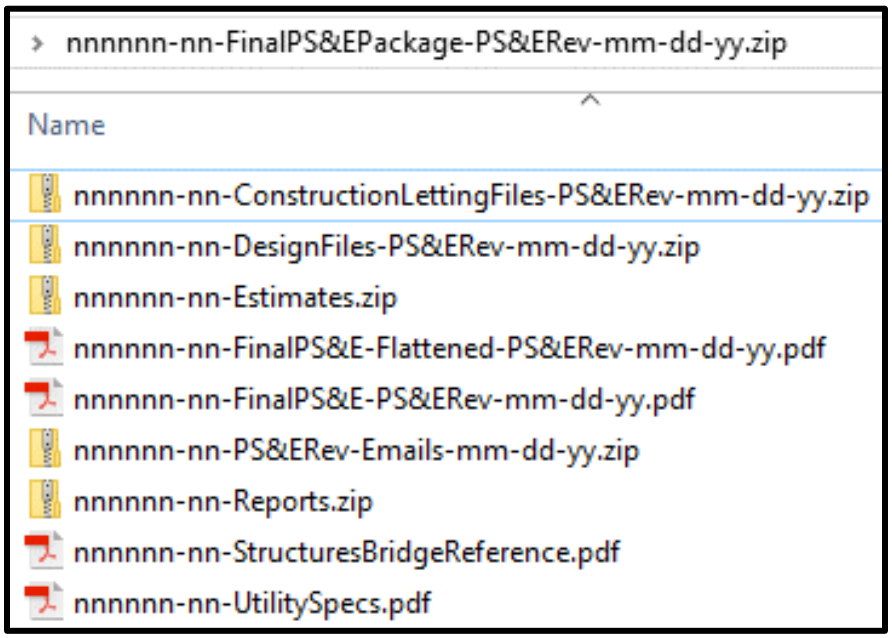


Figure 1-18
Complete Package PS&E Revision Package Example

This Complete Package will be uploaded to FileNet and an email notification will be sent out using the PS&E Revision Submittal Template. This email notification will include an attachment of the revised sheets.

1-106.00 FILENET PROPERTIES

When a file is added to FileNet there are several properties associated with the project. It is essential that each project have the properties filled in correctly for each deliverable and that the properties do not vary on the same project. If there is a change on the project, such as the project description, it is essential that the previously added properties for the project description be edited to reflect the change.

1-106.01 LATITUDE AND LONGITUDE

The project latitude and longitude are among the properties required when adding a project to FileNet. See *Figure 1-19, Latitude and Longitude in FileNet Properties.* The latitude and longitude shall be taken at the midpoint of the mainline of the project within the R.O.W. project limits. If a project is split into 2 or more construction projects where each construction project is given a new PIN, the midpoint shall be taken from each of the construction projects. These numbers shall be added in FileNet for all deliverables up through the Construction submittal and shall not change for the life of the project unless the R.O.W. limits change significantly. Personnel may use Google Earth or other similar software to locate latitude and longitude. Latitude and Longitude coordinates shall be accurate to four decimal places and shown in decimal degrees.

For guidance on converting State Plane coordinates to Latitude and Longitude, see State Plane Coordinates to LatLong.pdf. This file is located under the Documentation section of the Standard Design CADD Files and Documents web page.

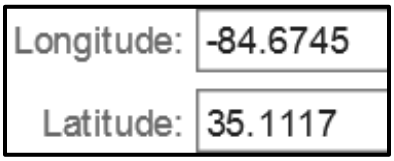


Figure 1-19
Latitude and Longitude in FileNet Properties

Note: The project latitude and longitude coordinates are also properties to be entered in the Estimated Quantities Excel file under the Project Data tab. *See Figure 1-20, Latitude and Longitude in Estimated Quantities Excel File.*

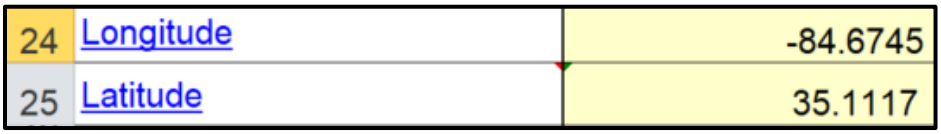


Figure 1-20
Latitude and Longitude in Estimated Quantities Excel File

1-106.02 PROJECT CONTRACT NUMBER

The Technical Lead shall assign “00” for the contract number in the file properties when adding a file to FileNet before the contract number is available. The contract number for a project is known one month prior to the Letting date and can be found on the Construction Division Website under Bid Lettings tab. Select the appropriate year Bid Lettings, then select the Letting for the appropriate month within that year. The contract numbers can be found under the “Notice to Contractors” link. Once the contract number is known, the Technical Lead shall update the contract number for all plans and associated files on FileNet for that project. Normally, this project number will not change unless the project is pushed out a Letting.

1-107.00 REMOVAL OF PLANS FROM FILENET

Once a project has been let to contract and awarded, the following files can be removed from FileNet:

- Line and Grade Package plans (**PDF & Zip**)
- All Estimates (**XLSM**)
- Public Meeting Plans (**PDF & Zip**)
- Incidentals (**PDF**)
- Field review plans (**PDF & Zip**)
- Permit sketches (**PDF**)

- Draft Traffic Control Plans (**PDF**)
- TMP (**PDF**)
- NPDES (**PDF**)
- Constructability Review (**PDF & Zip**)
- Plan-in-Hand Plans (**PDF & Zip**)
- PS&E Plans - EXCEPT for the most current (**PDF & Zip**)
- R.O.W. Revisions - EXCEPT for the most current (**Zip Only**)
- Letting Revisions - EXCEPT for the most current (**PDF & Zip**)
- Construction Revisions - EXCEPT for the most current (**PDF & Zip**)
- Quality Assurance Quality Control Documents

The most current project folder, **all** Functional Design PDFs, the most current ROW revision ZIP file, and the most current PS&E PDF and ZIP file shall remain on FileNet.

Five years after receipt of Notice of Completion from the Regional Operations Engineer and it is confirmed the project is closed, the project folder and the final Functional Design Plans and PS&E PDF and ZIP files can be removed. To confirm that a project can be removed from FileNet, verify in PDN that the project status is closed and it has been five years since receiving the Notice of Completion.

If plans are needed after removal, please contact the Roadway Plans Sales Section of the Engineering Project Development Division to obtain a PDF of the final construction plans including all revisions.

1-108.00 PROJECT NOTEBOOK

As discussed in the Requirements for Model Centric Design, projects using ORD need to have an associated **Project Notebook** to document the life cycle from design to construction. If a project is using MicroStation, a Project Notebook is not required. The Project Notebook summarizes the design decisions throughout all project phases, including design criteria, design exceptions, engineering assumptions, ORD versioning, and other impactful design information. This document will be utilized to review design accuracy, 3D model sufficiency, and serve as a project's official documentation throughout the lifespan of the project. As a result of this document servicing multiple functional purposes, it is important for the project team to communicate criteria, applied design decisions, and modeling information. It is also important for the reviewer at each stage and each capacity to understand their role when referencing the Project Notebook to complete their respective review.

Much of the information to be filled out in the Project Notebook will be completed by members of Roadway Design. Information provided to Roadway Design from other disciplines should be clearly communicated if it is expected that Roadway Design is responsible for filling out the entire document.

The Project Notebook is a project deliverable that is expected with the required project submittals. **The Project Notebook is required for all ORD projects and is expected to grow**

with each phase to document more details and decisions made as the project progresses into a more complete design. It is not expected to be filled out completely until final PS&E Plans are submitted or unless agreed upon by the TDOT PM. It will also be used in conjunction with the newly created ORD 3D Model Checklist during reviews.

SECTION 2 – PLANS PRODUCTION

1-200.00 QUALITY ASSURANCE-QUALITY CONTROL

The goal of the TDOT's Engineering Production Support Quality Assurance-Quality Control Section is to perform an independent review of the plans by personnel not involved with the development and design of the plans. This check is not intended to design the roadway and drainage components of the project. Quality Assurance measures are created to ensure that roadway Designers produce a quality set of plans that are complete, consistent across the state, and comply with federal and state policies. Designers and Design Managers should check plans to ensure that plans are accurate, constructible, cost effective and safe by conducting in-house checks and holding field reviews with other divisions within TDOT. It is essential that all TDOT Divisions review the plans and provide comments. **If a division is absent, the Project Manager shall contact the division to request comments.** The following sections have been created to provide guidance for plans development.

1-201.00 ROADWAY DESIGN CHECKLISTS

Roadway Design Checklists are provided for each stage of plan preparation to reduce errors and plan revisions and to standardize the preparation, format, and content of plans. Checklists for each submittal have been created to serve as a guide to ensure certain items are included on each sheet of the plans. These checklists shall be used by all Designers, Consultants, and any personnel checking plans. The Line and Grade, Functional Design Plans, Plan-in-Hand, PS&E and Resurfacing checklists are available on the Roadway Design Guidelines webpage in the Reference Document area.

It is recommended that the Technical Leads download each deliverable checklist for the current phase of the project as opposed to downloading all checklists for each phase at once. This will ensure the current checklist is downloaded. Prior to submitting plans for a field review, the checklist shall be completed for that particular stage of plans development. The Design Lead shall compile checklists from Technical Leads and submit the completed and signed checklist when distributing the Field Review Notification by email for each stage.

The Design Lead shall also refer to Roadway Design activities listed in the (PDN) to ensure that each plan set contains deliverables from other divisions. PDN is available from the Project Management website.

Note: Resurfacing Plans are treated differently than other projects. Refer to Chapter 5-502.00, Resurfacing Projects, for information regarding Resurfacing projects.

1-202.00 PREPARATION OF PLAN SHEETS

The TDOT Survey and Roadway Design Computer–Aided Drafting and Design Standards shall be followed by all divisions of TDOT, by Consultants, and by anyone conducting surveys or producing plans for TDOT projects. This document, CADDV8.pdf, can be found at the Standard Design CADD Files and Documents webpage in the Documentation section. The purpose of the CADD document is to ensure consistency in ORD files, correct file exchanges between outside entities and the Department as well as within the division, and that printed and archived files contain all necessary components and have the same appearance. Some of the most important information found in the CADD document is the following:

- OpenRoads Designer (ORD)
  - File naming convention
  - File extensions
  - Seed files
  - Color table
  - Area patterning
  - Text Size and Fonts
  - Level filters including correct level name, line weight, line style, and color
  - ***Level structure according to sheet
  - Office Templates for letters, 2nd sheets, and tabulated quantities
  - Plan and Profile Sheet Production
  - Cross Section Sheet Production
- Survey
  - Project Filenames
  - Data exchange between Survey and Roadway Design/Design personnel
  - Aerial Survey Files

* For each type of sheet (Present Layout, R.O.W. Details, Proposed Layout, Drainage Map, etc.), a Sheet Level Structure is set up in ORD to turn on and off levels pertaining to the sheet and reference files in the sheet. It is essential that each Technical Lead use the correct levels when placing data in design files that are referenced into the sheets so that the correct attributes are shown when plotting.

Note: Users shall **NOT** turn on levels that are not part of the Sheet Level Structure if requested to do so by another region or division. This negates the consistency of plans throughout the state.

1-202.01 SHEET BORDERS

Sheet borders are available in ORD with a level structure that ensures the correct area is printed and converted to PDF correctly for deliverables, printing, and archiving. Only TDOT approved sheet borders shall be used by all divisions within TDOT and all outside Consultants, utilities and others that are providing sheets to TDOT. To place a TDOT approved sheet border, refer to the ORD Fundamentals and Roadway Design I manuals on the ORD Training Material webpage for sheet creations.

To access the TDOT approved sheet borders in ORD, the user shall first download and run the TDOT configuration workspace zip file to the location that is shown in the download location path located on the ORD Resources webpage. Then, when opening an ORD file, set the WorkSpace to TDOT_Standards. *See Figure 1-21, TDOT_Standards WorkSpace.*

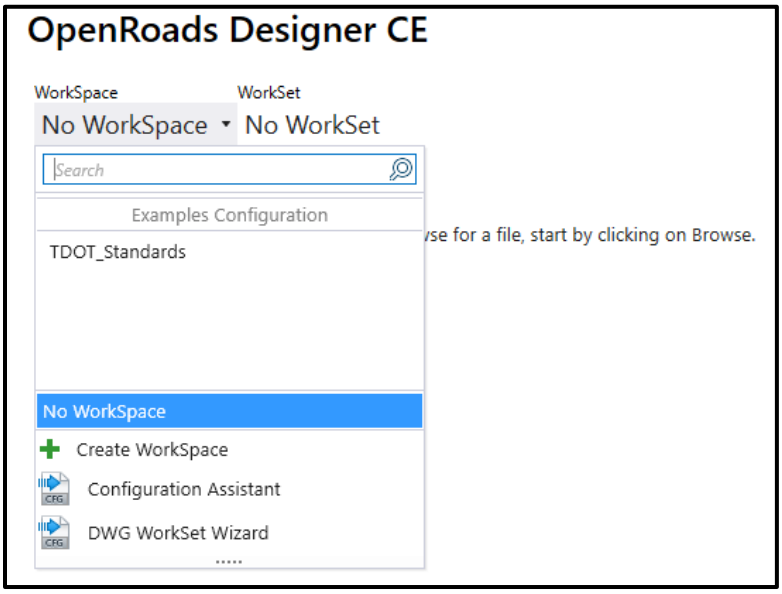


Figure 1-21
TDOT_Standards WorkSpace

Use the Place Named Boundary tool in ORD to begin inserting the correct borders for each type of sheet in the plan set. Here, you can select which type of sheet you want to place: Layout, Profile, or Cross Sections. Refer to the ORD Fundamentals and Roadway Design I manuals on the ORD Training Material webpage for creating and placing each type of sheet for a sheet series. Insert them with the appropriate scale set. See *Figures 1-22A, 1-22B and 1-22C for Sheet Type Creations*. Refer to Chapter 1-202.02 Sheet Scales for additional sheet scales options.

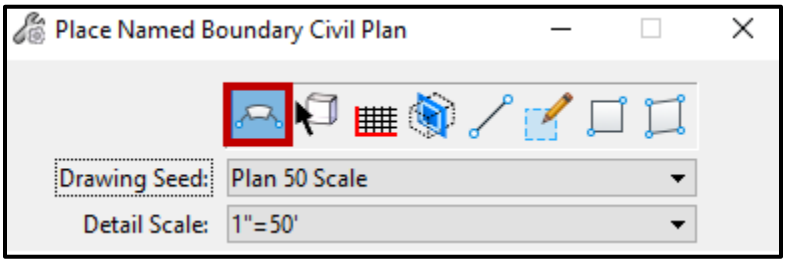


Figure 1-22A
Layout Sheet Creation

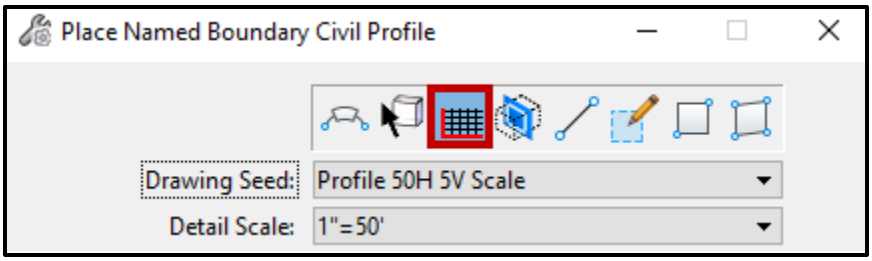


Figure 1-22B
Profile Sheet Creation

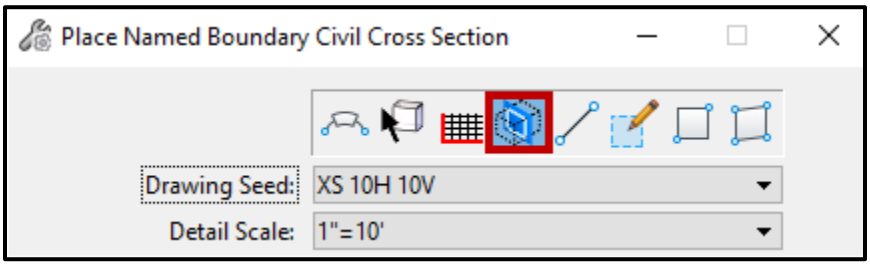


Figure 1-22C
Cross Sections Sheet Creation

1-202.02 SHEET SCALES

The sheet scale for all sheets is set by the seed file used to create that sheet.

- Seed2D or Seed3D yields an active scale of 1” = 50’. This is used for Present, R.O.W. Details, Proposed, Erosion Control, Traffic Control and other similar sheets.
- English General Notes, Special Notes, Estimated Quantities, and other similar sheets, and Index and Standard Drawings cells each yield an active scale of 1” = 1’.
- SeedXS yields an active scale of 1” = 10’.
- For title sheets see *Chapter 1-203.00 Development of Title Sheets.*
- Drainage Map and Property Map sheets should never use a scale smaller than 1” = 200’.

Some 2nd sheets like Ditch Details or Typical Section sheets are not drawn to scale but shall still use an approved sheet border with a 1" = 1' active scale.

1-202.03 SHEET TITLE BLOCK

For each sheet, there is a corresponding approved sheet title that is placed in the sheet title block. The sheet title block is in the lower right-hand corner of the sheet for all sheets except the Title sheet and Cross-Section sheets. These sheet titles are found by updating the Element Template to the applicable sheet title name and then using the Place Active Cell tool to place the sheet title. Some sheet titles will have station ranges and a scale that shall be filled in. The ranges shall be the same for all views of the same sheet, i.e. Present, R.O.W. Details, Proposed, Profile, EPSC, and Traffic Control. Sheet titles shall correspond with the index for each phase.

Cross section sheets do not have sheet title blocks. However, procedures shall be followed as outlined in the ORD Roadway Design 1 Manual for making and labeling cross section sheets. The name of the road shall appear in the lower right-hand corner as well as the beginning and ending station ranges for the sheet. The road name shall match the road name as it is defined on the present layout and typical section sheets. See *Figure 1-23, Cross-Section Sheet Example* for an example of the information shown on a cross-section sheet.

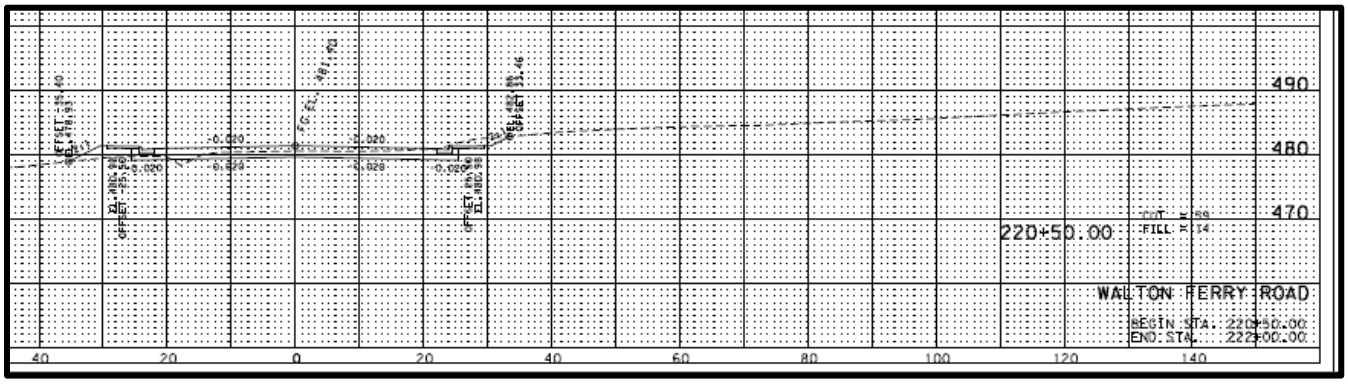


Figure 1-23
Cross-Section Sheet Example

1-202.04 ENGINEER'S SEAL BLOCK ON SHEETS

A square block outline for the engineer's seal is part of the sheet border which ensures each seal is placed at the correct size and location for all sheets. The square block outline is above the sheet border on plan sheets as shown in *Figure 1-24, Sheet Title Block, Engineer's Seal, and Coordinate Value* and above the Chief Engineer's and Commissioner's signatures on title sheets as shown in *Figure 1-27, Title Sheet Cell.* The seal will be left blank with the exception of sealing the title sheet and sealing appropriate sheets for submittal.

1-202.05 COORDINATE NOTATIONS ON SHEETS

Notation for the coordinate adjustment factors shall be on all roadway sheets except the title, index and standard drawings, project commitments, 2nd sheets (Estimated quantities, typical sections, details, notes, etc.), profiles, and cross sections sheets. This notation will be part of the sheet and the factor will need to be filled in. The coordinate adjustment factor is shown between the engineer's seal block and sheet title block. The notation shall read:

"Coordinates are NAD/83 (1995), are datum adjusted by the factor of 1.000XXX" and tied to the TGRN. All elevations are referenced to the NAVD 1988."

The "1995" refers to the year of the adjustment of coordinate values in Tennessee and 1.000XXX refers to the actual datum adjustment factor used for the project. These values are listed in the CADD survey file.

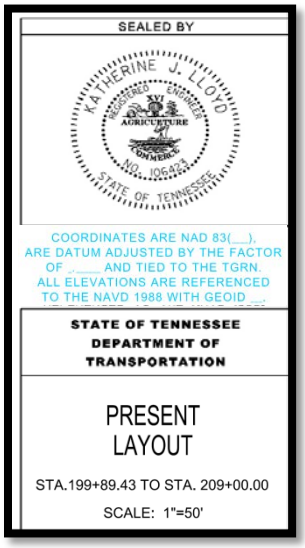


Figure 1-24
Sheet Title Block, Engineer's Seal, and Coordinate Value

1-202.06 PLAN PHASE STAMPS

For information requests (such as Initial Studies request, field reviews, etc.) and deliverables, a plan phase stamp identifying the appropriate stage of development shall be located on the right side above the engineer's seal block on the title sheet only. Plans for public hearings shall have plan phase stamps on every sheet except cross section sheets. A stamp is not required for Final Construction Plans at Turn-In. See *Figure 1-25, Plan Phase Stamps Examples.*

Stamps shall match the name of the FileNet deliverable as shown below:

Phase Stamp Name	Comments
LINE AND GRADE PACKAGE	1RD1
CAUTION – PRELIMINARY PLANS SUBJECT TO CHANGE	Use for design hearing or plans other than field review plans sent outside the Department
FUNCTIONAL DESIGN FIELD REVIEW	2PM5, 2RD1
FUNCTIONAL DESIGN FIELD REVIEW (UTILITIES ONLY)	No R.O.W. acquisition is required 2PM5, 2RD1
INFO ONLY	To be used on Estimated Quantities and Traffic Control sheets for information purposes only at Functional Design Field Review
FUNCTIONAL DESIGN PLANS	2RD1
FUNCTIONAL DESIGN PLANS (UTILITIES ONLY)	No R.O.W. acquisition is required 2RD1
PLAN-IN-HAND FIELD REVIEW	3PM2
PLAN-IN-HAND PLANS	3PM2
CONSTRUCTABILITY REVIEW	3PM2
PS&E FIELD REVIEW	4PM2
PS&E PLANS	4PM2, 4RD1
FINAL CONSTRUCTION PLANS – (INFO ONLY)	4RD1

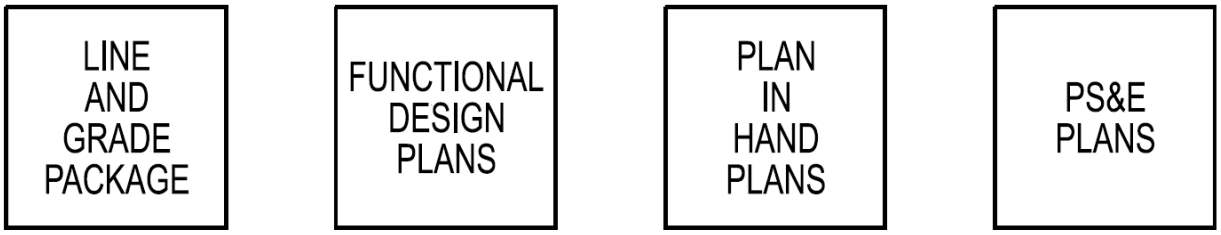


Figure 1-25
Plan Phase Stamps Examples

Guidance for placing stamps on PDF files can be found in the document Adding the Plan Phase Stamp Watermark to the PDF Plan Set.pdf located on the Standard Design CADD Files and Documents webpage.

Plan Phase stamps may be added to ORD DGN files as cells. These cells are found by selecting the applicable Element Template for the desired Plan Phase Stamp and then using the Place Active Cell tool to place the phase stamp on the plan sheet. See *Figure 1-26, Plan Phase Stamps ORD in Element Template*.

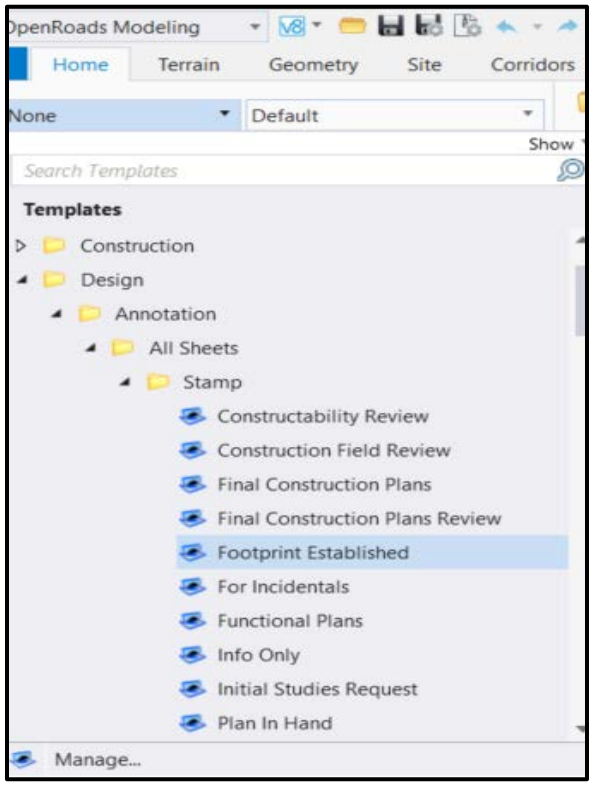


Figure 1-26
Plan Phase Stamps in ORD Element Template

1-203.00 DEVELOPMENT OF TITLE SHEETS

To ensure that all title sheets consistently have the same information, an all-inclusive title sheet has been created with embedded cells that are needed for all phases of the title sheet. For instructions on developing title sheets, users should follow Exercise 11.3 in the Fundamentals of ORD Manual that can be found on the ORD Training Material webpage.

Within ORD, a title sheet seed file is available that contains all necessary items for the development of Line and Grade, Functional Design, Plan-in Hand, and PS&E title sheets. If additional elements are needed for creation of the sheet, cells are available in ORD as Element Templates. The title sheet is created with fillable texts that can be modified but will maintain the correct text style and weight.

To access the TDOT specific element templates in ORD, the TDOT WorkSpace must be used when opening a file in ORD. See Chapter 1-202.01, Sheet Borders for additional information.

Line and Grade title sheets are developed and used for several initial studies requests such as Hydraulic Grade Approval, Environmental Boundaries and Technical Studies, Geotechnical Studies, Signals and Lighting analysis, Pavement Design Request, and Incidentals (Title Searches). The Functional Design, Plan-in-Hand, and PS&E title sheets have some

changes from the Line and Grade sheet; however, most components of the sheet are the same. Any that are different will be defined within the Functional, Plan-in-Hand, and PS&E Title Sheet Sections. *Figure 1-27, Title Sheet Cell* enumerates various sections of a title sheet cell.

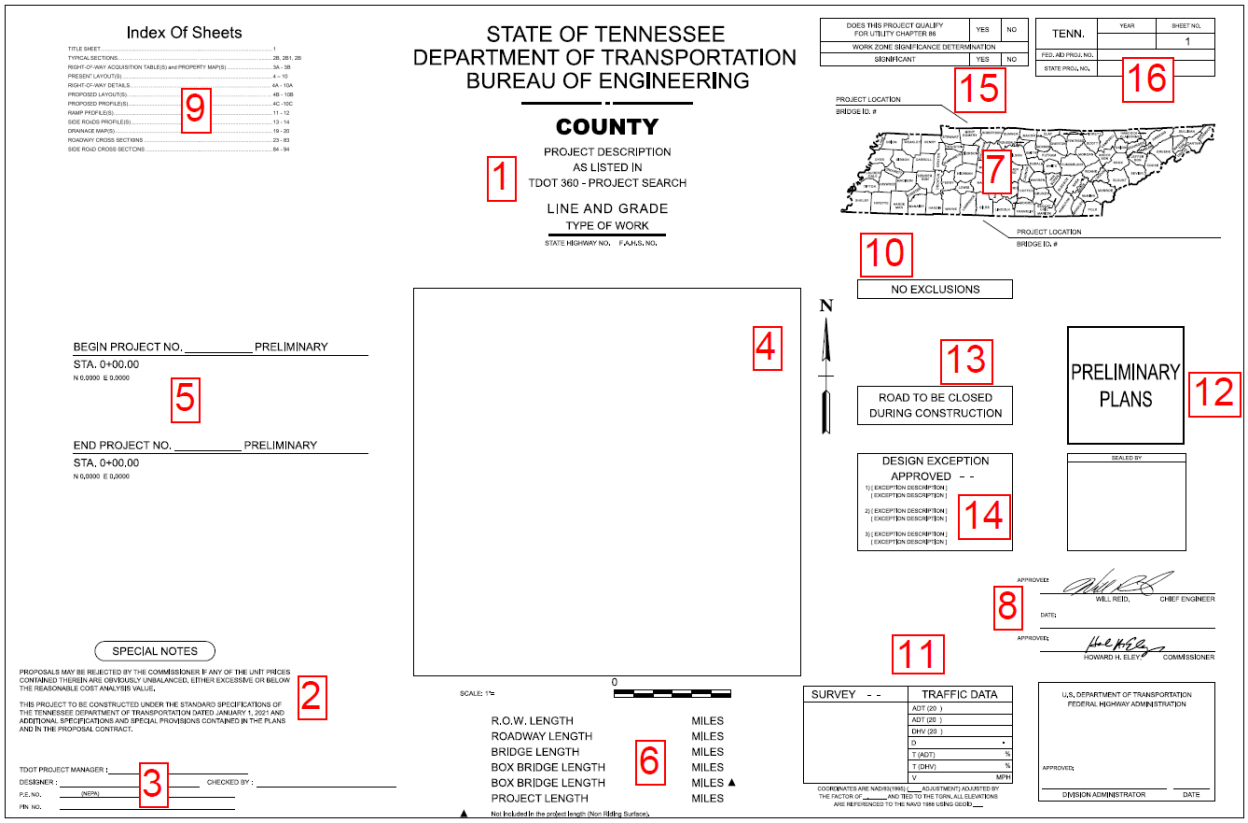


Figure 1-27
Title Sheet Cell

1	Project Description
2	Special Notes
3	Project, Designer, and Manager Identification
4	Map, Map Scale, and North Arrow
5	Project Limits
6	Project Lengths
7	Project Location and Bridge ID Number
8	Chief Engineer Signature, Commissioner Signature and Engineer's Seal Block

9	Preliminary Index of Sheets
10	Exclusions or No Exclusions
11	Traffic Data and Survey Data
12	Plan Phase Stamps
13	Road Closed During Construction
14	Design Exception Approval Dates
15	Chapter 86 Eligibility for Utilities and Work Zone Significance Determination
16	Identification Block

1-203.01 PROJECT DESCRIPTION

Project descriptions on the title sheet shall match descriptions as they are shown in TDOT 360 – Project Search application:

- County(s)
- State route number (if a State route), U.S. route number (if a U.S. route), or Local road name with Project Limits (from and to)
- Type of project
- Type of work
- State Highway number (if applicable)
- US Route number (if applicable)

The type of work being done shall be listed in the project description on the title sheet. The type of work shall correspond with what is shown in TDOT 360-Project Search application (Example: Bridge replacement, Widening, Resurfacing, etc.) For those that need further explanation on the type of work, additional information can be added (Example: Widening including pave, drain, bridge, lighting, signals).

Typical project descriptions for different roadway types are shown in *Figures 1-28* through *1-30.*



Figure 1-28
Interstate Project Description Example

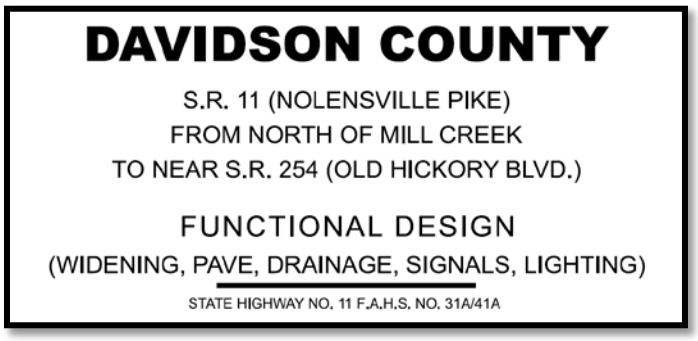


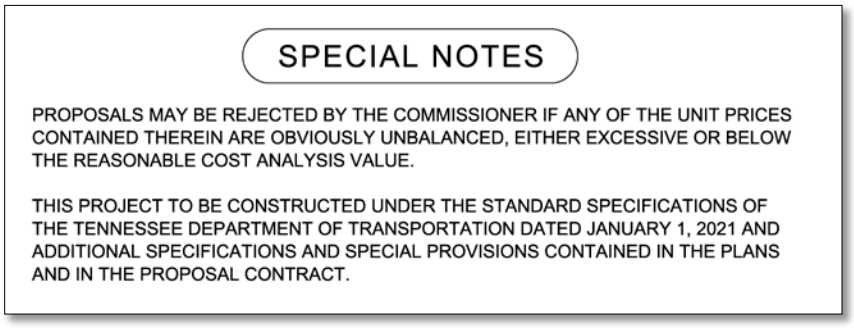
Figure 1-29
State Route Project Description Example



Figure 1-30
Local Road Project Description Example

1-203.02 SPECIAL NOTES

The Special Notes shown on the lower left hand corner of the project title sheet shall always be checked with current Roadway Design Guidelines and Instructional Bulletins to ensure that there is no change. It could be that the note changes between Line and Grade, Functional Design, Plan-in-Hand, and PS&E stages; thus, not allowing the Designer to copy and revise an existing title sheet but requiring a new title sheet. The current special note shall read as follows:


SPECIAL NOTES

PROPOSALS MAY BE REJECTED BY THE COMMISSIONER IF ANY OF THE UNIT PRICES CONTAINED THEREIN ARE OBVIOUSLY UNBALANCED, EITHER EXCESSIVE OR BELOW THE REASONABLE COST ANALYSIS VALUE.

THIS PROJECT TO BE CONSTRUCTED UNDER THE STANDARD SPECIFICATIONS OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION DATED JANUARY 1, 2021 AND ADDITIONAL SPECIFICATIONS AND SPECIAL PROVISIONS CONTAINED IN THE PLANS AND IN THE PROPOSAL CONTRACT.

Figure 1-31
Title Sheet Special Notes

1-203.03 PROJECT, DESIGNER, AND MANAGER IDENTIFICATION

On the lower left-hand corner of the title sheet, there are fillable options for the names of those involved in the project and for project information. For a TDOT-designed project, the TDOT Project Manager, Designer, and Checker shall be entered. For a Consultant-designed project, the appropriate TDOT Project Manager Title shall be added along with the Consultant firm, Designer, and Checker. The Preliminary Engineering NEPA (PE-N) number should be shown in the P.E. NO. field for plan submittals prior to R.O.W. or for Utilities Only. The Project Identification Number (PIN) shall also be entered.

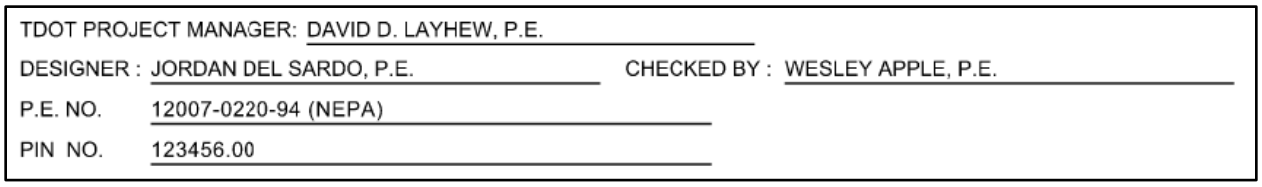

TDOT PROJECT MANAGER: DAVID D. LAYHEW, P.E.
DESIGNER : JORDAN DEL SARDO, P.E. CHECKED BY : WESLEY APPLE, P.E.
P.E. NO. 12007-0220-94 (NEPA)
PIN NO. 123456.00

Figure 1-32A
TDOT Designed Project

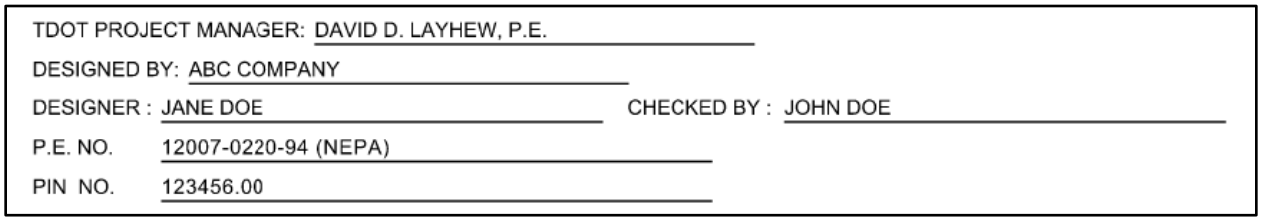

TDOT PROJECT MANAGER: DAVID D. LAYHEW, P.E.
DESIGNED BY: ABC COMPANY
DESIGNER : JANE DOE CHECKED BY : JOHN DOE
P.E. NO. 12007-0220-94 (NEPA)
PIN NO. 123456.00

Figure 1-32B
Consultant Designed Project

1-203.04 MAP, MAP SCALE, AND NORTH ARROW

A location map for the project showing the route to be improved, local roads, streams, railroads and towns shall be placed on the title sheet. Routes to major cities shall be labeled. See *Figure 1-27, Title Sheet Cell*.

The map scale shall be 1" = 2640' (1/2 mile) scale for projects less than 2 miles and 1" = 5280' (1 mile) scale for projects over 2 miles. The map scale shall be placed below the map. The North arrow shall be shown beside the map. See *Figure 1-33, Map, Map Scale, North Arrow, and Project Limits Example.*

1-203.05 PROJECT LIMITS

The begin/end project limits shall be noted with federal and/or state project number, corresponding project phase (Prelim., R.O.W. or Const.), stations, and northing and easting coordinates labeled to 4 decimal places. If the project has both federal and state project number, then both federal and state projects numbers will be included in the begin/end project limits labels. On Interstate plans, both Interstate log miles (based on Interstate mileposts) and stations will be required when designating the beginning and ending points on all projects. See *Figure 1-33, Map, Map Scale, North Arrow, and Project Limits Example* for an interstate example. Preliminary stations represent the begin/end R.O.W. limits. If no R.O.W. is acquired, then use the Begin/End construction limits.

On state highway plans, such as resurfacing projects, when using log miles to designate the beginning and ending points on projects, county log miles (mile posts) are to be used. The correct log miles as shown in the Project Online description shall be referenced.

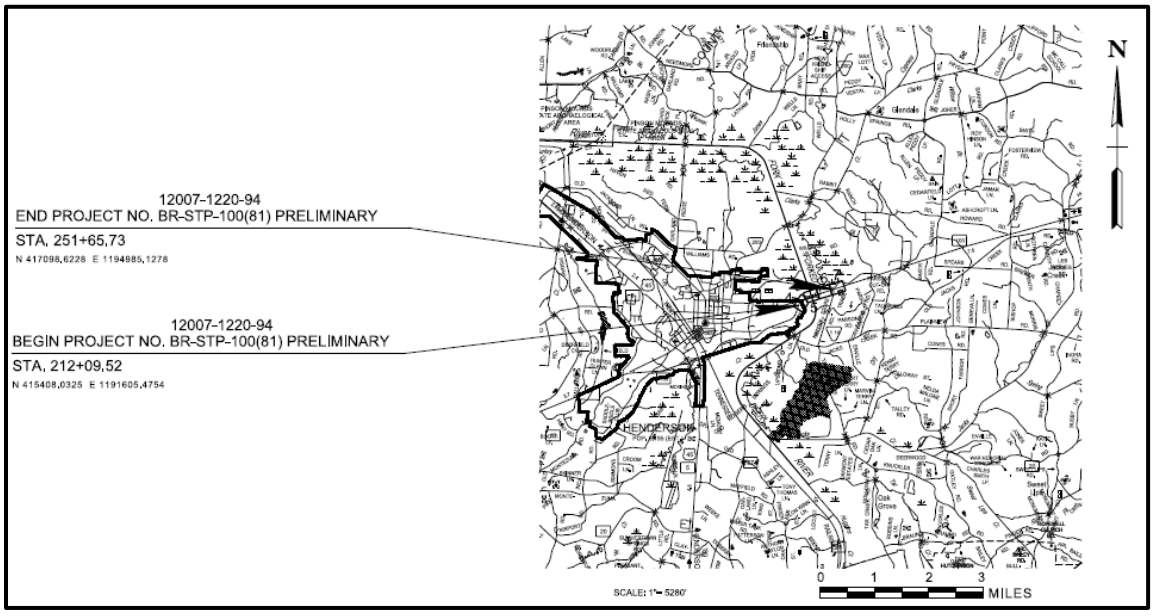


Figure 1-33
Map, Map Scale, North Arrow, and Project Limits Example

A rectangle representing each sheet border in the present layout series and its corresponding sheet number shall be placed along the mainline alignment within the title sheet map as shown in *Figure 1-34, Sheet Borders and Numbering on Map Example*.

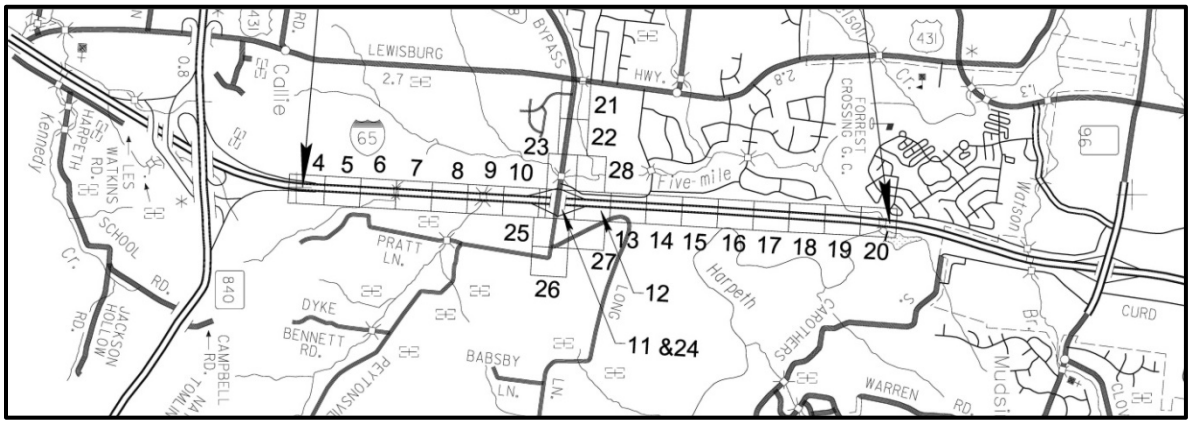


Figure 1-34
Sheet Borders and Numbering on Map Example

1-203.06 PROJECT LENGTHS

For all plan phases, the R.O.W. Length, Roadway Length, Bridge Length, Box Bridge Length, and Project Length shall be shown below the map and shall be noted to the 1000th of a mile and shown as X.XXX. These lengths shall be truncated at the third decimal. The R.O.W. Length is the length along the centerline between the beginning and ending R.O.W. flags. If the project is a Utilities Only project with no R.O.W. acquisition, use 0.000 as the R.O.W. length. The project length is the sum of the lengths for Roadway, Bridge, and Box Bridge and does not include the R.O.W. length. The project length shall be changed to include structure lengths (bridge and/or box bridge) if applicable. If box bridges serve as a riding surface for vehicles, that length shall be added together in the same manner as roadway and regular bridge length for a total project length. If the box bridge does not serve as a riding surface, the box bridge length will not be added in with the others, and a footnote to the Box Bridge Length shall be added below the Project Length to say “Not Included in the Project Length”. *See Figure 1-35, Project Length.* If information is unknown for early submittals, such as Initial Studies Request, leave the lengths blank.

R.O.W. LENGTH	__.__ MILES
ROADWAY LENGTH	__.__ MILES
BRIDGE LENGTH	__.__ MILES
BOX BRIDGE LENGTH	__.__ MILES
BOX BRIDGE LENGTH	__.__ MILES ▲
PROJECT LENGTH	__.__ MILES

▲ Not included in the project length (Non Riding Surface)

Figure 1-35
Project Length

1-203.07 PROJECT LOCATION AND BRIDGE ID NUMBER

The Project Location shall be identified for the county(s) on the state map located in the upper right corner of the title sheet cell.

The Bridge I.D. number(s), if applicable, for all existing bridges within the project limits (either on the mainline, side road or overpassing the project) shall be added under the Project Location as shown in *Figure 1-36, Project Location and Bridge I.D. Number*. Two options are shown in Figure 1-36 for single or multiple bridges. The Federal Bridge I.D. numbers can be found in the Concept Report, queried on state routes, interstates and many major local roads in ETRIMS, and found in TDOT 360 - Project Search application. If a project has a bridge and the bridge I.D. number cannot be found in any of these locations, the Designer shall request the information from the Regional Survey Office.

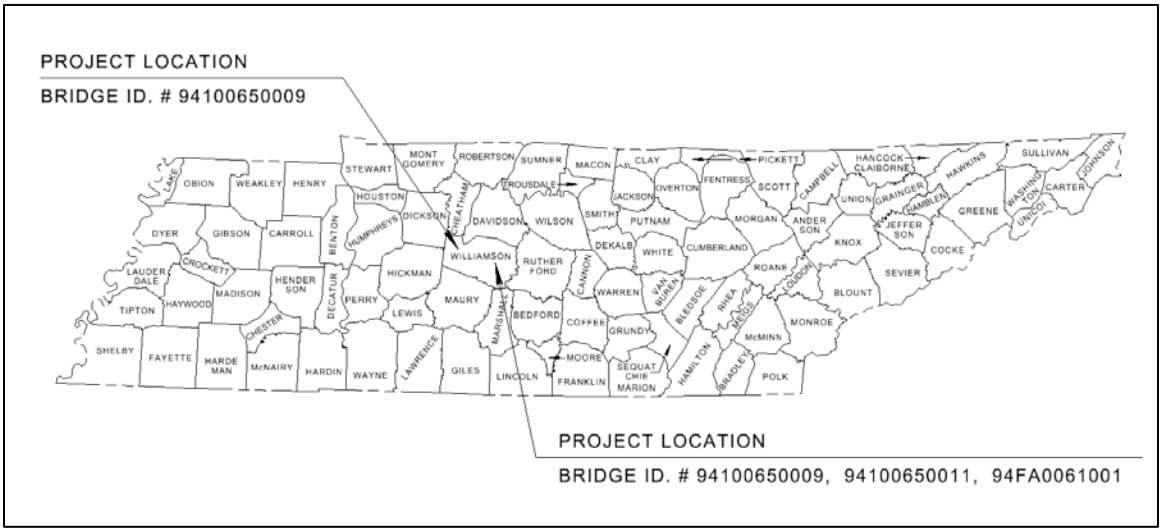


Figure 1-36
Project Location and Bridge I.D. Number

1-203.08 CHIEF ENGINEER AND COMMISSIONER SIGNATURES AND ENGINEER'S SEAL BLOCK

The current Chief Engineer and Commissioner signatures can be added to the title sheet by utilizing the scanned images available as ORD cells. Select the correct element template (Design >> Annotation >> Title Sheet >> Project Length) in the Attributes tab and then place the active cell. See *Figure 1-37, Chief Engineer and Commissioner Signatures.* A square block for the professional engineer's seal is located above the signature block. The engineer's seal is not added at the Line and Grade phase of plans development.

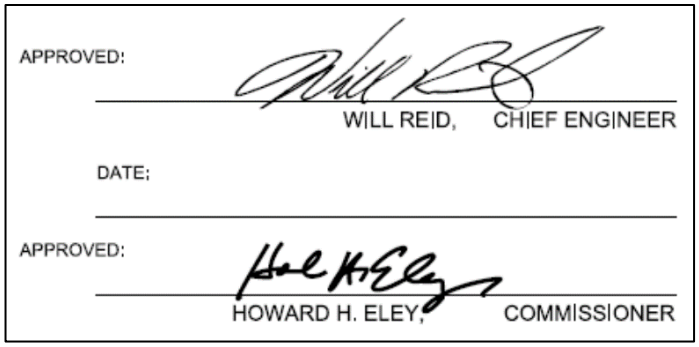


Figure 1-37
Chief Engineer and Commissioner Signatures

1-203.09 EXCLUSIONS OR NO EXCLUSIONS

If there are no portions of the roadway that are excluded from the proposed project, this shall be noted on the title sheet as "NO EXCLUSIONS" as shown in *Figure 1-38, No Exclusions*.



Figure 1-38
No Exclusions

If there is a portion of the roadway within the limits of the project that will not be improved or resurfaced, the following cell shall be placed on the title sheet and appropriate station ranges and lengths between the ranges shall be filled in as shown in *Figure 1-39, Exclusion Block.*

EXCLUSIONS	
STATION TO STATION	LENGTH (FT.)
-	.
-	.
-	.
TOTAL=	.

Figure 1-39
Exclusion Block

1-203.10 TRAFFIC DATA AND SURVEY DATA BLOCK

The cell for the Traffic Data Block is shown in *Figure 1-40, Traffic Data and Survey Data Block*. The first line shows Average Daily Traffic (ADT) data for the current year. The second and third lines show ADT data and Design Hourly Volume (DHV) data for the design year, which is 20 years from the current year. The other entries are Directional Volume (D), Truck ADT's, Truck DHV, and Design Speed (V). Information for this block can be found in the original Concept Report.

The traffic data block shall be updated at specific times throughout the project. See *Chapter 4-200.00, Traffic Report Request,* for information on obtaining updated traffic data.

The date of the original survey and the date of each survey update shall be listed beside the traffic data block on the current title sheet. Format shall be MM-DD-YY as shown in *Figure 1-40, Traffic Data and Survey Data Block*. For information on updating the survey, see *Chapter 1-305.00, Updating Surveys*.

The geoid model shall be listed on each title sheet as shown in *Figure 1-40, Traffic Data and Survey Data Block*. The geoid model and datum adjustment factor is found in the CADD survey file. The following note shall be added to all title sheets: "COORDINATES ARE NAD 83(INSERT YEAR), ARE DATUM ADJUSTED BY THE FACTOR OF X.XXXXXX AND TIED TO THE TGRN. ALL ELEVATIONS ARE REFERENCED TO THE NAVD 1988 WITH GEOID (INSERT MODEL)".

SURVEY 02-26-12	TRAFFIC DATA	
04-29-13 UPDATED	ADT (2018)	68160
06-09-14 UPDATED	ADT (2038)	104750
02-28-16 UPDATED	DHV (2038)	9666
09-27-17 UPDATED	D	65 - 35
	T (ADT)	17 %
	T (DHV)	11 %
	V	70 MPH

COORDINATES ARE NAD 83(1995), ARE DATUM ADJUSTED BY THE FACTOR OF 1.000084 AND TIED TO THE TGRN. ALL ELEVATIONS ARE REFERENCED TO THE NAVD 1988 WITH GEOID 12B.

Figure 1-40
Traffic Data and Survey Data Block

1-203.11 PLAN PHASE STAMPS

See *Chapter 1-202.06, Plan Phase Stamps*, for more details on the appropriate plan phase stamp to use. For placement of the phase stamp, see *Figure 1-27, Title Sheet Cell*.

1-203.12 ROAD CLOSED DURING CONSTRUCTION

For some projects, the road may be closed during construction. Usually, this is noted in the Concept Report by a letter from the local governments agreeing that the road shall be closed during construction. The Concept Report should also indicate whether the local government or TDOT is responsible for signing the detour route. If the road is going to be closed during construction, this should be noted on the Line and Grade, Functional Design, Plan-in-Hand, and PS&E title sheet as shown in *Figure 1-41, Road Closed During Construction*.

ROAD TO BE CLOSED
DURING CONSTRUCTION

Figure 1-41
Road Closed During Construction

1-203.13 DESIGN EXCEPTION APPROVAL DATES

Approved design exceptions shall be noted with approval date above the Traffic Data Block on the title sheet as shown in *Figure 1-42, Design Exception Block Examples*. For additional guidance regarding design exception request, please see *Chapter 2-105.00, Design Exception Requests*.

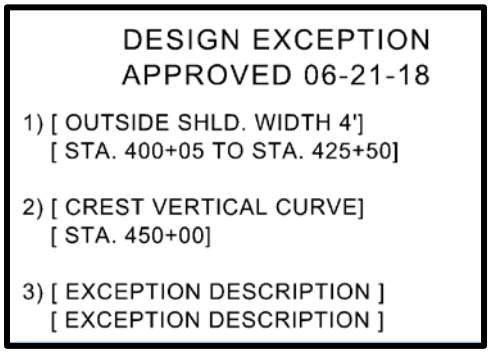


Figure 1-42
Design Exception Block Examples

1-203.14 CHAPTER 86 ELIGIBILITY FOR UTILITIES

Departmental Policy for Utility Relocations from Public Highway Rights-of-Way Under TCA §54-5-804, Number 340-07 applies to highway construction projects administered by TDOT that require the relocation of utility facilities located on public highway rights-of-way. A project will qualify for utility relocation reimbursement or for inclusion in the Department's highway construction contract if the utility meets the following conditions:

- Grade and Drainage projects with R.O.W. acquisition; and
- Bridge Replacement projects on the State highway system.

Non-qualifying projects are not considered as qualified for inclusion in Chapter 86, even if the utility is an Eligible Utility, in the following types of projects:

- Local Interstate Connectors (LIC)
- Resurfacing projects (State or Federal-aid funded)
- State Industrial Access (SIA) highways
- Minor intersection improvement projects with no R.O.W. acquired
- Bridge repair projects
- Safety funded projects
- Maintenance projects
- Signal installation projects
- Minor projects that have limited project funding available
- BRZE off-system bridges

- Any project that does not allow at least nine (9) months to process the project for Chapter 86 between the scheduled letting date for the construction contract and the date on which the project plans are sent to the utility as provided in TCA § 54-5-854.

The Project Manager/Design Lead shall discuss the project with appropriate Regional Utility Manager to verify if the project is eligible for Chapter 86 funds and shall mark the appropriate check box on the title sheet as shown in *Figure 1-43, Chapter 86 Eligibility for Utilities*.

DOES THIS PROJECT QUALIFY FOR UTILITY CHAPTER 86	YES _	NO _

Figure 1-43
Chapter 86 Eligibility for Utilities

1-203.15 WORK ZONE SIGNIFICANCE DETERMINATION

It is Departmental policy to plan, design, construct, maintain, and operate safe and efficient work zones. Consideration and management of work zone impacts begin at project inception, continue through all phases of design and construction, and are reflected through the Work Zone Safety and Mobility Process that address all aspects of work zone safety and mobility. A Significant Project is 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. See the Work Zone Safety & Mobility Manual for guidance on significance determination and additional information. For information regarding the functional classification for your project, see the Functional Classification maps.

The Technical Lead shall mark the appropriate check box to indicate the project's significance determination. This should also be included on Resurfacing title sheets. *See Figure 1-44, Work Zone Determination.*

WORK ZONE SIGNIFICANCE DETERMINATION		
SIGNIFICANT	YES	NO

Figure 1-44
Work Zone Determination

1-204.00 FUNCTIONAL DESIGN TITLE SHEET

To modify the Line and Grade Title sheet to a Functional Design title sheet, the Line and Grade levels can be turned off and Functional Design levels turned on as described in the Title Sheet Preset Filters Tutorial document located on the Standard Design CADD Files and Documents webpage in the Documentation section. See *Chapter 1-203.00, Development of Title*

Sheets. The Project Identification Number shall change from PE-N to PE-D. The Preliminary Engineering Design (PE-D) number shall be shown in the lower left-hand corner of the title sheet for Functional Design plan submittals, Utilities Only submittals, and for any subsequent plan submittals. The type of preliminary engineering number shall be specified on the title sheet adjacent to the P.E. project number and shown in parentheses as "Design". See *Figure 1-45A, PE-N Project Number* and *Figure 1-45B, PE-D Project Number*.

NOTE: The type of work shall be verified to reflect any changes in scope of project.

TDOT PROJECT MANAGER: DAVID D. LAYHEW, P.E.
DESIGNER : JORDAN DEL SARDO, P.E. CHECKED BY : WESLEY APPLE, P.E.
P.E. NO. 12007-0220-94 (NEPA)
PIN NO. 123456.00

Figure 1-45A
PE-N Project Number

TDOT PROJECT MANAGER: DAVID D. LAYHEW, P.E.
DESIGNER : JORDAN DEL SARDO, P.E. CHECKED BY : WESLEY APPLE, P.E.
P.E. NO. 12007-1220-94 (DESIGN)
PIN NO. 123456.00

Figure 1-45B
PE-D Project Number

The type of project will change from the Line and Grade Stage to Functional in the project description when the correct Functional levels are active. *See Figure 1-46, Project Description – Type of Project Change.* The project limits will change the type of project from Prelim. to R.O.W. when the Functional levels are active. See *Figure 1-47, Project Limits – Type of Project and State Federal Aid Number Change.* The state federal aid number shall be changed in the begin/end project limits labels to correspond with the R.O.W. funding phase. *See Chapter 1-203.05, Project Limits*. Additional sheets shall be added to the index. *See Chapter 1-204.01, Functional Design Index of Sheets.*

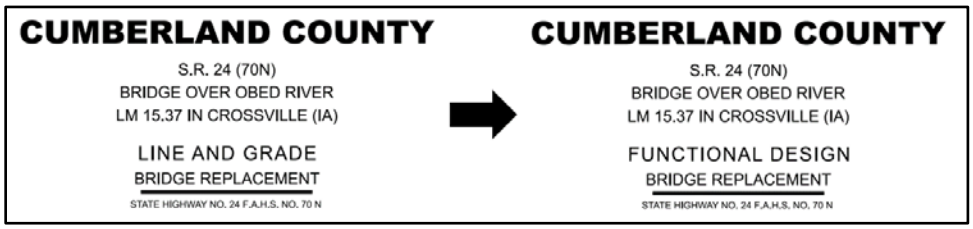


Figure 1-46
Project Description -Type of Project Change

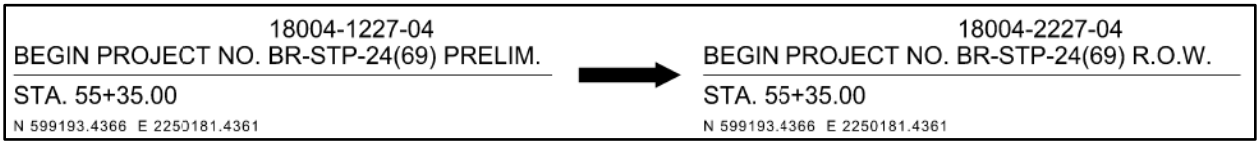


Figure 1-47
Project Limits - Type of Project and State Federal Aid Number Change

If a project is submitted for "Utilities Only", it shall be marked on the title sheet with a project phase stamp. See *Figure 1-48, Functional Design Plans (Utilities Only) Phase Stamp.*



Figure 1-48
Functional Design Plans (Utilities Only) Phase Stamp

1-204.01 FUNCTIONAL DESIGN INDEX OF SHEETS

The Index of Sheets is shown on the Functional Design title sheet in the upper left-hand corner. *Figure 1-49, Functional Design Index of Sheets Example* is an example functional design index containing the names of all sheets that could be part of the Functional Design plan set. The order and types of sheets shown shall be used by all Technical Leads. Technical Lead should refer to the Functional Design checklist, Functional Design Index Word document, and blue instructional text in the ORD title sheet seed file for additional information regarding sheet numbering. There could be sheets that are not used depending on the scope of the project. The number of sheets in a series may vary depending on the size of the project. Any sheets not used shall be removed from the list, but the order of the remaining sheets shall be maintained as shown. With the removal or addition of sheets, some sheets will have to be renumbered; however, there are sheets that shall always be represented by certain numbers. Sheet 3 shall always be the R.O.W. notes, Utility notes, and Utility Owners. Sheet 3A shall always show the R.O.W. Acquisition Table. Sheet 4 shall always be the first present layout sheet. There shall not be a combined Present Layout/R.O.W. Detail sheet, and plans shall always have a R.O.W. acquisition table. These sheets shall be separate sheets for legibility reasons and to reduce the amount of time the Designer spends moving text to make it legible. The only exception shall be if a project is turned in for "Utilities Only." In this situation, the Designer shall determine if the plans are too cluttered to have a combined Present Layout/R.O.W. Detail sheet.

As plans progress, there will be additional sheets added for the Plan-in-Hand phase that were not in the Functional Design submittal. **When plans are turned in for Plan-in-Hand, the original Functional Design sheet numbers shall remain as they were when turned in for Functional Design and shall not be altered to match Plan-in-Hand sheet numbers.**

Other Divisions that are developing their own sheets to add to the plan set should follow the naming convention shown in *Figure 1-49, Functional Design Index of Sheets Example*. The first sheet of their series, *-1, should contain an index for the rest of the sheets in that series.

FUNCTIONAL DESIGN PLANS INDEX OF SHEETS

TITLE SHEET	1
PROJECT COMMITMENTS	1B
TYPICAL SECTIONS AND PAVEMENT SCHEDULE	2B, 2B1, 2B2
ENVIRONMENTAL NOTES	2E, 2E1
RIGHT-OF-WAY NOTES, UTILITY NOTES, AND UTILITY OWNERS	3
RIGHT-OF-WAY ACQUISITION TABLE AND PROPERTY MAPS (S)	3A - 3B
PRESENT LAYOUT(S)	4 - 10
RIGHT-OF-WAY DETAILS	4A - 10A
PROPOSED LAYOUT(S)	4B - 10B
PROPOSED PROFILE(S)	4C -10C
RAMP PROFILE(S)	11 - 12
① SIDE ROADS PROFILE(S)	13 - 14
PRIVATE DRIVE, BUSINESS, AND FIELD ENTRANCE PROFILE(S)	15 - 18
DRAINAGE MAP(S)	19 - 20
CULVERT SECTION(S)	21 - 22
EROSION PREVENTION AND SEDIMENT CONTROL PLANS	23, 24, 25 – 27Z
ROADWAY CROSS SECTIONS	29 –81
SIDE ROAD CROSS SECTIONS	82 – 92
BRIDGE PLANS	B-1
ITS PLANS	ITS-1
LIGHTING PLANS	L-1
NATURAL STREAM DESIGN PLANS	NS-1
RETAINING WALL PLANS	R-1
SIGNAL PLANS	SIG-1

Figure 1-49
Functional Design Index of Sheets Example

The sheet numbers for Line and Grade shall not be changed to match the Functional sheet numbers but will remain on line 1 of the sheet identification block. The Functional Design phase, project year, project number, and sheet number shall be entered in line 2 of the identification block. The PROJECT NO. field should contain the federal project number. If no federal number is available, then the state project number shall be used. See *Figure 1-50, Functional Design Project Identification Block.*

TYPE	YEAR	PROJECT NO.	SHEET NO.
L&G	2024	BR-STP-24(69)	8
FUNC.	2025	BR-STP-24(69)	8

Figure 1-50
Functional Design Project Identification Block

1-204.02 SEALING THE FUNCTIONAL DESIGN TITLE SHEET

When a plan set is submitted for Functional Design R.O.W. Appraisals or for Utilities Only, only the Functional Design title sheet shall be sealed by the appropriate TDOT staff or the Consultant. The remainder of the sheets in the Functional Design plans shall not be sealed. TDOT approved sealing mechanisms shall be used to seal the title sheet. The seal block outline on the title sheet is located above the Chief Engineer's and Commissioner's signatures as shown in *Figure 1-51, Engineer's Seal on Functional Design Title Sheet.*

When turning in a plan set for PS&E, the original Functional Design title sheet shall be included in the submittal. It is recommended that when sealing the plans for Functional Design, or Utilities Only, an individual title sheet be sealed for future inclusion in PS&E Roadway plans submittal. The individual Functional Design title sheet shall be named ***nnnnnn-nn-*FunctionalDesignTitleSheet.pdf**.

The Department is utilizing Adobe Certified Document Services (CDS) for PDF documents. Vendors supplying the CDS certificates can be found on Adobe's website at www.adobe.com/security/partners_cds.html. Any of the companies listed can be used to purchase a token. A certification is to be specific to a single professional engineer utilizing the desktop-based document certification process and may not be done on a companywide basis. The professional engineer shall not allow anyone else to use the certification on his/her behalf.

Refer to the document Digital Signature Certification Workflow located on the Standard Design CADD Files and Documents webpage for information in applying a digital signature to a plan set.



Figure 1-51
Engineer's Seal on Functional Design Title Sheet

1-205.00 PLAN-IN-HAND TITLE SHEET

To modify the Functional title sheet to a Plan-in-Hand title sheet, the Functional levels can be turned off and Plan-in-Hand levels turned on as described in the Title Sheet Preset Filters Tutorial document located on the Standard Design CADD Files and Documents webpage in the Documentation section. See *Chapter 1-203.00, Development of Title Sheets*. Also, the type of project will change from Functional to Plan-in-Hand in the project description when the correct Plan-in-Hand levels are active. *See Figure 1-52, Project Description-Type of Project Change.* The project limits will change the type of project from R.O.W. to Const. when the Plan-in-Hand levels are active. See *Figure 1-53, Project Limits - Type of Project and State Federal Aid Number Change.* The state federal aid number shall be changed in the begin/end project limits labels to correspond with the Construction funding phase. *See Chapter 1-203.05, Project Limits*. Additional sheets shall be added to the index. *See Chapter 1-205.01 Plan-in-Hand Index of Sheets.*

NOTE: The type of work shall be verified to reflect any changes in scope of project.

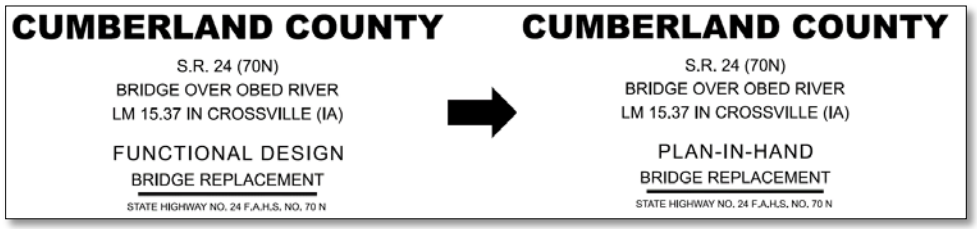


Figure 1-52
Project Description-Type of Project Change



Figure 1-53
Project Limits - Type of Project and State Federal Aid Number Change

1-205.01 PLAN-IN-HAND INDEX OF SHEETS

The Index of Sheets for Plan-in-Hand plans is not shown on the title sheet as it is in the Line and Grade and Functional Design plans. Designers shall place a note in the upper left corner of the title sheet which says, “See Sht. 1A for Index”. The index is combined with the Roadway Standard Drawings and immediately follows the Plan-in-Hand title sheet in the plans. *Figure 1-54, Plan-in-Hand Index of Sheets Example* shows an example Plan-In-Hand Index containing the names of all sheets that could be part of the Plan-in-Hand plan set. The Plan-in-Hand index lists all the sheets submitted in the Functional Design plans plus additional sheets in the 2nd sheets series as well as other sheets such as traffic control. Technical Leads should refer to the Plan-in-Hand checklist, Plan-in-Hand Index Word document, and blue instructional text in the ORD title sheet seed file for additional information regarding sheet numbering. As with the Line and Grade and Functional Design index, the order and types of sheets shown shall be followed by all Technical Leads. There could be sheets that are not used depending on the scope of the project. The number of sheets in a series could vary depending on the size of the project. Any sheets not used shall be removed from the list but the order of the remaining sheets shall be maintained as shown. With the removal or addition of sheets, some sheets may have different numbers than were shown in the Functional design plans; however, there are sheets that shall always be represented by certain numbers. Sheet 3 shall always be the R.O.W. notes, Utility notes, and Utility Owners. Sheet 3A shall always show the R.O.W. Acquisition Table. Sheet 4 shall always be the first present layout sheet.

Other Divisions that are developing their own sheets to add to the plan set should follow the naming convention shown in *Figure 1-54, Plan-in-Hand Index of Sheets Example*. The first sheet of their series, *-1, should contain an index for the rest of the sheets in that series.

PLAN-IN-HAND INDEX OF SHEETS

TITLE SHEET	1
ROADWAY INDEX AND STANDARD ROADWAY DRAWINGS	1A
STANDARD ROADAY DRAWINGS	1A1, 1A2
STANDARD STRUCTURE AND TRAFFIC OPERATIONS DRAWINGS	1A3
PROJECT COMMITMENTS	1B
ESTIMATED ROADWAY QUANTITIES	2, 2-1, 2-2
ESTIMATED BOX BRIDGE QUANTITIES	2A, 2A1
TYPICAL SECTIONS AND PAVEMENT SCHEDULE	2B, 2B1, 2B2
GENERAL NOTES	2C, 2C1
SPECIAL NOTES	2D, 2D1
ENVIRONMENTAL NOTES	2E, 2E1
TABULATED QUANTITIES	2F, 2F1, 2F2
DETAIL SHEETS	2G, 2G1, 2G2
RIGHT-OF-WAY NOTES, UTILITY NOTES, AND UTILITY OWNERS	3
RIGHT-OF-WAY ACQUISITION TABLE AND PROPERTY MAPS(S)	3A - 3B
PRESENT LAYOUT(S)	4 - 10
RIGHT-OF-WAY DETAILS	4A - 10A
PROPOSED LAYOUT(S)	4B - 10B
PROPOSED PROFILE(S)	4C -10C
RAMP PROFILE(S)	11 - 12
① SIDE ROADS PROFILE(S)	13 - 14
PRIVATE DRIVE, BUSINESS, AND FIELD ENTRANCE PROFILE(S)	15 - 18
DRAINAGE MAP(S)	19 - 20
CULVERT SECTION(S)	21 - 22
EROSION PREVENTION AND SEDIMENT CONTROL PLANS	23, 24, 25 – 27Z
ENVIRONMENTAL MITIGATION PLANS	28, 28A, 28B
SIGNING AND PAVEMENT MARKING PLAN(S)	29 – 35
SIGN SCHEDULE SHEET(S)	36 – 39
MISCELLANEOUS SIGNING DETAILS	40 – 40Z
ROADWAY CROSS SECTIONS	41 –95
SIDE ROAD CROSS SECTIONS	96 – 106
TRAFFIC CONTROL PLANS	T1 – T50Z
BRIDGE PLANS	B-1
GEOTECHNICAL PLANS	G-1
ITS PLANS	ITS-1
LIGHTING PLANS	L-1
NATURAL STREAM DESIGN PLANS	NS-1
RETAINING WALL PLANS	R-1
SIGNAL PLANS	SIG-1
STORM WATER POLLUTION PREVENTION PLAN (SWPPP) PLANS	S-1
UTILITY PLANS	U1–1

Footnotes:
① Haul Road profiles follow Side Road profiles in the sheet numbering sequence.

Figure 1-54
Plan-in-Hand Index of Sheets Example

The sheet numbers for Line and Grade and Functional shall not be changed to match the Plan-in-Hand sheet numbers but will remain on lines 1 and 2 of the sheet identification block. The Plan-in-Hand phase, project year, project number, and sheet number shall be entered in line 3 of the identification block. The PROJECT NO. field should contain the federal project number. If

no federal number is available, then the state project number shall be used. See *Figure 1-55, Plan-in-Hand Project Identification Block*.

TYPE	YEAR	PROJECT NO.	SHEET NO.
L&G	2024	BR-STP-24(69)	8
FUNC.	2025	BR-STP-24(69)	8
PIH	2026	BR-STP-24(69)	10

Figure 1-55
Plan-In-Hand Project Identification Block

1-206.00 PS&E TITLE SHEET

To modify the Plan-in-Hand title sheet to a PS&E title sheet, the Plan-in-Hand levels can be turned off and PS&E levels turned on as described in the Title Sheet Preset Filters Tutorial document located on the Standard Design CADD Files and Documents webpage in the Documentation section. See *Chapter 1-203.00, Development of Title Sheets*. Also, the type of project will change from Plan-in-Hand to PS&E in the project description when the correct PS&E levels are active. *See Figure 1-56, Project Description-Type of Project Change.* The project limits will stay Const. when the PS&E levels are active. See *Figure 1-57 Project Limits - Type of Project and State Federal Aid Number Change.* The state federal aid number shall be changed in the begin/end project limits labels to correspond with the Construction funding phase. *See Chapter 1-203.05, Project Limits.* Additional sheets shall be added to the index. *See Chapter 1-205.01 Plan-in-Hand Index of Sheets.*

NOTE: The type of work shall be verified to reflect any changes in scope of project.

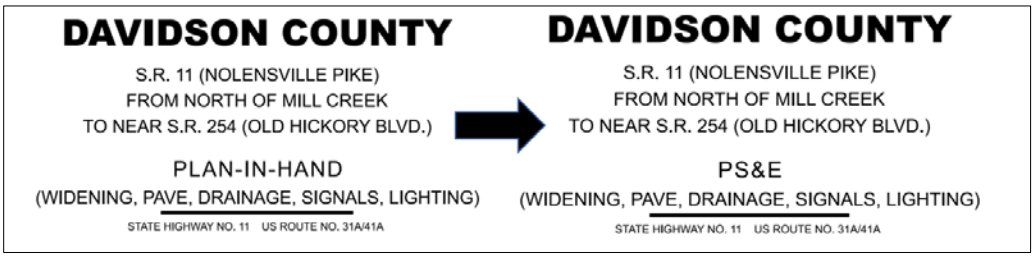


Figure 1-56
Project Description-Type of Project Change

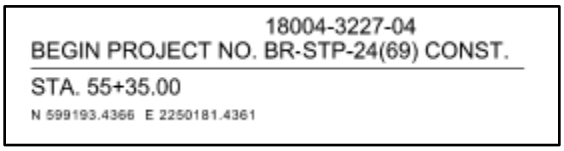


Figure 1-57
Project Limits - Type of Project and State Federal Aid Number Change

1-206.01 PS&E INDEX OF SHEETS

The Index of Sheets for PS&E plans is not shown on the title sheet as it is in the Line and Grade and Functional Design plans. Designers shall place a note in the upper left corner of the title sheet which says, “See Sht. 1A for Index”. The index is combined with the Roadway Standard Drawings and immediately follows the PS&E title sheet in the plans. *Figure 1-58, PS&E Index of Sheets Example* shows an example PS&E Index containing the names of all sheets that could be part of the PS&E plan set. The PS&E index lists all the sheets submitted in the PIH Design plans. Technical Leads should refer to the PS&E checklist, PS&E Index Word document, and blue instructional text in the ORD title sheet seed file for additional information regarding sheet numbering. As with the Line and Grade, Functional, and Plan-in-Hand index, the order and types of sheets shown shall be followed by all Technical Leads. There could be sheets that are not used depending on the scope of the project. The number of sheets in a series could vary depending on the size of the project. Any sheets not used shall be removed from the list but the order of the remaining sheets shall be maintained as shown. With the removal or addition of sheets, some sheets may have different numbers than were shown in the Functional design plans; however, there are sheets that shall always be represented by certain numbers. Sheet 3 shall always be the R.O.W. notes, Utility notes, and Utility Owners. Sheet 3A shall always show the R.O.W. Acquisition Table. Sheet 4 shall always be the first present layout sheet.

Other Divisions that are developing their own sheets to add to the plan set should follow the naming convention shown in *Figure 1-58, PS&E Index of Sheets Example*. The first sheet of their series, *-1, should contain an index for the rest of the sheets in that series.

PS&E INDEX OF SHEETS

SIGNATURE SHEETS	ROADWAY-SIGN1
TITLE SHEET	1
ROADWAY INDEX AND STANDARD ROADWAY DRAWINGS	1A
STANDARD ROADAY DRAWINGS	1A1, 1A2
STANDARD STRUCTURE AND TRAFFIC OPERATIONS DRAWINGS	1A3
PROJECT COMMITMENTS	1B
ESTIMATED ROADWAY QUANTITIES	2, 2-1, 2-2
ESTIMATED BOX BRIDGE QUANTITIES	2A, 2A1
TYPICAL SECTIONS AND PAVEMENT SCHEDULE.	2B, 2B1, 2B2
GENERAL NOTES	2C, 2C1
SPECIAL NOTES	2D, 2D1
ENVIRONMENTAL NOTES	2E, 2E1
TABULATED QUANTITIES	2F, 2F1, 2F2
DETAIL SHEETS	2G, 2G1, 2G2
RIGHT-OF-WAY NOTES, UTILITY NOTES, AND UTILITY OWNERS	3
RIGHT-OF-WAY ACQUISITION TABLE AND PROPERTY MAPS(S)	3A - 3B
PRESENT LAYOUT(S)	4 - 10
RIGHT-OF-WAY DETAILS	4A - 10A
PROPOSED LAYOUT(S)	4B - 10B
PROPOSED PROFILE(S)	4C -10C
RAMP PROFILE(S)	11 - 12
① SIDE ROADS PROFILE(S)	13 - 14
PRIVATE DRIVE, BUSINESS, AND FIELD ENTRANCE PROFILE(S)	15 - 18
DRAINAGE MAP(S)	19 - 20
CULVERT SECTION(S)	21 - 22
EROSION PREVENTION AND SEDIMENT CONTROL PLANS	23, 24, 25 – 27Z
ENVIRONMENTAL MITIGATION PLANS	28, 28A, 28B
SIGNING AND PAVEMENT MARKING PLAN(S)	29 – 35
SIGN SCHEDULE SHEET(S)	36 – 39
MISCELLANEOUS SIGNING DETAILS	40 – 40Z
ROADWAY CROSS SECTIONS	41 –95
SIDE ROAD CROSS SECTIONS	96 – 106
TRAFFIC CONTROL PLANS	T1 – T50Z
BRIDGE PLANS	B-1
GEOTECHNICAL PLANS	G-1
ITS PLANS	ITS-1
LIGHTING PLANS	L-1
NATURAL STREAM DESIGN PLANS	NS-1
RETAINING WALL PLANS	R-1
SIGNAL PLANS	SIG-1
STORM WATER POLLUTION PREVENTION PLAN (SWPPP) PLANS	S-1
UTILITY PLANS	U1–1

Footnotes:
① Haul Road profiles follow Side Road profiles in the sheet numbering sequence.

Figure 1-58
PS&E Index of Sheets Example

The sheet numbers for Line and Grade, Functional and Plan-in-Hand shall not be changed to match the PS&E sheet numbers but will remain on line 1, 2, and 3, respectfully, of the sheet identification block. The PS&E phase, project year, project number, and sheet number shall be entered in line 4 of the identification block. The PROJECT NO. field should contain the federal project number. If no federal number is available, then the state project number shall be used. See *Figure 1-59, PS&E Project Identification Block*.

TYPE	YEAR	PROJECT NO.	SHEET NO.
L&G	2024	BR-STP-24(69)	8
FUNC.	2025	BR-STP-24(69)	8
PIH	2026	BR-STP-24(69)	10
PS&E	2026	BR-STP-24(69)	10

Figure 1-59
PS&E Project Identification Block

1-206.02 SEALING PS&E PLANS

TDOT Divisions are responsible to complete, seal, and submit their respective sheets for the plan sets. Each submittal will contain its own index and estimated quantities.

Digital Signature Certification is the standard practice for signing and sealing TDOT plan sets. All PS&E sheets shall be signed and sealed using the digital process and manual signed and sealed sheets will not be accepted. A Signature sheet will be created for each set of PS&E Plans with an index of sheets listed below each responsible Engineer's information. This Signature sheet will be the only sheet to be digitally signed and sealed by the professional Engineer. The Signature sheet allows multiple Engineers to sign and seal one plan sheet. All remaining plan sheets will be watermarked with the Engineer's signature and date located in the box outlined for the placement of the engineer seal but will not be digitally signed. See *Figure 1-60, Signature Sheet Example.* The final combined set will follow the standard file naming convention *nnnnnn-nn-PS&E.pdf* where "*nnnnnn-nn*" represents the project identification number.

Sealing of Construction revisions will be completed using the same Signature process as the original PS&E Roadway submittal. A new Signature sheet will be created for the revised sheets and inserted directly following the original Signature sheet.

The Department is utilizing Adobe Certified Document Services (CDS) for PDF documents. Vendors supplying the CDS certificates can be found on Adobe's website at www.adobe.com/security/partners_cds.html. Any of the companies listed can be used to purchase a token. A certification is to be specific to a single professional engineer utilizing the desktop-based document certification process and may not be done on a companywide basis. The professional engineer shall not allow anyone else to use the certification on his behalf.

Refer to the document Digital Signature Certification Workflow located on the Standard Design CADD Files and Documents webpage for information in applying a digital signature to a plan set. For projects designed by TDOT Design Leads, most signature sheets will only have a signature of the engineer sealing the roadway plans in the first column. *Figure 1-60, Signature*

Sheet Example, shows an example of a signature sheet that would be common for consultant designed plans with multiple engineer signatures.

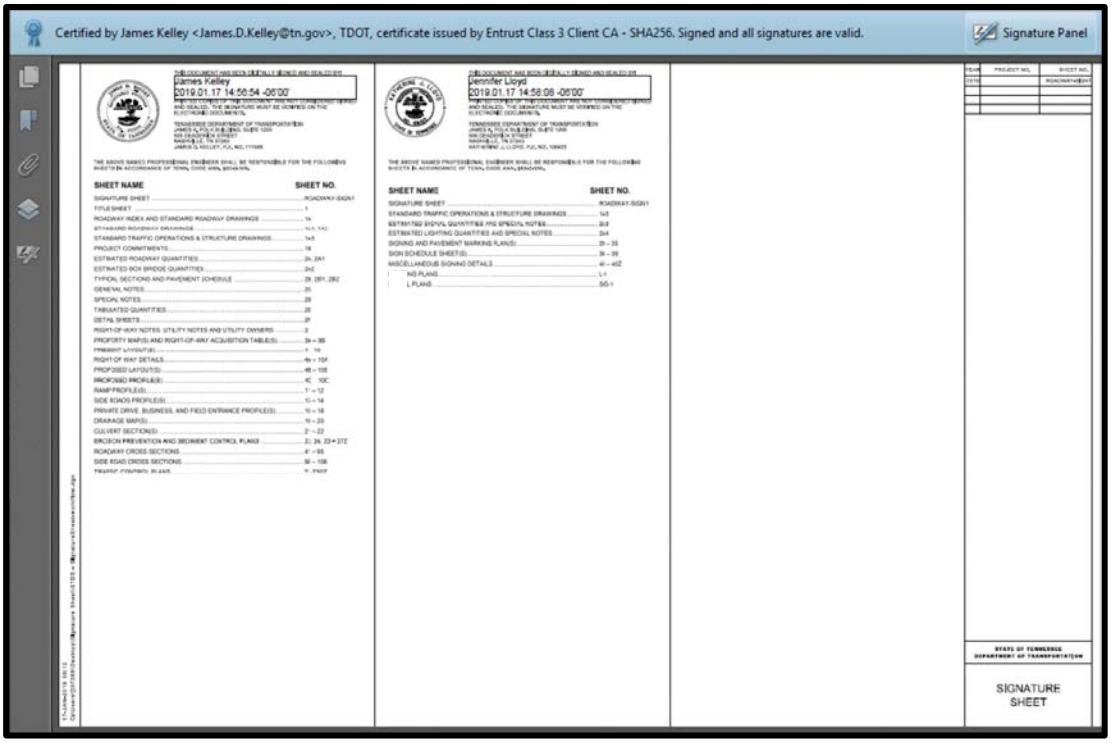


Figure 1-60
Signature Sheet Example

1-207.00 RESURFACING TITLE SHEET

The Project Length shown on the title sheet is different for a resurfacing project title sheet. The length should be shown to a hundredth of a mile. See *Figure 1-61, Resurfacing Project Length on Title Sheet.* Also, see TDOT Roadway Design Guidelines *Chapter 5-502 Resurfacing Projects,* for more information on resurfacing projects.

PROJECT LENGTH	XX.XX MILES
TOTAL LANE MILES RESURFACED	XX.XX MILES

Figure 1-61
Resurfacing Project Length on Title Sheet

The Project Limits for a resurfacing project and a resurfacing and safety project are shown in *Figure 1-62, Begin and End Project Flags on Title Sheet Resurfacing Project* and *Figure 1-63, Begin and End Project Flags on Title Sheet Resurfacing and Safety Project*. When the cost of the safety upgrades are greater than $10,000, the items for the safety improvements shall be

funded separately from the other resurfacing plan items. The project type will then be labeled as Resurface and Safety. If safety funding is already set up for the project and it is determined that the $10,000 minimum for safety funds cannot be met, the Designer should contact the Program Development and Administrative Division so that the safety funding source can be removed from the project.

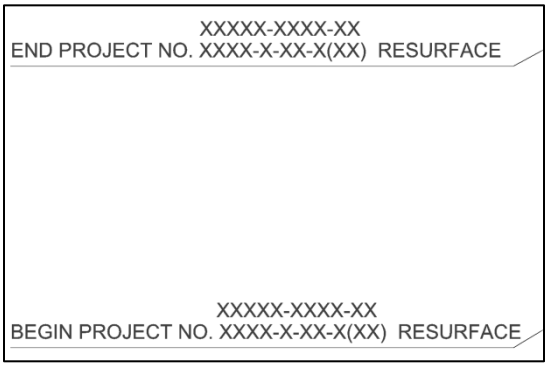


Figure 1-62
Begin and End Project Flags on Title Sheet Resurfacing Project

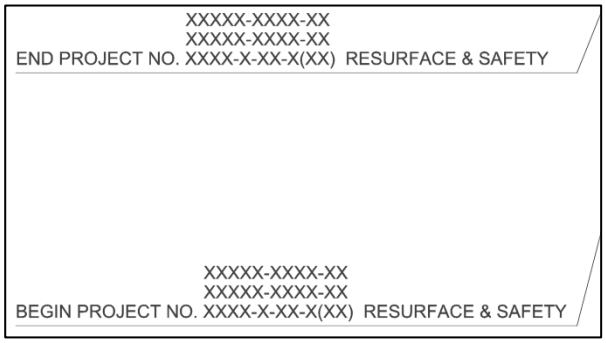


Figure 1-63
Begin and End Project Flags on Title Sheet Resurfacing and Safety Project

1-207.01 RESURFACING PROJECTS WITH BRIDGE REPAIR PLANS

On resurfacing projects that include bridge repairs, the Designer shall add the resurfacing project number and the bridge repair project number to the project number block on the top right corner of on the title sheet and all bridge repair sheets. The bridge repair type shall be listed as “BRIDGE”.

SECTION 3 – SURVEY INFORMATION

1-300.00 SURVEY REQUIREMENTS

Surveyors shall comply with the TDOT Roadway Design Survey Manual and the TDOT Survey & Roadway Design CADD Standards Manual when submitting the original files to Design Managers. These manuals are located on the Roadway Design Survey Standards webpage.

1-301.00 COORDINATE VALUES

Survey procedures require that all surveys shall be tied to the State Plane Coordinate System using the Tennessee Geodetic Reference Network (TGRN). All surveyed coordinate values will be based on the North American Datum 1983 (NAD/83) (1995 adjustment) coordinates and appropriate notes indicating such shall appear on the topography plot.

All design computations shall be based on these adjusted coordinate values. This will ensure that all computed points on the project have coordinate values tied to the State Plane System. Assumed coordinates will not be used.

Coordinate values for all P.I.s of horizontal curves shall be computed to four decimal places and shall be shown in the curve data on present layout sheets. Coordinate values for all begin/end project limits labels shall be computed to four decimal places. Coordinate values for all other points, such as the intersection of the mainline centerline and a side road centerline, shall be shown to two decimal places.

A notation near the title block in lower right hand corner for each sheet shall read, “Coordinates are NAD/83 (enter year), are datum adjusted by the factor of X.XXXXX and tied to the TGRN. All elevations are referenced to the NAVD 1988 with GEOID (enter model). The note will appear on all sheets except 2nd sheets, profile sheets and cross sections sheets regardless of whether coordinate points are shown. The “year” value refers to the year of the adjustment of coordinate values in Tennessee; X.XXXXX refers to the actual datum adjustment factor used for the project; and “model” refers to the GEOID model used. These values are listed in the CADD survey file. See *Chapter 1-203.10, Traffic Data and Survey Data Block* for guidance on placement of the coordinates note on the title sheet.

1-302.00 TVA TRANSMISSION LINES

Tennessee Valley Authority (TVA) requests that TDOT-provided Global Positioning System (GPS) coordinates for intersection points be labeled on present and proposed plan sheets where TVA transmission lines and roadway centerlines intersect. This will assist them in determining the precise location of TVA facilities in relationship to our proposed alignment.

1-303.00 DISTANCES, BEARINGS, AND CONTROL POINTS

In order to provide consistency and maintain accuracy, the following criteria are to be adopted for all roadway plans:

- Distances shown on the plans shall be no more accurate than the nearest 0.01 foot (35 ft., 35.0 ft., and 35.00 ft., are acceptable: 35.001 ft. is not acceptable), with the exception of the begin/end project limits labels where 0.001 is acceptable.
- Bearings shown on the plans shall be no more accurate than 1 (one) second (for example N 35 00’ 01” E is acceptable; N 35 00’ 01.1” E is not acceptable).
- GPS control points shall be shown to an accuracy of 0.0001 foot.

1-304.00 TRACT NUMBERS ON PLANS

On all design projects, tract, and/or parcel numbers assigned during the survey process **shall not** be deleted or altered unless directed by the HQ or Regional R.O.W. Office. Tract numbers are assigned during the survey process and have the same parcel number in the ORD Survey files. The parcel information contained in the ORD Survey files are used in survey and plan preparation and R.O.W. processes. There shall not be any duplicate tract numbers on any one project.

No tract shall be deleted after the plans have been printed for a design public hearing. For tracts where no acquisition is required, the Technical Lead shall place a single line through all the information for all such tracts in the R.O.W. Acquisition Table in the plans. The Technical Lead shall also place a line through all the no-acquisition tract numbers and owner names on the Property Maps sheets, Present Layout sheets, R.O.W. Details sheets, and on any other plan sheets where these tract numbers and owner names may appear. This will ensure that all tract information is retained in the ORD Survey file and not deleted nor altered. The tract information is then recoverable and can be used by other sections as the information is passed to the R.O.W. and Operations Divisions or returned to the Survey Office for updating.

1-305.00 UPDATING SURVEYS

It is the Technical Lead responsibility to thoroughly review the survey information. Requests for updates normally take place following the **Line and Grade Field Review** and the **Functional Design Plans Field Review**, if necessary. Every effort shall be made to make sure all additional information required is requested at these times which will reduce the number of times survey crews are sent out on the same project.

After a request is made for Environmental Boundaries and wetlands are identified by the Environmental Division or Environmental Tech Offices, the Technical Lead or Design Lead shall request additional survey information if the Environmental Boundary document does not provide updated survey information obtained during the identification process.

Additional survey requests shall be made by email sent to the appropriate Geodetics office and shall be created using the template file *Additional Survey Request Form*.xltx located under the Request subtab of the main Roadway Design Form & Letter tab on the Roadway Design Documents – PDN webpage.

When requesting additional information, requested information will be shown either in electronic format or on a marked set of prints. Also, it may be necessary to include ORD information. This is covered in the CADD Standards document (CADDV8.pdf) located on the Standard Design and Survey CADD Files and Documents webpage.

If a survey is updated, the updated survey date(s) shall be added to the title sheet of the current phase of the project beside the traffic block as shown in *Figure 1-40, Traffic Data and Survey Data Block.*

SECTION 4 – ESTIMATES

1-400.00 ESTIMATED ROADWAY QUANTITIES

For each project, Designers shall create and maintain an estimate file of all roadway quantities for project cost estimation. The project estimates may contain any combination of the following types of quantities: roadway, bridge, box bridge, utility, R.O.W. relocation, signal, and/or lighting. The estimated roadway quantity sheet included in the project plans may contain quantities provided by other TDOT Divisions. An item number should only be used once per project. All Divisions shall coordinate to determine if an item number is listed in multiple estimated quantity files.

Estimates can be used to help predict costs of future projects of similar scope. The estimated roadway quantities Excel file is part of various project deliverables, including finalized Line and Grade, Functional design plans, Plan-in-Hand Field Review, and final PS&E plans distribution.

The Bid Analysis and Estimating Office provides a dollar figure to each listed item based on historical data to determine a total cost that TDOT estimates it will need to complete the project. The projected cost estimate is used by the Project Development and Administration Division for budget updates throughout the life cycle of the project. The Program Development and Administration Division authorizes funding for each stage of the project and compiles the list of projects that are budgeted in the State Transportation Improvement Program (STIP). It is essential that Designers create a complete, accurate and updated estimate when changes occur to ensure that projected costs are within the funding allocated in the STIP.

Contractors also use the estimated roadway items to calculate a total dollar amount that it would cost them to build the job and use this amount to bid on the project. TDOT's and the contractors' estimates are compared during the Letting phase to ensure that the bids are not obviously unbalanced, too high, or too low compared to TDOT's cost estimate. Bid proposals may be rejected by the Commissioner if they are excessive or below the reasonable cost analysis value.

Lump Sum (LS) quantities shall be 1 (one) unless the estimated roadway quantities file includes multiple projects, and the same item number is in each project. Fractional Lump Sum (LS) quantities for the same item number must add up to equal one or the program that the Estimating Office uses will force it to one. Lump Sums for the same item number when multiple projects are in the proposal shall not be rounded to 1 (one) each. Instead, the total quantity for a Lump Sum item for all the projects in a single proposal shall total 1 (one). Lump Sums shall not add up to more than 1 (one) when the same item number is listed for multiple projects in the same estimated quantities file. An example would be Traffic Control for two projects let together with each quantity equal to 0.5.

For item numbers with units of measure of EACH, the quantity shall not be a fraction. Some quantities can be decimals such as pavement markings when unit of measure is L.M. (linear mile) if the quantity is low, or between 1 and 5.5, since rounding up or down creates a percent change greater than 10%. Square yards and tons shall always be whole numbers.

The quantity for all item numbers shall not be rounded if rounding (either up or down) results in a change of 10% or more in the total quantity. For example, if 1.5 is rounded to 2.0, then the change is 0.5/1.5 = 0.333 or 33.3%. If 1.75 is rounded to 2.0, then the percent change is 0.25/1.75 = 0.1428 or 14.3%. These examples shall not be rounded but shall remain 1.5 and 1.75, respectively. However, if the quantity is calculated to be 1.85, then the percent change if rounding up to 2.0 would be 0.15/1.85 = 0.081 or 8.1%. In this case, it is acceptable to round up to 2.0 (two) for this item.

1-401.00 CREATING THE LINE AND GRADE ROADWAY QUANTITIES ESTIMATE

The first estimate prepared by the Technical Lead for a project is the Line and Grade estimate. This estimate is a living document and shall be updated as the project develops.

Each estimate file contains quantities associated with each item of work that is needed to build the project. Each item has an official item number, description, unit of cost, and associated quantity. These items are listed in the **items.dat** file and only these approved items shall be used in plans. The uses for many items in the **items.dat** file are described in detail in TDOT's Standard Specifications For Road and Bridge Construction, *(See Part 1, Section 109, Measurement and Payment, and all Sections in Part 2).*

To download the complete list of approved roadway items in the items.dat file and/or to run a quick search for an item either by item number or description keyword, go to the Roadway Item Lists webpage.

If a new Roadway Design item number is needed, the Design Lead should contact the Engineering Production Support Division at TDOT.EngineeringProductionSupport@tn.gov. For any new Traffic Design related item number is needed, see Table 1-15, Traffic Design Emails. These divisions will determine if an item number will be assigned or included in another item. If a new item number is needed specific to a project, they will contact the HQ Construction Office to get the new number.

ITS	TDOT.TrafficDesign.ITS@tn.gov
Signals	TDOT.TrafficDesign.Signals@tn.gov
Lighting	TDOT.TrafficDesign.Lighting@tn.gov
Signs and Pavement Markings	TDOT.TrafficDesign.SignsandMarking@tn.gov
Work Zone	TDOT.TrafficDesign.WZ@tn.gov
Traffic Modeling Needs	TDOT.TrafficDesign.TrafficModeling@tn.gov

Table 1-15
Traffic Design Division Emails

The estimated roadway quantities sheet in project plans is created from an Excel file that works in conjunction with the items.dat file. The template for the estimated roadway quantities Excel file can be downloaded from the Roadway Design Documents webpage. *See Figure 1-64, Estimated Roadway Quantities Project Data* and *Figure 1-65, Estimated Roadway Quantities Block 1 Sheet* for examples of some of the tabs in the estimated roadway quantities Excel file.

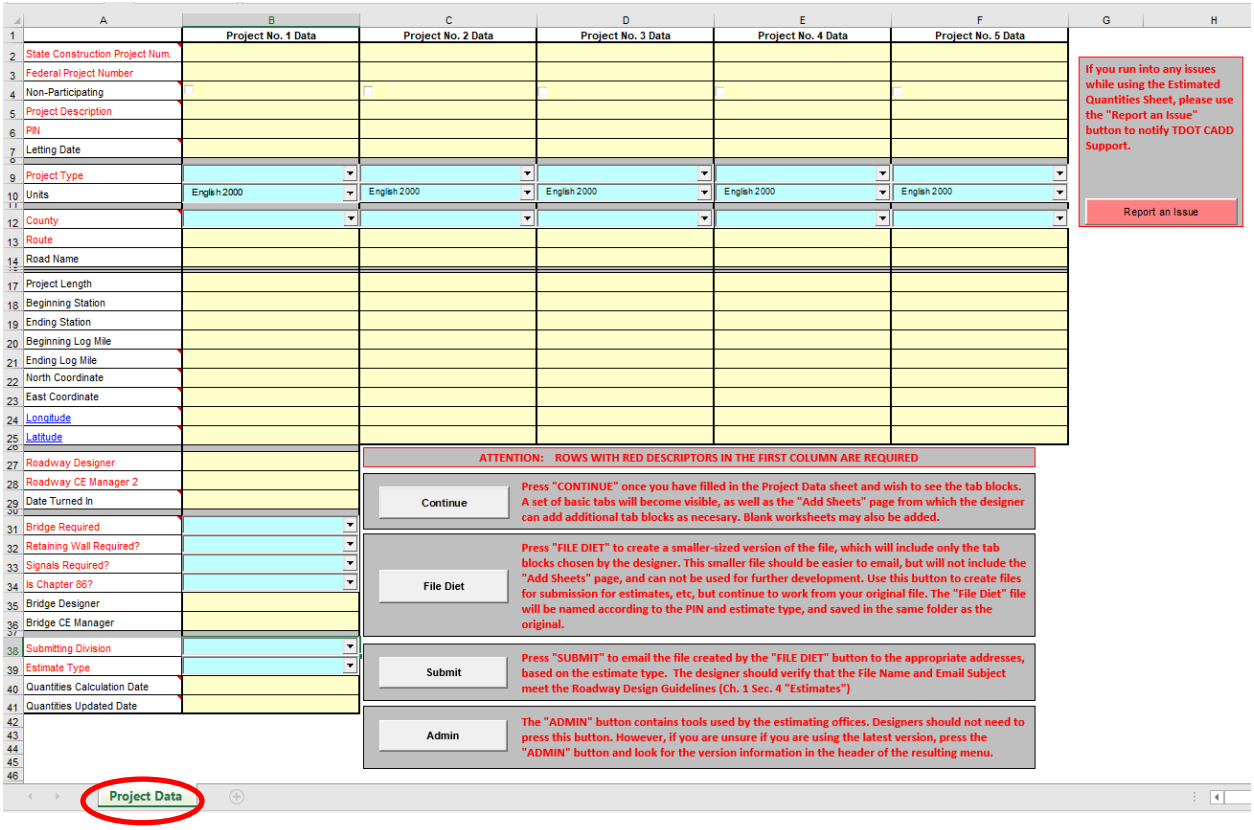


Figure 1-64
Estimated Roadway Quantities Project Data

Project Data Sheet Tab

- **ALL** Information shall be filled in. The Excel template requires Technical Leads to complete the Project Data fields for at least one project before proceeding to the estimated quantities tab sheets. Once all data is entered, Technical Leads should select the Continue button.
- The Excel template will accommodate projects with up to five State Project Numbers.
- Non-participating items are listed by column as designated on the Project Data tab.
- The North and East Coordinates shall coincide with the location of the Latitude and Longitude as defined in *Chapter 1-106.01, Latitude and Longitude*.
- Dates should be updated as needed for the entries in Letting Date, Date Turned In, and Quantities Updated Date with each submittal.

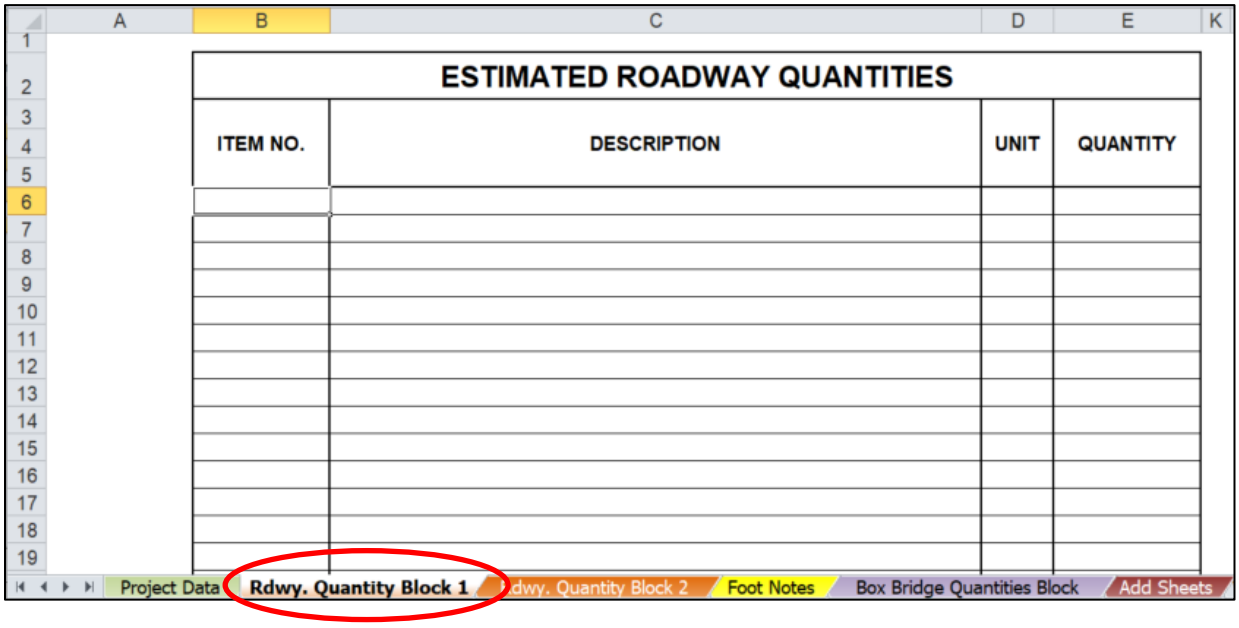
- If bridges, retaining walls, or other structures designed by the Structures Division are proposed, the Technical Lead shall include the Bridge Technical Lead and Design Lead on the project data portion of the estimate file.
- The File Diet button may be used to create an email-friendly copy of the spreadsheet which contains only the tables used by the Technical Lead. The resulting file is much smaller but should not be used for further development since all unused tables are deleted, and therefore it is not possible to add additional tables.
- The Submit button may be used to send the email-friendly copy created by the File Diet button to the appropriate mailing list, as determined by the Estimate Type.
- The Admin button is for use by the HQ Construction Estimates section and the Bid Analysis & Estimating Office. This button starts a workflow that allows for the data to be exported meeting their software's entry requirements.
- 

Figure 1-65
Estimated Roadway Quantities Block 1 Sheet

Rdwy. Quantity Block 1 Sheet

- All tab blocks are built into the Excel template. To add tab blocks sheets, select the "Add Sheets" tab. Sheets are organized by group. Select group first, then select the specific sheet, then click "Select" this will add the selected sheet. To delete, select "Delete Sheets", and select the desired sheet from the list.
- If additional copies of a sheet are needed, simply select the sheet again. Blank worksheets may be added by selecting "Blank Worksheet" from the "Add Sheets" menu. Additional footnotes sheets may be added by selecting "Footnotes". A notes section is provided in the upper right corner of additional footnotes sheets, so the Technical Lead may keep track of which sheets the footnotes refer to.

- Quantities from the added tab blocks can be linked into the main roadway quantity sheets. (Example: Catch Basins and Manholes, Guardrail, Pavement, Removal of Buildings and Obstructions, Traffic Control, etc.).
- Sheets shall not be renamed.
- If more than one PIN is associated with the project, the Technical Lead should use the buttons to the right to select the appropriate number of quantity columns (one per PIN). All items shall be listed in numerical order. There is a 'sort' button to help with this task.
- Quantities cannot contain commas.
- Quantities shall be rounded up to the nearest whole number with the exceptions of those as shown in Chapter 8 Item Numbers of the guidelines.
- Contractors are paid by the quantities that are ordered and used on the project. If there is an item number in question that may not be used on the project, it shall be added to the estimate. It is better to have it shown on the estimate and not used by the contractor than needed after Letting as a change order. These items shall be discussed at the Plan-in-Hand Field Review and footnoted "Requested by _____Division."
- Projected quantities for erosion control and traffic control shall be included in the Line and Grade estimate even though traffic control sheets are not included in the Line and Grade submittal or Functional design plans. Quantities from similar projects can be used to help estimate these quantities.
- If open-ended and/or lump sum item numbers are used, the Technical Lead shall fill in the descriptions in the estimate data file. Without completing these item descriptions, there is no way the estimator in the Bid Analysis & Estimating Office can complete the cost estimate.
- Box-Bridge items shall be listed on a sheet separate from the roadway items. Use the sheet labeled Box Bridge Quantities sheet.
- Alternate roadway items shall be listed after all other roadway items. The alternates will be designated in column C as Alternate AA1, Alternate AA2, Alternate AA3, Alternate AB1, Alternate AB2, and so on. AA1 would alternate with AA2 and AA3. AB1 would alternate with AB2, etc.
- No prices shall be entered in the estimate.

1-402.00 SUBMITTAL OF ESTIMATES

As previously noted in *Chapter 1-400.00, Estimated Roadway Quantities*, the Program Development and Administration Division authorizes funding for each stage of the project and compiles the list of projects that are budgeted in the STIP. It is essential that Technical Leads create a complete and accurate estimate and updates the estimate when changes occur to ensure that projected costs are within the funding allocated within the STIP. The Project Manager of the team will submit each estimate. The following sections will explain how often an estimate should be updated and submitted for use in budgeting.

SUBMITTAL OF THE LINE AND GRADE ESTIMATE

To Finalize Line and Grade Plans, the Project Manager responsible for the project shall place the Excel quantity file ***nnnnnn-nn-LineandGradeEstimate.xlsm*** on FileNet and send an email notification to the Program Development and Scheduling Office at TDOT.PDSO@tn.gov. The estimate shall be submitted after the Line and Grade Field Review is held and the estimate is updated accordingly.

The subject line shall read:

Region X, County Name, Route Name, PIN nnnnnn-nn, Line and Grade Estimate Submittal

Each Designer shall ensure the following is addressed in the Line and Grade estimate:

- If bridges, retaining walls, or other structures designed by the Structures Division are proposed, the Technical Lead shall indicate structures are required within the body of the email. This information is necessary to ensure that the structures are included in the preliminary estimate.
- The Technical Lead shall send the preliminary construction Excel quantities estimate data via email to the Design Lead/Project Manager responsible for the project. Design Leads and Technical Leads shall keep a copy of the estimate file in the project folder and keep the email message that shows the date the estimate was emailed.

If an estimate is submitted during the Context and Scoping stage, for plans associated with a public hearing, or from a request by the Program Development and Administrative Division, an updated estimate shall be submitted if a time lapse of one year has occurred since the previous estimate was submitted. If there is a time lapse of over one year between the Line and Grade field review submittal and the projected request date for R.O.W. funding, an updated Line and Grade estimate shall be completed and placed on FileNet with the name ***nnnnnn-nn-Lineand GradeEstimate.xlsm***. The name shall not include a revision date for the file placed on FileNet. The original estimate placed on FileNet shall be removed. The Project Manager shall email the Program Development and Scheduling Office at TDOT.PDSO@tn.gov. If there are items that will be used on the project, but the quantities are unknown, this shall be mentioned in the body of the email. The email shall also state that the estimate is being submitted because it has been a year since the last submittal. **If there are NO CHANGES in the estimate from the previous submittal, it shall be stated in the body of the email that there are NO CHANGES from the previous estimate that was submitted on DD/MM/YYYY** but shall still be placed on FileNet and the other removed**.** All updated estimates shall be kept in the project folder. For the project folder, a date shall be part of the naming convention so that the development of the estimate can be easily compared.

1-402.02 SUBMITTAL OF FUNCTIONAL DESIGN PLANS ESTIMATE FOR R.O.W. OR UTILITIES ONLY FUNDING

As plans develop in the Functional Design stage, additional items shall be added to the Line and Grade estimate and renamed to the Functional Design plans estimate ***nnnnnn-nn-FunctionalDesignPlansEstimate.xlsm***. This is a replacement for what was originally called the preliminary estimate. This is **not** a substitution for the Form 44 ROW estimate which will continue to be submitted by the R.O.W. personnel. PDN 2PM5 Hold Functional Design Plans Field review Meeting shall include updating the estimate from comments received at the Field Review. The Functional Design estimate shall be part of the request for R.O.W. or Utilities Only funding. If there are retaining walls on the project, please refer to *Chapter 2-900.07 Retaining Walls Quantities* for guidance on including retaining wall quantities in the Functional Design estimate for Functional Design plans. If there are landscaping quantities on the project, refer to *Chapter 5-504.00, Landscaping Plans*.

After Functional Design Plans submittal, if there is a time lapse of over one year between Functional Design Plans submittal and the distribution of the Plan-in-Hand Field Review notice, an updated Functional Design estimate shall be completed and placed on FileNet with the name ***nnnnnn-nn-FunctionalDesignPlansEstimate.xlsm***. The name shall not include a revision date for the file placed on FileNet. The previous estimate placed on FileNet shall be removed. The Project Manager shall email TDOT.Preliminary.Estimates@tn.gov with a carbon copy (Cc) to TDOT.PDSO@tn.gov that ***nnnnnn-nn-FunctionalDesignPlansEstimate.xlsm*** was placed on FileNet. The email shall state that the estimate is being submitted because it has been a year since the last submittal. **If there are NO CHANGES in the estimate from the previous submittal, it shall be stated in the email that there are NO CHANGES from the previous estimate that was submitted on DD/MM/YYYY,** but shall still be placed on FileNet and the other removed**.** All updated estimates shall be kept in the project folder. For the project folder, a date shall be part of the naming convention so that the development of the estimate can be easily compared.

If there are significant changes, additions, or revisions to the Functional Design plans that affect the estimate, a revised estimate shall be completed and placed on FileNet with the name ***nnnnnn-nn-FunctionalDesignPlansEstimate.xlsm***. The name shall not include a revision date for the file placed on FileNet. The previous estimate placed on FileNet shall be removed. The Project Manager shall email TDOT.Preliminary.Estimates@tn.gov with a carbon copy (Cc) to TDOT.PDSO@tn.gov. The email shall state that the estimate is being submitted because of significant changes, additions, or revisions to the Functional Design plans. All updated estimates shall be kept in the project folder. For the project folder, a date shall be part of the naming convention so that the development of the estimate can be easily compared.

1-402.03 RESUBMITTALS OF ESTIMATES DUE TO AN INSTRUCTIONAL BULLETIN OR ROADWAY DESIGN GUIDELINES CHANGE

As stated in previous sections, the Technical Lead shall update the estimate but the Project Manager will be the one that submits the estimate yearly and/or when significant changes have occurred. For projects that are not funded for construction but have been submitted Functional Design Plans the Technical Lead shall take time to update the estimate according to changes in Instructional Bulletins/Design Guidelines. For the same situation, the Consultant is allowed one week per calendar year to review the Instructional Bulletins/ Design Guidelines and update any estimates that correspond to those changes.

1-402.04 SUBMITTAL OF PLAN-IN-HAND ESTIMATE FOR FIELD REVIEW

When plans are developed and ready for Plan-in-Hand Field Review distribution, the estimate shall be complete with any previous missing items and descriptions filled in. If a Constructability Review was held, all changes to the quantities as a result of the review shall be reflected in the Plan-in-Hand Field Review quantity estimate. **The Project Manager or Design Lead shall request necessary information needed to complete the estimate sheet at least two weeks prior to the date set to print for outside distribution.** Requests for large projects should be made even earlier to ensure that the estimate is complete and that sheets from the estimates are correct in the Plan-in-Hand Field Review plan set. Plans sheets and items shall be requested from Geotechnical, Traffic Operations, Structures, and Utilities personnel as needed. All Divisions submitting estimates shall coordinate with other Divisions to verify no duplicate item numbers are submitted.

The Project Manager shall email the Plan-in-Hand Field Review quantity estimate with the name ***nnnnnn-nn-RoadwayPIHFieldReviewEstimate.xlsm*** to TDOT.Preliminary.Estimates@tn.gov with a carbon copy (Cc) to TDOT.PDSO@tn.gov on the same day the Plan-in-Hand Field Review Notice is sent out. If the project has sheet submittals from other functional groups, the Excel file for those quantities shall be obtained and emailed simultaneously with the estimated roadway quantities Excel estimate as attachments. *(See below for further instruction)*

The following must be completed **BEFORE** the estimate is emailed with the Plan-in-Hand Field Review Notice:

- The Technical Lead shall ensure that the totals on the estimate reflect all tabulation blocks shown in the plans.
- If there are Traffic Operations quantities (ITS, Signals, and/or Lighting), the Project Manager or Design Lead over the project shall request the appropriate Excel files containing these quantities:
  - ***nnnnn-nn-TrafficOpsITSPIHFieldReviewEstimate.xlsm***
  - ***nnnnnn-nnTrafficOpsSignalsPIHFieldReviewEstimate.xlsm***
  - ***nnnnnn-nn-TrafficOpsLightingPIHFieldReviewEstimate.xlsm***

These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.

- If there are structures (bridges) in the plans, the Project Manager over the project shall contact TDOT Structures Division personnel to request the Excel file ***nnnnnn-nn-StructuresPIHFieldReviewEstimate.xlsm*** containing these quantities. These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.
- If there are retaining walls in the plans, the Project Manager over the project shall contact Structures (TDOT.StructuresRW@tn.gov) to request the Excel file: ***nnnnnn-nn-StructuresPIHFieldReviewEstimate.xlsm***. If there are both structures and retaining walls, coordination shall occur between Structures personnel to combine these quantities into one file and to submit the file to the Project Manager or Design Lead that requested the information. These items will NOT be added to the estimated roadway quantities Excel file, but will be included as a separate file within the same email as an attachment.
- If there are utilities in the plans, the Project Manager over the project shall contact TDOT Regional Pre-Construction Utility Office to request the Excel file ***nnnnnn-nn-UtilityPIHFieldReviewEstimate.xlsm*** containing these quantities. These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.
- The Project Manager shall contact the R.O.W. office to check to see if there will be R.O.W. Removal Items for buildings and obstructions. The item numbers shall be furnished by the regional R.O.W. office and should be a lump sum item and footnoted. See *Chapter 9-205.00, Demolition* for additional information.

The estimate shall be thoroughly checked at the Plan-in-Hand Field Review to ensure that there are no missing quantities or adjustments that must be made to existing quantities. Close attention should be paid to the grade differences and the construction of structures to ensure if items are needed for temporary shoring. If there are significant changes and additions to quantity items due to comments at the Plan-in-Hand Field Review, a revised estimate for the applicable division shall be completed using the following naming conventions and emailed by the Project Manager to TDOT.Preliminary.Estimates@tn.gov with a carbon copy (Cc) to TDOT.PDSO@tn.gov.

- ***nnnnnn-nn*-RoadwayPIHFieldReviewEstimate.xlsm**
- ***nnnnnn-nn*-TrafficOpsITSPIHFieldReviewEstimate.xlsm**
- ***nnnnnn-nn*-TrafficOpsSignalsPIHFieldReviewEstimate.xlsm**
- ***nnnnnn-nn*-TrafficOpsLightingPIHFieldReviewEstimate.xlsm**
- ***nnnnnn-nn*-StructuresPIHFieldReviewEstimate.xlsm**
- ***nnnnnn-nn*-UtilityPIHFieldReviewEstimate.xlsm**

The email shall state that **the estimate(s) is being re-submitted because of significant changes and/or additions resulting from the Plan-in-Hand Field Review**. All updated estimates shall be kept in the project folder. For the project folder, a date shall be part of the naming convention so that the development of the estimate can be easily compared. It is not necessary to place the estimate on FileNet.

1-402.05 SUBMITTAL OF PS&E ESTIMATE FOR FIELD REVIEW

When plans are developed and ready for PS&E Field Review distribution, the estimate shall be complete with any previous missing items and descriptions filled in. If a Constructability Review was held, all changes to the quantities as a result of the review shall be reflected in the PS&E Field Review quantity estimate. **The Project Manager shall request necessary information needed to complete the estimate sheet at least two weeks prior to the date set to print for outside distribution.** Requests for large projects should be made even earlier to ensure that the estimate is complete and that sheets from the estimates are correct in the PS&E Field Review plan set. Plans sheets and items shall be requested from Geotechnical, Traffic Operations, Structures, and Utilities personnel as needed. All Divisions submitting estimates shall coordinate with other Divisions to verify no duplicate item numbers are submitted.

The Project Manager shall email the PS&E Field Review quantity estimate ***nnnnnn-nn-RoadwayPS&EEstimate.xlsm*** to TDOT.Preliminary.Estimates@tn.gov with a carbon copy (Cc) to TDOT.PDSO@tn.gov on the same day the PS&E Field Review Notice is sent out. If the project has sheet submittals from other functional groups, the Excel file for those quantities shall be obtained and emailed simultaneously with the estimated roadway quantities Excel estimate as attachments. *(See below for further instruction)*

The following must be completed **BEFORE** the estimate is emailed with the PS&E Field Review Notice:

- The Technical Lead shall ensure that the totals on the estimate reflect all tabulation blocks shown in the plans.
- If there are Traffic Operations quantities (ITS, Signals, and/or Lighting), the Project Manager over the project shall request the appropriate Excel files containing these quantities:
  - ***nnnnn-nn-TrafficOpsITSPS&EEstimate.xlsm***
  - ***nnnnnn-nnTrafficOpsSignalsPS&EEstimate.xlsm***
  - ***nnnnnn-nn-TrafficOpsLightingPS&EEstimate.xlsm***

  These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.
- If there are structures (bridges) in the plans, the Project Manager over the project shall contact TDOT Structures Division personnel to request the Excel file ***nnnnnn-nn-StructuresPS&EEstimate.xlsm*** containing these quantities. These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.

- If there are retaining walls in the plans, the Project Manager over the project shall contact Structures (TDOT.StructuresRW@tn.gov) to request the Excel file: ***nnnnnn-nn-StructuresPS&EEstimate.xlsm***. If there are both structures and retaining walls, coordination shall occur between Structures personnel to combine these quantities into one file and to submit the file to the Project Manager or Design Lead that requested the information. These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.
- If there are utilities in the plans, the Project Manager over the project shall contact TDOT Regional Pre-Construction Utility Office to request the Excel file ***nnnnnn-nn-UtilityPS&EEstimate.xlsm*** containing these quantities. These items will NOT be added to the estimated roadway quantities Excel file but will be included as a separate file within the same email as an attachment.
- The Project Manager shall contact the R.O.W. office to check to see if there will be R.O.W. Removal Items for buildings and obstructions. The item numbers shall be furnished by the regional R.O.W. office and should be a lump sum item and footnoted. See *Chapter 9-205.00, Demolition* for additional information.

The estimate shall be thoroughly checked at the PS&E Field Review to ensure that there are no missing quantities or adjustments that must be made to existing quantities. Close attention should be paid to the grade differences and the construction of structures to ensure if items are needed for temporary shoring. If there are significant changes and additions to quantity items due to comments at the PS&E Field Review, a revised estimate for the applicable division shall be completed using the following naming conventions and emailed by the Project Manager to TDOT.Preliminary.Estimates@tn.gov with a carbon copy (Cc) to TDOT.PDSO@tn.gov.

- ***nnnnnn-nn*-RoadwayPS&EEstimate.xlsm**
- ***nnnnnn-nn*-TrafficOpsITSPS&EEstimate.xlsm**
- ***nnnnnn-nn*-TrafficOpsSignalsPS&EEstimate.xlsm**
- ***nnnnnn-nn*-TrafficOpsLightingPS&EEstimate.xlsm**
- ***nnnnnn-nn*-StructuresPS&EEstimate.xlsm**
- ***nnnnnn-nn*-UtilityPS&EEstimate.xlsm**

The email shall state that **the estimate(s) is being re-submitted because of significant changes and/or additions resulting from the PS&E Field Review**. All updated estimates shall be kept in the project folder. For the project folder, a date shall be part of the naming convention so that the development of the estimate can be easily compared. It is not necessary to place the estimate on FileNet.

1-402.06 SUBMITTAL OF PS&E ESTIMATE FOR LETTING PROCESS

When the final PS&E plans are turned in for the Letting process for PDN 4PM2 the submittal will include a final construction estimate. **All Divisions submitting estimates shall**

coordinate with other Divisions to verify no duplicate item numbers are submitted. The Project Manager shall attach the construction Excel estimate ***nnnnnn-nn-RoadwayLettingEstimate.xlsm*** to the email containing the PS&E Submittal for Letting. The Project Manager will upload the Excel estimate file to FileNet. The previous estimate placed on FileNet shall be removed. The Project Manager shall email the PS&E Submittal Letter, Grading Report, and Letting Estimate to the addresses shown on the Distribution List.

The body of the email shall include that the construction plan set and estimated roadway quantities Excel file have been uploaded to FileNet.

A copy of the email shall be placed in the project folder to document the submittal of the construction estimate.

1-402.07 REVISION OF PS&E ESTIMATE FOR LETTING PROCESS

If there is a need to change, add, and/or delete quantities after Final Turn-in for the Letting process but prior to the letting of the project, a revision shall be made to the PS&E Excel estimate by the appropriate Project Manager. It shall become part of the project record and placed in the project folder. The file also needs to be updated in the Final PS&E Submittal Package ("Complete Package"). See Chapter 1-105.11 for more information regarding Letting Revisions. The revised estimate folder name shall be:

- ***nnnnnn-nn-Estimates-LettingRev-mm-dd-yy.zip***,

The Project Manager shall also create an estimate revision request using the Excel template file *Estimate Revision Request*. In the PS&E plan set, each revised quantity shall be shown on the estimated roadway quantities sheet tabulation block, included in the revision note on affected sheets, and reflected in any associated tabulation blocks and/or footnotes. For additional information on the Estimate revision process see *Chapter 7-303.00, Letting Revisions*. The Project Manager shall email the **"Estimate Revision Request"** form and revised plan sheets as an attachment to the addresses shown in the Distribution List.

Note: Once a project has been Let to contract and an estimate change is requested, an Estimate Revision Request form is not required as part of the Construction Revision. Neither HQ Construction Division nor the Bid Analysis & Estimating Office will alter the estimate in the system after the job has been awarded and has a contract number.

1-403.00 FOOTNOTES FOR ROADWAY ESTIMATED QUANTITY SHEET

For the Constructability Review (if applicable), PS&E Field Review, and final PS&E plans, footnotes shall be added in the estimated roadway quantities Excel file and shown on the estimated roadway quantities sheet in the plans. Footnotes are sometimes needed for items to provide clarity, to define when substitutions can be made, and to define maintenance schedules

or cycles. Footnotes for quantities should be in numerical order and placed in column A. Footnotes listed in tabulated quantities shall also be shown in the Estimated Quantities Sheet. Additional information for required footnotes can be found in the Roadway Design Guidelines Chapters 5, 6 and 7.

1. When an item is used in multiple locations for various reasons, footnotes shall be used to define what the use and quantity is for each item within the total. For example, Item Number 303-10.01, Mineral Aggregate (Size 57) with a total of 181 TONS may have the following footnote:

   INCLUDES 5 TONS FOR USE WITH SEDIMENT FILTER BAG, 9 TONS FOR CULVERT PROTECTION TYPE 1, AND 167 TONS FOR HAUL ROADS.

2. Where lump sum (LS) quantities are used, the description shall be filled in and a breakdown of the items included in the lump sum shall be footnoted. For example, Item Number 730-40.02, Temporary Traffic Signal System, LS, with a quantity of 1 may have a footnote similar to the following:

   INCLUDES ALL ITEMS NECESSARY TO KEEP EXISTING SIGNAL AT SR 248 AND I-65 SB OFF RAMP OPERATIONAL DURING ALL PHASES OF CONSTRUCTION. CONTRACTOR TO COORDINATE WITH CITY ENGINEER PRIOR TO ANY ADJUSTMENTS. CONTRACTOR SHALL OBTAIN THE APPROVAL FROM CITY ON MANNER OF MAINTAINING EQUIPMENT THROUGH CONSTRUCTION PHASING. VEHICLE DETECTION MUST BE MAINTAINED THROUGHOUT CONSTRUCTION (VIDEO OR OTHER MEANS ACCEPTABLE). MAY USE CONTRACTOR OWNED EQUIPMENT TO SUPPLEMENT EXISTING EQUIPMENT IF NEEDED. CONTRACTOR SHALL MAINTAIN ALL EQUIPMENT DURING CONSTRUCTION, THROUGH A MINIMUM OF 2 PHASES OF CONSTRUCTION. ITEM INCLUDES MAINTENANCE OF EXISTING POLES OR PROVIDING ALTERNATE TEMPORARY SIGNAL SUPPORT POLES. SEE TDOT STANDARD DRAWING T-SG-11 FOR ADDITIONAL DETAILS.

3. For items such as erosion control that might have to be replaced during the life cycle of the project, the following footnote below shall be used:

   SEE SUBSECTION 209.07 OF THE STANDARD SPECIFICATIONS FOR MAINTENANCE REPLACEMENT.

1-404.00 ESTIMATE CONFIDENTIALITY

The Project Team is hereby instructed to follow the TDOT guidelines regarding the handling of the construction cost estimates and unit bid prices as listed below.

1. Construction Cost Estimates: All Technical Leads are hereby instructed to keep the construction cost estimate confidential. These cost estimates shall never be made

public and may only be revealed to the proper officials of TDOT. Should an inquiry be made by a person other than a TDOT official, refer the inquirer to the Project Manager or Design Lead. Secure the cost estimates at all times so that no unauthorized person may have access to them.

2. Unit Bid Prices: After a project is let for construction, but prior to awarding it, all Technical Leads are hereby instructed not to divulge any unit prices bid on a project to anyone. When a project bid is rejected and not awarded, the unit prices are never to be made public. Any inquiry made in regard to bid prices shall be referred to the Project Manager or Design Lead for proper handling.

1-405.00 FINANCIAL PLANS

Federal law requires a financial plan to be completed for projects estimated to cost over $100 million. If a project exceeds $500 million, then the financial plan shall be submitted to Federal Highway Administration for review. Once the Environmental Document is completed and the $100 million cost threshold is met, the TDOT Federal Affairs Liaison will develop the initial document template. The financial plan must be updated annually by the Project Development Director. If it is determined later in the design development process that the cost estimate will exceed $100 million, the Project Development Director should contact the TDOT Federal Affairs Liaison and the Community Relations Office. The TDOT Federal Affairs Liaison will provide the Regional Project Management Director with the project specific financial plan template. An example of a completed document can be found on the Design Guidelines webpage.

SECTION 5 – VALUE ENGINEERING

1-500.00 VALUE ENGINEERING

Value Engineering is a systematic independent multidisciplinary team review process which utilizes project functional analysis to develop recommendations that:

- Optimize the value and quality of the project.
- Provide the needed functions, considering community and environmental commitments, safety, reliability, efficiency, and overall life-cycle cost.
- Reduce the time to develop and deliver the project.

1-501.00 VALUE ENGINEERING OFFICE RESPONSIBILITIES

TDOT has established a VE Program in accordance with 23 CFR Part 627. TDOT shall designate a VE Program Coordinator, hereinafter referred to as the "Coordinator", to promote and advance VE program activities. The program is administered by the Engineering Production Support Division's VE Office. The responsibilities of the VE Office include the following:

- Monitor Project Schedule and coordinate with TDOT's Project Management Division to identify projects that meet the project selection criteria.
- Ensure that VE analyses are conducted on all applicable projects.
- Coordinate all VE training requirements.
- Provide a list of current and potential VE projects on a quarterly basis to the FHWA.
- Provide an annual report to FHWA summarizing the results of the VE analyses.
- Coordinate with HQ Construction Office to fulfill any Program Performance Data requested by FHWA.

1-502.00 VALUE ENGINEERING PROJECT SELECTION POLICY

A VE analysis shall be conducted as early as practicable on all applicable projects developed by TDOT and Local Agencies that utilize federal-aid highway funding.

Applicable projects requiring VE analysis include the following:

a) Projects that are located on the National Highway System (NHS), utilize federal-aid highway funding, and have an estimated total project cost greater than or equal to $50 million.
b) Bridge projects that are located on the NHS, utilize federal-aid highway funding, and have an estimated total project cost greater than or equal to $40 million.

c) Any major project (as defined in 23 U.S.C. 106(h)) that is located on or off of the NHS and utilizes Federal-aid highway funding in any contract or phase comprising the major project.

d) Any project for which a VE analysis has not been conducted and a change is made to the project's scope or design between the final design and the construction Letting that results in an increase in the project's total cost such that it meets the thresholds identified in bullets a), b), or c) above.

e) Any other project which utilizes federal-aid highway program funding that FHWA determines to be appropriate. Design Build Projects do not require a VE analysis, but Construction Manager/General Contractor (CM/GC) projects do require a VE analysis if it meets the thresholds identified in bullets a), b), or c) above.

The total project cost is defined as the estimated costs of all work to be conducted on a project including the Context/Scoping, Functional, Plan-in-Hand, and PS&E stages. A bridge project is defined as any project whose primary purpose is to construct, reconstruct, rehabilitate, resurface, or restore a bridge. For projects split into smaller sections for development, the termini used in the environmental document shall control and be used for determining threshold requirements.

TDOT and Local Agencies may elect, on a case by case basis, to conduct a VE analysis on other complex projects if there is a potential to realize benefits from the analysis. Design Managers and Division Heads are encouraged to notify the Coordinator of any projects that they think have the potential to benefit from a VE analysis.

1-503.00 VALUE ENGINEERING ANALYSIS PROCEDURES

1-503.01 IDENTIFYING AND SCHEDULING VALUE ENGINEERING ANALYSIS

The Coordinator shall determine when the VE analysis will take place. The VE analysis shall be conducted as early as practicable during the project development. In most cases, the VE analysis shall be scheduled prior to the Functional Review.

When a project has been identified as a candidate for VE analysis, the Coordinator shall notify the Project Manager. The Project Manager shall then notify the Coordinator of any changes made to the project scope during the project development.

1-503.02 ASSEMBLING THE VALUE ENGINEERING ANALYSIS TEAM

The Coordinator shall select a multidisciplinary team composed of individuals who are not directly involved in the project’s planning or design. The team shall include members from key

project disciplines such as Roadway, Structures, Environmental, Geotechnical, Construction, Hydraulics, Materials and Test, Traffic Operations, Traffic Design, Strategic Transportation Investments, and Quality Assurance/Quality Control (QA/QC).

The Coordinator will select the team leader and they will work together during the planning and scheduling of the VE analysis. The team leader will guide the team during the project analysis and the Coordinator shall oversee the team's progress to ensure that the VE analysis process, as defined in 23 CFR Part 627.3, is followed.

1-503.03 VALUE ENGINEERING JOB PLAN

The VE team analysis shall follow the VE Job Plan, which consists of seven phases as defined in 23 CFR Part 627.3(f). Prior to the beginning of the VE team analysis, the Coordinator will scale the level of analysis conducted and effort expended for each phase to meet the needs of each individual project and convey this plan of analysis to the team leader.

Analyze Project Functions:

1. Information Phase: Review project information, including commitments and constraints, and identify and define the current project conditions and overall analysis goals.

2. Function Analysis Phase: Analyze the project information to understand the required functions of the project and define each required function using a two-word active verb/ measurable noun technique.

Generate Alternatives:

3. Creative Phase: Generate ideas to identify other ways to accomplish the required functions which improve the project's performance, enhance its quality, and/or lower its costs.
4. Evaluation Phase: Evaluate advantages and disadvantages for each design alternative, including life-cycle costs, and the need for additional environmental studies. Select feasible ideas for development.

Act on Recommendations:

5. Development Phase: Develop each selected alternative, including environmental, technical and cost supporting data, into fully supported recommendations
6. Presentation Phase: Present the VE recommendations to TDOT management and/or the Project Manager
7. Resolution Phase: The Coordinator will evaluate, document, and ensure implementation of all approved VE recommendations.

1-503.04 PRESENTATION OF RECOMMENDATIONS

The Coordinator and team leader will work together to create a VE Recommendations Report which includes analysis and cost information for each recommendation. The total estimated VE cost saving for all recommendations will determine how the recommendations are presented.

- For savings totaling $1 million or less, the VE Recommendations Report will be presented to the Project Manager, Regional Project Management Director, and Project Management Director for their evaluation and response.

- For savings totaling more than $1 million, a team member presentation of all recommendations will be made to TDOT management. The VE Recommendation Report will be available for all presentation attendees. A copy of the VE Recommendations Report shall be given to the Project Manager for their evaluation and response prior to the presentation.

The Coordinator will request a written response to each recommendation from the Project Manager. This written response shall explain whether or not the recommendation is found feasible to implement. The team presentation to TDOT Management shall also include any discussions and/or decisions made during the presentation.

1-504.00 VALUE ENGINEERING WORKBOOKS

After the response to all VE recommendations has been received from TDOT Management, the Coordinator shall assemble the VE Workbook. This Workbook shall include all Job Plan forms and all correspondence with TDOT Management. The Coordinator shall distribute the completed VE Workbook to the Project Manager and forward the VE workbook to the FHWA office. A copy shall be retained by the VE Office for at least 3 (three) years after the final acceptance of PS&E plans.

1-505.00 IMPLEMENTATIONS OF APPROVED RECOMMENDATIONS

The coordinator shall oversee the implementation of all accepted VE recommendations. The Project Manager shall be responsible for incorporating all accepted VE recommendations into the project prior to finalizing the PS&E plans. If the Project Manager determines that any accepted VE recommendation is no longer acceptable, he/she shall notify the coordinator and provide, in writing, the reason(s) for the changes. These changes shall be evaluated to determine if any additional action can be taken to modify the recommendation. The coordinator shall review the final PS&E plans to ensure all accepted VE recommendations have been implemented.

PDN - CHAPTER 2

GEOMETRIC

DESIGN CRITERIA

CHAPTER 2 GEOMETRIC DESIGN CRITERIA

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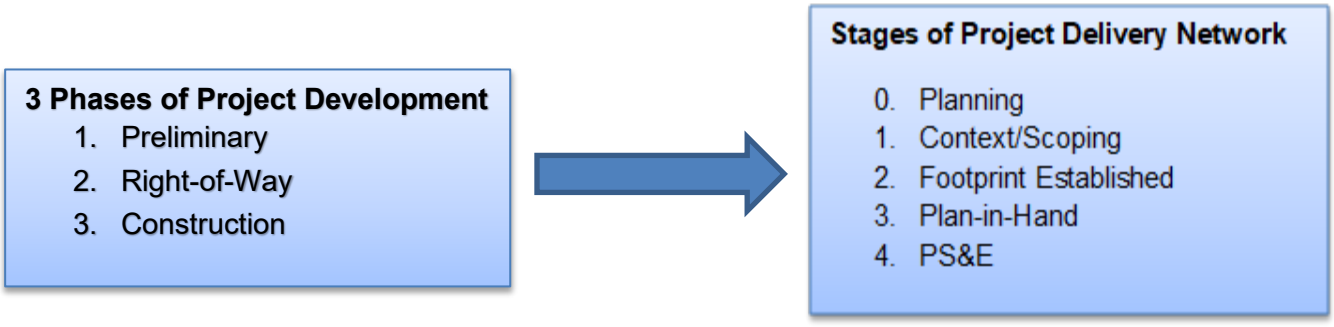
INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** –Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.
  All forms mentioned throughout this chapter can be found on the Roadway Design - TDOT Documents webpage.



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SECTION 1 – CONTROLLING GEOMETRIC DESIGN CRITERIA

2-100.00 CONTROLLING CRITERIA FOR DESIGN

The following sections define both horizontal and vertical design elements including the 10 controlling criteria for design as defined by the FHWA. The 10 controlling criteria can contribute substantial importance to the operation and safety performance of any highway. A formal written design exception process should be followed if any of the following criteria cannot be met. See *Chapter 2-105.00 Design Exception Requests* for further guidance on the process and required form. The 10 criteria are: Horizontal Curve Radius, Superelevation Rate, Lane Width, Shoulder Width, Cross Slopes, Maximum Grade, Stopping Sight Distance, Design Speed, Vertical Clearance, and Design Loading Structural Capacity.

2-101.00 HORIZONTAL DESIGN

The Horizontal Design consists of the horizontal alignment, typical section, slope development, and roadside design. The horizontal design elements are based off of several factors including design speed, rural or urban setting, type of terrain, AADT, and superelevation. The RD11-TS series - Typical Section and Design Criteria and RD11-SE series - Superelevation Details of the Roadway Standard Drawings shall be used to determine the horizontal curve radius, superelevation, lane width, shoulder width, cross slopes, and side slopes. The proposed design speed and road type are listed in the technical report but shall always be reviewed and compared to the standard drawings to ensure the correct typical section is listed based on road type.

2-101.01 HORIZONTAL CURVE RADIUS AND SUPERELEVATION RATES

Horizontal curves provide transitions between tangent sections of roadway. Refer to RD11-SE series - Superelevation Details of the Roadway Standard Drawings and Minimum Runoff Lengths RD11-LR series of the Roadway Standard Drawings to review requirements for horizontal curve radii based on speed of the road. Designers shall refer to these tables to determine the radius required when designing horizontal alignments. Curve data is generated for each horizontal curve by CADD software programs and shall be shown on all projects. The Designer shall fill in any missing data that is not automatically generated. See *Figure 2-1, Curve Data*.

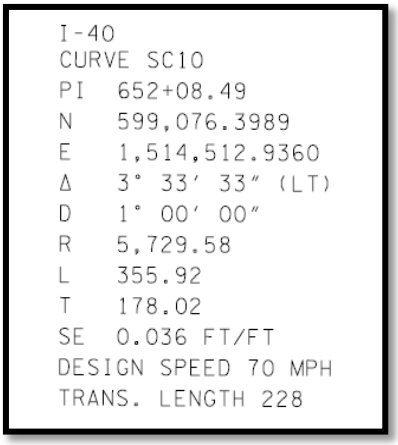


Figure 2-1
Curve Data

Superelevation rates and run-off for horizontal curves are also shown in the RD11-SE series – Superelevation Details of the Roadway Standard Drawings and RD11-LR series - Minimum Runoff Lengths of the Roadway Standard Drawings. For urban projects, the maximum desired superelevation rate is 0.04 ft/ft. For rural projects, the maximum desired superelevation rate is 0.08 ft/ft. If the design superelevation rates cannot be met due to existing conditions, R.O.W. limitations, or other factors, a Design Exception is required. See *Chapter 2-105.00 Design Exception Requests* for further guidance.

The most common type of horizontal curve is a simple circular curve; however, a spiral curve can be used to provide a gradual transition between tangent sections and circular curves. This allows vehicles to more easily transition into and out of a curve while staying within the travel lane. The superelevation tables in the RD11-LR series define when spiral curves shall be placed on projects. Spirals are recommended for curves 50 MPH or greater and superelevation of three percent or greater. In *Table 2-1, Example of Urban Superelevation Table Spiral Curves*, the first entry for a 50 MPH curve that requires a spiral curve is for a Radius of 2,290’.

E MAX = 0.04 DESIRABLE

e_d	V = 20 (MPH)						V = 25 (MPH)						V = 30 (MPH)						V = 35 (MPH)						V = 40 (MPH)						V = 45 (MPH)						V = 50 (MPH)					
	R	Number of Lanes					R	Number of Lanes					R	Number of Lanes					R	Number of Lanes					R	Number of Lanes					R	Number of Lanes					R	Number of Lanes				
(%)	MIN. (FT)	2	3	4	5	6	MIN. (FT)	2	3	4	5	6	MIN. (FT)	2	3	4	5	6	MIN. (FT)	2	3	4	5	6	MIN. (FT)	2	3	4	5	6	MIN. (FT)	2	3	4	5	6	MIN. (FT)	2	3	4	5	6
NC	107	0	0	0	0	0	198	0	0	0	0	0	333	0	0	0	0	0	510	0	0	0	0	0	762	0	0	0	0	0	1039	0	0	0	0	0	7220	0	0	0	0	0
2	92	32	40	49	57	65	167	34	43	51	60	69	273	36	45	55	64	73	408	39	48	58	68	78	593	41	52	62	72	83	794	44	55	67	78	89	4940	48	60	72	84	96
2.2	91	36	44	54	62	72	165	38	47	57	66	76	270	40	50	60	70	80	404	43	53	64	75	86	586	46	57	68	80	91	785	49	61	73	86	98	4280	53	66	79	92	106
2.4	91	39	48	58	68	78	164	41	51	62	72	83	268	44	54	65	76	88	400	46	58	70	81	93	580	50	62	74	87	100	776	53	66	80	93	107	3690	58	72	86	101	116
2.6	90	42	52	63	74	85	163	45	55	67	78	90	265	47	59	71	83	95	396	50	63	75	88	101	573	54	67	81	94	108	767	58	72	87	101	116	3130	62	78	94	109	125
2.8	89	45	57	68	79	91	161	48	60	72	84	96	263	51	63	76	89	102	393	54	67	81	95	109	567	58	72	87	101	116	758	62	77	93	109	125	2660	67	84	101	118	135
3	89	49	61	73	85	98	160	51	64	77	90	103	261	55	68	82	95	110	389	58	72	87	102	117	561	62	77	93	109	125	750	67	83	100	117	134	2290	72	90	108	126	145
3.2	88	52	65	78	91	104	159	55	68	82	96	110	259	58	72	87	102	117	385	62	77	93	108	124	556	66	82	99	116	133	742	71	89	107	124	143	1980	77	96	115	134	154
3.4	88	55	69	83	96	111	158	58	73	87	102	117	256	62	77	93	108	124	382	66	82	99	115	132	550	70	88	106	123	141	734	76	94	113	132	152	1720	82	102	122	143	164
3.6	87	58	73	88	102	117	157	62	77	93	108	124	254	65	81	98	115	132	378	70	87	105	122	140	544	74	93	112	130	150	726	80	100	120	140	161	1480	86	108	130	151	174
3.8	87	62	77	92	108	124	155	65	81	98	114	131	252	69	86	104	121	139	375	74	92	110	129	148	539	79	98	118	138	158	718	84	105	127	148	170	1260	91	114	137	160	183
4	86	65	81	97	114	130	154	69	85	103	120	138	250	73	91	109	127	146	371	77	96	116	135	156	533	83	103	124	145	166	711	89	111	133	156	179	926	96	120	144	168	193

METHOD 2 ④ METHOD 5

Table 2-1
Example of Urban Superelevation Table Spiral Curves

On isolated bridge replacement projects, intersection improvements, widening of existing roadways, etc., where use of spirals would provide no real benefit and/or would be difficult to construct, spirals will not be required. It will still be necessary to provide superelevation and superelevation lengths as shown on RD11-LR series.

2-101.02 TRAVEL, THROUGH, AND TURN LANE WIDTHS

The RD11-TS Series – Typical Sections and Design Criteria Roadway Standard Drawings show the lane width requirement for travel, through, and turn lanes for each road classification. If the lane widths cannot be met due to R.O.W. restrictions, existing conditions, existing structures, etc., a Design Exception Request form shall be submitted. See *Chapter 2-105.00, Design Exception Requests* for further guidance. Design Exceptions are generally not needed at the beginning and ending of a project where lane widths transition down to existing conditions (example twelve feet proposed lanes transition down to existing eleven feet lanes). However, for other roads specified in the Design Exception criteria, the designer shall refer to the typical section standards and evaluate all available information on the road to ensure the best, most economical lane width is proposed. If the Designer has questions or concerns due to the lane width, they should discuss it immediately with the Design Manager and Design Team as well as the Strategic Transportation Investment Division (STID) who furnished the technical report.

2-101.03 SHOULDER WIDTHS

Widths for outside and inside (if applicable) shoulders are defined in each of the RD11-TS Series – Typical Sections and Design Criteria Roadway Standard Drawings based on road classification. If the shoulder width needs to be reduced due to R.O.W. restrictions, existing conditions, existing structures, etc., a Design Exception Request form shall be submitted. See *Chapter 2-105.00, Design Exception Requests,* for further guidance.

For lower volume roads, the outside shoulder may be graded only and not paved. For most rural designs, the shoulder will have a greater portion that is paved with a 2' portion that is not. (12' shoulder will have 10' paved; 6' shoulder will have 4' paved; shoulders less than 6' should be fully paved). It is sometimes economical to pave out the additional 2' and this should be discussed at the Functional Plans field review.

When calculating drainage spread, the inside and/or outside shoulder may be used to carry a portion or all of the water. Often, initial drainage calculations include the entire shoulder width plus one-half of a travel lane for spread. On projects where the existing shoulders are used for spread on a closed drainage system, the Designer shall ensure that the reduced shoulder width can still accommodate the flow without increasing the spread more than the amount allowed into the travel lane.

2-101.04 CROSS SLOPES

The cross slopes of travel lanes and shoulders are defined in each of the RD11-TS Series – Typical Sections and Design Criteria Roadway Standard Drawings based on road classification. If the cross slope does not match the standard drawing, a Design Exception Request and Justification form shall be submitted. See *Chapter 2-105.00, Design Exception Requests* for further guidance. The cross slope of a road is normal crown (-0.02 ft/ft) unless it is in a superelevated section. Shoulder cross slopes are usually -0.04 ft/ft. The slopes of the shoulder and roadway pavement shall not exceed an algebraic difference of 0.07 ft/ft.

Designers shall refer to the appropriate RD11-TS Series – Typical Sections and Design Criteria Roadway Standard Drawings to determine what the change in cross slope should be for more than two travel lanes in the same direction. The Designer shall evaluate the drainage for all widening and new alignment projects to ensure the cross slope will drain the road and not cause ponding issues. This is especially critical on interstate widening projects where drainage occurs along a median barrier wall and the existing inside shoulder width may be reduced to accommodate additional lanes.

2-102.00 VERTICAL DESIGN

The Vertical Design consists of the vertical alignment and components of grade, stopping sight distance, passing sight distance, and vertical clearance. The vertical alignment and how it coincides with the horizontal alignment is reflected in the RD11-TS Series-Typical Sections and Design Criteria Roadway Standard Drawings. These standards shall be used to determine maximum grades for specific design speeds and terrain types, minimum stopping sight distance, and minimum passing sight distance.

There are often times when some of the vertical design criteria cannot be met for a portion of the road on a project. A Design Exception shall be requested for the following vertical

components: maximum grade, stopping sight distance, or vertical clearance. See *Chapter 2-105.00, Design Exception Requests* for further guidance.

2-102.01 VERTICAL GRADES

The RD11-TS Series - Typical Sections and Design Criteria Roadway Standard Drawings list the maximum vertical grade based on design speeds and terrain types. If the maximum grade is exceeded, a Design Exception is required. See *Chapter 2-105.00, Design Exception Requests* for further guidance. However, if the grades exceed the maximum recommendations where the Designer is matching existing vertical grade at the beginning and end of the project, a Design Exception is not needed. If there is a question of whether or not a Design Exception is needed, they shall contact the Engineering Production Support Division at TDOT.EngineeringProductionSupport@tn.gov.

The Designer shall consider constructability of the road, side roads, and private drives when designing the vertical grade. Large cuts and fills are very difficult to construct. If this is unavoidable, the Designer shall discuss traffic control options at the Functional Design field review.

2-102.02 STOPPING SIGHT DISTANCE

Stopping Sight Distance is the distance that a motorist needs to be able to stop before colliding into something in the road such as another vehicle, pedestrian, debris, etc. Stopping sight distance requirements are incorporated into the RD11-TS Series – Typical Sections and Design Criteria Roadway Standard Drawings. If the criteria for K-values for Stopping Sight Distance are not met, a Design Exception is required. See *Chapter 2-105.00, Design Exception Requests* for further guidance.

2-102.03 STOPPING SIGHT DISTANCE ON HORIZONTAL AND VERTICAL INTERSECTIONS

Designers shall evaluate stopping sight distance and understand the correlation between horizontal and vertical components. Stopping Sight Distance shall be determined for both horizontal and vertical curves at intersections. The Designer shall ensure that intersection sight distance is provided in addition to adequate stopping sight distance at all intersections, railroad crossings without train activated warning devices, and commercial drives. The Designer can calculate the line of sight in these cases. Refer to the RD11-SD Series – Intersection Sight Distance Roadway Standard Drawings- for line of sight calculations and tables.

2-102.04 STOPPING SIGHT DISTANCE ON HORIZONTAL AND VERTICAL CURVES

Sight distance should be determined for both horizontal and vertical curves at intersections. *Figure 2-2, Line of Sight for Stopping Sight Distance for Horizontal Curve*, depicts

a situation where the driver is traveling around a curve and the line of sight needed to ensure the other car is visible. If vegetation or other obstacles were in the designated clear zone area, the motorists would not be able to see the car. Designers shall always evaluate the line of sight for areas such as this and where guardrail, median barrier, retaining walls, vegetation, utility poles, and other roadside elements may cause a sight distance issue which in turn causes a stopping sight distance problem.

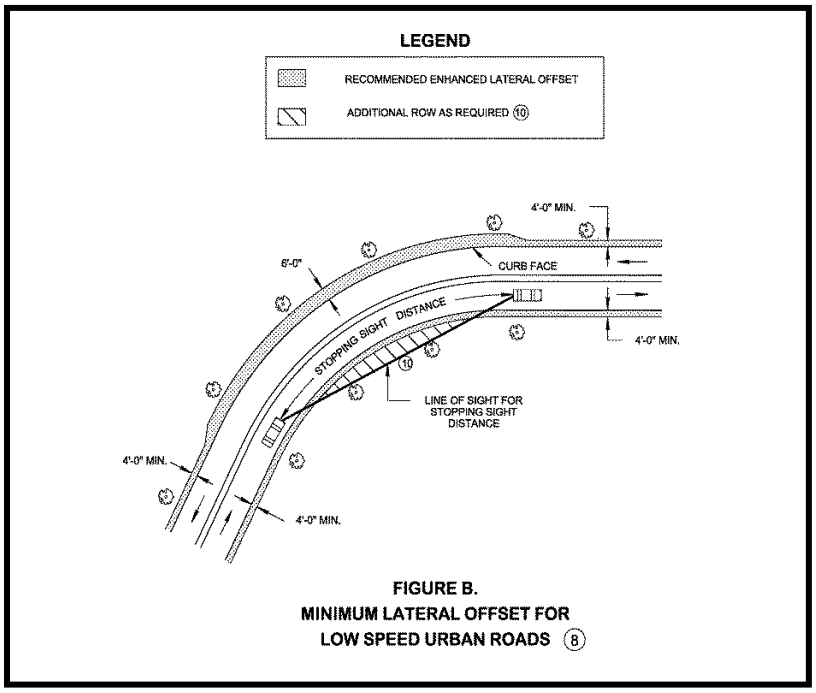


Figure 2-2
Line of Sight for Stopping Sight Distance for Horizontal Curve

Figure 2-3, Line of Sight for Stopping Sight Distance for Vertical Curve, depicts a situation where the driver is traveling over a hill and the road hazard is on the downgrade. Designers shall always evaluate the stopping sight distance on vertical curves where factors such as signalized intersections, side roads, driveway entrances, etc. could cause sight distance issues.

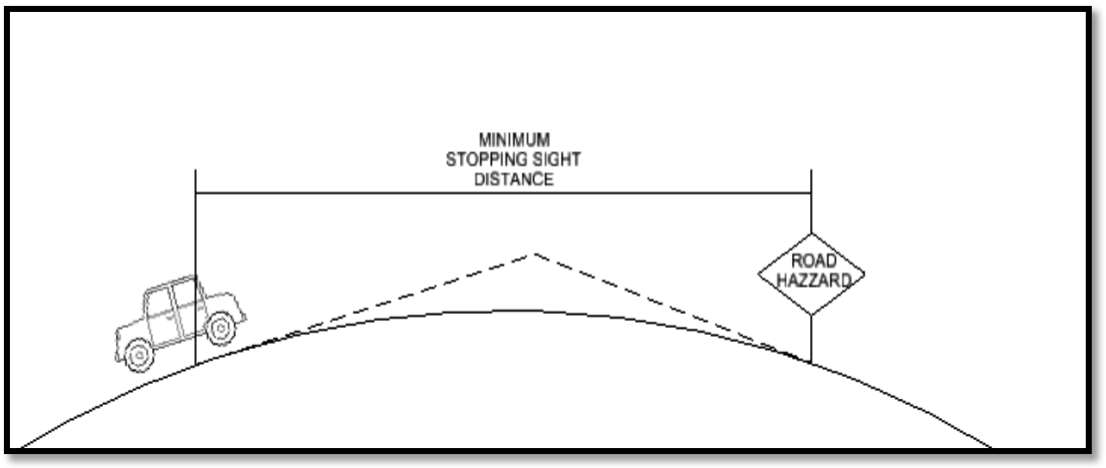


Figure 2-3
Line of Sight for Stopping Sight Distance for Vertical Curve

When designing traffic control plans, stopping sight distance should also be evaluated. When possible, lane drops should be avoided on horizontal and/or vertical curves so that drivers are in a tangent section during the lane drop. Also, designers should ensure that signing is adequate when there are existing stopping sight distance issues or when the construction may be impairing stopping sight distance.

2-102.05 VERTICAL CLEARANCES FOR BRIDGES

The minimum vertical clearance for all structures on all systems shall not be less than 16 feet over the entire roadway width, including the usable width of shoulder. The vertical clearance to sign trusses and pedestrian overpasses shall be 17 feet because of their reduced resistance to impacts. The vertical clearance from the deck to the cross bracing on through truss structures shall also be a minimum of 17 feet. The minimum vertical clearance for railroad crossings from the structure to the top of the rails shall be 23 feet. An allowance of 6 inches shall be added to all vertical clearances to accommodate future resurfacing.

If the length for Stopping Sight Distance is not met, a Design Exception is required. See *Chapter 2-105.00 Design Exception Requests* for further guidance. On crossings of low volume roadways where the cost of providing 16 feet of clearance might be considered unreasonable and may justify an exception, the Design Manager and Structures Division personnel shall complete a joint cost analysis justifying a reduction in vertical clearance. This cost analysis shall be submitted to the Director of the Structures Division for approval.

2-103.00 DESIGN SPEED

The design speed is different from the other controlling criteria in that it is a design control, rather than a specific design element. In other words, the selected design speed establishes the range of design values for many of the other geometric elements of the roadway. Generally, Design Exceptions are requested when the design speed cannot be maintained for the entire project. An example would be that a horizontal or vertical curve could not be designed to meet the proposed design speed. When this occurs, a Design Exception shall be requested for that curve. The project shall be signed with the appropriate advisory speed at locations on the plans where this occurs.

2-104.00 DESIGN LOADING STRUCTURAL CAPACITY

Safe load-carrying capacity for all State unrestricted legal loads or routine permit loads and, in the case of bridges and tunnels on the Interstate, all Federal legal loads is a controlling criteria and shall be evaluated. The Structures Division verifies the loading structural capacity of structures on the roadway. If the proposed design loading structural capacity is not met, a Design Exception shall be requested.

2-105.00 DESIGN EXCEPTION REQUESTS

Despite the range of flexibility that exists with respect to the controlling elements of design, there are situations in which the accepted criteria are not applicable to the project circumstances or cannot reasonably be met. For such instances, when it is appropriate, the design exception process allows for the use of criteria other than the accepted values. Design exceptions can be viewed as opportunities to add practicality or value to the design and should not necessarily be considered as violation of policy. See PDN 2RD1 for more information.

The design exception process requires formal approval for exceptions relating to the following 10 controlling criteria of design:

Type I Exception to Controlling Criteria

- Design Speed
- Design Loading Structural Capacity

For exceptions based on Type I Criteria, all roadways on the **NHS** may require FHWA's review. The Roadway Design Division Director provides final approval. Exceptions to Type I criteria are rare and additional information shall be provided.

Type II Exception to Controlling Criteria

- Lane Width
- Horizontal Curve Radius
- Stopping Sight Distance
- Shoulder Width
- Cross Slopes
- Vertical Clearance
- Superelevation Rate
- Maximum Grade

For exceptions based on Type II Criteria, all roadways on the **NHS** with design speeds **≥** 50 mph may require FHWA's review. The Roadway Design Division Director provides final approval.

All other roadways (non-NHS) exceptions to controlling criteria do not require FHWA's review; the Roadway Design Division Director provides final approval.

Projects designated as Limited Scope do not require a design exception.

Note:

Roadways on the Appalachian Development Highway System, or FHWA Projects of Division Interest (PODI) may require FHWA's review for design exceptions regardless of the controlling criteria.

Design exception requests for projects shall be submitted to the Regional Director of Project Development using the Design Exception Form. Once reviewed and recommended for approval, the Regional Director of Project Development shall forward the design exception request form to the Engineering Division Director (or Designee), who will either provide final approval or forward to FHWA for final approval, as appropriate.

Approved design exceptions **shall** be noted, with approval date, in the lower right corner of the title sheet as well as on the cover sheet for the Functional Design.

All applicable material from the following list shall be addressed in narrative form on the Design Exception Request Form by the Designer. For locally developed projects, the highest local official responsible for the project is responsible for this task.

1. Accident experience or data.
2. The effect of the variance from the design standard on safety and operation of the facility.
3. Any safety mitigation measures considered and provided to minimize the effect of the reduced design.
4. The compatibility of the design and operation with adjacent sections.
5. The comparative cost of the full standard versus the reduced design being proposed.
6. The long-term effect of the reduced design as compared to the full standard.

7. The difficulty in obtaining the full standard such as right-of-way restriction, delays, environmental impacts, etc.
8. Any capacity reductions or operational problems caused by the proposed exception.
9. Level of service for full standards versus the reduced design.
10. The cumulative effect of more than one standard that is being reduced.
11. The possibility of improving or correcting the reduced design feature in the future

SECTION 2 – NON-CONTROLLING GEOMETRIC DESIGN CRITERIA

2-200.00 NON-CONTROLLING GEOMETRIC DESIGN CRITERIA

In addition to the 10 controlling criteria designated by FHWA, there are other criteria that are critical to the geometric design. Any deviation from the standards for these design elements will require a Design Waiver as opposed to a Design Exception. See PDN 2RD1 for more information.

2-200.01 PASSING SIGHT DISTANCE

Passing sight distance requirements are incorporated into the RD11-TS Series – Typical Sections and Design Criteria Roadway Standard Drawings. Sufficient passing sight distance is a major factor when designing a two-lane road. The Designer shall ensure both the horizontal and vertical design is sufficient to provide passing zones. The motorist needs vertical sight distance as well as horizontal passing zone length. Refer to *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2011, Chapter 3.

2-200.02 VERTICAL CURVES

A vertical curve provides a transition between two different roadway profile grades, allowing the vehicle to negotiate the elevation rate change at a gradual rate rather than a sharp angle (see *Figure 2-4, Vertical Curves)*. The design of the curve is dependent on the intended design speed for the roadway, as well as drainage, slope acceptable rate of change, and friction. Refer to *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2011, Chapter 3. Proper design of vertical curves helps minimize and balance cut and fill; provides sufficient sight distance; and maintains adequate drainage. See the Roadway Design Typical Section and Design Criteria standard drawings for maximum grades, minimum stopping sight distances, design stopping sight distances, and minimum “K” values for crest, sag and passing sight distance for crest curves.

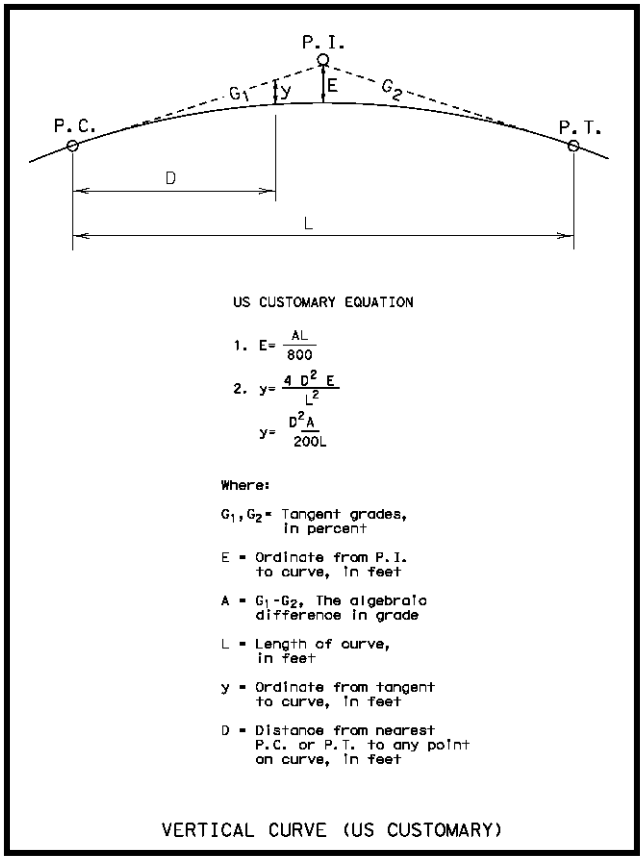


Figure 2-4
Vertical Curves

2-200.03 ROADSIDE SLOPE DEVELOPMENT

The soils and geology report is required as outlined in the Project Delivery Network 2GT1. Information from this report will provide the Designer with alternate slopes that may be needed that differ from the Standard Drawings and/or information on other measures that may be needed for slope stabilization, such as the addition of a rock pad, rock buttress, etc.

Roadside slopes are generally classified as a recoverable, traversable, non-traversable or critical slope.

- Traversable slopes consist of a slope that is 3:1 or flatter and free of obstructions in the clear zone.
- Recoverable slopes consist of a slope that is 4:1 or flatter and free of obstructions in the clear zone.

- Non-traversable slopes are either steeper than 3:1 or have obstructions in the clear zone.
- Critical slopes consist of a slope that is non-traversable and shall be protected by guardrail, retaining wall, barrier rail, cable barrier, etc.

2-200.04 CLEAR ZONE

Clear zone is the unobstructed traversable portion of the roadside that allows a driver who has lost control of their vehicle to re-gain control and stop safely. Clear zone criteria are defined in the S-CZ Series – Clear Zone and Safety Plans Roadway Standard Drawings. If at all possible, nothing shall be located within this area. However, the standard drawings take the Designer through the steps to determine what to do to a hazard that is located in the clear zone. Options are removal, relocation, making the obstacle breakaway, shielding with barrier, or delineating the object. Designers often miss obvious roadside hazards such as endwalls, interstate sign poles located in medians, etc. Rigid roadside features such as abutments or bridge parapets shall be placed such that a minimum 24' clear path (both travel lanes + shoulder) is provided for large farm equipment on rural roadways. Refer to the *Roadside Design Guide,* AASHTO, current version, for further information for clear zone areas.

CLEAR ZONES IN URBAN AREAS BEHIND CURB AND GUTTERS

In rural areas, the typical sections for clear zones are easily defined based on the typical sections and distance between the edge of pavement line and ditch. Clear zones in urban areas are usually harder to determine because of the numerous factors such as whether a grass strip is located between the back of curb and the sidewalk or if the sidewalk is a larger shared-use path, etc. The S-CZ Series (Clear Zone and Safety Plans) and MM-SW-1 Roadway Standard Drawings clearly define what the clear zone is in several situations. The Designer shall ensure that ADA accessibility requirements are met if a pole must be placed in a sidewalk area because there are no other options. In this case, there has to be a minimum of four feet (4') clearance from the hazard to the edge of the sidewalk (See MM-SW-1 for more information). This shall be discussed at the Functional Design field review with all utilities that are located within the project as well as the Traffic Operations Division if signals and/or lighting are proposed on the project.

CLEAR ZONES ON CURVED ALIGNMENTS

Designers shall evaluate the clear zone on curves. In Chapter 3 of the AASHTO *Roadside Design Guide,* a formula is given for an increase in clear zone on the outside of curves. The clear zone on a curved alignment is determined by increasing the value obtained from the *Roadside Design Guide* method for a tangent section of highway. The tangent section clear zone is increased by a curve correction factor, which is based on the degree of curvature and the design speed. No obstacles shall be located within the line of sight around the curve. It may be that additional R.O.W. is purchased to ensure that this criterion is met.

TABLE A. CLEAR ZONE DISTANCE (Lc) (FEET)

DESIGN SPEED	DESIGN ADT	FORESLOPES (H:V)			BACKSLOPES (H:V)		
		6:1 OR FLATTER	5:1 TO 4:1	3:1	6:1 OR FLATTER	5:1 TO 4:1	3:1
40 MPH OR LESS	UNDER 750 (7)	7 - 10	7 - 10	(4)	7 - 10	7 - 10	7 - 10
	750 - 1500	10 - 12	12 - 14	(4)	12 - 14	12 - 14	12 - 14
	1500 - 6000	12 - 14	14 - 16	(4)	14 - 16	14 - 16	14 - 16
	OVER 6000	14 - 16	16 - 18	(4)	16 - 18	16 - 18	16 - 18
45-50 MPH	UNDER 750 (7)	10 - 12	12 - 14	(4)	10 - 12	8 - 10	8 - 10
	750 - 1500	14 - 16	16 - 20	(4)	14 - 16	12 - 14	10 - 12
	1500 - 6000	16 - 18	20 - 26	(4)	16 - 18	14 - 16	12 - 14
	OVER 6000	20 - 22	24 - 28	(4)	20 - 22	18 - 20	14 - 16
55 MPH	UNDER 750 (7)	12 - 14	14 - 18	(4)	10 - 12	10 - 12	8 - 10
	750 - 1500	16 - 18	20 - 24	(4)	16 - 18	14 - 16	10 - 12
	1500 - 6000	20 - 22	24 - 30	(4)	20 - 22	16 - 18	14 - 16
	OVER 6000	22 - 24	26 - 32 (3)	(4)	22 - 24	20 - 22	16 - 18
60 MPH	UNDER 750 (7)	16 - 18	(9)	(9)	14 - 16	12 - 14	10 - 12
	750 - 1500	20 - 24	(9)	(9)	20 - 22	16 - 18	12 - 14
	1500 - 6000	26 - 30	(9)	(9)	24 - 26	18 - 22	14 - 18
	OVER 6000	30 - 32 (3)	(9)	(9)	26 - 28	24 - 26	20 - 22
65-70 MPH	UNDER 750 (7)	18 - 20	(9)	(9)	14 - 16	14 - 16	10 - 12
	750 - 1500	24 - 26	(9)	(9)	20 - 22	18 - 20	12 - 16
	1500 - 6000	28 - 32 (3)	(9)	(9)	26 - 28	22 - 24	16 - 20
	OVER 6000	30 - 34 (3)	(9)	(9)	28 - 30	26 - 30	22 - 24

ADAPTED FROM TABLE 3.1 OF THE "ROADSIDE DESIGN GUIDE," AASHTO, 2011.

Figure 2-5
Clear Zone Distance (Lc)

The Designer must remember that the clear zone values (Lc), *Figure 2-5, Clear Zone Distance (Lc),* are based on a constant side slope throughout the clear zone distance. In situations where the side slope changes within the calculated clear zone, the clear zone must be recalculated based on a weighted average of the side slopes.

2-200.05 DESIGN VEHICLE

Designers should consider the largest design vehicle that is likely to frequently use the road to determine the design vehicle. For urban areas, public transportation vehicles (CITY-BUS) shall be the design vehicle. For rural and suburban areas, a large school bus (S-BUS40) shall be the design vehicle. If the traffic report indicates 2% or more truck traffic, then a semi-truck (WB-67) size shall be evaluated for both rural and urban areas. Design vehicles should be carefully considered anywhere they are expected to make a turning movement through an intersection. For more information on design vehicles, see the AASHTO Green Book and Roadway Standard RD11-SD series. If the project design is unable to meet these design vehicles, a design waiver form should be submitted.

2-200.06 MULTIMODAL FACILITIES

The Designer shall refer to RDG Chapter 3, Multimodal Design for guidance on bicycle lanes. The MM-TS Series – Typical Sections and Design Criteria of the Roadway Standard Drawings provides width requirements for bicycle and pedestrian facilities for several applications.

2-201.00 DESIGN WAIVER REQUESTS

A Design Waiver is a variance not based on the 10 controlling design criteria. It is any variance from the TDOT Standard Drawings. These requests include, but are not limited to, clear zone width, passing sight distance, vertical curves, and multimodal features. A Design Waiver Request Form shall be submitted for approval by the Regional Project Development Director and then approved by the Engineering Divisoin Director (or Designee). See PDN 2RD1 for more information.

Approved design waivers **shall** be noted, with approval date, in the lower right corner of the title sheet as well as on the cover sheet for the Functional Design and Plan-in-Hand checklist. Justification shall be provided on the Design Waiver Request Form.

SECTION 3 – ROADSIDE DESIGN CRITERIA

2-300.00 ROADSIDE DESIGN CRITERIA

The roadside is defined as the area beyond the traveled way. The Roadside Safety Design focuses on the placement and selection of roadside safety features with the intention of minimizing the consequences of a motorist inadvertently leaving the roadway. Roadside safety technology is a rapidly changing, evolving field. As performance experience is gained and research programs reveal new and improved practices, roadside design criteria and safety policies are being updated as well.

While it may not be practical or feasible to apply all new technology to existing roadways, Designers should use this section to evaluate and reduce the severity of impacts during reconstruction projects on existing alignment. Refer to the Maintenance Division's Pavement Resurfacing Program Standard Operating Guidelines for low cost safety improvements that could be applied during the development of resurfacing plans.

This chapter discusses the development and evaluation of the forgiving roadside concept and its application to roadside design and clear zones applicable to new construction and major reconstruction projects. For more information refer to the AASHTO Roadside Design Guide and FHWA's Office of Safety. The designers shall complete the project-specific design criteria document as detailed in PDN Section 1RD1. At locations where the following roadside design criteria could not be met, Designers shall complete a Design Exception or a Design Waiver form for roadway cross sectional elements to evaluate safety in design.

2-301.00 CLEAR ZONE CONCEPT

As initially depicted in the Line and Grade package and finalized in the Functional Design Plans, a clear zone is the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles. The clear zone may consist of shoulders, bike lanes, auxiliary lanes (unless functioning as a through lane), a recoverable slope, a non-recoverable slope, and/or a clear run-out area. Obstacles located within this clear zone distance should be removed, relocated, redesigned to be crashworthy, or shielded by traffic barriers or crash cushions.

Roadway Standard Drawing S-CZ-1 provides a general approximation of clear zone distances. The tabulated data shown in the drawing are based on limited empirical research extrapolated to provide suggested clear zone distances to address for a wide range of conditions. Designers should keep in mind site-specific conditions, design speeds, rural versus urban locations, and practicality when reviewing clear zones. It is important to remember the clear zone distance with horizontal curves are always larger (10% to 50%) than tangent sections. The distances obtained from Roadway Standard Drawing S-CZ-1 should suggest only the

approximate center of a range to be considered and not a precise distance to be held as absolute. For roadways with low traffic volumes (ADT<2000), it may not be practical to apply even the minimum values found in Roadway Standard Drawing S-CZ-1.

2-302.00 ROADSIDE BARRIERS

Roadside barriers are used to protect the traveling public from an unavoidable and unmovable object, body of water, non-traversable slopes, and to prevent lane departures into oncoming traffic. Roadside barriers should only be placed in areas where a roadside hazard exists that cannot be removed and the potential harm from an impact with the barrier is less serious than impacting an object or the potential of overturning resulting from a non-traversable steep slope. The warrants below are meant as a guideline for Designers to make the determination initially determined in the Functional Design Plans and detailed fully in the Plan-in-Hand plans.

When barriers are indicated by warrant, Designers should first consider the following in the order listed:

1. Remove the obstacle. (Is the obstacle necessary? If not remove the obstacle.)
2. Relocate the obstacle to a point where it is less likely to be struck. (If the obstacle is necessary, can it be moved outside of the clear zone?)
3. Redesign the obstacle to be safely traversed. (Such as flattening a steep 2:1 slope to flatter than 3:1)
4. Reduce impact severity by using an appropriate breakaway device. (Typically applies to signs and some poles)

Based on site conditions, Designers should also consider the use of a rumble strip/stripe, to delineate the obstacle, provide advanced warning signs, and in some cases reduce the design speed (or posted speed for reconstruction projects).

The following sections give guidance on warrants, length of need, and choosing the appropriate barrier system.

2-302.01 BARRIER WARRANT 1: AT BRIDGES OR CULVERTS

Barriers are warranted anytime the road crosses a bridge, box culvert or slab bridge. Most structures will be designed with a specified concrete bridge rail by the Structures Division. A minimum length of bridge transition section with proper end terminal must be provided at bridge ends. Typical Length of Need (LON) distance will be greater so the designer should determine the minimum LON required for each approach. Due to existing considerations, providing the desired LON may be limited during reconstruction and rehabilitation projects or routine maintenance activities. The Designer should use sound engineering judgement during the roadside design of such projects. See *Chapter 2-302.06, Barrier Length of Need* for more information.

For installation details when Warrant 1 is met, see Roadway Standard Drawings - Safety Plan series:

- **S-PL-1** SAFETY PLAN AT ROADSIDE HAZARDS
- **S-PL-3** SAFETY PLAN MINIMUM INSTALLATION AT BRIDGE ENDS
- **S-PL-4** SAFETY PLAN FOR BRIDGE PIERS IN CLEAR ZONE
- **S-PL-5** SAFETY PLAN FOR BRIDGE ENDS IN MEDIANS

In some cases, box culverts or slab bridges may use guardrail instead of bridge parapet rail. The amount of fill over the bridge will determine how the guardrail will be installed. See *Chapter 2-303.01, Guardrail Special Designs* and Roadway Standard Drawing S-GRS-2 for more information.

During the development of reconstruction projects on existing alignment, at locations where a bridge transition with tangential guardrail end terminal could not be installed due to intersection side road or a driveway, the Designer should evaluate the best practices to reduce the crash severity. Some design alternatives include: maintaining the same hardware type to eliminate transition section; installing a curve guardrail (Roadway Standard Drawing S-GRS-7) rather than a tangential guardrail terminal; or installing a crash cushion, which will reduce the impact severity (but may not satisfy the length of need). These will offer significant safety benefits at locations with extreme site limitations. Bridges located within a horizontal curve on high speed (V>45 mph) rural highways may need further evaluation. Providing additional lateral offset (wider outside shoulder) will provide a safety benefit at locations with road departure crash history.

2-302.02 BARRIER WARRANT 2: NON-TRAVERSABLE SLOPES

One of the controlling criteria of geometric design is side slope (foreslope) development. Providing traversable foreslopes within the clear zone to reduce crash severity is also a roadside safety design criteria. A typical side slope design should follow the Roadway Standard Drawing RD11-TS- Series showing traversable side slope rates based on functional classification, speed, and ADT. In addition, the Roadway Standard Drawing RD11-S-11 provides traversable rounding details at slope break and Roadway Standard Drawing RD11-S-11A provides typical sections of traversable ditch designs. Refer to *Figure 2-6, Preferred Traversable "V" Ditch Cross Section Configurations* for preferred ditch configurations.

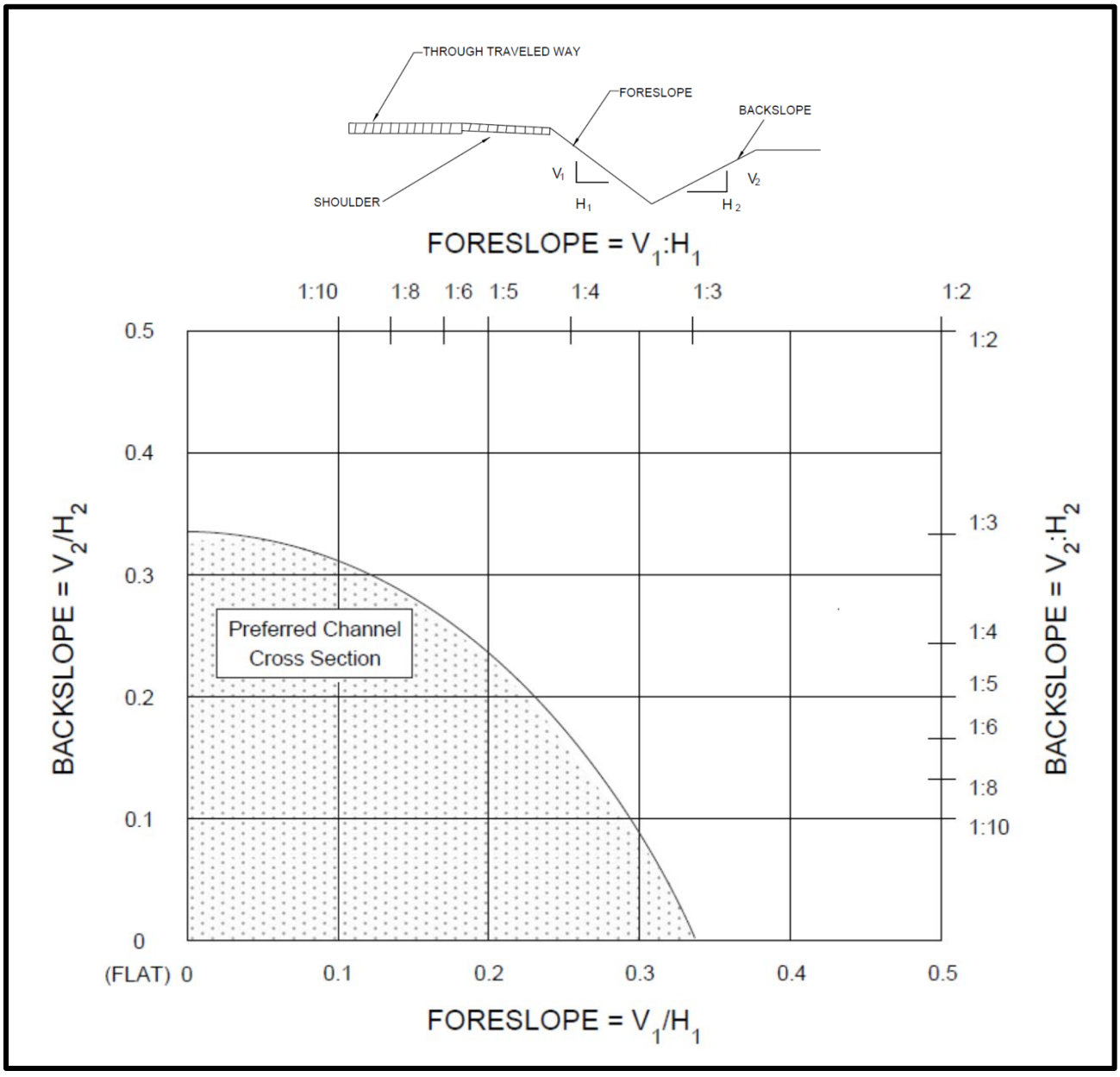


Figure 2-6
Preferred Traversable "V" Ditch Cross Section Configurations
(Ref. AASHTO Roadside Design Guidelines 4th Edition)

Fill section slopes (foreslopes) located inside the clear zone are categorized as:

- Recoverable slopes: fill slopes between 6:1 to 4:1, an errant vehicle could return to roadway,
- Non-recoverable slopes: fill slopes between 4:1 to 3:1, an errant vehicle usually maintains stability reaching the toe of the fill, therefore, additional 10' of clear landing area is desired within the ROW - See AASHTO Roadside Design Guide, 4th edition, Section 3.3.2 Non-Recoverable Foreslopes.
- Critical slopes: fill slopes steeper than 3:1.

Barriers are warranted if the combination of non-recoverable or critical fill slopes and the fill section height combine to create a hazard for an errant vehicle departing the travel lane. See the below *Figure 2-7, Comparative Barrier Consideration for Embankments* for warrant criteria.

In addition to the main roadway foreslope, there are other intersecting slopes of the roadway, driveway, or median crossovers located inside the clear zone called Transverse Slopes. Although the exposure to transverse slopes is less than foreslopes or backslopes, they generally are more critical to errant vehicles because run-off-the-road vehicles typically strike them head-on. Transverse slopes 6:1 or flatter are suggested for high speed facilities located inside the clear zone. Designer should use D-SEW-1A parallel pipe endwalls inside the clear zone matching 6:1 fill slope. Pipes located under median crossovers will use D-SEW-12D pipe endwall at 12:1 slope.

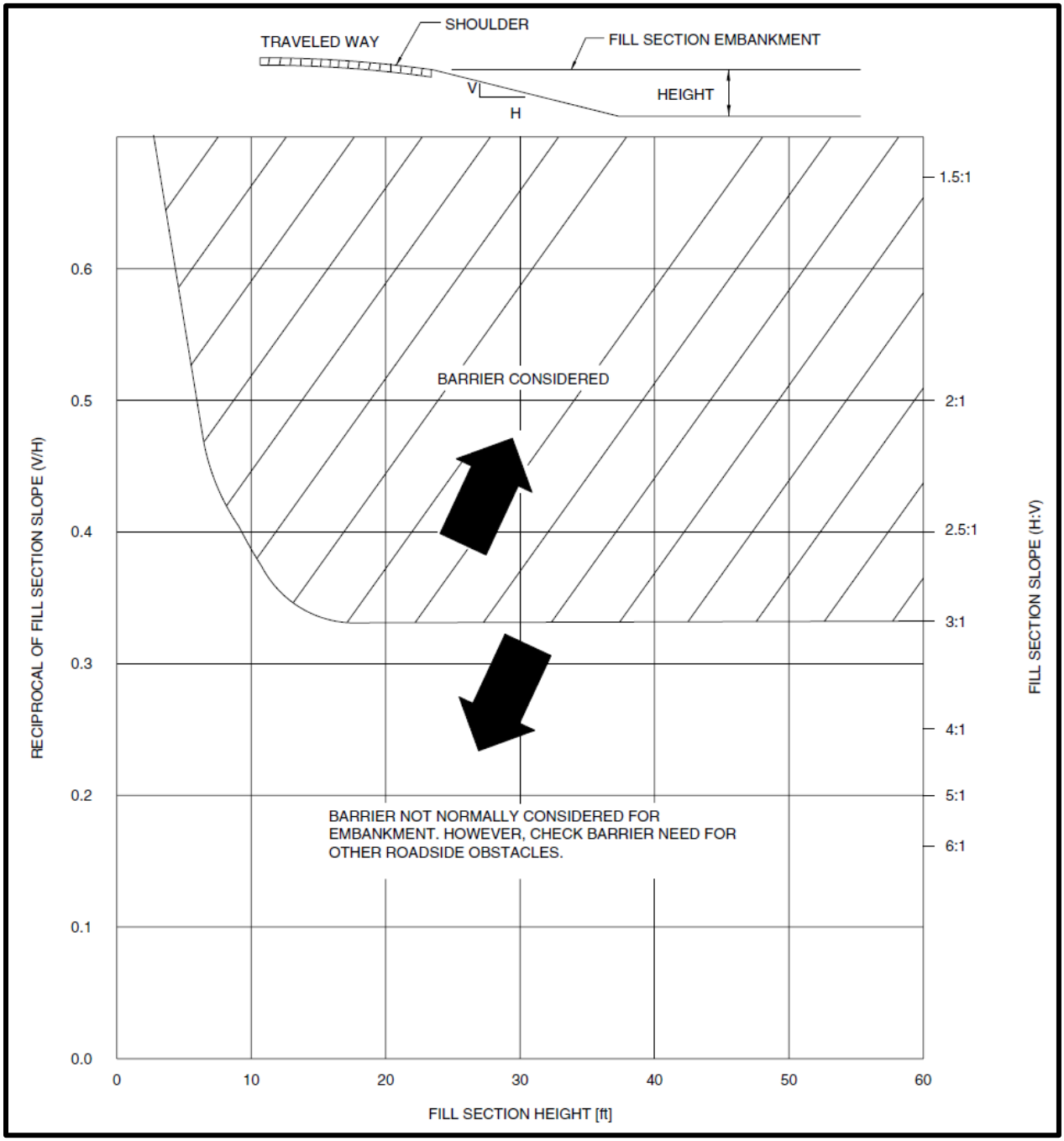


Figure 2-7
Comparative Barrier Consideration for Embankments

2-302.03 BARRIER WARRANT 3: ROADSIDE OBSTACLES

Barriers are warranted on high speed roadways anytime an obstacle is found inside the clear zone area (as defined on Roadway Standard Drawing S-CZ-1) based on traffic volumes, speeds, and slopes. Designers should consider the context of the roadway location since the implementation of S-CZ-1 may not be feasible in urban locations.

For installation details of barriers when Warrant 3 is met, see Roadway Safety Plan Standard Drawing S-PL Series. Typical obstacles are listed below, though other obstacles not on the list may also warrant a barrier if determined by engineering judgment.

Typical Roadside Obstacles Warranting Barriers

- Critical fill slopes (less than 3:1)
- Steep transverse slopes (fill slope of intersecting side road)
- Trees
- Poles
- Bridge Abutments and Piers
- Retaining Walls
- Streams
- Traffic Signal Poles
- Lighting Structures
- Overhead Sign Structures
- Utility Structures
- Pipe Headwalls (Type A, B, or Straight)

In general, the following roadside objects are not considered hazards. These objects may be installed in the clear zone (if noted conditions are met) without the need for shielding.

Typical Objects Not Warranting Barriers

- Objects utilizing breakaway supports approved by the Department such as small or large signs posts, light poles.
- Relatively smooth vertical backslopes (such as rock cuts) generally do not require protection as impacting a barrier is unlikely to provide any benefit to the occupant of the vehicle as opposed to striking the vertical backslope. Delineation of the backslope is recommended on the outside of a curve.
- Right-of-way Fences
- Cross drains utilizing Roadway Standard Drawing D-PE Series “U” endwalls or side drains (parallel drains) with D-SEW endwalls. These endwalls are designed to be traversable and will allow a vehicle to safely pass over.
- Small trees (less than 4” in diameter)

2-302.04 BARRIER WARRANT 4: FREEWAY MEDIAN DEPARTURES

On full or semi-full access-controlled highways or freeways where the opposing lanes of traffic are separated by an at-grade (paved) median, a barrier should be considered at locations where proper clear zone width cannot be provided. In cases when the freeway is separated by a depressed median, the fill slopes of the median should provide traversable clear zone distance in accordance with Roadway Standard Drawing S-CZ-1 for an errant vehicle to recover. If one or more of the below conditions exist, barriers are warranted for the median.

- This warrant is independent of, and superseded by, warrants 1 through 3. In cases where a bridge end, obstacle, or steep slope is present in the median, placing barriers for those conditions take precedence.
- For installation of barriers when Warrant 4 is met, double sided median guardrail, cable barrier, or concrete median barrier with crash cushions based on the site conditions may be used. See Roadway Standard Drawings: S-PL-6 and S-PL-6A.

2-302.05 EXCEPTIONS TO BARRIER WARRANTS

In certain cases, barriers should not be placed because doing so would be undesirable for the level of access provided by the roadway, be infeasible due to lack of sufficient space, or cause greater safety hazards than the hazard being shielded. In general, the following conditions generally do not warrant barrier protection.

Urban Context: Barriers are typically not recommended on low speed urban roads and streets (local roads and streets are usually posted 35 mph or less) because:

- Low speeds make roadway departure crashes less likely and less severe
- Urban zones require higher access that would be hindered by barriers
- Urban zones have many more intersections that make barrier installation impractical

Small Sections with Short Drop-offs: Barriers are typically not recommended to protect small critical fill slope sections of roadway (less than 100 feet along centerline) with drop-offs less than 10 feet because the risk from a vehicle encroaching this section is less than the risk of striking a barrier system.

Utility Poles: In many cases utility poles are within TDOT right-of-way and are often in the clear zone of rural highways. It is impractical and infeasible to install barriers to protect every utility pole. During the planning of new projects, coordination should be made with the utility company to relocate the poles as far away from the edge of the roadway as possible to mitigate risk. For poles that cannot be moved away from the clear zone the poles should be delineated. Utility owners currently occupying TDOT right-of-way may be asked to evaluate feasible alternatives as required by Title 23 U.S.C. for relocation within or outside of State right-of-way.

2-302.06 BARRIER LENGTH OF NEED

Once the need for a barrier is determined the next step is to calculate the amount of barrier needed. The distance required is referred to as “Length of Need” (LON). There are two types of hazards. The first one is a single obstacle (a rigid object) located inside the traversable clear zone, which will have shorter LON since the full width of clear zone will not be used during the determination of the length. The second one is a non-traversable obstacle such as a river. Non traversable objects travel beyond the maximum clear zone distance therefore LON calculations use max clear zone distance. Most of the time, the beginning of the critical fill slope approaching a bridge for a stream crossing determines the area of concern, therefore it will determine the LON.

As the clear zone distance to a single object or non-traversable object will vary for the opposing traffic, the LON will change at the trailing end as well. The Designer should pay extra attention calculating LON inside the horizontal curves since clear zone distances are 10 to 50 percent larger than the tangent sections. If warranted, the Designer should consider extending the trailing end of guardrail installation to contain errant vehicles failing to negotiate the outside of the curve as a good safety practice. The Roadway Safety Plan Standard Drawing series drawings show typical installations for various cases.

- **S-PL-1**: LON along the roadway for objects or hazards (Warrants 1, 2 and 3)
- **S-PL-3**: Minimum guardrail installation length for bridge ends. Designer must confirm LON requirement. (Warrant 1)
- **S-PL-4**: Minimum freeway bridge pier protection installation details. Designer shall calculate the minimum LON required. (Warrant 2)
- **S-PL-5**: Typical guardrail placement to protect grade separated bridge ends in the depressed median (Warrant 1)

2-302.07 BARRIER TYPE SELECTION CRITERIA

Utilize the following guidelines to determine the appropriate system. See appropriate Roadway Standard Drawings for installation details of each system, S-PL-6 and S-PL-6A.

A) BARRIER TYPE SELECTION CRITERIA FOR WARRANTS 1 THROUGH 3

Typical structural features placed within the clear zone distance: bridge piers, abutments, retaining walls, overhead sign supports, etc.

a. If the distance from the edge of shoulder to the object is less than 5 feet, use concrete median barrier S-SSMB-3 or S-SSMB-2
b. If the distance from the edge of shoulder to the object is greater than 5 feet, use guardrail. See Roadway Standard Drawing S-PL-6.
c. Some roadway features are critical such as bridge piers or MSE type retaining walls and are vulnerable to impact forces. Designers should communicate with the Structures Division to evaluate the design and select proper roadside safety hardware (TL-5 or TL-6) to protect such features and motorists.

B) BARRIER TYPE SELECTION CRITERIA FOR WARRANT 4

a. By design, highways separated by medians offer a safer operational environment on high speed facilities providing desirable traversable clear zone distances for errant vehicles to recover. However, Designers should evaluate the rare possibility of run-off-the road lane departure and evaluate if the facility needs cable barrier. Refer to *Chapter 2-305.00, Cable Barriers* for Cable Barrier evaluation criterion. Follow the guidance provided on Roadway Standard Drawing S-PL-6A, *Safety Hardware Placement in Median* for guidance provided to select appropriate hardware type based on site conditions.

2-303.00 GUARDRAIL

A guardrail system consists of rail, connections, terminals, and anchors. Guardrail consists of metal W-Beam rail supported by wooden post with wood blockouts or steel posts with wood or composite blockouts. If required for special conditions, powder coated alternative with corresponding pay item numbers may be used.

For a W-beam guardrail installation to perform properly, the system must be anchored at both ends to maintain tension (See Roadway Standard Drawings S-GRA series). Approach ends of guardrail must be terminated with an approved crashworthy end terminal with an earth pad (see *Chapter 2-306.02, Guardrail End Terminals*). If the trailing end is located outside the clear zone an anchor may be installed at the trailing end in lieu of a terminal to maintain tension on the GR system.

To ensure proper embedment depth for guardrail post, use 8’ long post option for all roadway fill sections 6:1 and steeper. Relocating slope break two feet behind the guardrail face will provide needed embedment depth eliminating the need for 8’ post. Performance of the guardrail system will be affected when used in conjunction with curbing (6” vertical or slope), or an offset placement from the edge of travelled lane due to placement of sidewalk, shared-use-path, etc. Refer to S-PL-6 for installation guidance.

At the point of impact, semi-rigid guardrail dynamic deflection may reach up to five feet. To provide the system with working room to perform, provide five feet behind the face of guardrail. This zone should be kept clear of rigid obstructions.

Double-sided guardrail (Median Divider Guardrail) may be used in limited cases in the median in place of concrete or cable barriers, particularly when the required length is relatively short. Median divider guardrail is also used when guardrail may be subject to impacts from either side. In cases where the median divider guardrail is installed near the edge of pavement, it is important that the area between the posts is free of asphalt to provide post rotation in soil for the post to perform as designed. See Roadway Standard Drawings S-GR31-1C, S-SSMB-6B or S-SSMB-6E for more details.

2-303.01 GUARDRAIL SPECIAL DESIGNS

Due to site conditions sometimes a guardrail system may not be installed as shown on the standard drawings. However, there are several special installations that may be utilized.

Guardrail at Underground Conflicts:

In the case when a utility or pipe culvert prevents driving guardrail posts the Designer shall refer to:

- Roadway Standard Drawing S-GRS-1 if omitting one post or if only one post is affected by the obstruction
- Roadway Standard Drawing S-GRS-3 if guardrail post or posts could not be driven due to underground facilities.

Guardrail across Box Culvert or Slab Bridge:

- In the case when guardrail runs across a box culvert or slab bridge that has fill of less than 3'-4" over the deck, the Designer shall refer to Roadway Standard Drawing S-GRS-2. In this case, the guardrail will be paid for under Item Number 705-01.04 Metal Beam Guard Fence per L.F.
- If the fill is greater than 3'- 4", guardrail will be installed in the typical method as shown on Roadway Standard Drawing S-GR31-1. In this case, the guardrail will be paid for under Item Number 705-06.01 W Beam GR (Type 2) Mash TL3 per L.F.

Guardrail at Intersections:

When the length of need for guardrail extends beyond the location of an intersection or a driveway, the guardrail shall be curved around the intersection radius and type in-line anchors installed as shown on Roadway Standard Drawing S-PL-2. When curved guardrail cannot be installed due to extreme site limitations, the Designer shall terminate the guardrail and install an in-line anchor (see S-GRA-4) to provide downstream tension for the GR system. Every effort should be made to locate the GR end as far away from the moving traffic to reduce crash severity. Such locations should be further evaluated to confirm if LON is provided.

Guardrail at Steep Slopes:

When a guardrail must be installed where the 2' earth pad behind the post cannot be installed on a slope steeper than 6:1, the length of the posts shall be increased to 8'. See Roadway Standard Drawings S-PL-6 and S-GR31-1 through S-GR31-1C.

Guardrail Height Transition Detail:

When MASH evaluated 31" GR has to be connected to existing 27" GR, the guardrail shall receive a transition section no steeper than 1" per span (6'-3 ½") vertical taper. See Roadway Standard Drawing S-GRS-4.

2-304.00 CONCRETE MEDIAN BARRIERS

Concrete Barrier is a rigid barrier consisting of a 36" or 51" tall concrete wall offering MASH TL-4 and TL-5 performance. See Roadway Standard Drawings – S-SSMB series for details. The 51" wall should be the Designer's first choice at all locations where satisfying sight distance is not critical. The 51" wall serves as a glare screen to limit headlight glare from opposing lanes in urban areas. TDOT utilizes a single slope wall. At impact, the barrier wall does not deflect resulting in a near sudden deceleration for the occupant of the impacting vehicle. Because of the sudden deceleration, the system should only be used when the level of protection is required. The barrier is best suited:

- To prevent crossover crashes at narrow, at grade medians.
- To prevent catastrophic damage to structures near the roadway.
- To prevent outside the curve run-off-road incidents for large vehicles.
- To limit the zone of intrusion of a large vehicle box and to limit the tilt angle.

The blunt ends of concrete median barrier walls are considered a roadside hazard because of their unyielding nature. The ends must be protected by means of an approved crash cushion (attenuator). Guardrail to concrete barrier transitions require a thrie beam transition section to prevent the guardrail from deflecting, creating a pocket that would allow a vehicle to impact the end of the wall. See Roadway Standard Drawings S-SSMB-6 through S-SSMB-6F and Roadway Standard Drawings – Guardrail Connections series for details of the semi-rigid transition guardrail.

2-305.00 CABLE BARRIERS

Cable barrier systems are typically installed at existing four lane divided highways with traversable depressed medians wider than minimum clear zone distance. Cable barriers may be used to mitigate locations experiencing the severe run-off-the-road left crash density or as an improved safety measure, to reduce crash severity. Cable barriers are designed to perform for impacts on either side; thus, only one run may be installed Fon recoverable, 4:1 or flatter fill slopes. High tension cable barrier consists of three or four high tension steel cables supported by steel posts. Cable barriers require an anchor to provide the tension, as well as, savage type fittings to adjust and maintain tension for the system to perform under the desired performance criteria. At the point of impact, cable barriers typically deflect up to 11 feet. In order to maintain maximum 10' deflection performance from a cable barrier system, the installed length shall not exceed 5000 ft from anchor to anchor with maximum 11' post spacing and initial tension as shown on Standard Drawing S-CB-2 Table B. Because of the deflection, cable barriers are not suited to shield objects close to the roadway or narrow medians. If proposed at these locations, use a reduced post spacing to limit the deflection rates.

The performance of high tension cable barrier systems depends on soil specific design of the anchoring system. Cable Barrier Terminals should not be included in the length of need since they do not offer re-directive capacity, but they are designed to be crashworthy. Terminals should be overlapped by another barrier system, if continuous barrier protection is needed while

transitioning from one hardware type to the other. Shorter runs of cable barrier systems that overlap are advantageous to maintain tension across critical areas. See Roadway Standard Drawing Series S-CB for cable barrier installation guidance.

2-306.00 END TREATMENTS

To prevent the end of barrier systems from becoming hazards to the driving public, the ends must be anchored and protected with either an attenuator or end terminal if they are located within the clear zone. The following sections provide the design considerations for Anchorages, Guardrail End Terminals, and Crash Cushions.

2-306.01 ANCHORAGES

For guardrails to function properly both ends must be anchored to provide the system with tension. Guardrail anchors are shown in the Roadway Standard Drawings – S-GRA Guardrail Anchor Series.

In cases where the end treatment is facing oncoming traffic and within the clear zone, an end terminal is required. The anchor is installed with the terminal (Type 38, or Type 21). Note: There is no separate anchor standard drawing for a Type 21 or Type 38 anchor since it is proprietary and is included in the cost of the end terminal.

When the end of the guardrail is located outside the clear zone of oncoming traffic or the trailing end of a guardrail that is outside the clear zone of opposing traffic, a crashworthy end treatment may not be required. In this case the Type 13 anchor may be installed.

When a guardrail is curved around an intersection or driveway, an anchor is installed along the tangent section of guardrail near the point of curvature to maintain system tension. In this case, an In-Line anchor is installed per Roadway Standard drawing S-GRA-4 as a best engineering practice to reduce crash severity. When site conditions permit, Designers should always prefer curved guardrail installation following the Roadway Standard Drawing S-GRS-7 Again, S-GRA-4 is for use on non-NHS roads; S-GRS-7 is for NHS roads; they are not interchangeable.

2-306.02 GUARDRAIL END TERMINALS

On every road the first choice for approach end terminal shall be the buried in backslope, Guardrail End Terminal (Type 12). See Roadway Standard Drawing S-GRT-1. This system is non-gating meaning the entire system is designed to redirect a vehicle. The buried in backslope end terminal requires a backslope of 2:1 or steeper. Guardrail lengths may be extended up to 200 feet to a section of backslope meeting the backslope requirements. When the above required conditions cannot be achieved, the Designer shall use the following guidance to choose the appropriate system:

On roadways with posted speeds greater than 45 mph, the tangential energy absorbing guardrail end terminal (Type 38) shall be used. See Roadway Standard Drawing S-GRT-2. For the system to work as designed, the earth pad as shown on Roadway Standard Drawing S-GRT-2P must be installed. Only SOFTSTOP provides re-directive capacity at the first post at determined GR need point (LON). At restrictive sites, Designers shall use SOFT STOP to reduce the installation length by two posts (12.5')

On roadways with posted speeds less than 45 mph, Type 21 (TL-2) terminals may be used instead of a Type 38. See Roadway Standard Drawing S-GRT-3. For the system to work as designed, the earth pad as shown on Roadway Standard Drawing S-GRT-2P must be installed.

If standard bridge parapet wall transitions and guardrail terminals are unable to meet the length of need installation requirements due to site limitations, a Curved Parapet Wall detail may be used on facilities with speeds less than or equal to 40 mph. See Roadway Standard Drawing S-CPW-1.

2-307.00 CRASH CUSHIONS

Crash cushions (impact attenuators) are used to shield fixed roadside objects located within the clear zone such as bridge piers, overhead sign supports, ends of retaining walls, concrete median barriers, bridge abutments, and bridge railings, etc. Crash cushions operate based on energy absorption or energy transfer by either decelerating a vehicle to a controlled stop after a frontal impact, or by redirecting a vehicle away from a fixed object after a side impact. Where a fixed roadside object is identified, the Designer should first consider removing, relocating, making the object breakaway, or shielding the fixed object with a longitudinal barrier. Where this is impractical, the use of an approved crash cushion system should be considered.

All crash cushions shown on TDOT Qualified Product List 34 are evaluated under NCHRP 350 and TDOT Qualified Product List 45 are evaluated under the AASHTO Manual for Assessing Safety Hardware (MASH) for Test Level 3 (TL-3) or Test Level 2 (TL-2). This requirement shall apply to all temporary work zone and permanent installations.

2-307.01 CRASH CUSHION WORK ENERGY PRINCIPLE (NON-GATING, RE-DIRECTIVE SYSTEMS)

Crash cushion design based on the work-energy principle involves the reduction of an impacting vehicle's kinetic energy to zero. If a vehicle will be stopped after an impact, then the "work" done on a vehicle equals the initial kinetic energy of the vehicle. An impact to a crash cushion will result in some damage to a vehicle; however, under the work-energy principle, the potential for serious injury to the vehicle occupants is reduced.

Crash cushions that operate under the work-energy principle utilize "crushable" or "deformable" material to convert the kinetic energy of a vehicle into other forms of energy including mechanical, potential, heat, and sound energy. Crash cushions of this type, referred to as compression crash cushions, require a rigid support backup structure or foundation to resist the impact force of the vehicle utilizing the energy-absorbing material. These types of crash cushions are considered non-gating, re-directive systems, in that they are not intended to capture the vehicle upon impact (unless frontal impact occurs); but rather, redirect the vehicle after collision. Various systems are available that offer re-directive capabilities on one or both sides of the system.

Table 2-2, Non-Gating Re-directive Crash Cushion Classification summarizes the three types of non-gating/re-directive crash cushion systems considered acceptable for use on TDOT projects. *See Figure 2-8, Crash Cushion Selection Flowchart* for selection flowchart.

Non-Gating Crash Cushion Classification	Roadway Location Characteristics			
	ADT	Impact Frequency per Year	Distance (D) from Travel Way (feet)	Repair Considerations
Reusable	<25,000	1-2	D>10	Many reusable components, Unlimited repair time
Low Maintenance	≥25,000	3 or more	D≤10	Time and workspace limitations
Self-Restoring	≥25,000	3 or more	D≤10	Multiple hits before repairs needed

Table 2-2
Non-Gating Redirective Crash Cushion Classification

2-307.02 CRASH CUSHION CONSERVATION OF MOMENTUM PRINCIPLE (GATING SYSTEMS)

The conservation of momentum principle for crash cushion design involves the transfer of the vehicle's momentum to an expandable mass of material located in the vehicle's path. The conservation of momentum principle is involved with all crash cushion impacts, since some portion of a vehicle's kinetic energy is transferred to the cushion by accelerating and moving various components of the cushion during an impact. For gating systems, this expandable mass will normally consist of containers filled with sand. Sometimes referred to as inertial crash cushions, these types of systems require no rigid backup or support to resist a vehicle's impact force and may be used for both temporary and permanent installations.

Gating systems are energy dissipation devices only and rely on the conservation of momentum principle. They have no capability to re-direct an errant vehicle but will either capture a vehicle or allow it to pass through the system along the same general path. Use of a gating crash cushion should be limited to locations where the roadside object is not likely to be impacted at an angle on the side with any significant velocity or when no other safety device product will fit the location (i.e. very wide hazards). Also, gating systems may be appropriate for use on low speed facilities and in temporary work zones with higher speeds where lane widths are constrained and the potential for a high angle impact is limited. Every gating system must be specifically designed for the fixed object it is intended to shield.

For gating, non-redirective systems (i.e. sand-filled barrel arrays), the Designer should verify that adequate clear run-out area is available behind the device. Barrel arrays should not be used where there is high potential for vehicles to impact the device in the reverse direction (e.g. a vehicle would hit the heaviest barrels placed directly adjacent to the fixed object being shielded).

2-307.03 CRASH CUSHION SELECTION GUIDELINES

The location of all permanent crash cushions should be shown on the Proposed Layout sheets along with the cushion type for each occurrence of a crash cushion on the project. In addition, the Designer should provide the available reserve area (length and width after deducting for offsets - see Roadway Standard Drawing S-CC-1) for each location where a crash cushion is to be installed. The Designer will specify the type of crash cushion to be used, and the contractor will choose an approved product for that type selected. In some instances, it may be necessary to provide special details for a given location. When special details are required, they should be shown on the Detail Sheets in the plans.

For new construction projects, use *Figure 2-8 Crash Cushion Selection Flowchart* to determine the appropriate type of crash cushion to specify, see Roadway Standard Drawing S-CC-1 for more details. Maintenance projects shall follow the maintenance contract. See Roadway Standard Drawing S-GR28 series.

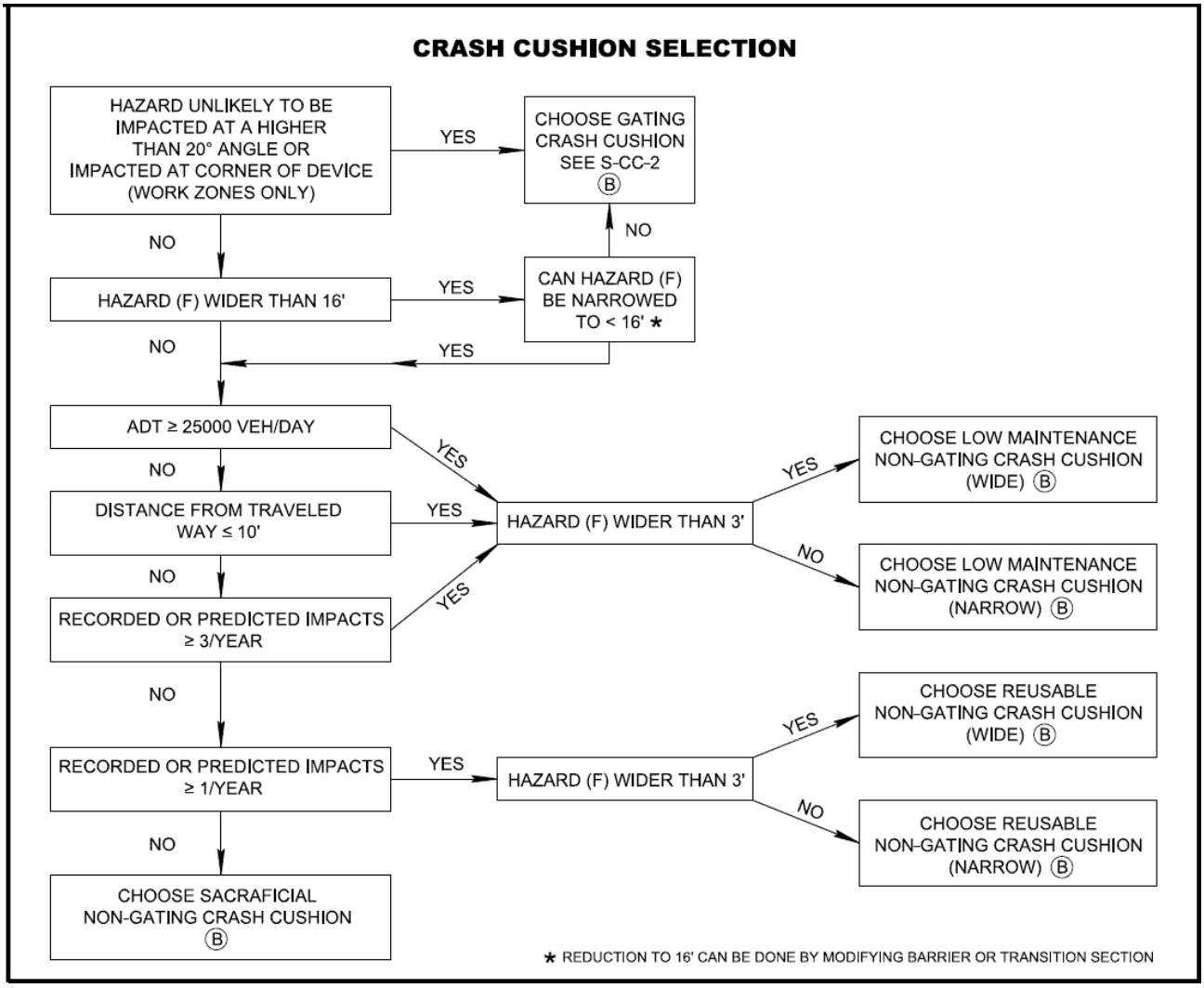


Figure 2-8
Crash Cushion Selection Flowchart
*Reduction to 16’ can be done by modifying barrier or transition section
(From Roadway Standard Drawing S-CC-1, see note B)

2-307.04 CRASH CUSHION SELECTION BASED ON SITE CHARACTERISTICS

Provisions for providing adequate space (reserve area) for crash cushions to shield fixed objects should be made during the Functional Design Plans stage for new roadway construction projects and for the rehabilitation or reconstruction of existing roadways. Roadway Standard Drawing S-CC-1 provides the minimum and desired reserve area dimensions that should be made available. The preferred condition represents the optimum and desirable values for any location. The unrestricted conditions represent the minimum dimensions for all locations. The restricted conditions shall be used only where it can be demonstrated that dimensions of the unrestricted

condition are unattainable. The information in the table is for preliminary design purposes. Final design should be based on the crash cushion system selected and the manufacturer's specifications. Additionally, the table values are generic and may not apply to some proprietary systems.

To allow crash cushions to compress uniformly during an impact, systems should be installed on a hard, smooth, and generally flat surface of asphalt or concrete (preferred). All non-gating systems will require a foundation of this type. This can easily be accommodated for new construction; however, at retrofit locations or major roadway rehabilitation sites, the Designer should attempt to remove sloped surfaces as part of the project plans. Longitudinal and transverse slopes in excess of 5 percent should be avoided. Additionally, if the cross slope varies by more than 2 percent over the length of the system, the Designer may need to make site alterations. For gating systems, the hard-flat surface should be placed to provide a uniform foundation on which the barrel-array pattern may be installed, and the design masses of the sand-filled barrels can be marked. These marked locations will aid in the proper reconstruction of the barrel system to its originally designed capacity and configuration after a vehicle impact.

On new construction projects, no curb, curb and gutter, or raised pavement should be designed in the area surrounding or occupied by the crash cushion. When retrofitting an existing location, existing curbs, curb and gutter, or raised pavement should be removed where possible. If an existing curb is to remain, it shall be no more than 4 inches in height. The Designer should also verify that the existing curb has not previously contributed to poor crash performance.

The Designer should verify if sight distance will be compromised by installing a crash cushion at some intersection locations (i.e. locations at the end of concrete median barriers located at at-grade intersections). Where this is a concern, the Designer should choose a system that provides reduced overall height while still meeting the attenuation need at the location.

2-307.05 CRASH CUSHIONS IN TEMPORARY WORK ZONES

For temporary work or construction zones, the Designer should select a crash cushion system consistent with the expected time and site conditions that may be present at the given location. If the posted speed limit is greater than 45 mph, crash cushions installed in temporary work zones shall meet Test Level 3 criteria and each system must be listed on the Qualified Products List. Temporary systems shall be selected, designed, and installed based on the same guidance provided for permanent applications.

Non-gating, re-directive systems are approved for use in temporary work zones and available in narrow widths giving the ability to satisfy attenuation requirements where working conditions are constrained, provided that a paved surface is available for proper anchorage.

With all temporary applications, the selected system should provide adequate separation distance between the installed system and the actual area where work is being performed due to the possibility of flying debris during an impact. Additionally, sight distance at intersecting

roadways or points of ingress/egress to the work zone should be considered and checked during the selection process.

2-308.00 CHECKING DRAINAGE PLANS PRIOR TO CONSTRUCTION

Before finalizing drainage plans, the Designer is to ensure that the drainage portion of the PS&E plans is consistent with current standard drawings. This will consist of making sure that the invert elevations shown on the proposed plan sheets facilitate the use of standard small drainage structures. The Designer is to use the same invert drop across the structures that are used on the standard drawings. This check must be completed prior to submitting the PS&E plans. It is necessary to make this adjustment in order to eliminate costly construction changes to the catch basins, manholes, junction boxes, etc. Check depth for 10 ft. or deeper structures for constructability prior to the PS&E Field Review.

Invert elevations are to be shown in the plans for all pipes entering and leaving these small drainage structures. The grate elevation is to be shown for all catch basins. The top of lid elevation is to be shown for all manholes. The top of slab elevation is to be shown for all junction boxes. The proper tabulation of these structures is shown in the TDOT Drainage Manual.

SECTION 4 – SIGNS

2-400.00 ROADWAY SIGNING SHEETS DEVELOPMENT GUIDELINES

The development of signing plans and sign schedule sheets is the responsibility of the Design Office preparing the roadway plans. A Designer is assigned in each regional Design Office to serve as the Signing Designer. The Signing Designer is responsible for development of all roadway signing and sign schedule sheets for projects developed in the region. In addition, the Signing Designer will provide signing, item numbers, quantities, signing details, standard drawings, and signing notes to roadway Designers. See Traffic Operations Division, Traffic Design Manual, Module 3: Signing and Pavement Marking Design and Traffic Operations Sign Policy, Design and Programs Section webpage for more guidance.

The Roadway Design Manager will be responsible for determining whether the Signing Designer or the Roadway Designer will be responsible for CADD work to place signing on plans sheets for individual projects.

The Design Manager will be responsible for determining if Signing and/or Pavement Marking sheets are needed on projects other than freeways and full-access controlled highways. On all other projects, the proposed signing will normally be located on the proposed layout sheets. On projects utilizing pavement marking sheets, proposed signing should be shown on the same sheets.

The workflow for preparation of roadway signing plan sheets is as follows:

1. At the start of the Functional Design Phase, the Designer will provide a PDF set of plans, proposed layout sheet (or signing and marking sheet files) CADD files to the regional signing Designer to develop signing and sign schedule sheets.
2. After developing signing and sign schedule sheets, the Signing Designer submits a PDF file to Regional Traffic Engineering Office for review.
3. The Regional Traffic Engineering Office reviews the proposed signing and provides the Signing Designer with any comments.
4. The Signing Designer makes any needed changes and submits a PDF file of the proposed Signing Sheets and Sign Schedule sheets to the Traffic Operations Division, Headquarters Traffic Engineering Office (TDOT.TrafficOps.Sign-Reviews@tn.gov) for review.
5. The Signing Designer submits the proposed signing and sign schedule sheets to the Roadway Designer at the PS&E Plan Review, which is eight weeks prior to PS&E plans turn-in.

Freeway and full access control projects

For freeway and full access control projects Signing and Pavement Marking sheets will be developed for placement of signing and pavement markings.

The Signing Designer should coordinate with the Roadway Designer concerning any design issues that may arise during the development of the signing plans. The Signing Designer should coordinate with the Structures Division to have overhead, cantilever, or bridge mounted structures be designed and structural standard drawing numbers are received.

Consultant Projects

For projects developed by design consultants, signing will be developed by the consultant Designer. The consultant will be responsible for furnishing PDF plans and CADD files to the Roadway Design Lead when construction plans are started. The Roadway Design Manager will forward the information to the Signing Designer to develop project signing as outlined above.

Other Projects

On projects (resurfacing, bridge replacement, etc.) requiring no more than three sizes of permanent signs, the Designer may place Traffic Operations Standard Drawing T-S-20 Sign Details in the Index of Standard Drawings. The Designer will need to show the proposed location and designate the type of sign (R1-1, R1-2, TN-5, etc.) on the plans. These signs will be paid for per each under Item Numbers. 713-16.20 through 713-16.39. Appropriate Foot Notes, General Notes, and Standard Drawings will also need to be included.

If any sign needed for a project is not included on Traffic Operations Standard Drawing T-S-20, or if there are any questions, contact the Regional Design Office Signing Designer for further guidance.

2-401.00 ADVANCE GUIDE SIGNS AND EXIT DIRECTIONAL SIGNS ON TRAFFIC CONTROL PLANS

The Designer shall include advance guide signs and exit directional signs (green and white signs) on all phases of the traffic control plan for projects on access controlled highways including interchange cross streets. Advance guide signs and exit directional signs should also be shown on the traffic control plan on access controlled resurfacing projects when the traffic control phasing requires the placement of temporary pavement markings which conflict with directional signs or requires directional signs to be relocated or adjusted. It will be the Designer's responsibility to prepare any required traffic control sheets for all phases showing the layout and location of all directional and guide signs. Supplemental signing is not required to be shown.

Existing signs should be used as part of the traffic control plan for as long as possible throughout the different construction phases provided signs are located in accordance with MUTCD and do not provide inaccurate information. The most common conflict of existing signing with new construction occurs when overhead guide signs with down arrows or diagrammatic signs displaying lane lines are over lanes that are closed during certain construction phases. Once existing signs cannot be used at the original location, the Designer should attempt to relocate the existing sign or place the permanent sign. If relocation or placement of the permanent sign is not feasible, a new temporary advance guide sign or exit directional sign shall be shown on the traffic control plan for the affected construction phase and for any other construction phase the sign is needed. Sign location shall conform to the MUTCD. Sign size should be the same as the sign removed if feasible. There shall be at least one temporary advance directional and temporary exit directional for each exit on the project.

For signs located on overhead structures, the Designer should contact the Traffic Operations Division, Traffic Operations Sign Policy, Design and Programs Section (TDOT.TrafficOps.Sign-Reviews@tn.gov) and the Regional Traffic Engineer for additional guidance.

The following guidance should be used when it is necessary to install temporary exit directional signs or temporary advanced guide signs. The Designer should contact the Traffic Operations Division, Traffic Operations Sign Policy, Design and Programs Section (TDOT.TrafficOps.Sign-Reviews@tn.gov) or the Regional Traffic Engineer for any additional technical questions or guidance required.

1. In the event it is not feasible to replace an exit directional sign with the existing sign size, the new sign shall be 48” x 96”, 0.100” sheet aluminum. The letters will be minimum 8 inch “D” (all capital) letters and there will be a ¾” border with a 2” radius. The color will be a reflective green background with a reflective white copy. The supports will be included in the sq. ft. of the sign face as it is with other construction signs.

2. The information on exit directional signs should be the same as the information on the existing signs that were removed. There shall be no more than four lines of copy on these signs. The layout of these signs should look as close to the existing as possible.
3. On advanced guide signs; the first line shall be the exit number for the interchange (i.e. EXIT 234), the second line will be the first destination (i.e. OLD HICKORY BLVD), the third line will be the second (i.e. MADISON), the fourth line will be NEXT RIGHT (Center all lines of copy). These signs should be located no closer than one half mile from the exit directional sign.
4. The exit directional sign shall have the same exit number and destinations as the advance guide but in lieu of NEXT RIGHT there will be a type “B” arrow at a 45 degree angle to the right. (Center all lines of copy.) These signs should be located at the beginning of the taper for the appropriate exit ramp.
5. If an interchange has a TN (TN-6a -TN-6d) or U.S. (M1-4) route shield on the directional signing, then a shield, and if needed, a cardinal direction (M3-1 –M3-4) shield, will be shown mounted to the left support under both the advance and exit directional signs.
6. If more lines of copy are needed, then the Designer can add a 24” x 96” or another 48”x 96” aluminum sheet to the bottom of the first sign, but the size shall not be larger than a total of 96”x96”.
7. Removal of existing signs shall be paid for under item number 713-15, Removal of Signs, Posts, and Footings, Lump Sum.
8. New signs shall be paid for under item number 712-06, New Signs (Construction), per S.F. Team Leads should contact the HQ Construction Office to have item numbers assigned when the traffic control plan involves relocating existing signs.
9. See Chapter 9-160.00 for notes to be placed in the General Notes on all access controlled and freeway projects and on access controlled and freeway resurfacing projects when the traffic control phasing requires placement of temporary pavement markings which conflict with directional signs or requires directional signs to be relocated or adjusted.

If advance guide signs or exit directional signs are included in the traffic control plan, the Designer or Design Manager (for consultant projects) shall upload the traffic control plan to FileNet and an email notification sent to the Traffic Operations Division, Traffic Operations Sign Policy, Design and Programs Section (TDOT.TrafficOps.Sign-Reviews@tn.gov). See PDN for more information. For resurfacing projects with advance guide signs or exit directional signs, plans should be sent as soon as possible. Only traffic control plans with advance guide signs or exit directional signs shall be sent to the Traffic Operations Division, Traffic Operations Sign Policy, Design and Programs Section for review.

The Designer shall place a copy of the email in the project folder to document the submittal of traffic control plans for advance guide or exit directional signing review.

The naming convention for the traffic control plan PDF will include the PIN and the Region #, ***nnnnnn-nn*-TrafficControlReview-RegX.pdf**. If there are modifications to the traffic control

plans that affect the advance guide signs or exit directional signs, then the naming convention will be ***nnnnnn-nn*-TrafficControlReview-RegX-Rev-00-00-00.pdf**. The revised traffic control plan review request will contain all traffic control sheets.

Example: 123456-00-TrafficControlReview-Reg1.pdf

2-402.00 HISTORICAL MARKERS

On projects impacting a Tennessee Historical Marker sign, the Designer shall add Item Numbers 713-16.50 to 713-16.60 “Remove and Replace Sign (description)” per EACH to the quantities, as needed. The Designer shall also add special note from Chapter 9-220.00.

SECTION 5 – PAVEMENT MARKINGS

2-500.00 PAVEMENT MARKING GUIDELINES

These guidelines are general in nature for average-type projects. It is not intended that these guidelines supersede the exercise of good engineering judgment in the development of a pavement marking plan for a project. Special problem areas may require special treatment, that shall be determined at or prior to the PS&E Field Review. Traffic volumes may be found in the project specific traffic reports, ETRIMS or the Strategic Transportation Investments Division latest Traffic Flow Maps.

Permanent striping will consist of both centerlines and edge lines on all pavements with a minimum total width of 16 feet.

If surface materials other than hot plant mix asphalt (such as cold mix asphalt, DBST, etc.) are applied, no temporary or permanent centerline markings will be required, since these surface materials would be incapable of retaining the pavement markings.

See Chapter 2-501.00 through 2-502.00 for guidance for temporary and permanent pavement marking and Chapter 9-135.00 for pavement marking general notes.

See Traffic Design Manual, Module 3: Signing and Pavement Marking Design.

2-501.00 TEMPORARY PAVEMENT MARKINGS

Temporary pavement markings on the intermediate layers of pavement open to traffic will be installed to permanent standards daily with reflectorized paint or the approved QPL equivalent. If there are no centerline pavement markings on the existing roadway before the proposed construction or resurfacing project begins, no temporary centerline pavement markings will be required on the roadway during construction.

The temporary pavement markings will be paid for under Item Number 716-05.01, Painted Pavement Marking (4” Line) per L.M., Item Number 716-05.20, Painted Pavement Marking (6” Line), per L.M., Item Number 716-05.02, Painted Pavement Marking (8” Barrier Line),or Item Number 716-05.49, Painted Pavement Marking (8” Line) per L.F.

If the permanent marking material is thermoplastic, the contractor may elect to mark the final layer of pavement with reflectorized paint to permanent standards daily and wait until the paving operation has been completed before the permanent markings are installed. In this case, the temporary markings for the final layer will not be measured and paid for directly, but the costs are to be included in the price bid for the permanent markings.

2-501.01 TEMPORARY PAVEMENT MARKING FOR USE ON PAVEMENT SURFACE OTHER THAN FINAL

1. ON ALL FREEWAYS AND CONTROLLED ACCESS ROUTES (During Construction)

   A. On Non-Transition Sections:

      a. **Lane lines** – use 8” painted white skip lines (Item Number 716-05.49, Painted Pavement Marking (8” line)) and white raised pavement markers (716-01.06, Temporary Raised Pavement Marker, White) on 40’ spacing.

      b. **Left edge lines** (yellow) – Use 8” painted solid yellow lines (Item Number 716-05.49, Painted Pavement Marking (8” line)) and yellow raised pavement markers (Item No. 716-01.07, Temporary Raised Pavement Marker, Yellow) on 20’ spacing.

      c. **Right edge lines** (white) – Allow as equals:

         Use 8” solid white wet-reflective temporary tape (according to manufacturer’s specifications). (Item No. 712-09.21, Removable Wet Reflective Pavement Marking Tape),

         Use 8” painted solid white lines (Item No. 712-09.02, Removable Pavement Marking (8” barrier line)) with an approved white barrier rail delineator on top of barrier rail (Item No. 712-04.50, Barrier Rail Delineator) on 20’ spacing, **OR**

         Use 8” painted solid white lines (Item No. 716-05.49, Painted Pavement Marking (8” Line)) only with white flexible delineators (Item No. 712-04.10, Temporary Flexible Tubular Delineator) at outside edge of shoulder on 20’ spacing when no barrier rail is present.

   B. On Transition Sections

      a. **Lane lines** – Use 8” painted solid white lines (Item No. 716-05.49, Painted Pavement Marking (8” Line)) and white raised pavement markers (Item No. 716-01.06, Temporary Raised Pavement Marker, White) on 20’ spacing.

      b. **Left edge lines** (yellow) – Use 8” painted solid yellow lines (Item No. 716-05.49, Painted Pavement Marking (8” Line)) and yellow raised pavement markers (Item No. 716-01.07, Temporary Raised Pavement Marker, Yellow) on 20’ spacing.

      c. **Right edge lines** (white) – Allow as equals:

         Use 8” solid white wet-reflective temporary tape (Item No. 712-09.21, Removable Wet Reflective Pavement Marking Tape). (according to manufacturer’s specifications)

         Use 8” painted solid white lines (Item No. 712-09.02, Removable Pavement Marking (8” barrier line)) with an approved white barrier rail delineator on top of barrier rail (Item No.712-04.50, Barrier Rail Delineator), on 20’ spacing, **OR**

Use 8” painted solid white lines (Item No. 716-05.49, Painted Pavement Marking (8” Line)) only with white flexible delineators (Item No. 712-04.10, Temporary Flexible Tubular Delineator) at outside edge of shoulder on 20’ spacing when no barrier rail is present.

NOTES:

1. Raised pavement markers are to be placed in a single row, not staggered, under all applications.
2. If Project Engineer has specific recommendations, they should be discussed at the PS&E Field Review.
3. Missing raised pavement markers shall be replaced:
    a. at least monthly or,
    b. at the instruction of the engineer
4. All raised pavement markers shall be removed before placement of the final pavement surface. The cost of removal shall be included in the price bid for raised pavement markers, Item Numbers 716-01.05 Temporary Raised Pavement Marker per Each, 716-01.06 Temporary Raised Pavement Marker, White per Each, and/or 716-01.07 Temporary Raised Pavement Marker, Yellow per Each.

2. STATE ROUTES WITH 4 OR MORE LANES (Unlit During Construction)
    a. **Lane Lines** – Use 8” wide white painted skip lines (Item No. 716-05.49, Painted Pavement Marking (8” Line)) and raised pavement markers (Item No. 716-01.06, Temporary Raised Pavement Marker, White) on 80’ spacing.
    b. **Edge and center lines** – Use solid lines (yellow or white, as appropriate) with an 8” width. Raised pavement markers (yellow or white, as appropriate) may be specified for use on a case-by-case basis, as determined at the Plan-in-Hand Field Review. Raised pavement markers should not be used on right edge line. When raised pavement markers are used for the left edge line, spacing shall be 20 feet.

NOTES:

1. Raised pavement markers are to be placed in a single row, not staggered, under all applications.
2. If Project Engineer has specific recommendations, they should be discussed at the Plan-in-Hand Field Review.
3. Missing raised pavement markers shall be replaced; at least monthly or, at the instruction of the engineer
4. All raised pavement markers shall be removed before placement of the final pavement surface. The cost of removal shall be included in the price bid for raised pavement markers, Item Numbers 716-01.05 Temporary Raised Pavement

Marker per Each, 716-01.06 Temporary Raised Pavement Marker, White per Each, and/or 716-01.07 Temporary Raised Pavement Marker, Yellow per Each.

3. ALL OTHER STATE ROUTES

   a. **All Lines** – Use 4" marking lines. Centerline yellow raised pavement markers may be considered on a case-by-case basis. Discuss need at Plan-in-Hand Field Review.

NOTES:

1. Raised pavement markers are to be placed in a single row, not staggered, under all applications.
2. If Project Engineer has specific recommendations, they should be discussed at the Plan-in-Hand Field Review.
3. Missing raised pavement markers shall be replaced:
   a. at least monthly or,
   b. at the instruction of the engineer.
4. All raised pavement markers shall be removed before placement of the final pavement surface. The cost of removal shall be included in the price bid for raised pavement markers, Item Numbers 716-01.05 Temporary Raised Pavement Marker per Each, 716-01.06 Temporary Raised Pavement Marker, White per Each, and/or 716-01.07 Temporary Raised Pavement Marker, Yellow per Each.

2-502.00 PERMANENT PAVEMENT MARKINGS

The Designer should refer to Tables 2-3A and 2-3B for pavement marking guidelines for all freeways and state routes. In addition to pavement marking guidelines, Tables 2-3A and 2-3B provide guidance for the placement of rumble strips and rumble stripes. This guidance shall be used on all new, reconstruction, and resurfacing projects except in areas which require special treatment as determined at the Plan-in-Hand Field Review and approved by the Project Manager.

Type	Thickness (mils)	Bead Package	Pavement Type				Comments
			Asphalt			Concrete	
			Conventional	OGFC	HFS		
Thermoplastic Spray	60	Type I	X		X	X	Spray Thermoplastic, Multipolymer
Thermoplastic Extruded	100	Type I & IV	X	X Note 1	X	X	Enhanced Flatline Thermoplastic, Multipolymer
Thermoplastic Ribbon	100	Type I & IV	X	X Note 1	X		Enhanced Flatline Thermoplastic with clean borders, Multipolymer

Profile Thermoplastic	**125**	**Type IV**	**X**	**X**	**X**	**X**	**Audible feedback, Wet visibility Per SP 716PTA**
Polyurea	**20**	**Type I**	**X**	**X**	**X**		**Moisture resistance**
Tape	**85**	**NA**	**X**			**X**	
Specialty Pavement Markings							
Extruded	**100**	**Type I & IV**	**X Note 2**		**X Note 2**	**X Note 2**	**Enhanced Flatline Thermoplastic,**
Pre-formed	**90 - 125**	**N/A**	**X Note 2**		**X Note 2**	**X Note 2**	
Temporary Traffic Control							
Paint	**15**	**N/A**	**X**	**X**	**X**	**X**	**See Chapter 2-500.00**

Notes:

1. For projects using an Open-Graded Friction Course (OGFC) for the surface layer, only Enhanced Flatline Thermoplastic (Item No 716-12.02) may be used for the edge, center, skip and lane lines. Use the width of line specified in Table 2-3B. The Designer shall footnote the Enhanced Flatline Thermoplastic Quantity with the following note: "*Contractor shall use the extruded or ribbon method for application*."
2. Specialty Striping Items: stop lines, cross walks, arrows, words, shapes, channelization, and other specialty striping items other than lane and edge lines. The contractor may elect to use either thermoplastic or preformed thermoplastic for specialty striping items.

Table 2-3A
Permanent Pavement Markings Selection Guide Base on Pavement Type

Roadway Functional Classification			Permanent Pavement Markings Snowplowable Raised Pavement Markers Rumble Strip and Rumble Stripe									
			100 mills Extruded or Ribbon Thermoplastic with Type I & IV bead Package 716-12.02 6" Enhanced Flatline Thermoplastic	100 mills Extruded or Ribbon Thermoplastic with Type I & IV bead Package 716-12.09 12" Enhanced Flatline Thermoplastic Or 716-02.07 Plastic Pavement Marking 24" Barrier Line	60 mills Spray Thermoplastic with Type I bead Package 716-13.02 6" Spray Thermoplastic	15 mil Painted Pavement Marking 716—05.01 4" Painted Pavement Marking	716-01.21 SRPM (Bi-Dir) (1-color, 2-sides)	716-01.22 SRPM (Mono-Dir)	716-01.23 SRPM (Bi-Dir) (2-colors, 2-sided)	411-12-01 16" Rumble Strip	411-12-03 8" Rumble Stripe	411-12.04 4" Rumble Stripe	411-12.05 CL Rumble Stripe
	Freeways or Divided State Route	Edge Lines	X Note 3							X Note 2			
		HOV Lane Lines		X Note 4					X Note 1				
		Dotted Lines Note 5	X Note 3										
		Gore Marking		X Note 4					X Notes 1, 4				
		Lane Lines	X Note 3					X Note 1	X Note 1				
	Undivided State Route Urban	Center line	X Note 3				X Note 1						
		Edge Lines	X Note 3				X Note 1						
		Lane Lines	X Note 3					X Note 1					
		Dotted Lines Note 5	X Note 3										
	Undivided State Route Rural	Center Line	X Note 3				X Note 1						Note 2
		Edge Lines Shoulder ≥8'	X Note 3							X Note 2			
		Edge Lines Shoulder 2' < 8'	X Note 3								X Note 2		
		Edge Lines Shoulder ≤ 2'	X Note 3									X Note 2	
		Lane Lines	X Note 3										
	Local Roads and streets ADT ≥ 2000	All Lines Notes 6, 7, & 8	X		X								
	Local Roads ADT < 2000	All Lines Note 7 & 8				X							

Table 2-3B
Permanent Pavement Markings, Raised Pavement Markers,
Rumble Strip and Rumble Stripe Guidelines Notes

Notes:

1. Snowplowable Raised Pavement Markers (SRPMs) shall conform to this guidance:

    1. SRPMs located along centerlines of 2 direction roadways (Yellow Stripe) shall be paid for under Item No. 716-01.21 “Snowplowable Raised Pavement Markers (Bi-Dir) (1-Color)” per each. Lenses shall be yellow.

    2. SRPMs on lane lines between lanes of the same travel (Broken White Stripes) direction on undivided roadways shall be paid under Item No. 716-01.22, “Snowplowable Raised Pavement Markers (Mono-Dir) (1-Color)” per each. Lenses shall be clear or white.

    3. SRPMs on lane lines between lanes of the same travel (Broken White Stripes) direction on divided roadways shall be paid for under Item No. 716-01.23, “Snowplowable Raised Pavement Markers (Bi-Dir) (2-Color)” per each. Lenses shall be clear or white on the upstream side (facing traffic), lenses shall be red facing downstream side (facing wrong-way traffic).

    4. Refer to T-M-series standard drawings for details. Three lane and multilane roads with 2-way traffic will normally require both mono-directional and bi-directional snowplowable raised pavement markers. Two lane roads will normally require bi-directional snowplowable raised pavement markers.

    5. Payment for the removal of Snowplowable Raised Pavement Markers shall be paid for under Item number 716-01.30 (Removal of Snowplowable Reflective Marker, per each). The cost shall not be included in the cost of installing the following items for Snowplowable Reflective Marker: 716-01.21, 716-01.22, and 716-01.23.

    6. Installation of SRPMs may be optional at undivided rural state routes with speed < 45 mph if historical crash data supports lane departure concerns.

2. Rumble Strip/Stripe

    1. All resurfacing projects shall follow the guidance in Table 2-3B for pavement marking and rumble installations. See 2-504.00 and 2-505.00 for additional guidance regarding rumble strip and rumble stripe placement. Application of rumble shall be included on all rural roadway resurfacing projects if there is no existing rumble on the shoulder. Pavement markings and rumble strips/stripes shall be applied to the roadway surface after it has been scraped clean of overgrown vegetation and swept of loose debris.

    2. Rumble strips are not required on ramps.

    3. If a bike lane is proposed on a shoulder, only non-continuous rumble shall be used. See Standard Drawings MM-PM-2, T-M-15A and T-M-16.

4. Centerline Rumble Stripes (See T-M-16A) may only be used if justified by crash history and if the road meets the following conditions:
    i. Design Speed of 45 mph or greater
    ii. ADT of 2000 or greater
    iii. Lane width of 12 feet or greater
    iv. Undivided Section
    v. No passing or one-way passing zone
5. For concrete shoulders, the rumble strip is to be placed in accordance with standard drawings RP-CS-1 or RP-CS-2. Item No. 501-03.10, Concrete Shoulder Rumble Strip, L.F. The length of scoring shall be measured as the actual length of pavement scored.
6. Freeways and divided highways, See STD DWG T-M-15

   Undivided state routes, See STD DWG T-M-15A, STD DWG T-M-16, and 16A
7. The Designer or the Field Engineer may choose to alternate rumble with profile thermoplastic pavement marking (per SP716PTA) when the following conditions exist:
    i. On roadways with rigid pavement shoulders, when it is not practical or desirable to install ground-in rumble on the inside and outside edge line pavement markings.
    ii. On shoulder pavement types, Micro surface and Thin lift.
    iii. On bridge decks without an asphalt layer.

3. Specialty Pavement Marking Materials: Polyurea, Profile Thermoplastic, and Tape. The Designer may choose to use one of the specialty pavement marking material as needed.
4. Use applicable standard drawings:
    1. Freeways, See STD DWG T-M-5, T-M-6, T-M-7, and T-M-8
    2. State Route, See STD DWG T-M-1, T-M-2, and T-M-3
    3. HOV Lanes, See STD DWG T-M-5
    4. Gore Areas, See T-M-6, SRPM along edge line only.
5. Dotted Lines and Dotted Line Extensions shall be utilized when called out on the Standard Drawings. See Standard Drawings T-M-4, 5, 6, and 8.

6. On Local Roads with the ADT ≥ 2000, permanent pavement markings may be Item Number 716-13.02 Spray Thermo Pavement Marking (60 mil 6 IN) per L.M. or Item Number 716-12.02 Enhanced Flatline Thermoplastic Pavement Marking (6 IN) per L.M.
7. For non-State Route Local Roads with ADT< 2000, no permanent striping is required on the final surface if Item Number 716-05.01 Painted Pavement Marking (15 mil 4 IN) is used as the temporary striping for the final layer.
8. Low cost resurfacing treatments may have modified marking recommendations.

2-503.00 RUMBLE STRIPS

Rumble **strips** are an effective countermeasure for reducing roadway departure crashes. The noise and vibration produced by rumble strips alert drivers when they leave the traveled way.

The scored rumble strip shall be constructed in accordance with Standard Drawing T-M-15. Rumble strips are to be paid for under Item No. 411-12.01 Scoring Shoulders (Continuous) (16 inch Width) per L.M. For estimating purposes, the item will be measured longitudinally along the edge of each shoulder and will usually be two (2) times the project length less deductions for entrance and exit ramps, public roads, and bridges.

Refer to *Chapter 2-502.00, Permanent Pavement Markings*, for guidelines for placement of rumble strips on non-access-controlled state routes. When rumble strips are placed on non-access-controlled routes, paved shoulders should be 8 ft. or wider. A 60-foot rumble will be followed by a 15-foot gap in the rumble to allow for bicycles to cross without having to traverse the rumble strip. Rumble strips should normally be placed on rural routes with posted speeds of 45 mph or greater. Rumble strips may be used on urban routes where crash history or other factors warrant the placement. When placed on urban routes, the Designer should consider expected bicycle traffic and noise generated. Alternatively, mumble stripes may be used on urban routes to mitigate external noise. Scored rumble strip shall be constructed in accordance with Standard Drawing T-M-15A. Rumble strips are to be paid for under Item No. 411-12.02 Scoring Shoulders (Non-continuous) (16 inch Width) per L.M. The item will be measured and paid as the actual length of pavement scored along each shoulder.

Typically rumble strips reduce run-off-the-road crashes, which includes rollover and fixed-object crashes. Shoulder rumble strips are 16” wide scored strips placed as a countermeasure to assist drivers who may unintentionally drift over the edge line. Rumble strips shall be specified on all new construction and resurfacing projects on freeways and access-controlled facilities. Both the inside and the outside shoulders shall be scored. Typically, rumble strips are applied on freeways and access-controlled facilities 16” wide at a 12” offset from the edge line.

2-503.01 TYPES OF RUMBLE STRIPS

1. SCORED SHOULDER RUMBLE STRIPS

Scored rumble strips and scored rumble stripes provide an audible warning to vehicles leaving the travel lane. Unlike a scored rumble stripe which is placed at the edge line location, a scored rumble strip is placed on the shoulder adjacent to the travel lane and edge line. Shoulder rumble strips should be omitted on concrete bridge decks, adjacent to ramps, acceleration and deceleration lanes.

Based on pavement type the application of rumble strips varies as follows:

A. Flexible pavement

Install new paved shoulder rumble strips per Standard Drawings T-M- 15 and 15A. It is recommended to seal the scored strip on OGFC. Shoulder rumble strips on thin lift should be limited to the depth of 1/4” per Standard Drawing T-M-16A. Do not remove more than 50% of new pavement depth during scoring. Alternatively, raised or inverted profiled thermoplastic pavement marking may be installed. Shoulder rumble strips on chip seal is not recommended. Application of fog seal over the existing rumble does not affect the performance.

B. Rigid Pavement

There are two alternatives available to install rigid pavement rumbles: stamped or scored.

Install stamped concrete shoulder per Standard Drawing RP-CS-1 and scored concrete shoulder per RP-CS-2.

Rumble strips on concrete shoulders shall be paid for under Item No. 501-03.10 Concrete Shoulder Rumble Strips per L.F. The item will be measured as the actual length of pavement scored along each shoulder.

2. RAISED RUMBLE STRIPS

A. Transverse rumble strips

They are used to alert drivers for a need to slow down or stop, or to other upcoming changes that may not be anticipated by an inattentive driver. These rumble strips are placed in the travel lane perpendicular to the direction of travel per Standard Drawing T-WZ-56. Typical locations for these rumble strips are on approaches to intersections, toll plazas, horizontal curves and work zones.

B. Transverse raised bituminous rumble Strips

Raised bituminous rumble strips are a traffic warning device, and when required, shall be constructed installed in accordance with Standard Drawing T-WZ-56. Raised bituminous rumble strips will require a detail to be furnished in the plans. This type of rumble strip is to be used for warning or unexpected stop conditions and shall not be

used routinely as a shoulder treatment. The raised bituminous rumble strip may be used to warn the motoring public at approaches to T-intersections or narrow bridges. They should not be used in urban residential zones without engineering justification.

For more information refer to FHWA Technical Advisory T 5040.39: Shoulder and Edge Line Rumble Strips for use and information on the purpose and effectiveness of shoulder and edge line rumble strips. Additionally, it provides application considerations, design and installation information, suggestions for mitigating adverse effects and public outreach.

2-504.00 RUMBLE STRIPES

Rumble **stripes** is the term used for rumble strips painted with a retroreflective pavement marking to increase the visibility of the pavement edge at night and during inclement weather conditions.

1. SCORED EDGE LINE RUMBLE STRIPES

They are an effective means of reducing run-off-the-road crashes. They are primarily used to warn drivers when they have drifted from their lane. Edge line rumble stripes are a variation on shoulder rumble strips. The pavement markings are placed within the rumble strip, improving the visibility of the marking. Typically rumble stripes are applied on two or four lane rural highways with variable shoulder widths.

Scored Edge line rumble stripes should be omitted adjacent to tapers and along the radius of side road approaches, entrances and median crossovers. However, they are recommended at lane reduction taper sections. Edge line rumble stripes may be applied 4” or 8” wide with skip to minimize impacts to the other road users such as bike. Like rumble strips, edge line rumble strips may be applied at 1/4” deep with thin lift pavement or 3/8” as a standard depth per Standard Drawing T-M-16A.

2. RAISED EDGE LINE RUMBLE STRIPES

Raised edge line rumble stripes should be installed using raised or inverted profiled thermoplastic pavement marking. This treatment provides a rumble effect and enhances visibility compared with standard lane markings, particularly at night and during wet conditions. This treatment may be installed at locations where flexible pavement depth is too shallow to install scored edge line rumble stripes. However, due to the material cost, only locations that justify the safety benefit may receive the treatment. Also, the treatment would be limited to areas where there is little or no snow because snowplow blades will easily scrape off the markings.

3. SCORED CENTER LINE RUMBLE STRIPES

Scored center line rumble stripes are an effective countermeasure to reduce head-on collisions and opposite-direction sideswipes (often referred to as cross-over or cross-center line crashes). Center line rumble strips are primarily used to warn drivers whose vehicles are crossing

center lines of two-lane, two-way roads at no passing zones. Center line rumble strips shall be installed per Standard Drawing T-M-16A and are to be paid for under Item No. 411-12.04 Scoring for Rumble Stripe (Non-Continuous) (4IN Width), per L.M. by doubling the quantity and having a description, “CONTINIOUS”. Center line rumble stripes should be omitted adjacent to tapers and along the radius of side road approaches, entrances, and median crossovers.

For more information refer to, FHWA Technical Advisory T 5040.40 for use and information on the purpose and effectiveness of center line rumble strips. Additionally, it provides application considerations, design and installation information, suggestions for mitigating adverse effects and public outreach.

2-505.00 MUMBLE STRIPES

Mumble stripes are similar to traditional rumble strips, but they have a wave pattern that is grounded into the pavement that lessens the external noise produced when vehicles travel across them. The sinusoidal mumble stripe pattern does lower roadside noise levels while maintaining interior cabin noise and vibration levels adequate to alert the driver. Therefore, they are the preferred alternative on roadways in urban zones. Reach out to the Engineering Production Support Division for more information.

2-506.00 SAFETY EDGE

A safety edge is a sloped (25 to 30 degree) asphalt edge that more easily allows vehicles that have run off the road to regain the roadway than a standard vertical face. The Designer should calculate the additional quantities needed for the pavement required for safety edges.

For resurfacing projects, a safety edge will be applied only when identified on the PS&E Report submitted by the Regional Resurfacing Coordinator. If the total existing drop off and any additional elevation difference from paving operations results in a drop off exceeding 1.75”, a safety edge should be used. See *Chapter 9-140.00, Pavement*, for note that shall be added to the plans on all projects that specify safety edge.

2-507.00 FLEXIBLE DELINEATORS

Flexible delineators will be installed on all freeway and access-controlled highways. Flexible delineators may also be used on other routes. On resurfacing projects (4R, etc.), the Designer will be responsible for computing the quantity of flexible delineators and shall refer to Roadway Standard Drawing T-WZ-PBR2 to calculate quantities. The Designer shall replace delineators along the ramps as well as along the main line on freeway and access-controlled highway resurfacing projects.

On projects with signing and marking plans, the location of the flexible delineators should be shown on the signing and marking plan sheets. If signing and marking plans are not included, the Designer does not need to show the location of the proposed delineators but must make sure

Roadway Standard Drawing T-S-11 is included in the plans so the proper location can be determined by the engineer and contractor.

2-508.00 SPECIALTY PAVEMENT MARKINGS

Contractors will have the option of using either Thermoplastic or Preformed Plastic Pavement Markings specialty markings. For plan development and bidding purposes, Designers will use the appropriate Thermoplastic Pavement Marking items numbers. All specialty pavement marking item numbers shall be footnoted:

"Contractor may elect to substitute Preformed Plastic for Thermoplastic. Preformed Plastic shall be paid for at the same unit price as bid for Thermoplastic."

On projects where plastic specialty pavement items are being used, the following items will be used:

1. Crosswalk with longitudinal lines as shown on Standard Drawing T-M-4 will use the following pay item:

   716-02.09, Plastic Pavement Marking (Longitudinal Cross Walk) per L.F.

The measurement for this marking is identical to that for standard crosswalk, for example, one measurement along the centerline of the crosswalk (perpendicular to curbs).

2. Dotted white line for vehicle double turn path delineation requires an 8-inch stripe. Pay item will be as follows:

   716-02.08, Plastic Pavement Marking (8" Dotted Line) per L.F.

2-509.00 USE OF REMOVABLE PAVEMENT MARKING LINE

Item No. 712-09.01, Removable Pavement Marking Line per L.F., shall be used as temporary marking for directional or separation of traffic during the traffic control phases of construction when these lines are used on a roadway surface that is to remain in place and undisturbed. Item No. 712-09.08, Removable Pavement Marking Line per L.F., shall be used for lane shifts as shown in T-WZ-16. When a barrier is in use, item no. 712-09.02, Removable Pavement Marking Line (8" Barrier Line) shall be used in that location as shown the Standard Drawing.

2-510.00 SNOWPLOWABLE RAISED PAVEMENT MARKERS

Snowplowable raised pavement markers shall be included on all freeway and full-access controlled roadways. See Table 2-3B for guidance.

Snowplowable raised pavement markers should be included on state routes with the exception of undivided state routes with speed < 45 mph. Reflective pavement markers are to be

placed in accordance with the Roadway Standard Drawing T-M-series and the current edition of the MUTCD.

Spacing of snowplowable raised pavement markers may be reduced or additional snowplowable raised pavement markers added in areas that require special treatment as determined by the Design Manager or at the Functional Design Plans field review. When additional snowplowable raised pavement markers are used, the markers shall be placed in accordance with the current edition of the MUTCD. Raised pavement markers may be omitted on urban roadways where roadway lighting is present. Raised pavement markers should not be used on the right edge line. See Table 2-3B for guidance regarding type of markers to be used.

On freeway, full-access control, and state route resurfacing projects, the Resurfacing PS&E Team shall be responsible for verifying the existence of snowplowable raised pavement markers and for computing the quantity of these markers for removal. The Designer shall also compute the quantity for new snowplowable raised pavement markers to be installed for these projects.

SECTION 6 – INTERSECTIONS

2-600.00 INTERSECTIONS

Intersections are either at-grade (two roads meet and cross each other) or are grade-separated (i.e. an interchange). Intersections are either uncontrolled, controlled by traffic signals/signs, shared spaces (such as a roundabout), or are interchanges. Chapter 3, Multimodal Design, should be used to ensure that bicycle, pedestrian, and transit are considered in addition to roadway traffic at urban locations. The guidelines also ensure compliance with the Americans with Disabilities Act (ADA) and Public Rights-of-Way Accessibility Guidelines (PROWAG). For more information, please see the TDOT Multimodal Project Scoping Manual.

2-601.00 LANE DROP AFTER INTERSECTION

Existing two-lane highways are often widened to a multi-lane section at intersections to provide additional capacity (especially at signalized locations). When this occurs, the lane may be dropped at the intersection, at a crossroad or may carry through and transition after the intersection.

In order to address the resulting lane drop situation, follow the schematic shown in *Figure 2-9, Minimum Length (X) for Lane Reduction Transition through an Intersection with a Lane Reduction Taper (L)* , which shows the minimum length for the additional through lanes required to adequately sign the lane drop and minimize lane changing within the intersection. Use *Table 2-4, Guidelines for Advance Placement of Warning Signs*, to help find the “d” value reflected in *Figure 2-9, Minimum Length (X) for Lane Reduction Transition through an Intersection with a Lane Reduction Taper (L)*. An example for computing the required transition lengths is also included with this figure.

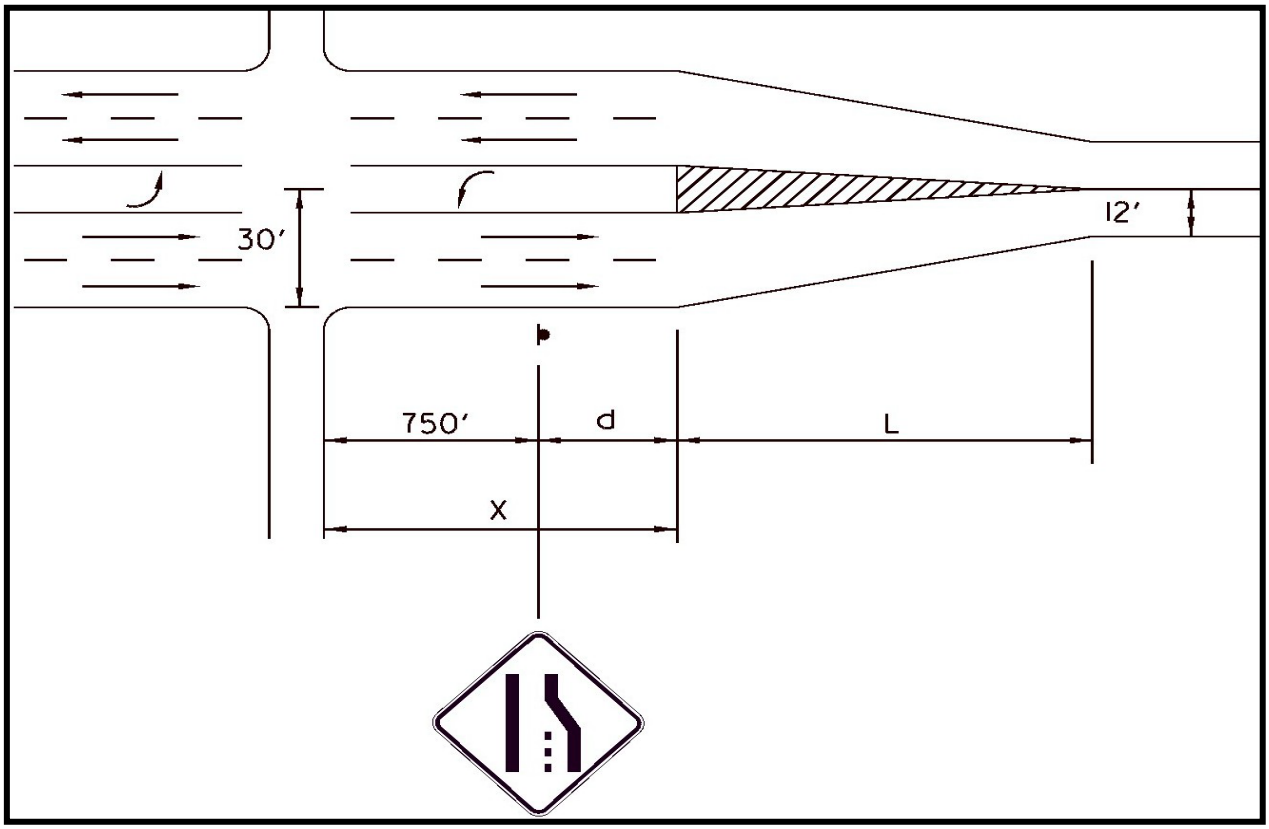


Figure 2-9
Minimum Length (X) for Lane Reduction Transition through an Intersection with a Lane Reduction Taper (L)

$L = (S^2 \times W)/60$ (for speed less than 45 mph)
$L = S \times W$ (for speed 45 mph or more)

750 ft = Minimum distance at which sign is not visible to traffic approaching intersection (in order to minimize lane changing within intersection).
X = Minimum length for lane reduction transition (ft)
S = Speed (mph)
W = Width of the offset distance (ft.)
d = As required by *M.U.T.C.D.*, Sec. 2C.05, Table 2C-4, Condition A.
L = Taper length, as required by *M.U.T.C.D.*, Sec. 3B.09, Fig. 3B-14.

Note 1: Terminating the outside lane as a right-turn lane at an intersection may be considered subject to the review and approval of the TDOT Signal Section and the Design Manager.

Note 2: See *M.U.T.C.D* Section 2C.42 for guidance, options, and standard use of Lane

Ends Signs.

To find "**d**" use the following table:

Posted or 85th - Percentile Speed	Advance Placement Distance[1]								
	Condition A: Speed Reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed Advisory Speed (mph) for the Condition							
		0[3]	10[4]	20[4]	30[4]	40[4]	50[4]	60[4]	70[4]
20 mph	225 ft	100 ft[6]	N/A[5]	-	-	-	-	-	-
25 mph	325 ft	100 ft[6]	N/A[5]	N/A[5]	-	-	-	-	-
30 mph	460 ft	100 ft[6]	N/A[5]	N/A[5]	-	-	-	-	-
35 mph	565 ft	100 ft[6]	N/A[5]	N/A[5]	N/A[5]	-	-	-	-
40 mph	670 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	-	-	-	-
45 mph	775 ft	175 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	-	-	-
50 mph	885 ft	250 ft	200 ft	175 ft	125 ft	100 ft[6]	-	-	-
55 mph	990 ft	325 ft	275 ft	225 ft	200 ft	125 ft	N/A[5]	-	-
60 mph	1,100 ft	400 ft	350 ft	325 ft	275 ft	200 ft	100 ft[6]	-	-
65 mph	1,200 ft	475 ft	450 ft	400 ft	350 ft	275 ft	200 ft	100 ft[6]	-
70 mph	1,250 ft	550 ft	525 ft	500 ft	450 ft	375 ft	275 ft	150 ft	-
75 mph	1,350 ft	650 ft	625 ft	600 ft	550 ft	475 ft	375 ft	250 ft	100 ft[6]

Table 2-4
Guidelines for Advance Placement of Warning Signs

Reference: M.U.T.C.D. 2009 Manual (Table 2C-4 of Section C.05)

Notes:

[1]The distances are adjusted for a sign legibility distance of 180 ft for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 feet, which is appropriate for an alignment warning symbol sign.

For Conditions A and B, warning signs with less than 6-inch legend or more than four words, a minimum of 100 feet should be added to the advance placement distance to provide adequate legibility of the warning sign.

[2]Typical conditions *a*re locations where the road user must use extra time to adjust speed and

change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PRT of 14.0 to 14.5 seconds for vehicle maneuvers (2005 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 180 feet for the appropriate sign.

[3]Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2005 AASHTO Policy, Exhibit 3-1, Stopping Sight Distance, providing a PRT of 2.5 seconds, a deceleration rate of 11.2 feet/second^2, minus the sign legibility distance of 180 feet.

[4]Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PRT, a vehicle deceleration rate of 10 feet/second^2, minus the sign legibility distance of 250 ft.

[5]No suggested distances are provided for these speeds, as the placement location is dependent on site conditions and other signing. An alignment warning sign may be placed anywhere from the point of curvature up to 100 feet in advance of the curve. However, the alignment warning sign should be installed in advance of the curve and at least 100 feet from any other signs.

[6]The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.

EXAMPLE:

For Condition A: Speed Reduction and Lane Changing in Heavy Traffic:

Posted speed = 55 mph

X = 750 feet + d = 750 feet + 990 feet = 1,740 feet

L = S × W (for speed 45 mph or more) = 55 × 18 = 990 feet

Where:

L = Taper Length (ft)

S = Posted speed (55 mph)

W= Transition Width (30 feet – 12 feet = 18 feet)

For Condition B: Deceleration from Posted speed of 45mph to speed of 30 mph:

X = 750 feet + d = 750 feet + 100 feet = 850 feet

$L=\frac{WS^2}{60}$ (for speed less than 45 mph) = $L=\frac{18 \times 45^2}{60} = 607.5$ ft

Where:

L = Taper Length (ft)

S = Posted speed (45 mph)

W= Transition Width (30 feet – 12 feet = 18 feet)

2-602.00 TURNING LANES AT INTERSECTIONS

Left and right turn lanes are added at intersections to increase capacity and improve safety and traffic flow.

The following guidelines are applicable to right and left-turn lanes and give procedures for desirable design. Design may be limited by geometric or other constraints, but these guidelines shall be followed as closely as possible. *Figure 2-10, Turning Lane Terminology*, shows the terminology for turning lanes.

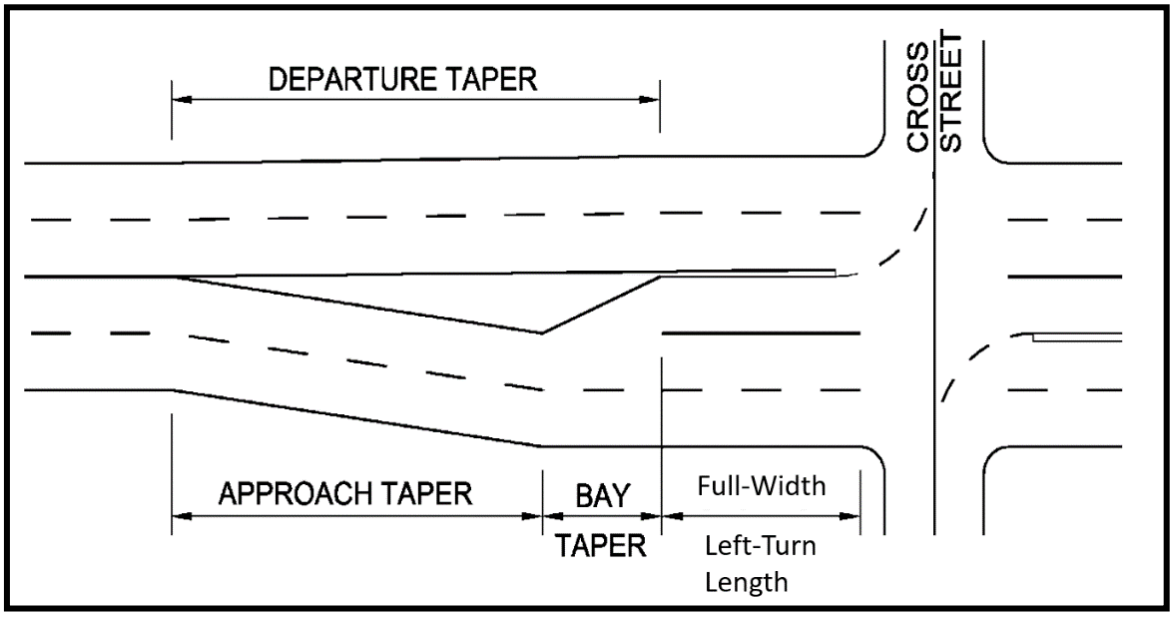


Figure 2-10
Turning Lane Terminology

1) APPROACH TAPER

(a) $L = W \times S$, Speed ≥ 45 mph

(b) $L = \frac{WS^2}{60}$, Speed < 45 mph

Where: L = Length of Taper in feet
W = Width of Offset in feet;
S = Design Speed in miles per hour

2) BAY TAPER

$L=\frac{WS}{3}$, L, W, S as defined for approach taper above.

3) FULL-WIDTH LEFT-TURN LANE WIDTH

Refer to TDOT Highway Systems Access Manual, Volume 3 for turn lane warrants and guidance on turn lane sizing.

4) DEPARTURE TAPER

The departure taper begins at the end of the bay taper and ends at the beginning of the approach taper and cannot exceed the approach taper rate criteria.

2-603.00 J-TURN INTERSECTIONS

A J-turn intersection is an intersection that prevents direct crossing and left-turn movements from the minor approach roadway. This is a variation of the restricted crossing u-turn (RCUT). It is often used in areas where the crash rate is high due to motorists attempting to cross a median into oncoming traffic traveling at a high speed. *Figure 2-11, J Turn in Maury County, TN*, is a J-turn located on Canaan Road and US 43/SR 6 in Mt. Pleasant, Maury County, TN. This J-turn was constructed because there were several crashes at the intersection with over 50% involving right angle collisions and a posted speed of 55 mph. From the figure, the J-turn requires side road movements to be made indirectly by making a right turn into traffic (move 1) (opposite than the direction they want to travel), traveling about a quarter-mile on the divided main road (moves 2-3-4), turning left into the median (move 5), proceeding to the J-Turn area (move 6) until it is safe to proceed into traffic (move 7) in the original direction they want to go. Refer to TDOT Highway Systems Access Manual, Volume 3 for design guidance of J-turn intersection and other U-turn dependent designs.



Figure 2-11
J Turn in Maury County, TN (Not to Scale)

2-604.00 INTERSECTIONS LOCATED NEAR THE LIMITS OF CONSTRUCTION

On new construction or reconstruction projects when an intersection is located at the beginning or end limit of construction the project shall comply with the following:

A. If design of the intersection is included in the scope of the project defined by the technical report, the Designer shall include the entire intersection (i.e. place the construction limit at a point beyond the stop bar on the far side of the intersection from the project.) **This includes installing updates to ensure all ADA and PROWAG measures are met.**

B. If design of the intersection is not included in the scope of the work defined by the Concept Report, the Designer shall exclude the entire intersection (i.e. place the construction limit at a point no closer than the stop bar on the near side of the intersection from the project).

C. In no case shall the Designer place the construction limits between the stop bars of a signalized intersection.

SECTION 7 – INTERCHANGES

2-700.00 INTERCHANGES

There are several types of interchanges including diamond, directional, cloverleaf, single point urban interchanges (SPUI), and diverging diamonds. Information on Interchanges can be found in *A Policy of Geometric Design of Highways and Streets,* Chapter 10, AASHTO, 2018. See *Figure 2-12, Types of Interchanges*.

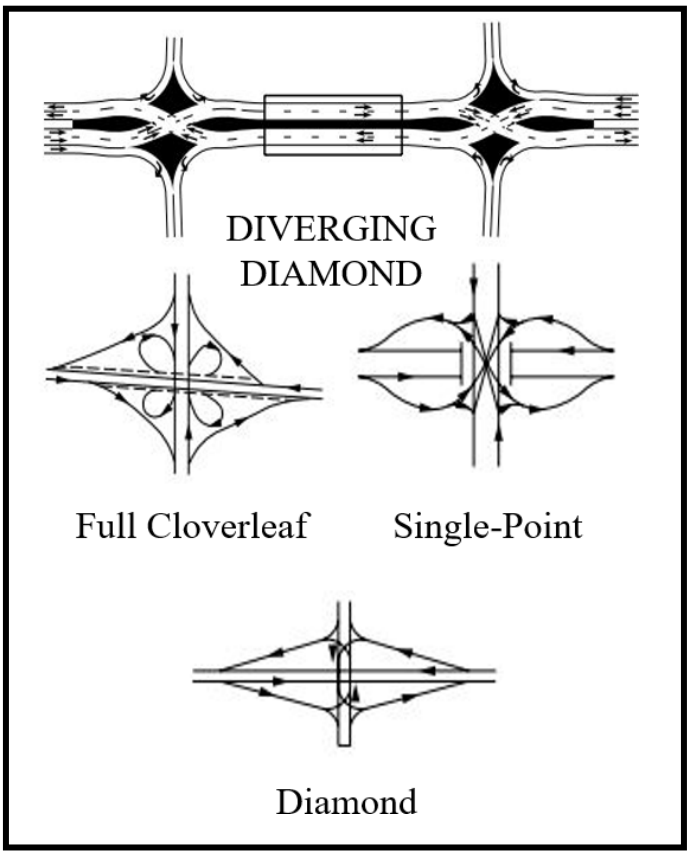


Figure 2-12 Types of Interchanges

2-700.01 INTERCHANGE RAMP DESIGN

A ramp is used to connect two or more legs at an interchange. They are composed of a terminal at each leg and a connecting road. See *A Policy of Geometric Design of Highways and Streets,* Section 10.9.6.1, AASHTO, 2018 for more information. See *Figure 2-13, Common Ramp Types*.

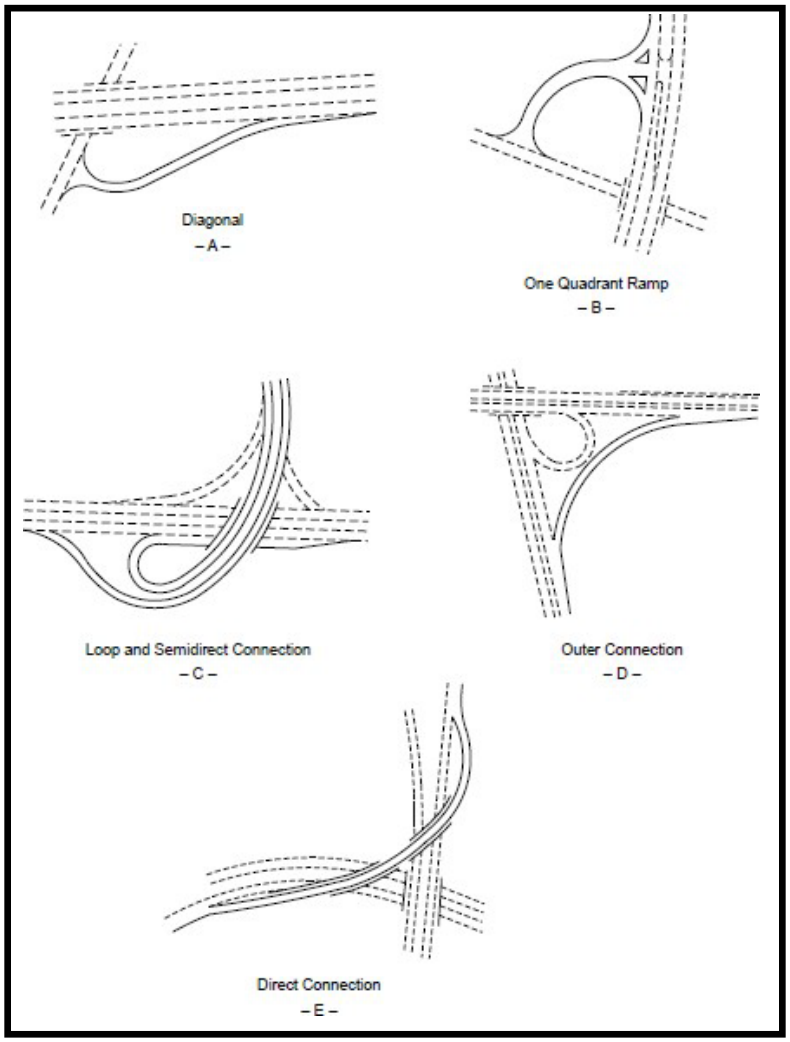


Figure 2-13
Common Ramp Types

2-700.02 TWO-LANE ENTRANCE RAMPS ON FREEWAYS AND EXPRESSWAYS

Designers shall use the parallel design when introducing two-lane entrance ramps to freeways and expressways. Parallel ramps are preferred on both single and multi-lane ramps.

The parallel design is preferable for two reasons: (1) past experience with the tapered

design has been undesirable from an operational and safety standpoint; (2) uniformity of design due to the fact that most two-lane entrance ramps statewide are the parallel type.

For examples of the parallel design for two-lane entrance ramps, refer to *A Policy on Geometric Design of Highways and Streets*, AASHTO, 2018, Figure 10-76 and Figure 10-77.

2-700.03 ACCESS CONTROL AT INTERCHANGE RAMPS

Refer to TDOT Highway Systems Access Manual, Volume 3 for spacing requirements of across points near interchange ramps.

Refer to the AASHTO Highway Safety Manual and the Interstate System Access Informational Guide for additional guidance on access control at interchange ramps.

SECTION 8 – MEDIANS

2-800.00 MEDIANS

Safety and improved traffic operations dictate the need for providing roadways with medians in the State of Tennessee. Both flush and depressed median widths and other general median principles are shown in the RD11-TS series - Typical Sections and Design Criteria section of the Roadway Standard Drawings and discussed in TDOT Highway Systems Access Manual, Volume 3. Due to safety concerns, many median divided roadways are access controlled and do not allow an opening for every private drive.

2-800.01 MEDIAN OPENING SPACING

Refer to TDOT Highway Systems Access Manual, Volume 3 for median opening spacing requirements.

2-800.02 MEDIAN OPENING SPACING - EXAMPLES

Refer to the Median Opening Spacing Guide for example problems detailing the procedure to be used in determining the appropriate median opening spacing.

2-800.03 LEFT TURN LANES IN MEDIANS

As discussed in *A Policy of Geometric Design of Highways and Streets*, Chapter 9, it is desirable to align left-turn lanes in medians – see *Figure 2-14, Left-Turn Lane Alignment*. The advantages of this placement are:

a) Better visibility of opposing through traffic as left turners look for gaps.

b) Decreased conflict between opposing left-turn vehicle paths.

c) Increased numbers of left-turn vehicles served in a given period of time. The farther left the turn lane, the shorter the crossing distance for left-turn vehicles, allowing drivers to choose shorter gaps in opposing traffic and clear the intersection. There is also an increase in capacity at signalized intersections, due to more flexibility in left-turn phasing and shorter clearance intervals.

The following guidelines apply to four-lane divided roadways with a maximum median width of 48 feet. For medians greater than 48 feet, designers should offset left turn lanes to reduce the length required for the left turn onto an intersecting road.

The centerline of left-turn lanes shall be placed along the centerline of the median, so that opposing left-turn lanes are directly opposite each other. Excess pavement area between the turn

lane and adjacent through lane shall be marked with channelization striping (see *Figure 2-14, Left-Turn Lane Alignment*)

For future traffic signal warrants, see Chapter 4 in the TDOT Traffic Design Manual and use the Hourly Percentages.

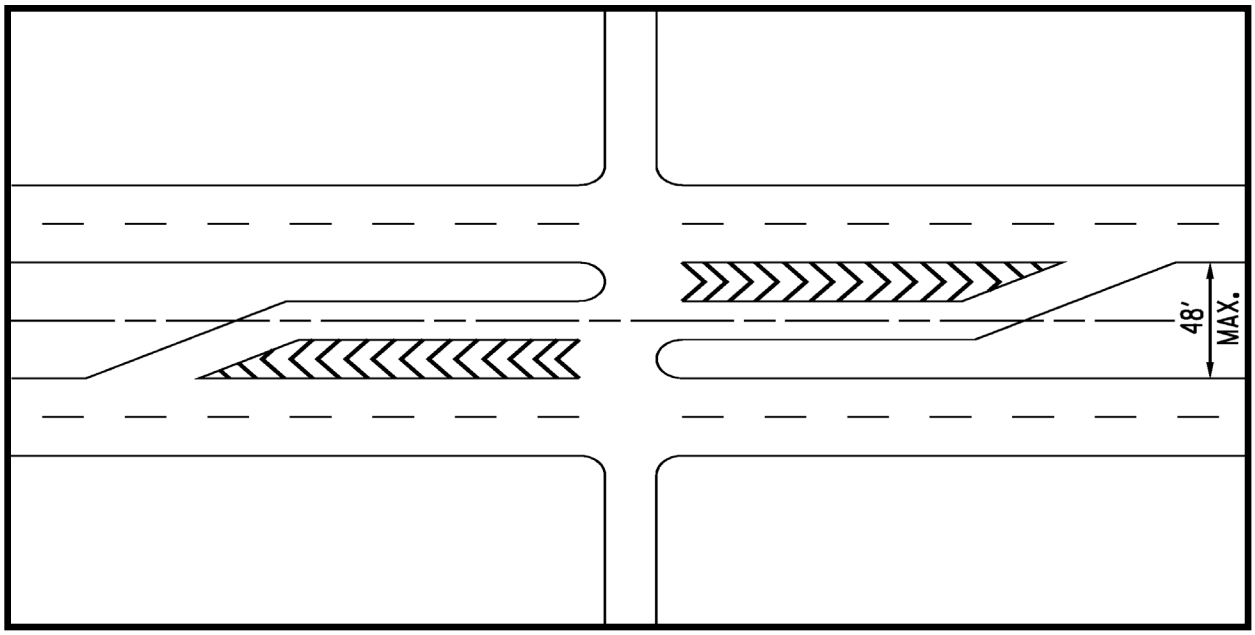


Figure 2-14

Left-Turn Lane Alignment

SECTION 9 – RETAINING WALL DESIGN

2-900.00 RETAINING WALLS

During the development of many roadway design projects, a retaining wall is proposed due to right-of-way limitations, environmental impacts, drainage issues, or the need to reduce damage to adjacent properties. The development of a retaining wall involves TDOT personnel including Project Development, Structures, and the Geotechnical Engineering Section of the Materials and Tests Division. A consultant may also serve as the Designer in place of Project Development and/or Structures personnel. When biological, environmental, hazardous materials, historical, or archeological factors are involved, it shall be necessary to coordinate with the Environmental Division to ensure the affected area is properly identified and protected.

The following sections will define the role each TDOT Division has in designing retaining walls, the steps needed to create retaining wall sheets, and which sheets are mandatory for field reviews and plan submittals.

2-900.01 RETAINING WALL SHEET NAMES, NUMBER, AND ORDER IN PLANS

All Retaining Wall Detail Sheets shall be designated as an “R” series. Refer to Chapter One of the Roadway Design Guidelines for information on the correct placement of the sheets in the index and plan sets for Functional, Plan-in-Hand, and PS&E Projects.

NOTE: Sheets with retaining wall information shall no longer be part of the Roadway “2” series sheets in construction plans.

The following series of sheets shall be used for each retaining wall:

1. *Retaining Wall (R)*
   The sheet title block shall be named: *Retaining Wall Estimated Quantities*
   The sheet number will be *R.sht, RA.sht, RB.sht, etc.*
   These sheet(s) shall be provided by the Structures Division and Geotechnical Engineering Section and include the quantities for all retaining walls.

2. *Retaining Wall (R#)*
   The sheet title block shall be named: *Retaining Wall (R#) Geotechnical Design Notes and Requirements*
   The sheet number will be *R1.sht, R2.sht, R3.sht, etc.*

These sheet(s) shall be provided by the Structure Division and Geotechnical Engineering Section.

3. *Retaining Wall (R#A)*
The sheet title block shall be named: *Retaining Wall (R#A) Geometric Layout*
The sheet number will be *R1A.sht, R2A.sht, R3A.sht, etc.*
These sheet(s) shall be provided by the Designer.

4. *Retaining Wall (R#B)*
The sheet title block shall be named: *Retaining Wall (R#B) Soil Profiles and Details*
The sheet number will be *R1B.sht, R2B.sht, R3B.sht, etc.*
These sheet(s) shall be provided by the Structures Division and Geotechnical Engineering Section.

If additional sheets are needed, the following naming format will be used:

5. *Retaining Wall (R#C, R#D, etc.)*
If there is additional information needed for a wall that falls outside the normal sheet titles as shown in previous numbers 1-4, this sheet series can be used and named as needed by Structures or Geotechnical.
The sheet title block shall be named: *Retaining Wall (R#C) XXXXXXX*
The sheet number will be *R1C.sht, R2C.sht, R3C.sht, etc.*
These sheet(s) shall be provided by the Structures Division and Geotechnical Engineering Section.

The following is an example of the retaining wall portion of the R.O.W. Index for a project with three retaining walls where the additional sheet (R#C) was not needed.

RETAINING WALL DETAILS R1-R3B

The order of sheets in the plans shall be the following:
R1, R1A, R1B, R2, R2A, R2B, R3, R3A, and R3B.

The following is an example of the retaining wall portion of the Construction Index for a project with three retaining walls where the additional sheet (R#C) was not needed.

RETAINING WALL ESTIMATE AND DETAILS… *R,R1-R3B

The order of sheets in the plans shall be the following:
*R, R1, R1A, R1B, R2, R2A, R2B, R3, R3A, and R3B.

*Note that the Retaining Wall Estimates, sheet (R) is only in the construction plan set.

2-900.02 DEVELOP THE RETAINING WALL GEOMETRIC LAYOUT SHEET

During initial plans development, the Designer shall determine if a retaining wall shall be considered. When it is, **Steps 1- 4** shall be followed to develop the *Retaining Wall (R#A) Geometric Layout* sheet, often referred to as the conceptual drawing.

STEP 1: PREPARE THE PLAN, PROFILE, AND CROSS SECTION SHEETS

The following sheets in the roadway plans shall include the proposed retaining wall(s):

Present Layout Sheet: The Designer shall show the retaining wall on the present sheet. The station and offset for beginning, ending, and all breakpoints along the wall shall be labeled.

Proposed Layout Sheet: The Designer shall show the retaining wall on the proposed sheet. The station and offset for beginning, ending, and all breakpoints along the wall shall be labeled.

Profile Sheet: The Designer shall show a profile view of the top and bottom of the wall. The bottom of the wall shall be 2’ below the ground line. The station and elevation for beginning, ending, and all breakpoints along the wall shall be labeled.

Cross Sections: The Designer shall display the centerline of the retaining wall in the cross sections. The Present R.O.W. limits and Proposed R.O.W. limits shall also be displayed onto the cross sections. For walls that are 100’ or greater in length, cross sections shall be cut at the beginning and end stations of the wall, at **50’** station increments along the wall, and additional cross sections at 10’ increments 50’ prior to the beginning and 50’ after the end of the wall. This will aid the Structures Division in determining the exact location of the beginning and ending stations of the wall. For retaining walls less than 100’ in length, cross sections shall be cut at the beginning and end stations of the wall, at **10’** station increments along the wall, and additional cross sections at 10’ increments 50’ prior to the beginning and 50’ after the end of the wall. These cross sections will be submitted in the ***nnnnnn-nn-RetainingWall*.zip** file but shall not be part of the R.O.W. or Construction .zip submittal. These cross sections shall remain in the Designer’s files for information purposes only.

STEP 2: PREPARE THE RETAINING WALL (R#A) GEOMETRIC LAYOUT SHEET

In addition to sheets in the roadway plans, a Retaining Wall Detail Geometric Layout Sheet, as shown in *Figure 2-15, Example Retaining Wall Detail Geometric Layout Sheet,* shall be developed by the Designer for each proposed retaining wall that includes the retaining wall Plan View, Profile View, and Typical Section details.

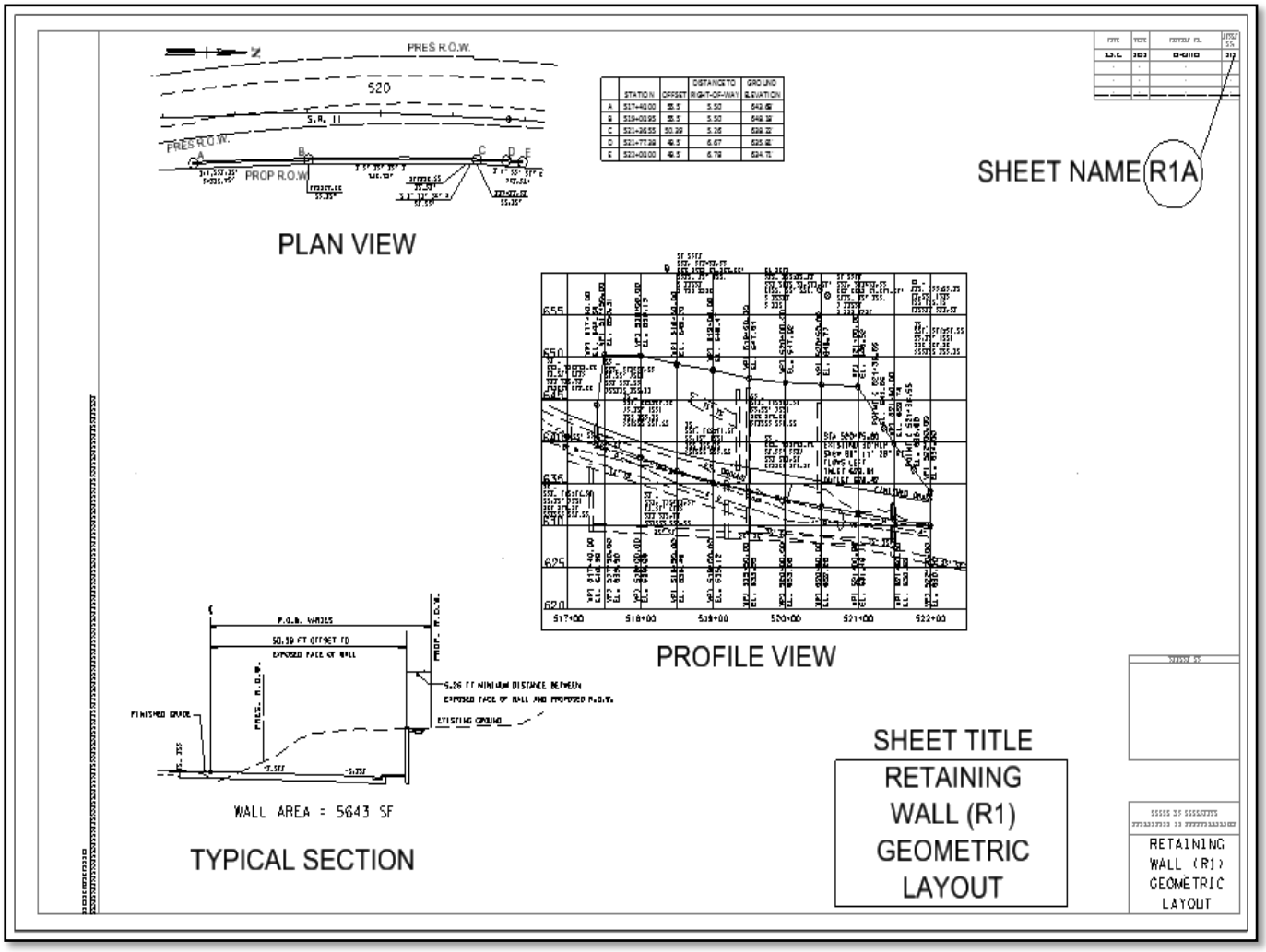
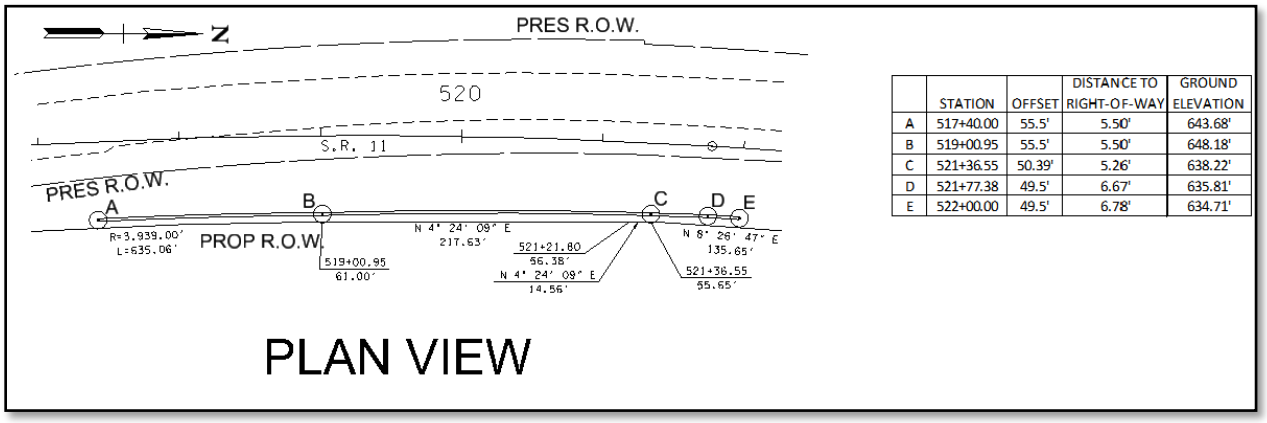


Figure 2-15
Example Retaining Wall Detail Geometric Layout Sheet

Plan View: The Designer shall show the proposed layout of the retaining wall relative to the roadway centerline and Present and Proposed R.O.W. boundaries. All Proposed R.O.W. and/or easements shall be labeled. The layout shall show an alphabetical representation for the beginning, ending, and all breakpoints along the length of the wall. A chart shall be shown representing each of these points by stations based on the proposed centerline, offsets from proposed centerline to the exposed face of wall, distances between the exposed face of wall and Proposed R.O.W., and the ground elevations at the center of the wall. (Assume wall thickness is 1').



	STATION	OFFSET	DISTANCE TO RIGHT-OF-WAY	GROUND ELEVATION
A	517+40.00	55.5'	5.50'	643.68'
B	519+00.95	55.5'	5.50'	648.18'
C	521+36.55	50.39'	5.26'	638.22'
D	521+77.38	49.5'	6.67'	635.81'
E	522+00.00	49.5'	6.78'	634.71'

Figure 2-16
Example Retaining Wall Plan View

For clarity, the plan view used for the Retaining Wall (R#A) Geometric Layout Sheet shall not show any other features. The present and the proposed layout sheets shall have the retaining wall shown with additional features (existing and proposed utilities (if available), drainage structures, etc.).

Profile View: The Designer shall show a profile view of the top and bottom of the wall. The bottom of the wall shall be 2' below the ground line (this depth may change after review by the Structures Division). The stations and elevations for beginning, ending, and all breakpoints along the wall shall be labeled. The corresponding Points as shown in the Plan View shall also be shown in the profile. For this example, only Points C and D needed to be added. Because Point B at Sta. 519+00.95 was within 1' of the VPI at Sta. 519+00.00, the elevation was the same; thus, the point did not need to be labeled.

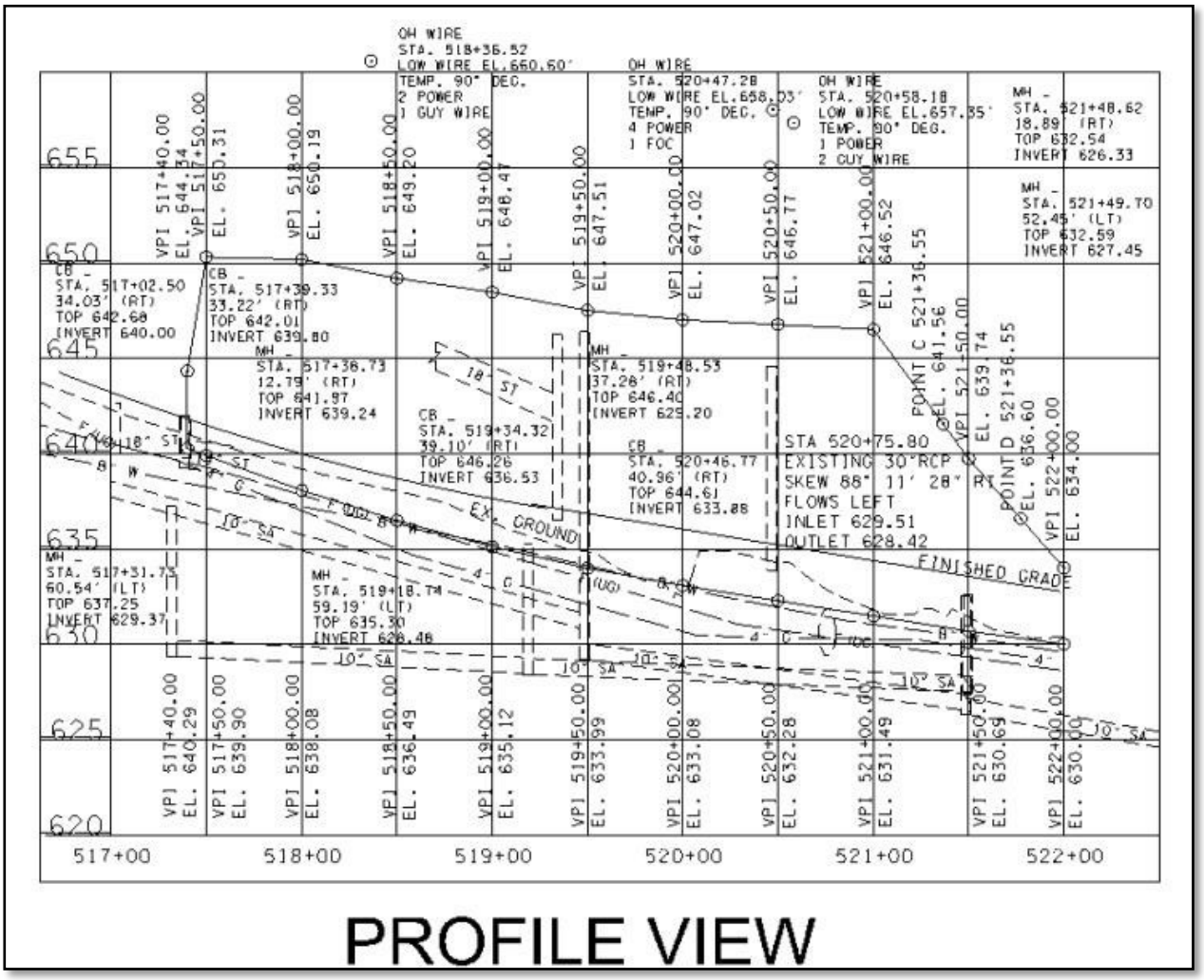


Figure 2-17
Example Retaining Wall Profile View

The example profile view displays existing drainage, utilities, etc. The designer shall make the decision to display additional features (existing and proposed utilities (if available), drainage structures, etc.) as long as clarity is not an issue. The profile sheet in the plans shall show all of these features.

Typical Section: The Designer shall show a typical section of the retaining wall. The chart shown in Plan View represents all stations and offsets for the beginning, ending, and all breakpoints along the wall. A typical section shall be shown at the station where the minimum distance between the exposed face of the wall and the Proposed R.O.W. occurs. For this example, the minimum distance (5.26') occurs at Sta. 521+36.55, Point "C". The Present and Proposed R.O.W. lines shall be shown and labeled with the distance between the centerline and Proposed R.O.W. labeled as "R.O.W. Varies" or as a defined distance for areas with fixed R.O.W. width. Slope and

construction easements shall be shown and labeled if applicable. The offset from the roadway centerline to the exposed face of the retaining wall shall be labeled. The offset does not include wall thickness. **Note the location of the exposed face of the wall in a cut section.** The square footage of the wall shall be shown if applicable.

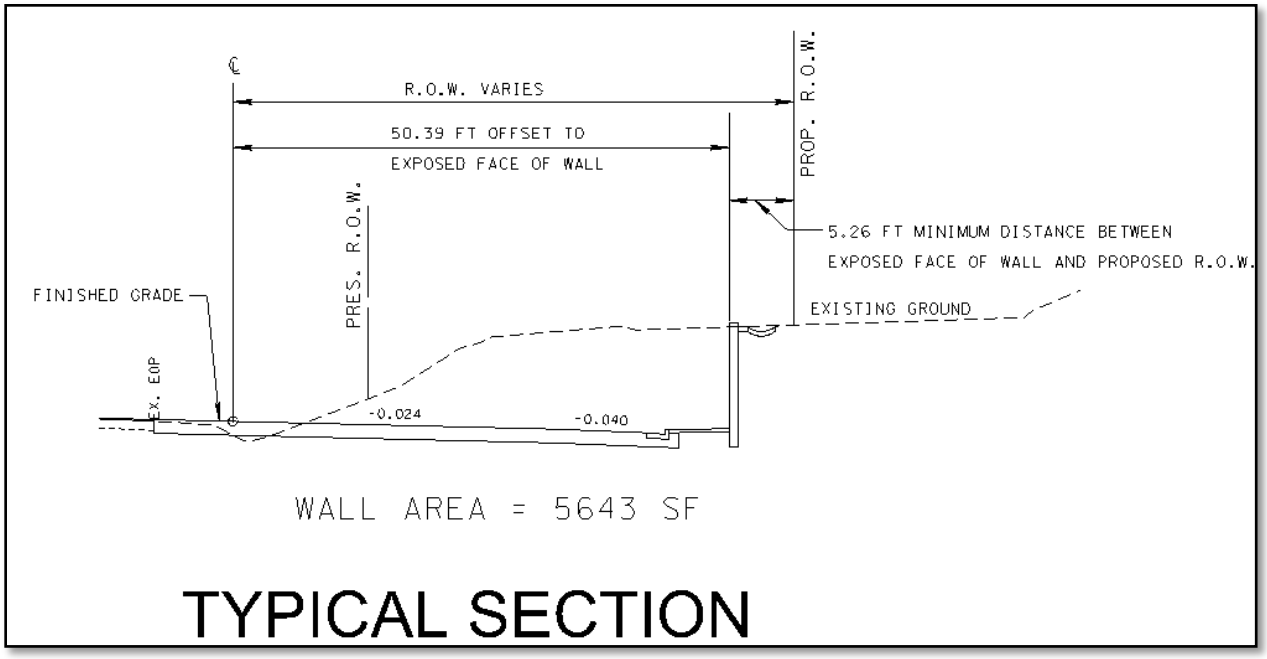


Figure 2-18
Example of Retaining Wall Typical Sections for Cut Section

For examples of walls shown in Cut and Fill Sections, see *Figure 2-18, Example of Retaining Wall Typical Sections for Cut Section* and *Figure 2-19, Example of Retaining Wall Typical Sections for Fill Section*. The typical section shall be shown to represent the section of the wall with the minimum distance between the exposed face of the wall and the Proposed R.O.W. The Present and Proposed R.O.W. lines shall be displayed and labeled with the distance between the centerline and Proposed R.O.W. labeled as “R.O.W. Varies” or as a defined distance for areas with fixed R.O.W. width. The offset from the roadway centerline to the exposed face of the retaining wall shall be labeled. **Note the location of the exposed face of the wall in a fill section.** The square footage of the wall shall also be shown, if applicable.

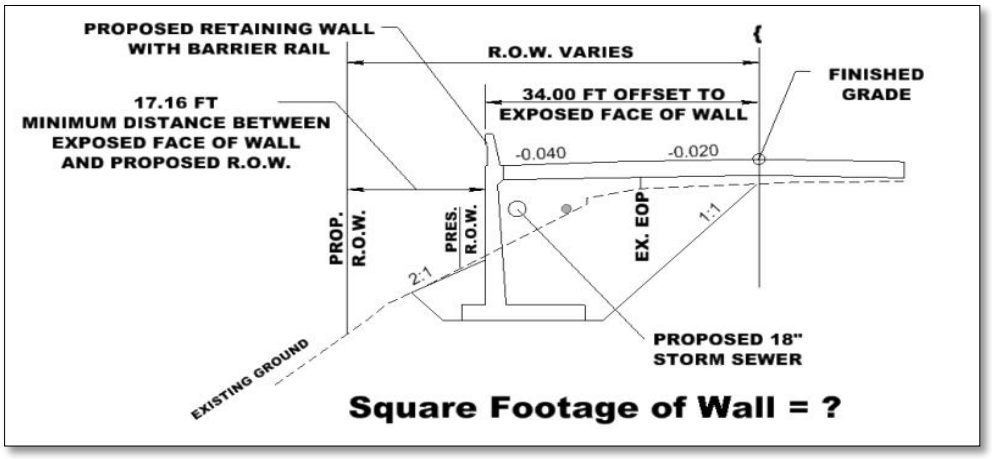


Figure 2-19
Example of Retaining Wall Typical Sections for Fill Section

See Roadway and Pavement Appurtenances - Wall Series Roadway Design Standard Drawings for additional information including retaining wall type restrictions on wall types that cannot be built within available ROW limits.

STEP 3: FILENET ARCHIVING

The Designer or Consultant Manager shall place the following files in a compressed file and place it on FileNet with the name:
nnnnnn-nn-Retainingwall.zip

- Roadway plan sheets including present, proposed, profile, and cross-section as defined in Step 1(.tin and .gpk files)
- Survey, Proposed and Alignment Files, and cross sections cut at intervals as defined in Step 1
- Retaining Wall (R#A) Geometric Layout Sheet as defined in Step 2(.dgn)
- Retaining Wall Design Letter as shown in Step 4 (.docx)

STEP 4: RETAINING WALL DESIGN LETTER

The Project Development Manager shall email the Proposed Retaining Wall Design letter (see *Figure 2-20, Example Proposed Retaining Wall Design Letter,* for example) to the Retaining Wall email address of the Structures Division (TDOT.StructuresRW@tn.gov) and CC the Geotechnical Engineering Section (TDOT.Geotech@tn.gov) and the Designer. For projects where the wall crosses over a waterway or connects to a bridge over a waterway, the Hydraulic

Section of the Structures Division (TDOT.Structures@tn.gov) shall also be included in the email distribution. Any additional requirements on the wall shall be noted in the letter (such as a barrier system, light and/or signal pole, sign, or ITS features incorporated into the wall). If there is proposed lighting or signals in proximity to the wall, TDOT.TrafficOps.Sign-Reviews@tn.gov and/or TDOT.TrafficOps.SNL-Reviews@tn.gov shall be included in the email distribution. If there is an ITS feature concerning the wall, TDOT.TrafficOps.ITS-Reviews@tn.gov shall be included in the email distribution.

The subject line in the email distribution shall be noted by:

> **Region X, County Name, Project Description (as shown in POS), Federal Project Number, State Project Number, PIN nnnnnn-nn, Retaining Wall Design**

The Designer shall archive the Proposed Retaining Wall Design letter on FileNet as part of the zip file (Refer to Step 3: FileNet Archiving).

TN TDOT Department of Transportation

PROPOSED RETAINING WALL DESIGN

TO: Structures Division, TDOT.StructuresRW@tn.gov

FROM: Project Development Manager

DATE: Click here to enter a date.

SUBJECT: COUNTY:
PIN:
PROJECT NO.
PROJECT DESCRIPTION:

During the development of the subject project, our office determined retaining walls shall be considered. I am requesting the Structures Division coordinate with the Geotechnical Section to evaluate each retaining wall to determine if the retaining wall is a feasible option for locations as shown on the plans and request that they coordinate the acquisition of soil surveys deemed necessary by the structural designer. Please notify our office immediately if a wall is deemed not to be a feasible solution.

The retaining wall information shown on the preliminary plans is conceptual in nature; therefore, any changes to the length, location, or footprint of proposed walls could affect R.O.W. in an already constrained location. Please note the following R.O.W. restrictions, known environmental constraints, or project commitments when determining your design and approved alternatives: (Designer to enter all R.O.W. restrictions, environmental constraints, and/or project commitments for each wall location here)

The *Retaining Wall Detail (R1A.sht, R2A.sht, etc.) Geometric Layout* sheet(s) and related files are on FileNet under the name: *nnnnnn-nn-RetainingWall*.zip. For all walls, additional information or changes to all *Retaining Wall Detail (R1A.sht, R2A.sht, etc.) Geometric Layout* sheet(s) pertaining to wall length, location, or footprint of the wall shall be provided to the TDOT Project Development Designer or Consultant Designer by this date Click here to enter a date.. (Designer to enter date three weeks prior to the date scheduled to print for the R.O.W. Field Review).

For each wall **designed** by the Structures Division, the Structures Division shall also provide *Preliminary Retaining Wall Details (R1.sht, R2.sht, etc.) Geotechnical Design Notes* sheet(s) for insertion into the plans for R.O.W. field review by this date Click here to enter a date.. (Designer to enter date one week prior to the date scheduled to print for R.O.W. Field Review distribution). *Retaining Wall Details (R1B.sht, R2B.sht,etc.) Soil Profiles and Details* sheet(s) **shall not** be provided.

For each wall **not designed** by the Structures Division, the *Retaining Wall Details (R1.sht , R2.sht, etc.) Geotechnical Design Notes* and *Retaining Wall Details (R1B.sht, R2B.sht, etc.) Soil Profiles and Details* sheet(s) **shall not** be provided for the R.O.W. Field Review.

☐This project will have a Design Meeting (PPRM Activity #400) on Click here to enter a date..

For further information, please contact: , Phone: ( ) - , Email: .

CC: Geotechnical Engineering Section: TDOT.Geotech@tn.gov
Project Delivery Designer (Enter Email)
Or Consultant Designer
Traffic Operations Division:
If plans include ITS Communication TDOT.TrafficOps.ITS-Reviews@tn.gov
If plans include signals and/or lighting TDOT.TrafficOps.SNL-Reviews@tn.gov

Figure 2-20
Example Proposed Retaining Wall Design Letter

2-900.03 RETAINING WALL ASSESSMENT AT SITE REVIEW

At the Site Review, the Structures Division and the Geotechnical Engineering Section will analyze all proposed retaining wall(s), ensure there are no other alternatives but to build the wall(s), and use the checklist (*Figure 2-21*, *Retaining Wall Constructability Check List in Site Review Document*) within the Site Review document to determine if the wall(s) are susceptible to constructability issues:

Retaining Wall Number ___ Road Name/Sta. Range: _____

1. Circle all of the following that may apply:

    a. The footprint of the wall is within 10’ of R.O.W.
    b. Existing and/or Proposed Utilities (Signal Poles, TVA towers or fixed Structures) are near the footprint of the wall
    c. Existing and /or Proposed Drainage Structures are near the footprint of the wall
    d. Foundation Improvement for the wall could affect traffic phasing
    e. This is a Top Down Constructed wall (Soldier Pile\Lagging, Soil Nail)
    f. This wall is needed to mitigate pyritic material
    g. This wall will be greater than 10 feet in height
    h. There are 2 or more traffic phases (affect when the wall is built)
    i. ITS Infrastructure is within 10 feet of the footprint of the wall
    j. There is a RR adjacent to the wall (RR usually does not want MSE wall)
    k. The wall is within the clear zone
    l. The proposed slope in front of the wall is 2:1 or steeper or zero percent
    m. There are environmental limitations (wetlands near or needs stream relocation, etc.)

When 3 or more are circled, the wall will be considered to be susceptible to constructability issues.

Figure 2-21
Retaining Wall Constructability Check List in Site Review Document

Once the analysis is complete, the wall is classified into one of these categories:

1. Category One -Retaining walls **WITH** constructability issues
2. Category Two- Retaining walls **WITHOUT** constructability issues

2-900.04 GUIDELINES FOR CATEGORY ONE RETAINING WALLS

For Category One retaining walls with constructability issues, the following guidance shall be used for each wall:

1. The Structures Division or a Structures Consultant **shall design** the wall.
2. The Plan-In-Hand Field Review and plans shall contain the ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s). These sheets shall be delivered to Project Development by the date noted in the Retaining Wall Design Letter to allow the designer to print for Plan-In-Hand Field Review Distribution. Updates to the sheet(s) as a result of comments from the Plan-In-Hand Field Review shall be completed and returned to Project Development for insertion into Plan-In-Hand plans.
3. The ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** **sheet(s)** shall list **only one** allowable wall type.
4. If there are R.O.W./Easement station ranges that shall remain clear of utilities or there are other restrictions, it shall be noted on the ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s). Because this sheet is part of the submittal, it is not necessary to add the note to a Project Commitment sheet.
5. If an agreement has been made between the department and a city or county concerning a specific decorative wall finish, Project Development shall notify Structures and Geotech immediately for approval. A note shall be added to the ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s) and can also be added as a project commitment. See Chapter 2-900.06, Decorative Facing on Retaining Walls.
6. The Plan-in-Hand Field Review and plans shall contain the ***Retaining Wall (R#A) Geometric Layout*** sheet(s). The proposed square footage of the wall shall be shown on the sheet. Information for the sheet shall be delivered by the date noted in the Retaining Wall Design Letter to allow Project Development the time necessary to make any changes recommended by the Structures Division.
7. Any revisions concerning the retaining wall shall be processed by Project Development with changes to the sheet(s) completed by the appropriate division(s).
8. The PS&E Field Review plans shall contain the ***Retaining Wall Estimated Quantities (R)*** sheet(s), ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s), ***Retaining Wall R#A) Geometric Layout*** sheet(s), and the ***Retaining Wall (R#B) Soil Profiles and Details*** sheet(s) for each wall. Project Development shall request sheets developed by the Structures Division a minimum of two months prior to the print date for PS&E Field Review plans distribution. Updates shall be made to the sheet(s) as a result of comments from the PS&E Field Review and Constructability Review held by Headquarters Construction and Regional Operations, if applicable. Project Development shall send the updated ***Retaining Wall (R#A) Geometric Layout*** sheet(s) for each wall to the Structures Division for insertion into the final PS&E plans a minimum of two weeks prior to the Construction submittal date and shall not include the sheets in the Roadway plans submittal. The Structures Division shall seal and submit all sheets pertaining to retaining walls at PS&E submittal.
9. Value Engineering change proposals shall not be accepted from contractors for category one retaining walls.

2-900.05 GUIDELINES FOR CATEGORY TWO RETAINING WALLS

For Category Two retaining walls without constructability issues, the following guidance shall be used for each wall:

1. The Structures Division **shall not design** the wall.
2. The Plan-in-Hand Field Review and Plans shall contain the ***Retaining Wall (R#A) Geometric Layout*** sheet(s) only. The proposed square footage of the wall shall be shown on this sheet. Information for the sheet shall be delivered by the date noted in the Retaining Wall Design Letter to allow Project Development the time necessary to make any changes recommended by the Structures Division.
3. ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s) shall not be completed for Plan-In-Hand Field Review and plans; thus project commitments must be added to the project commitment sheet for the wall if there are R.O.W./easement station ranges that shall remain clear of utilities or other restrictions.
4. ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s) shall not be completed for Plan-In-Hand Field Review and plans. plans; thus project commitments must be added if an agreement has been made between the department and a city or county concerning a specific decorative wall finish. Project Development shall notify Structures and Geotech immediately for approval. (See Chapter 2-900.06, Decorative Facing on Retaining Walls.)
5. The PS&E Field Review plans shall contain the ***Retaining Wall Estimated Quantities (R)*** sheet(s), ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s), ***Retaining Wall (R#A) Geometric Layout*** sheet(s), and the ***Retaining Wall (R#B) Soil Profiles and Details*** sheet(s) for each wall. Project Development shall request sheets developed by the Structures Division and the Structure Estimate a minimum of two months prior to the proposed date to print PS&E Field Review plans for distribution. Updates shall be made to the sheet(s) as a result of comments from the PS&E Field Review.
6. Any project commitments added to the Project commitment sheets for R.O.W. submittal shall be removed and only be shown in the ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s) to ensure that there is only one note pertaining to thewall and diminish the likelihood of conflicting notes. Structures and Project Development shall work together to ensure that the notes are covered in the correct sheets.
7. Project Development shall send the updated ***Retaining Wall (R#A) Geometric Layout*** sheet(s) for each wall to the Structures Division for insertion into the final PS&E plans a minimum of two weeks prior to the PS&E submittal date. This sheet shall not be turned in with the Roadway Plans. The retaining wall shall be designed by the contractor that was awarded the project. Walls designed and constructed by the contractor shall be limited to the approved alternatives for the wall as specified on the ***Retaining Wall (R#) Geotechnical Design Notes and Requirements*** sheet(s).
8. See *Chapter 2-900.07, Retaining Wall Quantities*

2-900.06 DECORATIVE FACING ON RETAINING WALLS

If the outside entity requests a decorative facing on walls, TDOT shall recommend the acceptable wall types for that finish. The wall finish shall be compatible with the Department's acceptable wall types. However, if the decorative facing is compatible with the acceptable wall type but unique in appearance, the additional cost of the decorative facing shall be paid for by the county/city. An estimate for the additional cost of the decorative facing shall be calculated by the Structures Division. The Project Development Manager and the Structures Manager overseeing the wall design shall contact the Local Programs Development Office at Local.Programs@tn.gov to discuss a potential contract between TDOT and the entity for the additional costs of the decorative finish.

2-900.07 RETAINING WALL QUANTITIES

Accurate retaining wall quantities are necessary when preparing an estimate for the project during the lifetime of the project. Retaining wall quantities must be estimated as early as possible and included in the request for R.O.W. funding. The quantities must also be included in any R.O.W. revisions that include retaining wall quantities.

Project Development shall calculate the following **roadway items** as applicable associated with each retaining wall:

ITEM NO.	DESCRIPTION	QUANTITY
620-05	CONCRETE PARAPET WITH STRUCTURAL TUBING	L.F.
620-10	CONCRETE PARAPET WITH PEDESTRIAN RAILING	L.F.
711-05.70	32" SINGLE SLOPE CONCRETE BARRIER WALL	L.F.
711-05.71	51" SINGLE SLOPE CONCRETE BARRIER WALL	L.F.

Structures and Geotech personnel shall calculate the quantity for each retaining wall. Each retaining wall shall be paid for separately utilizing Item Numbers 604-07.01 through 604-07.XX, as needed, with quantities calculated in square feet (S.F.).

ITEM NO.	DESCRIPTION	QUANTITY
*604-07.01 through 604-07.XX	RETAINING WALL (DESCRIPTION)	S.F.

NOTE: The description shall be filled in with the wall number, beginning and end station, and the location of the wall in reference to the centerline of the associated road, ramp, or side road left (LT) or right (RT).

Example: 604-07.01 RETAINING WALL (R1, STA. 500+00.00 to STA. 502+05.00, LT)
Example: 604-07.02 RETAINING WALL (R2, STA. 603+15.00 to STA. 604+55.00, RT)

The following quantities are **INCLUDED** in the square footage of the wall and shall not be listed as separate pay items:

ITEM NO.	DESCRIPTION	QUANTITY
203-40.10	TIE-BACK ANCHORS (SOIL)	L.F.
203-40.11	TIE-BACK ANCHORS (ROCK)	L.F.
203-40.12	TIE-BACK ANCHORS (3-STRAND UNCLASSIFIED)	L.F.
203-40.13	TIE-BACK ANCHORS (4-STRAND UNCLASSIFIED)	L.F.
203-40.14	TIE-BACK ANCHORS (5-STRAND UNCLASSIFIED)	L.F.
203-40.18	TIE-BACK ANCHORS (ABANDONED)	L.F.
604-01.52	CUSTOM ELASTOMERIC FORM LINER	LS
604-04.01	APPLIED TEXTURE FINISH (NEW STRUCTURES)	S.Y.
710-09.01	6" PERFORATED PIPE WITH VERTICAL DRAIN SYSTEM	L.F.

Structures and Geotech personnel shall calculate the foundation quantities associated with each Category 1 retaining wall **only**. For gravity type retaining walls, the Roadway Designer will use standard drawings and associated item numbers. **Foundation Items** for each retaining wall shall be paid for separately and are not included in the square footage of the wall. Foundation items include but are not limited to the following:

ITEM NO.	DESCRIPTION	QUANTITY
203-02.01	BORROW EXCAVATION (GRADED SOLID ROCK) (off site)	TON
203-02.02	BORROW EXCAVATION (GRADED SOLID ROCK) (on site)	C.Y.
203-03.01	BORROW EXCAVATION (SELECT MATERIAL)	C.Y.
203-03.05	BORROW EXCAVATION (SELECT MATERIAL)	TON
606-03.03	STEEL PILES (12 INCH)	L.F.
606-03.05	STEEL PILES (12 INCH) COLUMN	L.F.
606-04.03	STEEL PILES (14 INCH)	L.F.
606-04.05	STEEL PILES (14 INCH) COLUMN	L.F.
625-02.01 through 625-02.06	DRILLED SHAFT-SOIL (DIA.)	V.F.
625-02.13 through 625-02.18	DRILLED SHAFT-ROCK (DIA.)	V.F.
625-02.25 through 625-02.30	DRILLED SHAFT CASING-PERMANENT (DIA.)	V.F.
625-02.40	DRILLED SHAFT (SH-SCC) CONCRETE	C.Y.
625-02.44	DRILLED SHAFT REINFORCING STEEL	LB.
626-01.01	AGGREGATE FOUNDATION SYSTEMS	L.S.
740-10.04	GEOTEXTILE (TYPE IV) (STABILIZATION)	S.Y.
930-08.26	LOADING TEST (SOIL NAILS)	EACH
Numerous Items	DRILLING	

2-900.08 R.O.W. FUNDING REQUEST AND R.O.W. REVISIONS

Accurate retaining wall quantities are necessary when preparing an estimate for the project. It is essential that the quantities are estimated as early as possible and included in the request for R.O.W. or Utilities Only funding and included in an updated estimate of R.O.W. when revisions to proposed walls occur that affect quantities.

The Project Manager requests R.O.W. or Utilities Only funding following the Functional Design field review. All changes in retaining wall quantities as a result from the Functional Design Field Review shall be addressed prior to requesting funding. An Estimated Roadway Quantity Excel file is included in the R.O.W. funding request submittal package. The Structures Division does not turn in an estimate for the Functional Design phase; thus, it is essential that the Project Manager communicate with the Structures Manager to obtain applicable pay items for each wall to be included in the Estimated Roadway Quantity Excel file. At a minimum, the roadway items pertaining to the wall and square footage of the wall shall be in the Excel file (See *Chapter 2-900.07, Retaining Wall Quantities*). Any other available quantities provided by Structures shall be included in the Excel File.

If there are significant changes, additions, deletions, etc. to the retaining wall(s) after R.O.W. or Utilities Only submittal, a plans revision shall be distributed and shall include an updated Estimated Roadway Quantity Excel file. The Project Manager or Designer shall include the updated estimate in the R.O.W. revision email distribution to TDOT.Preliminary.Estimates@tn.gov and TDOT.PDSO@tn.gov. The email shall state that the estimate is updated and refer to the R.O.W. revision letter for additional information. If a proposed retaining wall was considered a Category Two wall in the R.O.W. submittal but becomes a Category One wall during the development of the project, a R.O.W. revision must be distributed with the additional sheets added to the plans.

2-900.09 PS&E FIELD REVIEW, SUBMITTAL, AND REVISIONS

Project Development and Structures shall follow the steps as outlined in *Chapter 2-900.04, Guidelines for Category One Retaining Walls* and *Chapter 2-900.05, Guidelines for Category Two Retaining Walls* for both the PS&E Field Review and Final Construction plans submittal. Project Development personnel shall ensure that all pay items except those specified as roadway items shall be removed from the Estimated Roadway Quantity Excel File.

If there are significant changes, additions, deletions, etc. to the retaining wall(s) after PS&E submittal, a plans revision shall be distributed for sheet *(R) Retaining Wall Estimated Quantities* and shall include an updated Estimated Roadway Quantity Excel file for retaining wall roadway quantities, if applicable.

2-900.10 RETAINING WALL FOOTNOTES ON PS&E PLANS

The Designer shall add the following footnote on the Estimated Roadway Quantity sheet

for PS&E Field Reviews and final Construction plans on all projects that have retaining walls:

1. ALL COST OF BUILDING AND INSTALLING THE RETAINING WALL, INCLUDING FOUDATION PREPARATION, BACKFILLING, AND EXCAVATION, SHALL BE INCLUDED IN THE SQUARE FOOTAGE COST OF THE RETAINING WALL. QUANTITIES FOR FOUNDATION PREPARATION, BACKFILL, AND EXCAVATION ARE REFLECTED IN THE END AREA CALCULATIONS ON CROSS SECTIONS AND IN GRADING QUANTITY ROADWAY ITEM 203-01, ROAD AND DRAINAGE EXCAVATION (C.Y.). THE DESIGNER HAS NOTED THE PORTION OF THIS QUANTITY FOR THESE ITEMS ON THE PROFILE SHEET XX AND ON THE GRADING QUANITITY TABULATION SHEET. THE PORTION OF THIS QUANTITY HAS BEEN REMOVED FROM ROADWAY ITEM 203-01, ROAD AND DRAINAGE EXCAVATION (C.Y.). FOR FURTHER INFORMATION ON RETAINING WALLS AND QUANTITIES, SEE SHEET(S) (*R, R1, R1A, R1B, R2, R2A, R2B, etc.*).

If a Concrete Parapet is on one retaining wall, the quantity shall be shown as a roadway item and the following footnote shall be added:

2. CONCRETE PARAPET IS LOCATED ON RETAINING WALL R# AND IS NOT INCLUDED IN THE COST OF THE RETAINING WALL.

If Concrete Parapet is on multiple retaining walls, the quantity shall be shown as a roadway item and the following footnote shall be added:

3. CONCRETE PARAPET IS NOT INCLUDED IN THE COST OF THE RETAINING WALL. BREAKDOWN OF CONCRETE PARAPET FOR EACH WALL IS XX L.F. FOR R#, XX L.F. FOR R#, XX L.F. FOR R#, (*ETC.*)

If Concrete Barrier is on one retaining wall, the quantity shall be shown as a roadway item and the following footnote shall be added:

4. CONCRETE BARRIER IS LOCATED ON RETAINING WALL R# AND IS NOT INCLUDED IN THE COST OF THE RETAINING WALL.

If Concrete Barrier is on multiple retaining walls, the quantity shall be shown as a roadway item and the following footnote shall be added:

5. CONCRETE BARRIER IS NOT INCLUDED IN THE COST OF THE RETAINING WALL. BREAKDOWN OF CONCRETE BARRIER FOR EACH WALL IS XX L.F. FOR R#, XX L.F. FOR R#, XX L.F. FOR R#, (*etc.*)

2-900.11 RETAINING WALL BARRIER SYSTEM REQUIREMENTS

The Designer shall show proper barrier type associated with the acceptable wall type. See the Roadway and Pavement Appurtenances - Wall Series Roadway of Design Standard Drawings for type and placement of barrier.

Retaining walls in fill sections may require a barrier system due to the drop off. If there is sufficient room, the barrier system should be placed away from the wall. If the only option is to include the barrier as part of the wall, the Designer shall notify the Structures Division.

Retaining walls in cut sections may require a barrier system. Generally, all retaining wall types inside the clear zone require a concrete barrier. If the wall is outside of the clear zone, a retaining wall may not be required unless deemed appropriate by engineering judgment.

SECTION 10 – EARTHWORK DESIGN

2-1000.00 EARTHWORK CONSIDERATIONS

The earthwork design is dependent on all the other roadway design elements, such as horizontal alignment, vertical alignment, roadway cross section, etc. The designer must use good engineering judgement to achieve an appropriate balance between all these elements to provide a final roadway design that meets all the constraints for a particular project. One of the major tasks in roadway construction is removing and placing earth materials to achieve the desired earth grade cross-section. The Designer should define where the roadway material is to be obtained, where it will be placed, and the amount of material to be excavated, etc. when developing plans. This section will discuss information that should be taken into consideration when a Designer is calculating earthwork and trying to balance their job.

The geotechnical report and geotechnical related drawings should be consulted by the Roadway Designer to determine what type of materials will be encountered during excavation and embankment construction for a project. The geotechnical report should provide enough information to determine the type materials described below and project specific recommendations for shrink and swell factors. It is recommended that the Designer contact the Geotechnical Engineering Section (TDOT.Geotech@tn.gov) of the Materials and Test Division as needed to clarify any questions arising regarding the nature of materials to be encountered and accounted for in the grading tabulations and bid quantities.

The following terms and definitions will be used by all TDOT Divisions so that a consistent definition is used in all phases of project development and in contract documents. Guidance to Designers as to the material breakdown to be shown on the plans and cross-sections should be found in the geotechnical report.

A. SOIL MATERIAL

Soil material is material that is predominantly made up of naturally occurring mineral particles which are readily separated into relatively small pieces, and in which the mass may contain air, water, or organic materials. This material may contain rock pieces in the form of disconnected slabs, lenses, or boulders of less than approximately 0.5 cubic yards. The main soil groups consist of clay, silt, sand, gravel, cobbles, boulders (less than 0.5 cubic yard volume) or a combination of any of the constituents. For construction purposes, this material would typically be considered to be excavatable by conventional excavation machinery such as pans, track hoes, or front-end excavators/loaders. This material would have a shrink factor as given in the shrink factors shown in Section 2-405.05, Shrinkage and Swell Factors, of the Design Guidelines or as recommended by the Geotechnical Engineering Section of the Materials and Tests Division.

B. SOLID ROCK MATERIAL

Solid rock material is that naturally occurring material, composed of mineral particles so firmly bonded together; great effort is required to separate the particles (i.e. blasting or heavy crushing forces). For construction purposes, this material would typically have to be blasted to separate into pieces small enough to load and transport on earth moving trucks and which when subjected to proper pre-split and production blasting would result in a uniform stable rock cut face. Note that this material would not by definition necessarily be a proven source of any rock type aggregate such as solid rock, graded solid rock, rip rap, or other rock aggregate construction products. This material would have a significant swell factor as given in swell factors shown in *Chapter 2-1002.00, Shrinkage and Swell Factors*, of the Design Guidelines or as recommended by the Geotechnical Engineering Section of the Materials and Tests Division.

C. SOFT ROCK OR DEGRADABLE ROCK

This material is that naturally occurring material composed of mineral particles that are so firmly bonded such that they are not separated into small pieces yet has such relatively low bonding strength that would allow for separating into small pieces through moderate to heavy crushing forces. For construction purposes this material would have to be subjected to ripping type equipment, hoe rams, or rugged use of a large bulldozer in order to separate the material such that it can be readily loaded into earth moving trucks. These materials would typically be shales, claystones, siltstones, weathered sandstones, weathered schist and weathered gneiss. This material would have a relatively small shrink or swell factor depending on the type material and the degree of weathering, disintegration, or degradation.

D. TRANSITIONAL MATERIALS

This material is that material comprised of a combination of soil and rock (Materials A, B, and C as defined above) occurring in either non-uniform interbedded layers of the above materials (i.e. shale material with relatively thin layers of solid rock such as hard limestone) or erratic localized changes of material types both laterally and with depth (such as a geologic formation resulting in pinnacled rock columns, floating boulders or lenses intercalated with clay soil, a common occurrence in certain regions of Tennessee). For construction purposes, this material may have to be excavated using a combination of excavation methods such as blasting of rock pinnacles, layers or boulders along with a ripping of weathered rock and excavating of soil with track hoes or loaders all within a localized area. This material would not be suitable for the use of excavating pan type equipment.

E. COMMON EXCAVATION

Common excavation is that sum of materials excavated from a project inclusive of all those materials described in **A, C,** and **D** above. The grouping of these materials

is to generally define those materials that would not generally be acceptable to permanently place on a pre-split, blasted face and also to define those materials that would not be considered a source of a defined fill material such as solid rock fill, graded solid rock, rip rap or other rock type aggregates. Typically the materials in this grouping would have either a shrink factor or a relatively low swell factor as compared to solid rock material described in B above.

F. UNCLASSIFIED EXCAVATION

Unclassified excavation is that sum of materials excavated from a project inclusive of all those items described in **A, B, C,** and **D** above. On most projects, road and drainage excavation will be listed as unclassified and is to be bid as one item regardless of the type material encountered. See Section 203.02(a) of the Standard Specifications for Road and Bridge Construction.

2-1001.00 EARTHWORK BALANCES ON WIDENING OF EXISTING ROADWAYS

When balancing the earthwork on a project that involves a grade change on the existing roadway, attention needs to be paid to the construction sequencing. It is not possible to maintain traffic on the existing roadway and, at the same time, use material from that roadway to lower the grade, or conversely, to add material to raise the grade of the existing roadway.

When the Designer considers the need to stockpile material, detour traffic, or maintain traffic by other means, this shall be detailed in the traffic control plans, earthwork balances, or elsewhere as deemed appropriate.

When widening symmetrically along the existing roadway, please request HQ Geotech to core the existing roadway pavement to ensure that the pavement structure is adequate for the widening if additional measures and/or full depth replacement of the existing pavement is needed to meet the needs of the 20 year design.

2-1002.00 SHRINKAGE AND SWELL FACTORS

Although the recommended shrink and swell factors to be used for each project are to be requested from the Geotechnical Engineering Section, below is some general guidance. Shrinkage and swell of earth and rock material vary with types of material, weather conditions, equipment used, depth of cuts and fills, and length of haul. Table 2-5, *Shrink and Swell Factors* are examples and are offered as a guide.

Light Cut and Fills	
1 – 2 foot cut and fills	Earth 30% to 50% Chert 20% to 30%
2 – 4 foot cut and fills	Earth 25% to 30% Chert 10% to 15%
4 - 6 foot cut and fills	Earth 15% to 20% Chert 8% to 12%
Heavy Cut and Fills	Earth 10% Chert 0% to 8%
Heavy Cuts and Light Fills	
Cuts 12 feet+, Fills 1 - 2 feet (average)	Earth 15% to 20% Chert 5% to 10%
Cuts 12 feet+, Fills 2 – 4 feet (average)	Earth 10% to 15% Chert 5% to 10%
Shale and Slate	5% to 10% shrinkage; varies with type of material
Sandstone	0% shrinkage to 15% swell; varies with type of material and weather conditions
Limestone	If material is a small percentage and mixed with embankment, 0% shrinkage Heavy cuts and fills: 15% to 20% swell Light fills: 20% swell
Light work through wooded areas call for heavier shrinkage.	
Do not call for rock to be placed in fills less than 3 feet in height unless requested by the Geotechnical Engineering Section.	

Table 2-5
Shrink and Swell Factors

2-1003.00 GRADING LINE THROUGH SOLID ROCK

Do not show a solid rock grading line on the typical sections. Specifications for excavation of rock at the subgrade and where rock slopes are to be seeded are covered in the TDOT Standard Specifications for Road and Bridge Construction.

2-1004.00 PRESPLITTING OF ROCK EXCAVATION

On all projects having rock excavation, a quantity shall be included for pre-splitting the rock at the outside limits of the cut areas containing the rock. Pre-splitting shall not be required on slopes flatter than 1:1 as per Section 203 of the Standard Specifications.

The quantity of pre-splitting shall be computed from the roadway cross-sections and paid for under Item Number 203-01.11 Presplitting of Rock Excavation per S.Y. or Item Number 203-01.12 Oriented Presplitting of Rock Excavation per S.Y.

2-1005.00 CAPPING ROCK FILLS

In areas where a solid rock fill is expected and grassed slopes are designed, provide road and drainage excavation (unclassified) or borrow excavation (unclassified) in sufficient quantity to cap these fills with a minimum of ± 9 inches of common material before placing topsoil and seeding.

2-1006.00 EARTHWORK BALANCES IN PLANS

Earthwork balances shall be computed using average end areas. Examples of how to calculate earthwork balances are as follows:

1. Calculation procedure for balanced Earthwork.

250,000 C.Y.	Exc. (Common)
-13,000 C.Y.	Topsoil from Exc. Areas
- 5,000 C.Y.	Topsoil from Emb. Areas
232,000 C.Y.	Exc. (Common) available for balance

Exc. (Com) x (1 – 0.15) + [Exc. (Rock) x 1.15] vs. Emb.

232,000 x 0.85 + (45,000 x 1.15) vs. 248,950 C.Y.

197,200 + 51,750 vs. 248,950 C.Y.
248,950 C.Y. = 248,950 C.Y.

2. Calculation procedure for unbalanced Earthwork.

350,000 C.Y. Exc. (Common)

-13,000 C.Y.	Topsoil from exc. Areas
- 5,000 C.Y.	Topsoil for emb. Area
332,000 C.Y.	Exc. (Common) available for balance

Exc. (Com) x 0.85 + [Exc. (Rock) x 1.15] vs. Emb.

332,000 x 0.85 + (45,000 x 1.15) vs. 248,950 C.Y.

333,950 C.Y. vs. 248,950 C.Y.

The 85,000 C.Y. of excess material has had the shrinkage factor applied to it (this assumes all excess material will be common). When this quantity is multiplied by the shrinkage factor (to "un-shrink" it), the excess then becomes 97,750 C.Y.

2-1007.00 TOPSOIL REQUIREMENTS FOR EARTHWORK BALANCES

In areas to be seeded or sodded, compute the quantity of topsoil required based on a 3-inch ± thickness with 100% shrinkage.

A note shall be added to the plans below the earthwork tabulation block detailing any special areas where topsoil will not be required (such as rock fills not to be seeded). Include topsoil and seeding quantities for sodded or paved ditch areas on projects requiring topsoil and seeded slopes.

Topsoil shall be secured from within the proposed roadway balances where possible. If necessary, embankment areas shall be stripped in addition to excavation areas.

When final earthwork balances are calculated, the topsoil shall be taken into account in the following manner:

1. Calculate the topsoil needed and the topsoil available to see if all the topsoil can possibly be obtained from the proposed roadway areas.
2. Adjust the cross-section end areas as necessary to reflect the topsoil that is to be stripped. These adjusted areas are to be used to balance the job.
3. Balance the project using the proper shrinkage and swell factors.
4. Include the topsoil on the estimated grading quantities tabulated block.

If no topsoil can be secured from the project area to accommodate seeding/sodding, include Item Number 203-07 Furnishing & Spreading Topsoil per C.Y. in the estimated quantities.

If adequate topsoil can be secured from the project area to accommodate seeding/sodding, include Item Number 203-04 Placing and Spreading Topsoil per C.Y. in the estimated quantities.

If adequate topsoil cannot be secured from the project area to accommodate seeding/sodding, include Item Number 203-04 Placing and Spreading Topsoil per C.Y. and Item Number 203-07 Furnishing & Spreading Topsoil per C.Y. in the estimated quantities.

Using the example in *Chapter 2-1006.00, Earthwork Balances in Plans*, a total of 18,000 C.Y. of topsoil has been stripped from the project area. According to the TDOT Standard Specifications for Road and Bridge Construction, payment for stripping and stockpiling of topsoil shall be paid for under Item Number 203-01, Road & Drainage Excavation (Unclassified). Given the 100% shrinkage factor, when placing and spreading topsoil, the thickness used in calculations should be 6" since the final thickness needs to be 3".

For example, 18,000 C.Y. of topsoil spread 6" thick will cover 22.31 acres. This will be paid for under Item Number 203-04, Placing and Spreading Topsoil, per C.Y. If the project area that needs topsoil is greater than 22.31 acres, then the additional topsoil will be paid for under Item Number 203-07, Furnishing & Spreading Topsoil.

2-1008.00 ESTIMATED GRADING QUANTITIES TABULATED BLOCK

The Estimated Grading Quantities tabulated block should be shown on Sheet 2E, Tabulated Quantities Sheet. An example of the tabulated block is shown in *Table 2-6, Estimated Grading Quantities – Balanced Example* and *Table 2-7, Estimated Grading Quantities – Unbalanced Example.*

On all projects using Item No. 203-01, Road and Drainage Excavation (Unclassified), it is to be referred to as unclassified excavation. When the Designer has received the Soils and Geology Report stating approximately what portion is common and what portion is solid rock, the Designer is to include the quantities in the block, even if the quantity is zero. If the Designer does not know the composition of the material being excavated, the Designer should use write 'UNKNOWN' in the Rock cell.

ESTIMATED GRADING QUANTITIES

DESCRIPTION	UNADJUSTED VOLUMES (CY)		ADJUSTED VOLUMES (CY)
	EXC.	EMB.	EXC.
MAINLINE	225000	237500	191250
SIDE ROADS	7000	11450	5950
PVT. DRIVES, BUSINESS AND FIELD ENTRANCES	0	0	
INDEPENDENT DITCHES	0	0	
TEMPORARY CONSTRUCTION EXITS	0	0	
OTHER (BRIDGE EXCAVATION, PAVEMENT, ETC...)	0	0	
TOPSOIL (EMB.)	5000		
TOPSOIL (EXC.)	13000		
TOPSOIL TOTALS (SEE TOPSOIL TAB)			

ROCK (C.Y.)		TOTALS (C.Y.)				
EXC.	EMB.	EXC. (UNCL.)	EMB. (UNCL.)	EXC (COMMON)	EXC. (AVAIL.)	EXC. (ADJ.)
45000	0	295000	248950	250000	232000	248950

BALANCE SUMMARY

SHRINK = 15 % SWELL = 15 %

EXC.		EMB.
248950	VS.	-248950
AVAILABLE	=	0
WASTE MATERIAL	=	0

Table 2-6
Estimated Grading Quantities – Balanced Example

ESTIMATED GRADING QUANTITIES

DESCRIPTION	UNADJUSTED VOLUMES (CY)		ADJUSTED VOLUMES (CY)
	EXC.	EMB.	EXC.
MAINLINE	325000	375150	276250
SIDE ROADS	7000	11450	5950
PVT. DRIVES, BUSINESS AND FIELD ENTRANCES			
INDEPENDENT DITCHES			
TEMPORARY CONSTRUCTION EXITS			
OTHER (BRIDGE EXCAVATION, PAVEMENT, ETC...)			
TOPSOIL (EMB.)	5000		
TOPSOIL (EXC.)	13000		
TOPSOIL TOTALS (SEE TOPSOIL TABLE)			

ROCK (C.Y.)		TOTALS (C.Y.)				
EXC.	EMB.	EXC. (UNCL.)	EMB. (UNCL.)	EXC (COMMON)	EXC. (AVAIL.)	EXC. (ADJ.)
45000		395000	386600	350000	332000	333950

BALANCE SUMMARY

SHRINK = 15 % SWELL = 15 %

EMB.		EXC.
386600	VS.	-333950
AVAILABLE	=	52650
BORROW MATERIAL	=	60548

Table 2-7
Estimated Grading Quantities – Unbalanced Example

2-1009.00 GRADING REPORT

All grading report sheets shall show the federal and/or state project numbers, route numbers and/or street names and county on each sheet. The Designer should use the Grading Report template. Each sheet shall be numbered to reflect both the individual sheet number as well as the total number of quantity sheets in the submission. See *Figure 2-22, Sample Grading Report.*

GRADING REPORT

COMPUTED BY: Jordan Del Sardo
CHECKED BY: David D. Layhew
FEDERAL PROJECT NO: N/A
ROUTE NO. OR STREET: Macedonia Road

SHEET 1 OF 18
STATE NO.: 65455-3623-04
PIN: 124501.00
COUNTY: Morgan

ESTIMATED GRADING QUANTITIES

DESCRIPTION	UNADJUSTED VOLUMES (CY)		ADJUSTED VOLUMES (CY)
	EXC.	EMB.	EXC.
MAINLINE	4235	6578	3388
SIDE ROADS	2341	654	1873
PVT. DRIVES, BUSINESS AND FIELD ENTRANCES			
INDEPENDENT DITCHES			
TEMPORARY CONSTRUCTION EXITS			
OTHER (BRIDGE EXCAVATION, PAVEMENT, ETC...)	542		434
TOPSOIL (EMB.)			
TOPSOIL (EXC.)			
TOPSOIL TOTALS (SEE TOPSOIL TABLE)			

ROCK (C.Y.)		TOTALS (C.Y.)				
EXC.	EMB.	EXC. (UNCL.)	EMB. (UNCL.)	EXC (COMMON)	EXC. (AVAIL.)	EXC. (ADJ.)
543		7661	7232	7118	7118	6346

BALANCE SUMMARY				
SHRINK = 20 %		SWELL = 20 %		
	EMB.		EXC.	
	7232	VS.	-6346	
AVAILABLE	=		886	
BORROW MATERIAL	=		1064	

Macedonia Road Earthwork

Station	Material Name	End Areas (sq. ft.)	Unadjusted Volumes (cu. yd.)	Adjusted Volumes (cu. yd.)	Mult Factor	Mass Ordinate	Accum Unadj Vol (cu. yd.)	Accum Adj Vol (cu. yd.)
2+94.13	EARTH							
	Excavation	24	0	0	1.00		0	0
	Fill	0	0	0	1.00	0	0	0
2+95.00	EARTH							
	Excavation	23	1	1	1.00		1	1
	Fill	0	0	0	1.00	1	0	0
2+97.65	EARTH							
	Excavation	123	7	7	1.00		8	8
	Fill	0	0	0	1.00	8	0	0

Figure 2-22
Sample Grading Report

SECTION 11 – TRUCK CLIMBING LANES

2-1100.00 TRUCK CLIMBING LANE DESIGN

It is desirable to provide a truck-climbing lane as an added lane for the upgrade direction of a highway where the grade, traffic volumes and heavy-vehicle volumes combine to degrade traffic operations from those on the approach to grade. This section discusses guidelines for determining the location of truck-climbing lanes, critical lengths of grade, design criteria for truck-climbing lanes and guidance on how to develop truck speed profiles. For additional guidance on these topics, see AASHTO *A Policy on Geometric Design of Highways and Streets.*

2-1100.01 LOCATION GUIDELINES

A truck-climbing lane may be necessary to allow a specific upgrade to operate at an acceptable level of service. The following criteria will apply:

Two-Lane Highways – On a two-lane, two-way highway, a truck-climbing lane should be considered if the following conditions are satisfied:

- The upgrade traffic flow is in excess of 200 veh/h; and
- The heavy-vehicle volume (i.e., trucks, buses and recreational vehicles) exceeds 20 veh/h during the design hour; and

One of the following conditions exists:

- The critical length of grade is exceeded for the 10 mph speed reduction curve (see *Figure 2-23, Critical Length of Grade for Design*), or
- The level of service (LOS) on the upgrade is E or F, or
- There is a reduction of two or more LOS when moving from the approach segment to the upgrade; or
- The construction costs and the construction impacts (e.g., environmental, right- of-way) are considered reasonable.

Multi-lane Highways – A truck-climbing lane should be considered on a multi-lane highway if the following conditions are satisfied:

- The directional service volume for LOS D is exceeded on the upgrade; and
- The directional service volume exceeds 1000 veh/h/lane; and

- One of the following conditions exists:
    - The critical length of grade is exceeded for the 10 mph speed reduction curve (see *Figure 2-23, Critical Length of Grade for Design*), or
    - The LOS on the upgrade is E or F, or
    - There is a reduction of one or more LOS when moving from the approach segment to the upgrade; and
    - The construction costs and the construction impacts (e.g., environmental, right-of-way) are considered reasonably.

Also, truck-climbing lanes should be considered where the above criteria are not met and if there is an adverse crash experience on the upgrade related to slow-moving heavy vehicles.

2-1100.02 CAPACITY ANALYSIS

See the *Highway Capacity Manual 2016* for guidance on conducting capacity analyses for climbing lanes on two-lane and multi-lane highways.

2-1100.03 CRITICAL LENGTH OF GRADE

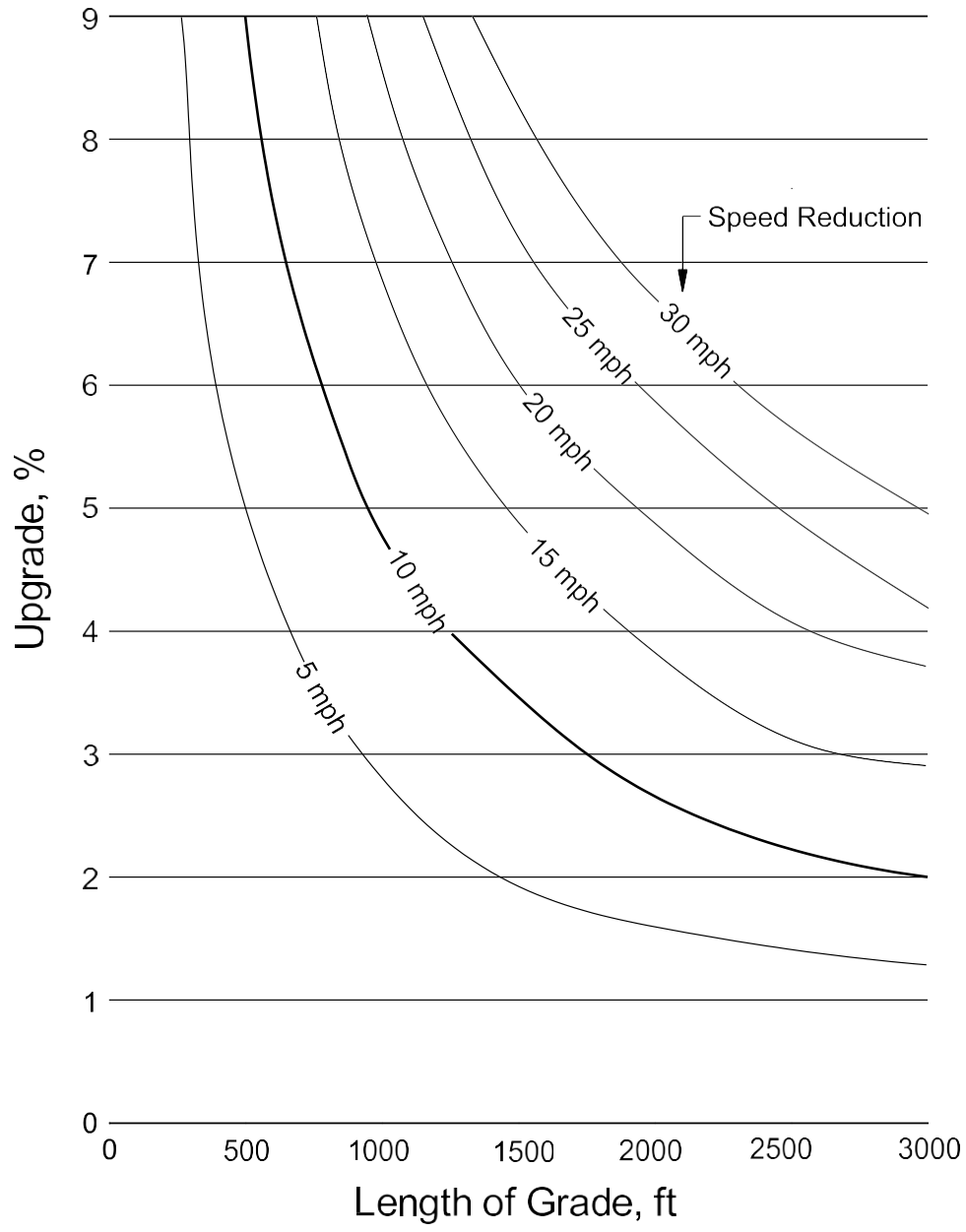
The critical length of grade is the maximum length of a specific upgrade on which a truck can operate without an unreasonable reduction in speed. The highway gradient, in combination with the length of the grade, will determine the truck speed reduction on upgrades.

The following will apply to the critical length of grade:

1. Design Vehicle – *Figure 2-23, Critical Length of Grade for Design,* presents the critical length of grade for a 200 lb/hp truck. This vehicle is representative of size and type of a heavy vehicle normally used for design on main roads.
2. Criteria – *Figure 2-23, Critical Length of Grade for Design,* provides the critical lengths of grade for a given percent grade and acceptable truck speed reduction. Although these curves are based on an initial truck speed of 70 mph, they apply to any design or posted speed. For design purposes, use the 10 mph speed reduction curve in the figure to determine if the critical length of grade is exceeded.
3. Momentum Grades – Where an upgrade is preceded by a downgrade, trucks will often increase their speed to ascend the upgrade. A speed increase of 5 mph on moderate downgrades (3%-5%) and 10 mph on steeper downgrades (6%-8%) of sufficient length are reasonable adjustments to the initial speed. This assumption allows the use of a higher speed reduction curve in *Figure 2-23, Critical Length of Grade for Design*. However, the Designer should also consider that these speed increases may not always be attainable. If traffic volumes are sufficiently high, a truck may be behind another vehicle when descending the momentum grade, thereby restricting the

increase in speed. Therefore, only consider these increases in speed if the highway has a LOS C or better.

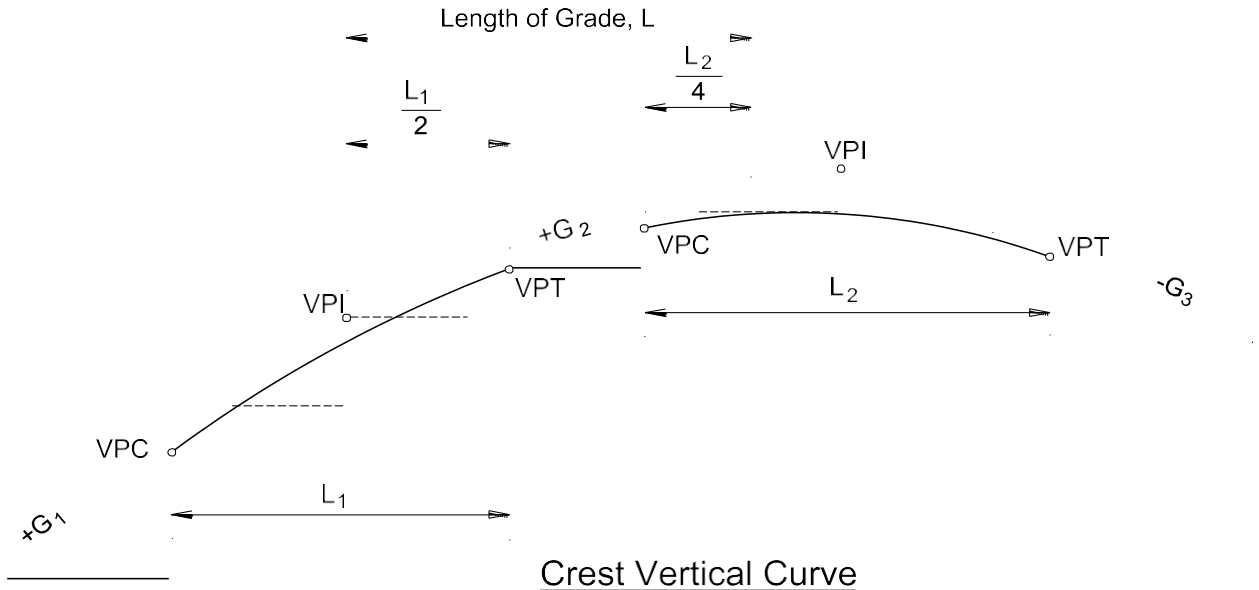
4. Measurement – Vertical curves are part of the length of grade. *Figure 2-24, Measurement for Length of Grade,* illustrates how to measure the length of grade to determine the critical length of grade using *Figure 2-23, Critical Length of Grade for Design*.
5. Application – If the critical length of grade is exceeded, flatten the grade, if practical, or evaluate the need for a truck-climbing lane. Typically, only two-lane highways have operational probles that require truck-climbing lanes.



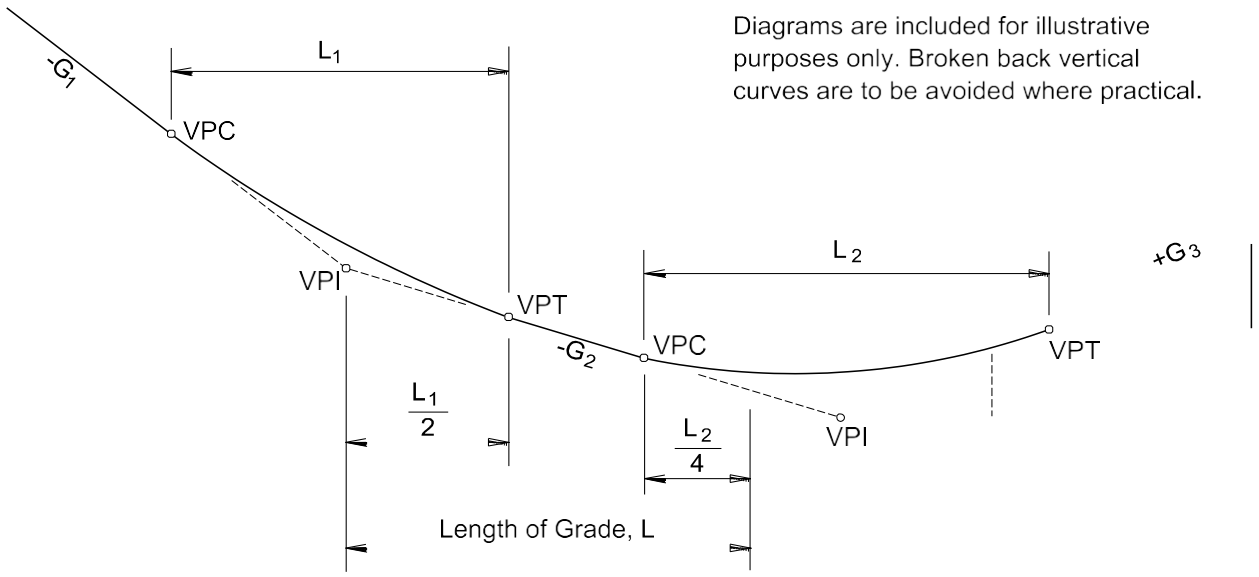
Notes:

1. Typically, the 10 mph curve will be used.
2. Figure is based on a truck with initial speed of 70 mph. However, it may be used for any design or posted speed.
3. This figure is based on a 200 lb/hp heavy vehicle.
4. Figure is from the AASHTO A Policy on Geometric Design of Highways and Streets.

Figure 2-23
Critical Length of Grade for Design



Crest Vertical Curve



Diagrams are included for illustrative purposes only. Broken back vertical curves are to be avoided where practical.

Sag Vertical Curve

Notes:

1. *For vertical curves where the two tangent grades are in the same direction (both upgrades or both downgrades), 50% of the curve length will be part of the length of grade.*
2. *For vertical curves where the two tangent grades are in opposite directions (one grade up and one grade down), 25% of the curve length will be part of the length of grade.*

Figure 2-24
Measurement for Length of Grade

Highway Types – The critical-length-of-grade criteria applies equally to two-lane or multi-lane highways, and applies equally to urban and rural facilities.

Alternative Critical Lengths of Grades – In many design situations, *Figure 2-23*, *Critical Length of Grade for Design***,** may not be directly applicable to the determination of the critical length of grade for one of following reasons:

- The truck population for a given site may be such that a weight/power ratio is either less than or greater than the 200 lb/hp design vehicle (e.g., coal mining trucks, gravel trucks).
- The truck speed at the entrance to the grade may differ from the 70 mph assumed in *Figure 2-23 Critical Length of Grade for Design*.
- The profile may not consist of a constant percent grade.

For these situations, the Designer may want to consider using the software program Truck Speed Profile Model (TSPM) described in NCHRP Report 505 *Review of Truck Characteristics as Factors in Roadway Design* to determine the applicable critical length of grade. This program may be used to generate speed truck profiles for any specified truck weight/power ratio, initial truck speed, and sequence of grades.

Example Problems – Examples No. 1 and No. 2 illustrate the use of Figure 2-23 *Critical Length of Grade for Design*, to determine the critical length of grade. Example No. 3 illustrates the use of *Figure 2-23*, *Critical Length of Grade for Design,* and *Figure 2-24*, *Measurement for Length of Grade*. In the examples, the use of subscripts 1, 2, etc., indicate the successive gradients and lengths of grade on the highway segment.

Example No. 1

Given: Level Approach
G = +4%
L = 1500 ft (length of grade)
Rural Principal Arterial

Problem: Determine if the critical length of grade is exceeded.

Solution: *Figure, 2-21*, *Critical Length of Grade for Design*, yields a critical length of grade of 1200 ft for a 10-mph speed reduction. The length of grade (L) exceeds this value. Therefore, flatten the grade, if practical, or evaluate the need for a truck-climbing lane.

Example No. 2

Given: Level Approach

G_1 = +4.5%
L_1 = 500 ft
G_2 = +2%
L_2 = 700 ft
Rural Arterial with a significant number of heavy trucks

Problem: Determine if the critical length of grade is exceeded for the combination of grades G_1 and G_2.

Solution: From *Figure 2-23, Critical Length of Grade for Design*, G_1 yields a truck speed reduction of 5 mph. G_2 yields a speed reduction of approximately 3 mph. The total of 8 mph is less than the maximum 10 mph speed reduction. Therefore, the critical length of grade is not exceeded.

Example No. 3

Given: *Figure 2-23. Critical Length of Grade Calculations,* illustrates the vertical alignment on a low-volume, two-lane rural collector highway with no large trucks.

Problem: Determine if the critical length of grade is exceeded for G_2 or for the combination upgrade G_3 and G_4.

Solution: Use the following steps:

Step 1: Determine the length of grade using the criteria in *Figure 2-25. Critical Length of Grade Calculations.* For this example, the following calculations are used:

$$L_2 = \frac{1000}{4} + 600 + \frac{800}{4} = 1050 \text{ ft}$$

$$L_3 = \frac{800}{4} + 700 + \frac{400}{2} = 1100 \text{ ft}$$

$$L_4 = \frac{400}{2} + 300 + \frac{600}{4} = 650 \text{ ft}$$

Step 2: Determine the critical length of grade in both directions. Use *Figure 2-23*, *Critical Length of Grade for Design,* to determine the critical length of grade.

- For trucks traveling left to right, enter into *Figure 2-23, Critical Length of Grade for Design,* the value for G_3 (3.5%) and L_3 = 1100 ft. The speed reduction is 7.0 mph. For G_4 (2%) and L_4 = 650 ft., the speed reduction is approximately 3.5 mph. The total speed reduction on the combination upgrade G_3 and G_4 is 10.5 mph. This exceeds the maximum 10 mph speed reduction. However, on low-volume roads, one can assume a 5 mph increase in truck speed for the 3% “momentum” grade (G_2), which precedes G_3. Therefore, a speed reduction may be as high as 15 mph before concluding that the combination grade exceeds the critical length of grade. Assuming the benefits of the momentum grade, this leads to the conclusion that the critical length of grade is not exceeded.

- For trucks traveling in the opposite direction, on *Figure 2-23, Critical Length of Grade for Design*, enter in the value for G_2 (3%) and determine the critical length of grade for the 10 mph speed reduction (i.e., 1700 ft). Because L_2 is less than 1700 ft (i.e., 1050 ft), the critical length of grade for this direction is not exceeded.

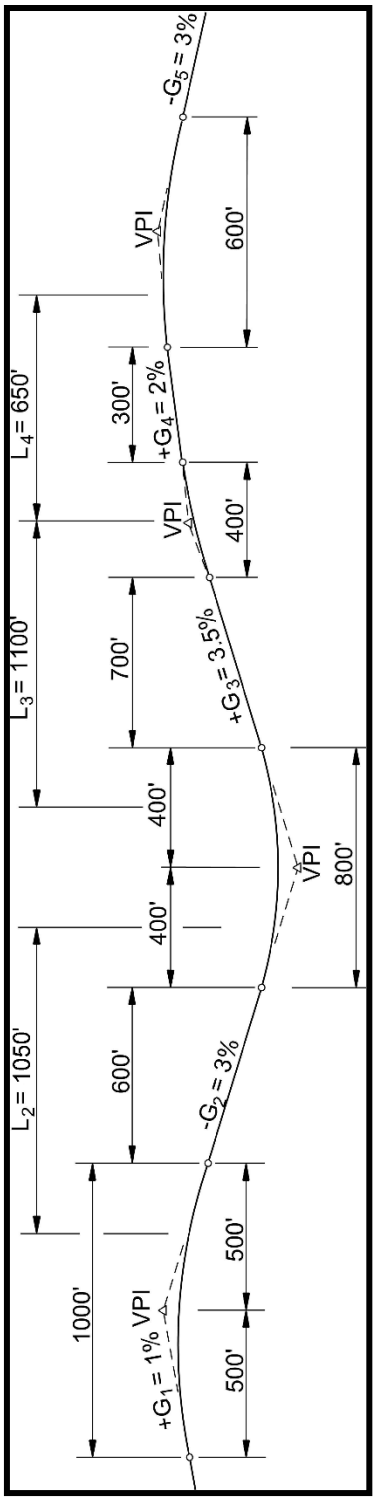


Figure 2-25
Critical Length Of Grade Calculations
(Example No. 3)

2-1100.04 DESIGN CRITERIA

Table 2-8, Design Criteria for Truck-Climbing Lanes, summarizes the design criteria for a truck-climbing lane. Also, consider the following:

1. Design Speed – For entering speeds equal to or greater than 70 mph, use 70 mph for the truck design speed. For speeds less than 70 mph, use the roadway design speed or the posted speed limit, whichever is less. Under restricted conditions, the Designer may want to consider the effect a momentum grade will have on the entering speed. See Section 2-800.03 for additional information on momentum grades. However, the maximum speed will be 70 mph.

2. Cross Slope – On tangent sections, refer to RD11-SE-1 for cross slope information on the truck-climbing lanes.

3. Superelevation – For horizontal curves, superelevate the truck-climbing lane at the same rate as the adjacent travel lane.

4. Performance Curves – *Figure 2-26*, *Performance Curves for Trucks (200 lb/hp)*, presents the deceleration and acceleration rates for a 200 lb/hp truck.

5. End of Full-Width Lane – In addition to the criteria in *Table 2-8*, *Design Criteria for Truck-Climbing Lanes*, ensure that there is sufficient sight distance available to the point where the truck, RV, or bus will begin to merge back into the through travel lane. At a minimum, this will be stopping sight distance. Desirably, the driver should have decision sight distance available to the roadway surface (i.e., height of object = 0.0 ft.) at the end of the taper. See the AASHTO *A Policy on Geometric Design of Highways and Streets* for decision sight distance values.

   The full-lane width should be extended beyond the crest vertical curve and not ended just beyond the crest of the grade. Desirably the full-lane width should not end on a horizontal curve.

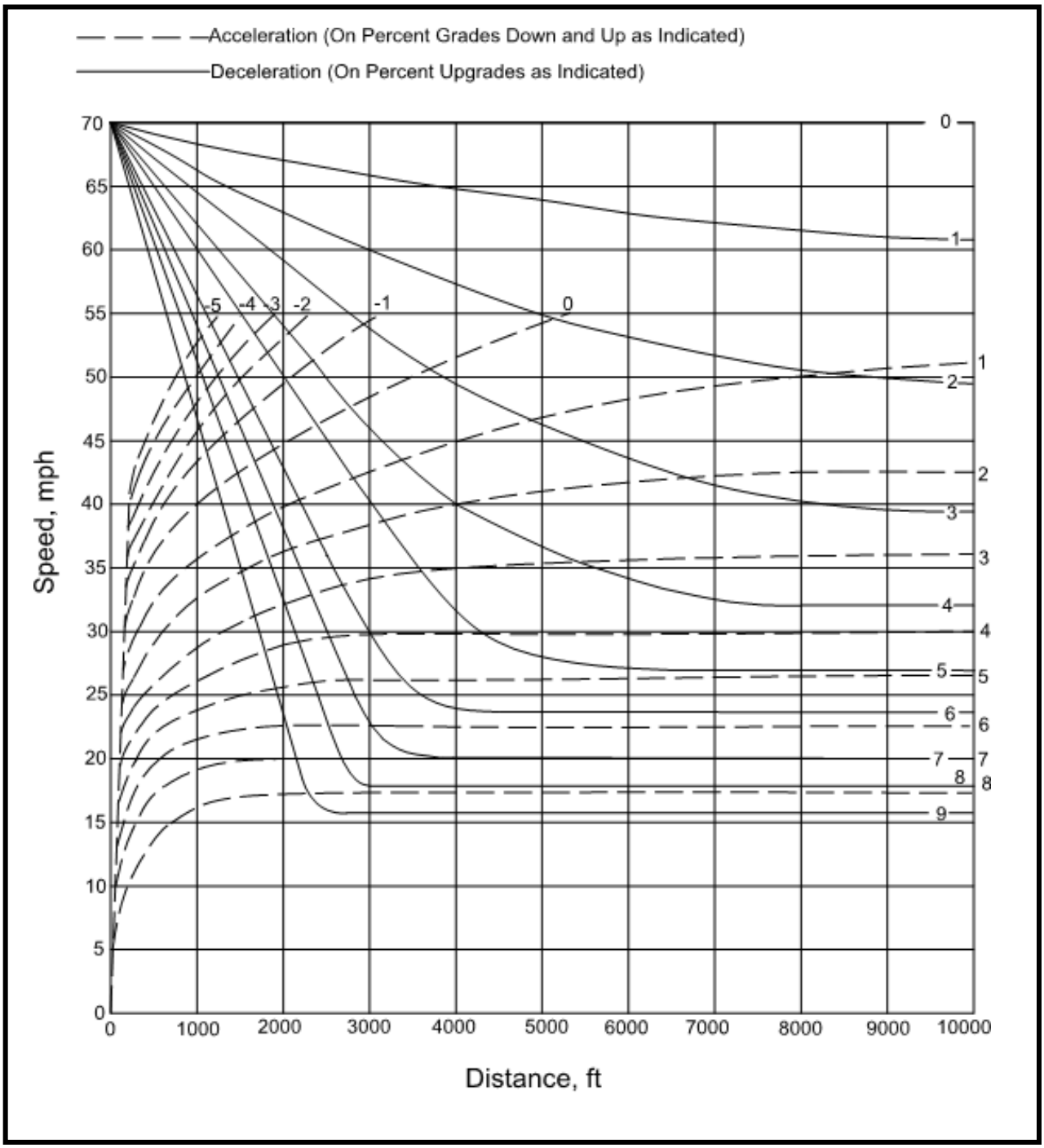
6. Signing and Pavement Markings – Contact the Regional Project Delivery Signing Designer for signing and pavement marking guidance for truck-climbing lanes.

Design Element	Desirable	Minimum
Lane Width	12 ft	Width of adjacent lane
Shoulder Width	Same width as approach shoulder	Interstate: 6 ft Other Highways: 4 ft
Cross Slope on Tangent	0.02 ft/ft	0.02 ft/ft
Beginning of Full-Width Lane (1)	Location where the truck speed has been reduced to 10 mph below the posted speed limit	Location where the truck speed has been reduced to 45 mph
End of Full-Width Lane (2)	Location where truck has reached highway posted speed or 55 mph, whichever is less	Location where truck has reached 10 mph below highway posted speed limit
Entering Taper	25:1	300 ft
Exiting Taper	Interstate: 70:1 Other Highways: 600 ft	50:1
Minimum Full-Width Length	1000 ft or greater	Interstate Only: 1000 ft

Table 2-8
Design Criteria for Truck-Climbing Lanes

Notes:

1. *Use Figure 2-26, Performance Curves for Trucks (200 lb/hp) to determine truck deceleration rates. In determining the applicable truck speed, the Designer may consider the effect of momentum grades.*
2. *Use Figure 2-26, Performance Curves for Trucks (200 lb/hp) to determine truck acceleration rates. Also, see Comment 5 in Section 2-1100.03.*



Notes:

1. *For entering speeds equal to or greater than 70 mph, use an initial speed of 70 mph. For speeds less than 70 mph, use the design speed or posted speed limit as the initial speed.*
2. *Figure is from the AASHTO A Policy on Geometric Design of Highways and Streets.*

Figure 2-26
Performance Curves for Trucks (200 lb/hp)

2-1100.05 DOWNGRADES

Truck lanes on downgrades are not typically considered. However, steep downhill grades may also have a detrimental effect on the capacity and safety of facilities with high traffic volumes and numerous heavy trucks. Although specific criteria have not been established for these conditions, trucks descending steep downgrades in low gear may produce nearly as great an effect on operations as an equivalent upgrade. The need for a truck lane for downhill traffic will be considered on a site-by-site basis.

2-1100.06 TRUCK SPEED PROFILE

For highways with a single grade, the critical length of grade and deceleration and acceleration rates can be directly determined from *Figure 2-26, Performance Curves for Trucks (200 lb/hp)*. However, most highways have a continuous series of grades. Often, it is necessary to find the impact of a series of significant grades in succession. If several different grades are present, then a speed profile may need to be developed. The following example illustrates how to construct a truck speed profile and how to use *Figure 2-26, Performance Curves for Trucks (200 lb/hp)*.

Example No. 4

Given: Level Approach
G_1 = +3% for 800 ft (VPI to VPI)
G_2 = +5% for 3200 ft (VPI to VPI)
G_3 = -2% beyond the composite upgrade (G_1 and G_2)
V = 60 mph design speed with a 55 mph posted speed limit
Rural Principal Arterial

Problem: Using the criteria in Table 2-8*, Design Criteria for Truck-Climbing Lanes*, and *Figure 2-26, Performance Curves for Trucks (200 lb/hp),* construct a truck speed profile and determine the beginning and ending points of the full-width climbing lane.

Solution: Apply the following steps:

Step 1: Determine the truck speed on G_1 using*, Figure 2-26, Performance Curves for Trucks (200 lb/hp),* and plot the truck speed at 200 ft increments. Assume an initial truck speed of 55 mph. Move horizontally along the 55 mph line to the 3% deceleration curve. This is approximately 2800 ft along the horizontal axis. This is the starting point for G_1.

Figure 2-27 Distance From VPI_1 (ft)	Horizontal Distance on Figure 2-26 (ft)	Truck Speed (mph)	Comments
0	2800	55	VPI_1
200	3000	54	
400	3200	53	
600	3400	52	
800	3600	51	VPI_2

Table 2-9
Truck Speed on G_1

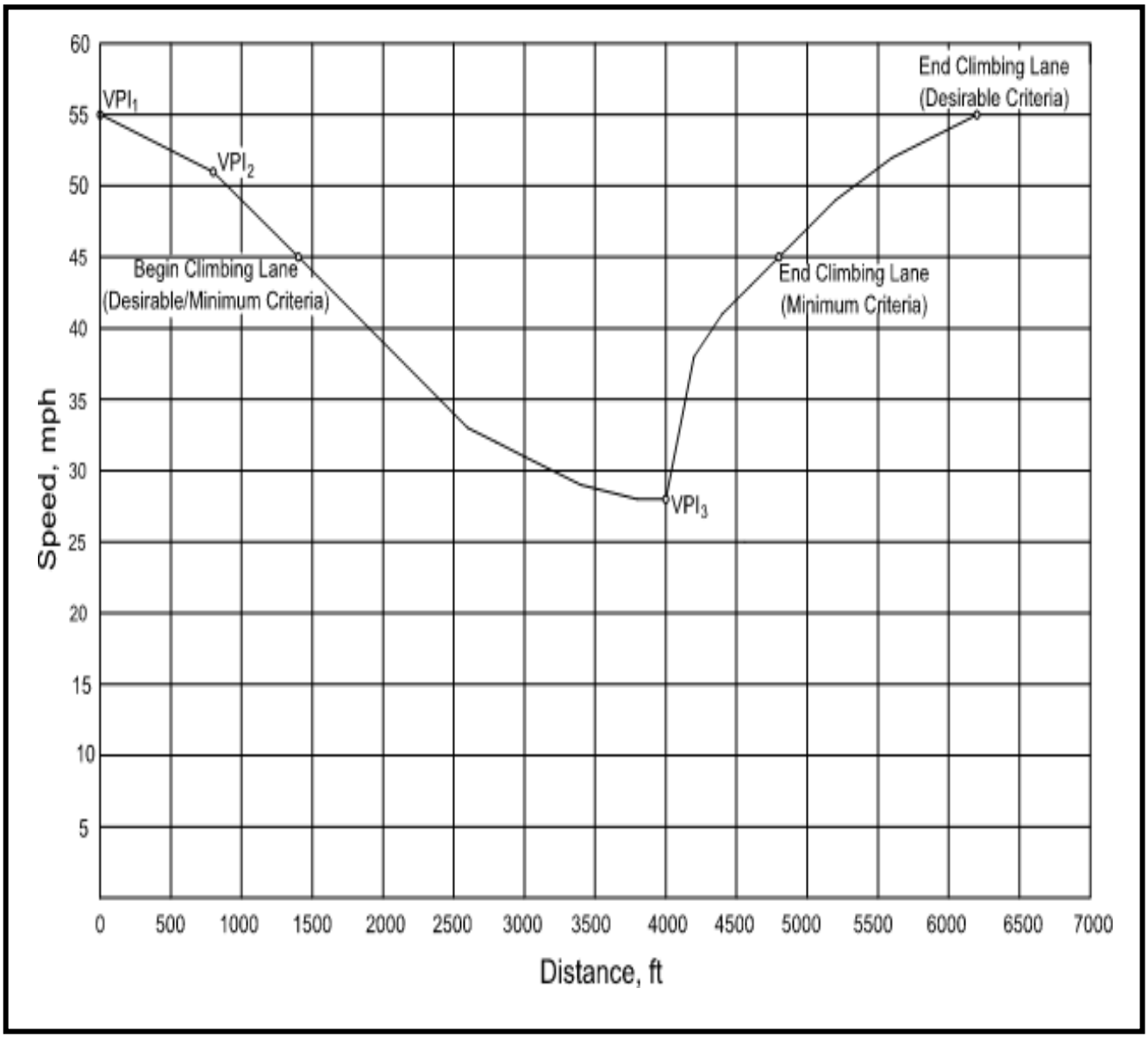


Figure 2-27
Truck Speed Profile

Step 2: Determine the truck speed on G_2 using *Figure 2-26, Performance Curves for Trucks (200 lb/hp)* and plot the truck speed at 200 ft. increments in *Figure 2-27, Truck Speed Profile*. From Step 1, the initial speed on G_2 is the final speed from G_1 (i.e., 51 mph). Move right horizontally along the 51 mph line to the 5% deceleration curve. This is approximately 1900 ft. along the horizontal axis. This is the starting point for G_2.

Figure 2-27 Distance From VPI_1 (ft)	Horizontal Distance on Figure 2-26 (ft)	Truck Speed (mph)	Comments
800	1900	51	VPI_2
1000	2100	49	
1200	2300	47	
1400	2500	45	
1600	2700	43	
1800	2900	41	
2000	3100	39	
2200	3300	37	
2400	3500	35	
2600	3700	33	
2800	3900	32	
3000	4100	31	
3200	4300	30	
3400	4500	29	
3600	4700	29	
3800	4900	28	
4000	5100	28	VPI_3

Table 2-10
Truck Speed on G_2

Step 3: Determine the truck speed on G_3 using *Figure 2-26, Performance Curves for Trucks,* until the truck has fully accelerated to 55 mph, and plot the truck speed at 200 ft. increments in *Figure 2-27, Truck Speed Profile*. The truck will have a speed of 28 mph as it enters the 2% downgrade at VPI_3. Read into *Figure 2-26, Performance Curves for Trucks,* at the 28 mph point on the vertical axis and move over horizontally to the -2% line. This is approximately 150 ft. along the horizontal axis. This is the starting point for G_3.

Figure 2-27 Distance From VPI_1 (ft)	Horizontal Distance on Figure 2-26 (ft)	Truck Speed (mph)	Comments
4000	150	28	VPI_3
4200	350	38	
4400	550	41	
4600	750	43	
4800	950	45	
5000	1150	47	
5200	1350	49	
5400	1550	50	
5600	1750	52	
5800	1950	53	
6000	2150	54	
6200	2350	55	

Table 2-11
Truck Speed on G_3

Step 4: Determine the beginning and end of the full-width climbing lane. From Table 2-*8, Design Criteria for Truck-Climbing Lanes*, the desirable and minimum beginning of the full-width lane will be where the truck has reached a speed of 45 mph (10 mph below the posted speed). This point occurs 1400 ft. beyond VPI_1.

For ending the full-width climbing lane, the desirable criterion from Table 2-*8, Design Criteria for Truck-Climbing Lanes*, is where the truck speed has reached the posted speed limit (55 mph) or 6200 ft. beyond the VPI_1. The minimum criterion is where the truck has reached a speed of 45 mph (10 mph below the posted speed). This occurs at 4800 ft. beyond VPI_1.

SECTION 12 – STRUCTURAL DESIGN

2-1200.00 CONCRETE BOX AND SLAB TYPE CULVERTS AND BRIDGES

As structures are proposed or changed on projects, the impact to the environment shall be considered. Early consideration for the type of structure and construction of the structure shall be considered, especially when there are restrictions of piers being placed in the water or construction time restrictions. Precast, pre-stressed bridge deck panels will not be allowed to be used on concrete box or slab type culverts.

2-1200.01 TYPE DESIGNATION

For each culvert or bridge, the plans must clearly indicate the type (box or slab) that should be used on the project. The type shall be shown and labeled on the plans along with corresponding quantities as noted in the checklists for each project stage.

The current Standard Drawings for box or slab type culverts or bridges are found in the Standard Structure Drawings. Special or new designs may be requested through the proper channels from the Structures Division.

For all projects having either concrete box and/or slab culverts or bridge projects, the Standard Drawing Index Sheet shall include the appropriate STD-17 series of drawings showing the particular structures that apply to the project.

2-1200.02 PAVED APRON FOR BOX CULVERT AND BRIDGE OUTLETS

A paved apron may be used on concrete box culverts and bridges in selected locations as determined by the Design Manager if requested by the Structures or Construction Division. Standard Drawing STD-17-19 should be used when an apron is required.

The quantities shall be added to the concrete, steel, and foundation fill material quantities for the box culvert or slab bridge. Footnote these quantities to show the amount of concrete and steel bar reinforcement included for the paved aprons, when applicable. The steel bar reinforcement may be computed using a weight of 58 pounds per 100 square feet of apron, plus the weight of the A500 bars (use 3.13 pounds per bar).

2-1200.03 CONCRETE BOX AND SLAB TYPE CULVERTS AND BRIDGES IN SHALLOW FILLS

On concrete box and slab type culverts and bridges where there is little or no fill to be placed on top of the structure and/or there are significant effects on construction due to grades, superelevation or curvature, the Designer shall place information on the plans as follows:

A. Where the horizontal curvature of the roadway, as opposed to the normally straight nature of the inlet and outlet, is sufficient that the guardrail may encroach on the shoulder and/or roadway (See *Figure 2-28, Potential Guardrail Encroachment*), the Designer shall investigate the need to have the inlet and outlet constructed on a curve parallel to the centerline of the roadway.

If curved inlets and/or outlets are required, a note similar to the one below shall be placed on the culvert section.

"The inlet and outlet ends of the box culvert at Sta. ___ shall be curved parallel to the centerline of the roadway."

B. Where grades and/or superelevation cause significant effects on construction, the Designer shall show the following additional details and elevations on the culvert drainage section as shown in *Figure 2-29, Box Bridge or Culvert Elevation Details*:

1. Add detail of box showing flow line, top of wall and top of slab adjacent to vertical walls on both inlet and outlet ends.

2. Show elevations of top of curb and top of wingwalls to suit roadway grades and superelevation. The height of curb may vary; but shall not exceed a height of 2.5 feet above the top of the box. In the event this cannot be avoided, the Designer will contact the Hydraulics Section of the Structures Division to resolve the issue.

   Provide a cross-section of the roadway on top of the box showing the asphalt paving needed on the box to obtain the roadway grade and proper pavement cross slope. See *Figure 2-30, Typical Cross-Section Information for Box and Slab Type Culverts and Bridges*.

3. Show crown or superelevation when the concrete top slab is to be the riding surface.

C. Table 2-12*, Adjustment Factor for Estimating Additional Reinforcing Steel Quantities in the Vertical Walls of Concrete Box or Slab Type Culverts or Bridges* to determine the appropriate adjustment factor. (See associated *Figure 2-31, Typical Concrete Box or Slab Type Culvert or Bridge Modification*). The Structures Division will assist the Designer in these calculations, if assistance is requested.

D. If the top slab is to be used as the riding surface and the design speed is less than 40 mph, the following note shall be added to the plans as a footnote for the concrete item for box bridges.

“Bridge deck finish to be burlap drag in accordance with method “A” as specified in Subsection 604.23 of the *Tennessee Department of Transportation Standard Specifications.”*

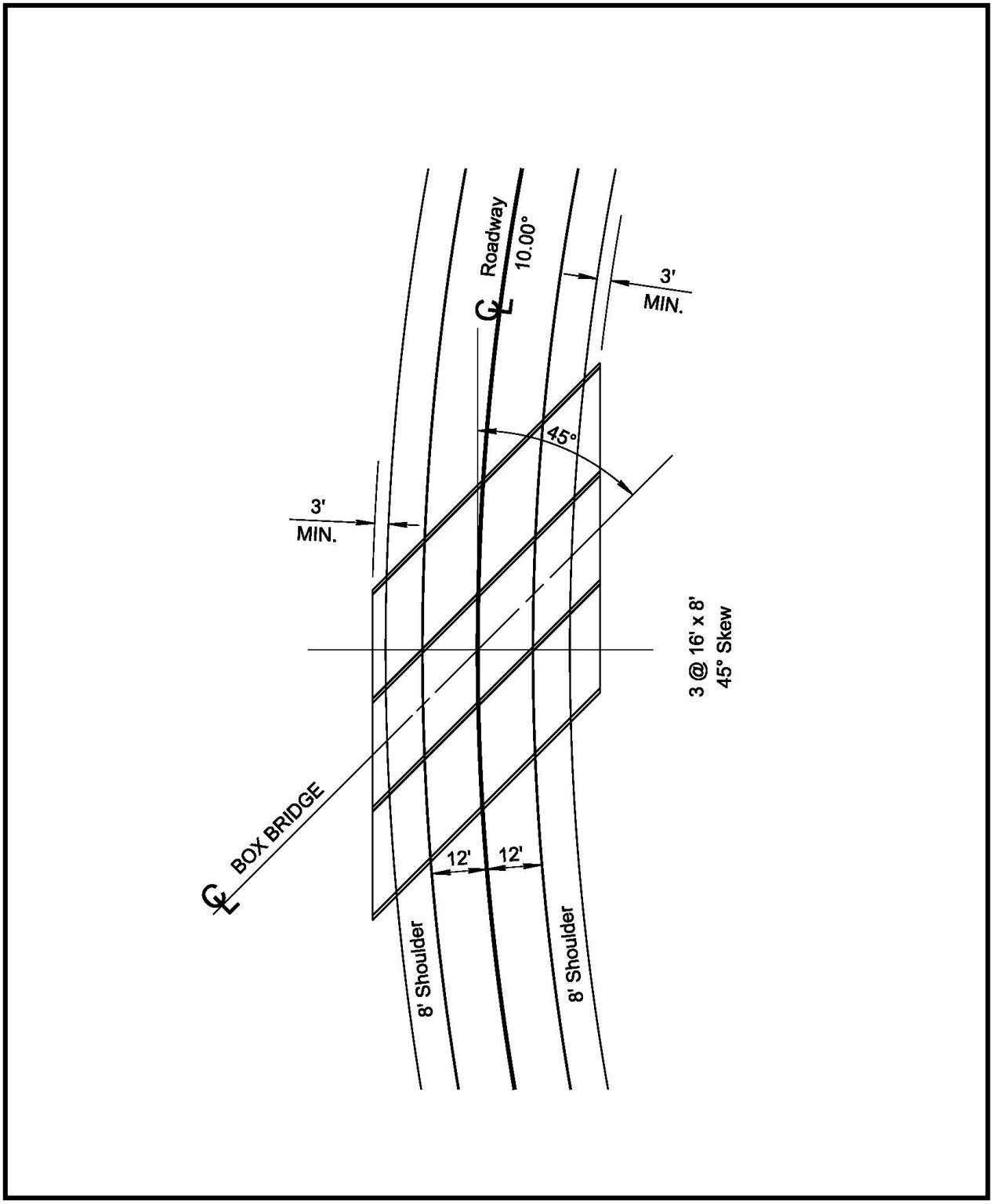


Figure 2-28
Potential Guardrail Encroachment

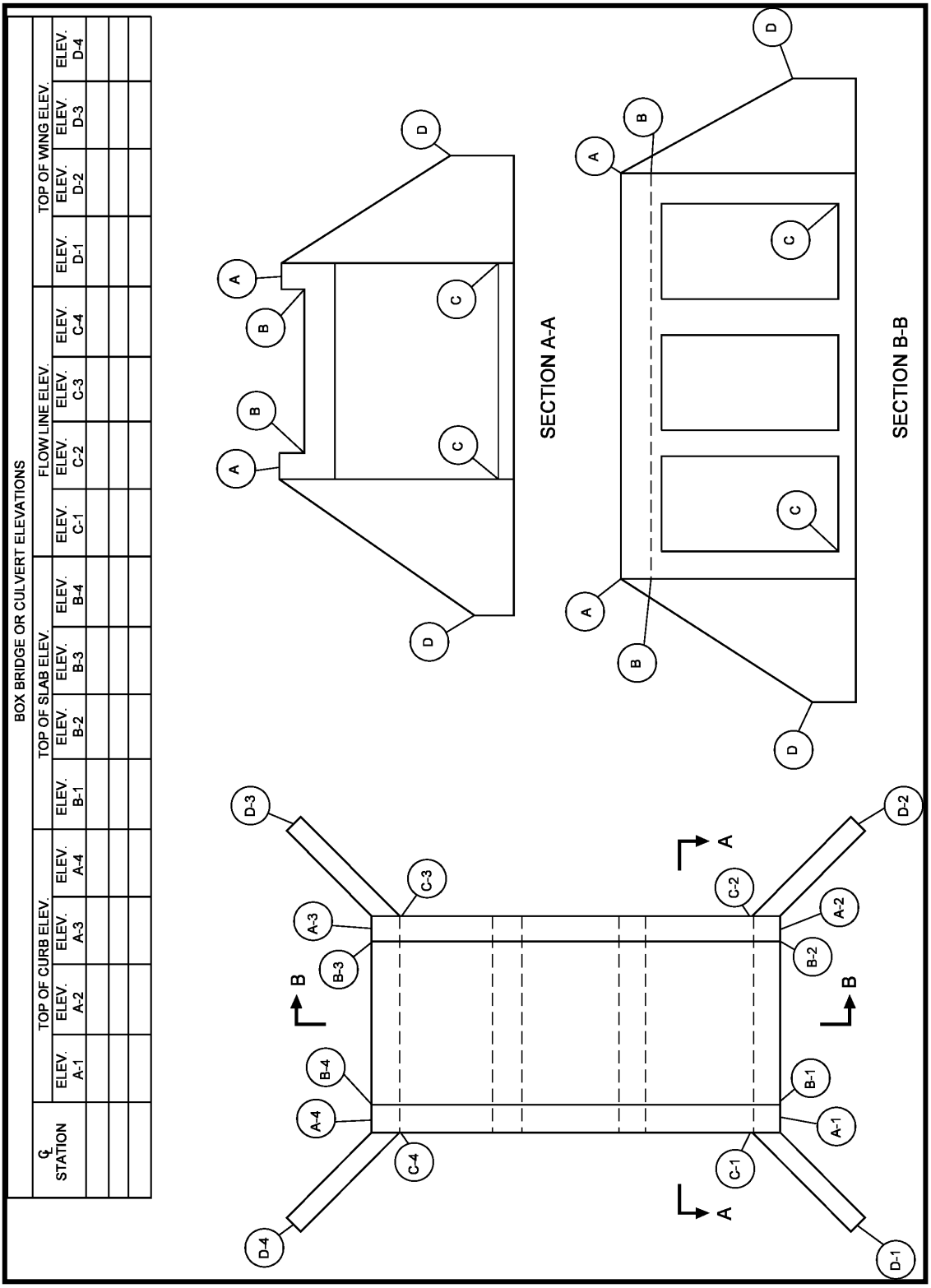


Figure 2-29
Box Bridge or Culvert Elevation Details

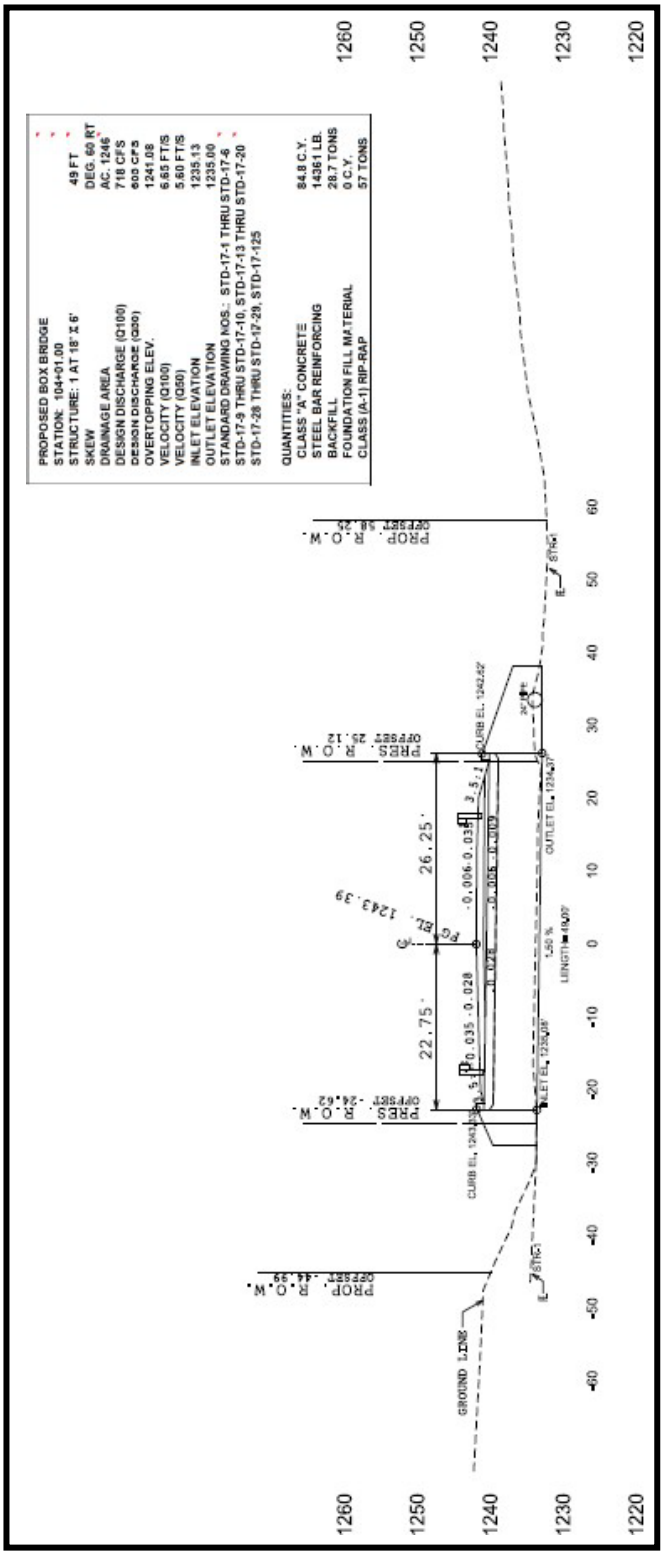


Figure 2-30
Typical Cross-Section Information for Box and Slab Type Culverts and Bridges

ADJUSTMENT FACTOR FOR ESTIMATING ADDITIONAL REINFORCING STEEL QUANTITIES IN THE VERTICAL WALLS OF CONCRETE BOX OR SLAB TYPE CULVERTS OR BRIDGES		
SPAN WIDTH IN FEET	*EXTERIOR WALL IN LB./L.F./V.F.	*INTERIOR WALL IN LB./L.F./V.F.
8	2.27	1.33
10	2.45	1.50
12	2.94	1.71
14	3.94	2.17
16	3.94	2.17
18	3.94	2.17

* ADDITIONAL POUNDS OF REINFORCING STEEL IN VERTICAL WALLS BASED ON POUNDS PER LINEAR FOOT ONE FOOT IN HEIGHT FOR ANY NUMBER OF BARRELS ON ANY SKEW. THIS TABLE IS GOOD FOR AN INCREASE IN WALL HEIGHT NOT EXCEEDING TWO FEET AND FILL HEIGHTS NOT EXCEEDING TWO FEET.

Table 2-12
Adjustment Factor for Estimating Additional Reinforcing Steel Quantities in the Vertical Walls of Concrete Box or Slab Type Culverts or Bridges

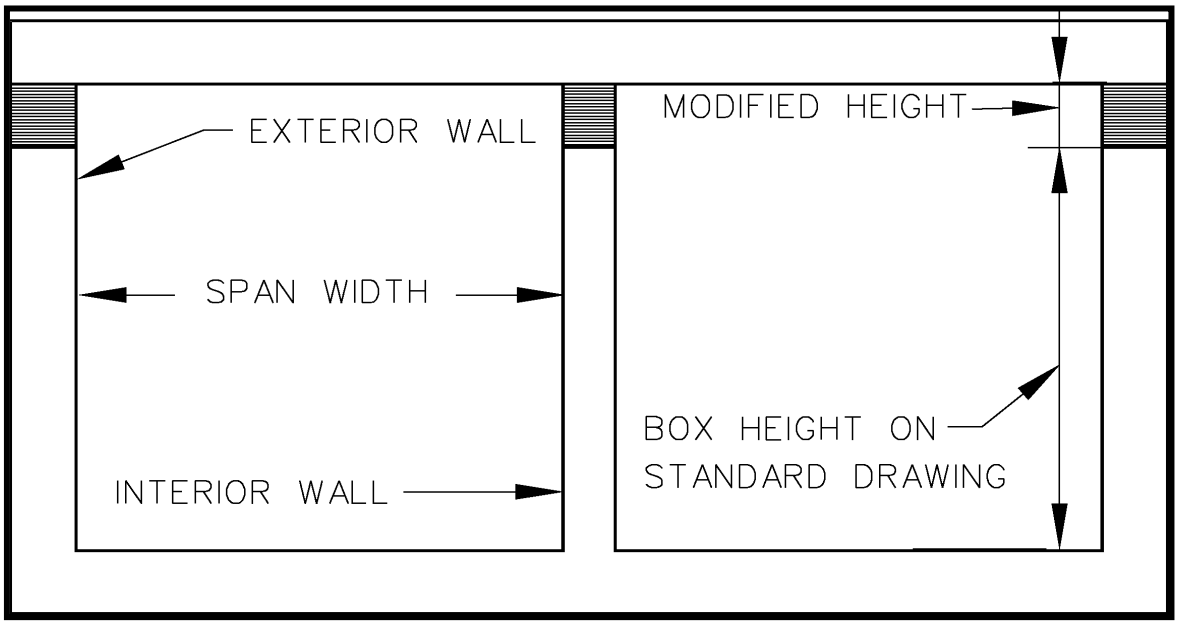


Figure 2-31
Typical Concrete Box or Slab Type Culvert or Bridge Modification

2-1200.04 STEEL BAR REINFORCEMENT (ROADWAY)

On all projects which include reinforced concrete box or slab type culverts or bridges, Standard Drawing STD-9-1, Standard Reinforcing Bar Support Details for Concrete Slabs, shall be listed on the appropriate culvert sheets and in the Structures Standard Drawing index.

If the top slab used on concrete box or slab type culverts or bridges is to be used as a riding surface or has less than 1 foot of fill over it, then epoxy-coated reinforcing steel is to be used in the top mat of the top slab and curbs, including tie bars for curbs and corner bars of the exterior walls. All other steel is to be in the form of black bars. The unit cost bid for Item Number 604-02.02, Steel Bar Reinforcement (Box Bridges), is to include any additional cost for epoxy-coated steel as noted on plans details or Standard Drawings.

If the project has a reinforced concrete deck bridge, STD-9-1 will appear in the bridge index and it will not be necessary to list it again in the roadway index.

2-1201.00 HAUL ROADS

Haul roads are required to provide temporary access to facilitate the movement of equipment and materials on a project site during construction. Haul roads should encroach no further than the top of a stream bank. If access is needed to extend into or across a stream, this is considered a temporary stream crossing and Designers should refer to Standard Drawing EC-STR-25. For clarification purposes, this section is only referring to haul roads and not temporary stream crossings.

2-1201.01 HAUL ROAD DESIGN CONSIDERATIONS

If a stream has Q50 discharge greater than or equal to 500 cfs, the Designer should request that the Hydraulics Section of the Structures Division prepare a hydraulic design of the haul road. Otherwise, Designers are responsible for designing the haul roads. Haul roads shall be shown on the Typical Section, Property Map, Present Layout, ROW Detail, Proposed Layout, Profile, Drainage Map, EPSC, Traffic Control, and Bridge Layout sheets. A separate sheet is not required for the haul road profile but if included with a side road, the sheet name shall be modified to include the haul road.

If the haul roads are strictly to be used for the transport of materials to the construction site, the haul road widths shall be a minimum of 22’-0”. If the haul roads are also to be used for the staging of work, the haul road widths shall be increased to 38’-0”, which should be adequate for most cranes with lift capacities up to 200 tons. The profile of haul roads above ground shall be at least 12”. If the haul roads are to be constructed in a floodplain, the haul road profile shall be at least 12” above the 5-year storm event water surface elevation. The Designer shall seek additional guidance during field reviews from the Headquarters Construction Office and Regional

Operations staff to determine the location and appropriate size of the haul roads. It is recommended to limit extending haul roads more than 25' along a stream top of bank.

2-1201.02 HAUL ROAD COMPENSATION

The cost of supplying and placing all materials for the initial construction of the haul road and cost for removal of the haul road shall be paid under Item Number 203-50 Construction of Haul Road and the unit of measure shall be Lump Sum. The cost for constructing the haul road includes the following items:

- Geotextile (Type IV)(Stabilization)
- [1]Borrow Excavation (Graded Solid Rock)
- [1]Machined Rip-Rap (Class A-1)
- [1]Machined Rip Rap (Class B)
- [1]Machined Rip Rap (Class C)
- [2]Mineral Aggregate (Size 57)
- Temporary Drainage Pipe – May not be necessary on all haul roads

[1] If the haul road is constructed in a dry or unsaturated area, Borrow Excavation (graded solid rock) shall be used. If the haul road is constructed in water or in an area within the flood plain, Machined Rip-Rap (Class A-1, Class B, or, Class C) shall be used in place of Borrow Excavation.

[2] An additional ten (10) percent for Mineral Aggregate is included in Item 203-50. The additional ten (10) percent is for the maintenance of the haul road due to inclement weather events outside the contractor's control.

Item Number 203-50 shall be footnoted as shown below in the Roadway Estimated Quantities sheet:

FOOTNOTE:
ITEM NUMBER 203-50 SHALL INCLUDE GEOTEXTILE (TYPE IV), BORROW EXCAVATION (GRADED SOLID ROCK) OR MACHINED RIP-RAP (CLASS A-1, CLASS B, OR CLASS C), MINERAL AGGREGATE (SIZE 57), AND TEMPORARY DRAINAGE PIPE (IF APPLICABLE). THE MINERAL AGGREGRATE INCLUDES AN ADDITIONAL TEN (10) PERCENT FOR MAINTENANCE.

Any item numbers needed for stabilization of the area due to the removal of the haul road shall be paid for separately.

2-1201.03 HAUL ROAD TYPICAL SECTION

The following haul road typical section (see *Figure 2-32, Haul Road Typical Section*) shall be shown and labeled with the appropriate width and depth based on the anticipated function and loads. The typical section shall be revised accordingly for haul roads constructed in a floodplain. The note shall also be shown.

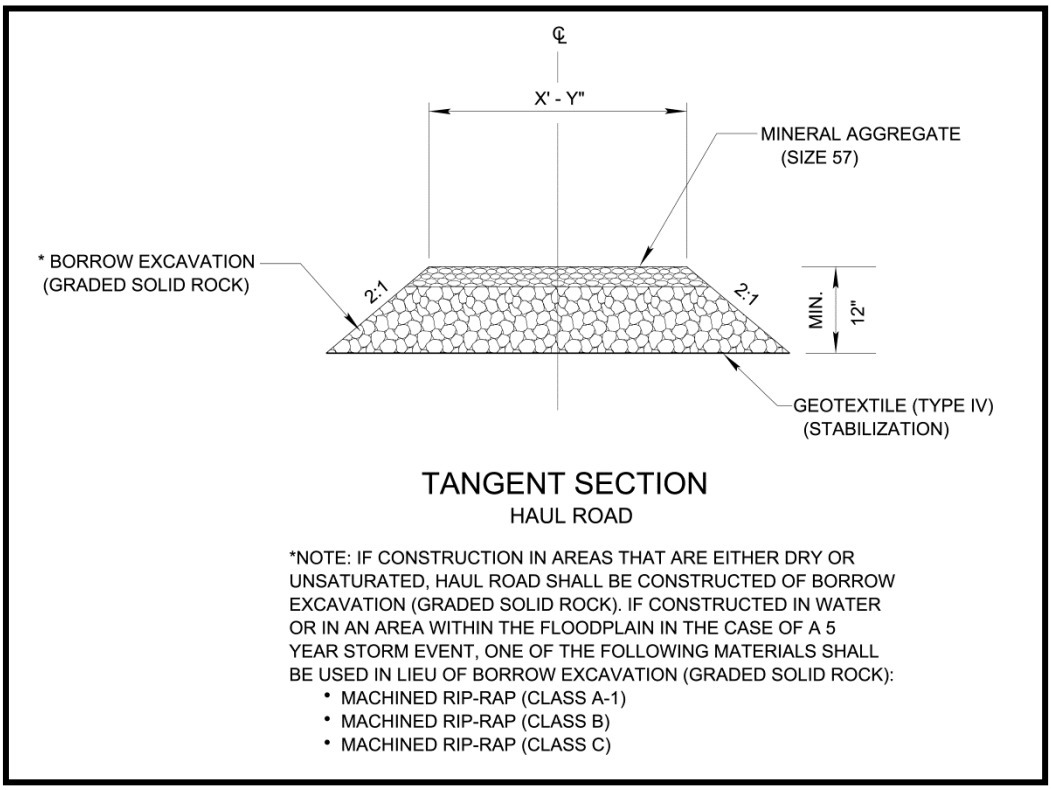


Figure 2-32
Haul Road Typical Section

Any changes to the haul road typical section in the field shall be approved by the Regional Operations Engineer. The Regional Operations Engineer shall request a revision from the Designer. The Designer shall check with the Regional Environmental Tech Group to determine if the permit needs to be modified due to the typical section revision.

SECTION 13 - ROUNDABOUT DESIGN

Refer to the Roundabout Design Reference Guide.

SECTION 14 – ROAD RECONFIGURATION AND ROAD DIET

2-1400.00 ROAD RECONFIGURATION

Road Configuration is repurposing the existing available pavement width to improve safety and to accommodate non-motorized users to achieve systemic imporovements by modifying roadway geometric design elements (lane width, number of lanes, shoulder width and speed). Road Reconfiguration provides the opportunity to address existing safety issues or multimodal accommodation in an expedited and cost-effective manner by using pavement markings only. Additional information regarding Multimodal Design can be found in the Roadway Design Guidelines Chapter 3 – Multimodal Design Guidelines.

A Road Reconguration shall maintain the current Level of Service (LOS) without negatively impacting operational safety of the motorist and non-motorized users (both existing and new). All road reconfigurations must meet TDOT's roadway typical section design standards (Roadway Standard Drawing RD11-TS-Series) or require completion of Design Exception Request or a Design Waiver Request justifying the reason for the deviation. All Design Exception request will be addressed by the Engineering Division as outlined under Chapter 2-105.00 Design Exception Request and Design Waiver requests will be addressed by the Engineering Division as outlined under Chapter 2-201.00 Design Waiver Request. A Road Reconfiguration request shall be coordinated with local agencies and a local agency coordination letter should be included in the Road Reconfiguration request.

2-1401.00 ROAD DIET

A Road Diet is the reduction of vehicular lanes of an existing four or six lane roadway to a three or five lane roadway to improve safety, and/or accommodate non-motorized users to achieve systemic improvements. Roadway projects identified as a candidate for a Road Diet must be evaluated using the Road Diet and Road Reconfiguration Request form.

A Road Diet shall maintain a reasonable Level of Service (LOS) without negatively impacting operational safety of the motorist or non-motorized users. Consider whether future LOS will be affected by urbanization which may subsequently change the context, capacity, and performance of an existing rural roadway section. Existing roadway sections functioning at LOS D capacity or worse are not good candidates for a road diet. Any LOS reduction should clearly justify the safety benefits and be included in the Road Diet and Road Reconfiguration Request form.

2-1402.00 PLANS DISTRIBUTION AND REVIEW PROCESS

All Road Reconfiguration and Road Diet requests shall be submitted by the Team Lead or requesting agency to the Regional Traffic Office. All relevant forms, analyses, and documentation should be included.

The Engineering Division will share the information amongst the committee represented by TDOT Traffic Operations, Engineering Production Support, Multimodal, Long Range Planning, Maintenance, Regional Project Delivery, and Regional Traffic Engineering Offices. This committee will identify whether the geometric design criteria, operational safety impacts, and context elements could be mitigated safely within the existing right-of-way. Requests should be submitted early in the project development process to provide enough time to complete this review. The Team Lead will receive a response and comments from the committee addressing whether the proposed Road Diet could be implemented within the scope of the project or if a separate project with additional planning would be required. The Team Lead or requestor shall keep all reference materials and correspondence in the project folder.

SECTION 15 – DRIVEWAYS

2-1500.00 DRIVEWAYS

A driveway is defined as an improved area leading from a public road to private property. There are three types of driveways: private drives, business entrances, and field entrances. Driveways should be provided for the following:

A. Where Existing Road is being improved

1. Tie into existing driveway

2. Relocate drive if connection to existing drive is too steep (see Limits of Vertical Grade)

2. Tracts where there is no prior access

A. New Roadway Construction

1. Provide access to each tract if requested

All driveways on private and public side roads shall be shown on Present, Proposed, Profile, Signing and Marking, and Traffic Control sheets. The following section provides design requirements and considerations when creating a driveway. Designers will be required to add in ROW details for the driveway parcel in COGO. Designers will need to look at the grade sections to develop the correct construction easements. Designers should follow the standard guidance for construction easements of applying 10 ft for urban and 15 ft for rural. *See Figure 2-35, Rural Type Projects Typical Driveway Notation* and *Figure 2-36, Urban Type Projects Typical Driveway Notation* for examples of how to display driveways on plans. For additional information see also, TDOT Highway System Access Manual (HSAM) and the Driveway Design Guide.

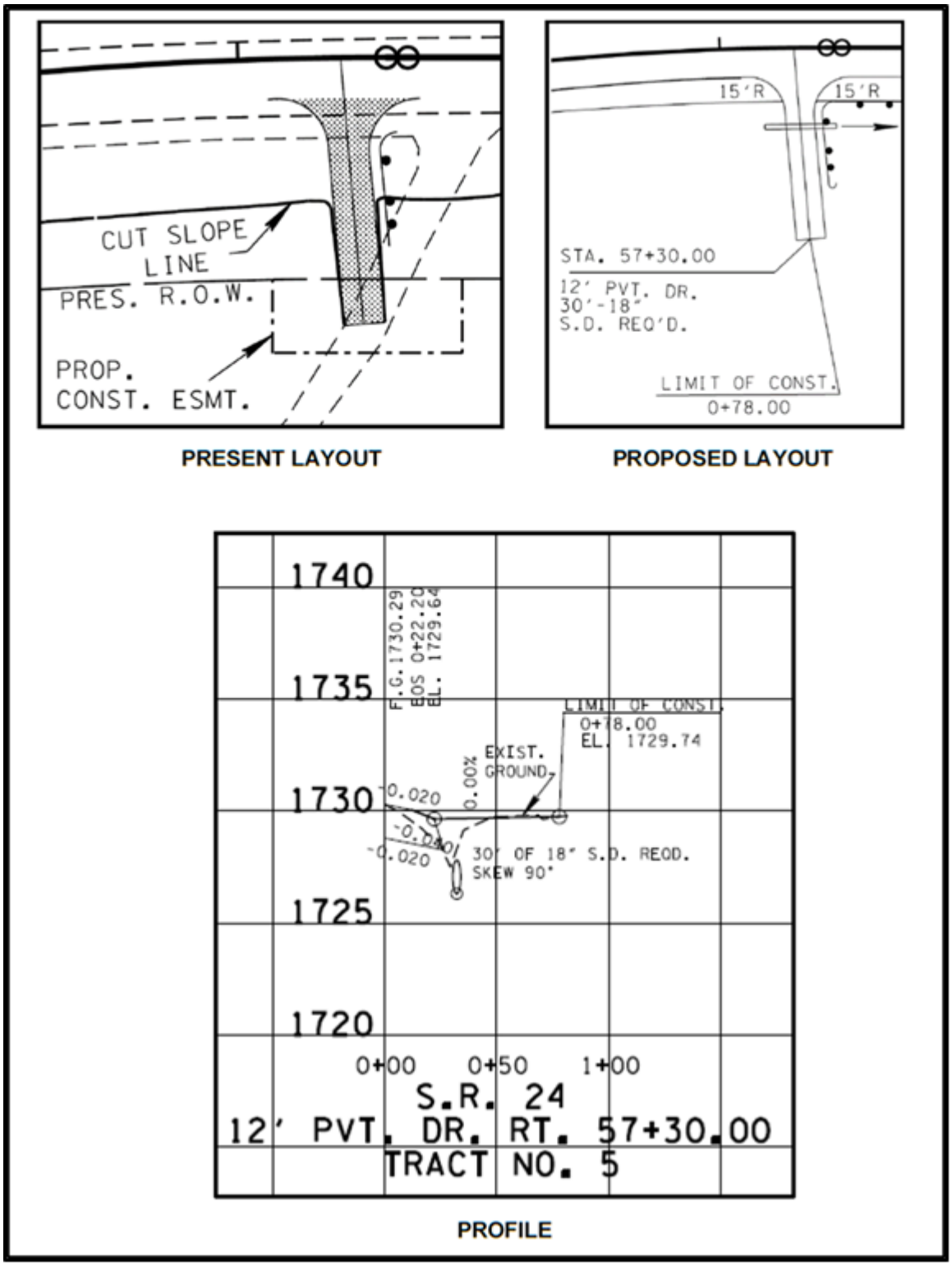


Figure 2-35
Rural Type Projects Typical Driveway Notation

Note: This figure is for layout procedure purposes only. Please refer to TDOT Highway System Access Manual (HSAM) and Roadway Standard Drawings RP-D-15, RP-D-16 and RP-R-1 for design information.

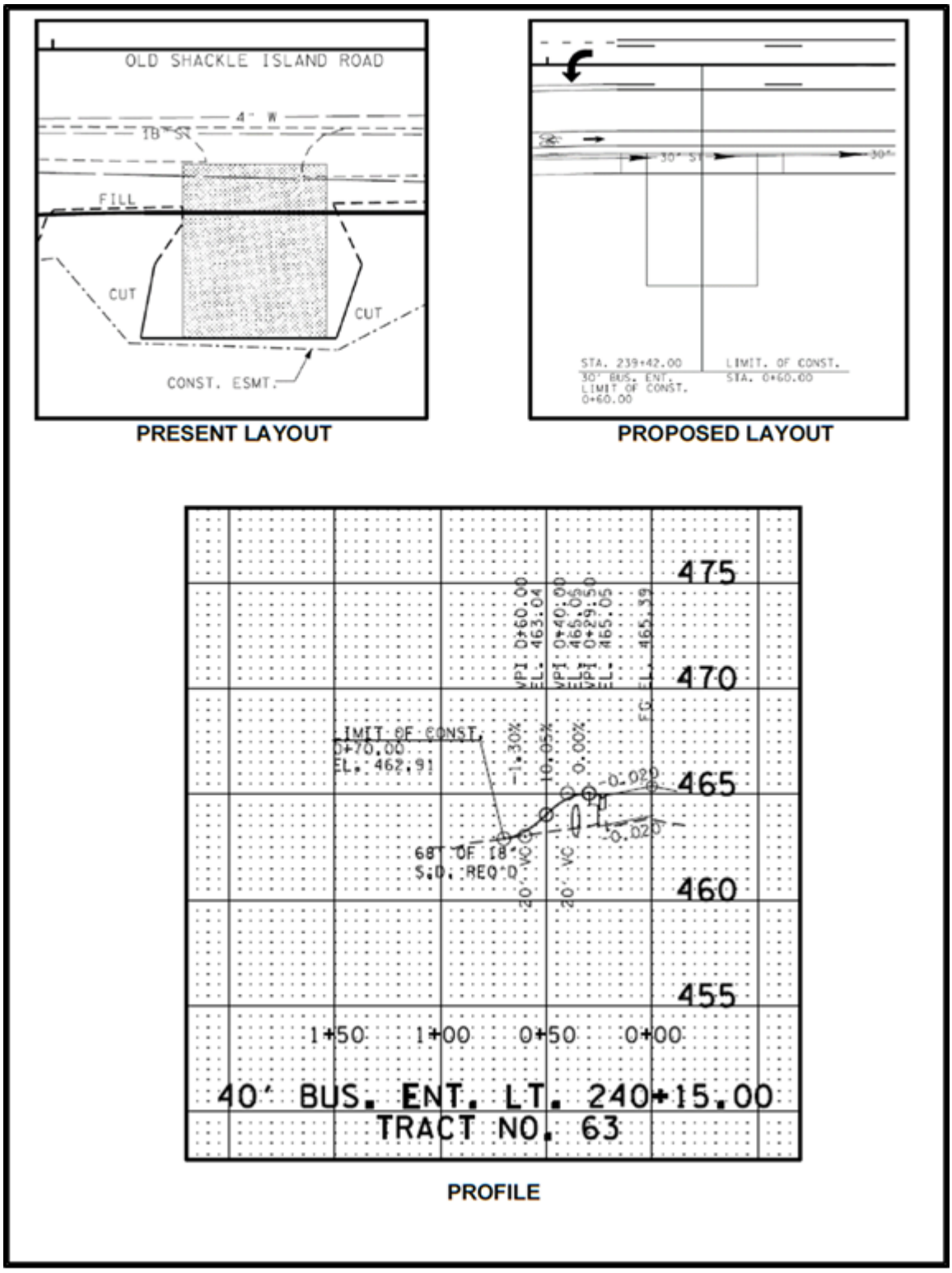


Figure 2-36
Urban Type Projects Typical Driveway Notation

Note: This figure is for layout procedure purposes only. Please refer to TDOT Highway System Access Manual (HSAM) and Roadway Standard Drawings RP-D-15, RP-D-16 and RP-R-1 for design information. .

2-1501.00 DRIVEWAY TYPICAL SECTION AND DESIGN CRITERIA

A new asphalt driveway section should consist of a surface, binder, and a base layer. See *Figure 2-37, Driveway Typical Section*. Where the surface of an existing drive is concrete, substitute 6 inches of concrete for surface and binder and 4 inches for base. Designers shall add a footnote for the Item Number 303-01, Mineral Aggregate, Type A Base, Grading D that notes the quantity used for driveways. When a Designer is connecting into an existing drive, the surface material should match.

If an existing drive is greater than 12 feet in width, the width of the proposed drive shall be equal to the existing width but not greater than the maximum allowable width, typically 40' for commercial. See Roadway Standard Drawing - RP Series for more information.

If an existing drive is gravel, surfacing will be for one shoulder width. The remainder of the drive will be replaced with gravel to the touchdown point.

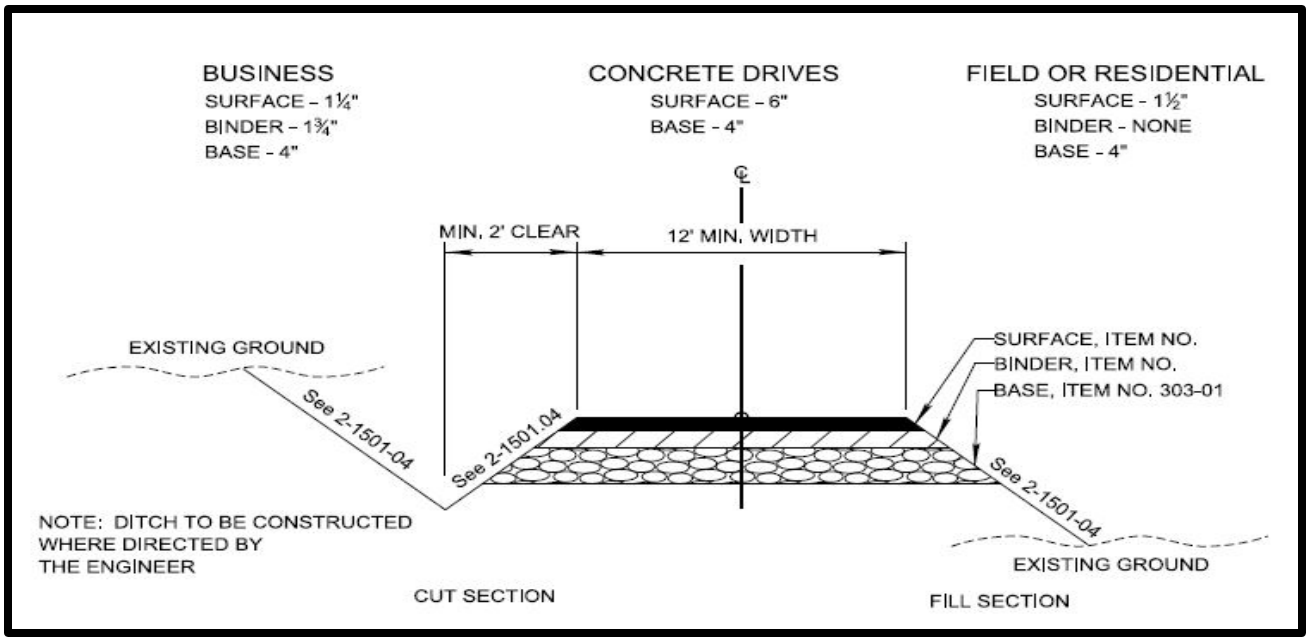


Figure 2-37
Driveway Typical Section

2-1501.01 DRIVEWAY VERTICAL CURVES

Vertical grade limits vary between rural and urban designs, both for private drives and field entrances and for business entrances. See *Table 2-13, Vertical Grade Limits for Rural and Urban Roadways* for maximum vertical grade limits. Vertical curve K values are 1 for a crest curve and 2 for a sag curve. See Volume 3 - Page 3-51 of the TDOT Highway System Access Manual (HSAM) and Roadway Standard Drawing RP-R-1 for additional vertical curve information.

Rural Roadways Vertical Grade Limits	
Private Drives & Field Entrances	15% maximum
Business Entrances	8% Maximum
Urban Roadway Design Vertical Grade Limits	
Private Drives and Field Entrances	10% Maximum
Business Entrances	8% Maximum

Table 2-13
Vertical Grade Limits for Rural and Urban Roadways

2-1501.02 DRIVEWAY HORIZONTAL CURVES

For private drives, business entrance, and field entrance design on rural roadways, horizontal curve radius limits are 10 ft minimum and 20 ft maximum. For private drives, business entrance and field entrance design on urban roadways, horizontal curve radius limits are 5 ft minimum and 15 ft maximum. See Volume 3 – Pages 4-41 through 3-49 of the TDOT Highway System Access Manual (HSAM) and Roadway Standard Drawing RP-R-1 for additional horizontal curve information.

2-1501.03 DRIVEWAY CROSS SLOPE

Positive drainage should be maintained throughout the length of the driveway. One driveway edge may be higher than the other or the center line may be higher than the edges, creating driveway cross slope. Where the driveway and sidewalk intersect, the driveway cross slope is the same as the sidewalk grade.

2-1501.04 DRIVEWAY EDGE

A driveway edge should be clearly defined and visible to all users. The designer should avoid sudden drop-offs along the edge of drive. Fixed objects such as utility poles, fire hydrants, and drainage inlets should be set back from the edge of the driveway and from the edge of the roadway. If there is a side drain and the side drain is within the clear zone, maintain mainline side slopes through the safety endwall. If a parallel side drain is not required, 2:1 slopes may be used beyond the driveway radius. Designers should review the roadway and driveway slopes to ensure that a non-traversable slope within the clear zone is not created when the drop off is five foot or more.

2-1501.05 DRIVEWAY APRONS

Right-of-Way plans for new construction or reconstruction projects shall accommodate the appropriate driveway aprons. The driveway standard drawings have been modified to provide Public Right-of-Way Accessibility Guidelines (PROWAG) compliant cross-slope for sidewalks through driveway aprons. For curb and gutter sections, this typical section is to begin at the back

edge of the proposed or future sidewalk. The aprons have also been modified to provide for a better turning radius into the drive. See Roadway Standard Drawings RP-D-15 and RP-D-16.

2-1501.06 DRIVEWAY SIDE DRAINS

A side drain is a pipe located under a driveway, at the toe of slope in a fill section or in the ditch line in a cut section. The drainage pipe (side drain) shall be a minimum of eighteen inches (18") in diameter. The side drain cover should be 12 inches from the top of pipe to the bottom of the driveway base. Endwalls are required if the drainage pipe falls within the clear zone. The pipe slope should be 0.5% to 2% slope for proper flow. See Roadway Standard Drawings D- SEW-1A, D-SEW-12D, and RP-R-1 for additional information. See the Driveway Design Guide for side drain calculation information.

2-1502.00 MULTIMODAL ROADWAY DESIGN IN DRIVEWAYS

Multimodal components must be considered when designing driveways. Driveway guidance has traditionally focused on accommodating motor vehicles, but now emphasis is also being placed on managing access and accommodating pedestrians and cyclists. The design of a driveway affects the safety and mobility of motorists, cyclists, and pedestrians. See *Chapter 3 Multimodal Design* for additional information for multimodal components.

2-1503.00 GUIDELINES FOR CONSTRUCTION AND RESURFACING OF DRIVEWAYS ON HIGHWAY PROJECTS

2-1503.01 GENERAL

For new construction projects, new driveway entrances shall be located and designed in accordance to the TDOT TDOT Highway System Access Manual (HSAM) and to the current Roadway Standard Drawings RP-D-series and RP-R-series. For retrofit, resurfacing, and reconstruction projects the designer should leave existing driveway entrances in place if the existing locations do not affect operational safety. It is important to identify potential conflicts during field reviews and have Traffic Operations Division evaluate the potential conflicts. This must be done early in the design process because if an existing driveway entrance needs to be relocated it can affect Right-of-Way acquisition.

DEFINITION OF TERMS

- Paved Shoulder Width - The width of the shoulder paved as part of the project.
- Paver Width - The width of asphalt paving machine used on mainline paving with maximum width of 12 feet or to extend beyond Right-of-Way limit.
- Normal Right-of-Way – The areas of land including the normal slopes of the highway and the public road intersection.

2-1503.02 RESURFACING

A. Where directed by the TDOT Engineer, the Contractor shall be required to shape public side roads, business entrances, and private drives, as well as clean existing drains before placing materials. All costs are to be included in the price bid for other items of construction.

B. Resurfacing projects on roadways with shoulders and ditches (no curb or gutter):

1. Private driveways, field entrances, and business entrances will be resurfaced a paver width as a minimum. A pavement taper to transition the new pavement shall be required, it shall be based on an additional 1 foot of width per inch depth of pavement. If the shoulder is narrow enough that the sum of the shoulder and the transition are less than a paver width (lane width), the transition shall occur within the paver width. If the sum of the shoulder and the transition is greater than a paver width, the transition shall occur outside of the paver width.

C. Resurfacing projects on roadway with urban curb and gutters

1. Residential driveways and business entrances shall have a minimum width of material not less than one foot used in the transition to feather the pavement edge.

D. In all cases, the length of the pavement transition, the thickness and width of the resurfacing and any additional pavement materials shall be as directed by the TDOT Engineer.

E. During resurfacing projects, it is the Department's intent to evaluate the repair or installation of curb ramps which meet the PROWAG whenever possible as encountered through resurfacing. See TDOT Policy Number 530-01 for additional information. According to TCA §54-5-202, when resurfacing or performing any maintenance work on a roadway, the Department is responsible for work from "curb to curb". Due to the limited resources of some localities, the Department will attempt to install or repair curb ramps whenever possible. The local government is responsible for maintaining sidewalks, curb ramps, etc.

2-1503.03 NEW OR RECONSTRUCTION

A. Facilities with Full Access Control
Full access control will be maintained for the entire designated project limits.

B. Facilities with Limited Access Control
Access will be allowed at public roads and streets only. No driveways will be permitted access to the mainline project.

C. Facilities with Partial Access Control or Non-Access Control - driveways permitted:

1. Fence Opening: For Partial Access Control facilities, one 50-foot opening in the control access fence will be provided per tract remainder, unless access

is provided from an intersecting road or based on physical conditions and/or conflicts with other design considerations, which prevent an access opening.

2. Existing Driveways:

   a. For Partial Access Control facilities, one existing paved driveway per tract remainder will be replaced in-kind to a touchdown point. For Non-Access Control facilities, exiting paved driveways will be replaced in-kind to a touchdown point.

   b. Where the existing driveway is unpaved and the proposed driveway equals or exceeds 7 percent in grade, each proposed driveway will be paved to a touchdown point or until the grade is less than 7 percent.

   c. Where the existing driveway is unpaved and the proposed driveway is less than 7 percent in grade, each proposed driveway will be paved a shoulder width from the edge of pavement and the remainder of that driveway replaced in-kind to a touchdown point.

3. Requirements for field entrances and/or other driveways:

   a. New driveways provided in the plans will be paved based on the 7 percent criteria. Those 7 percent or steeper in grade will be paved and those flatter than 7 percent will be covered with base stone.

   b. Field entrances provided in the plans will be covered with base stone.

   c. Normally, one field entrance or driveway, whichever is appropriate per tract remainder will be provided except in the following circumstances:

      1. In the project's preconstruction condition, there is a barrier to access such as a substantial cut, fill, ditch or curb.

      2. A non-gated fence where the existing frontage is totally fenced.

      3. In the project's post-construction condition, there is a substantial cut, fill, or ditch.

   d. Small remainders and damage considerations are to be reviewed by Design Managers and the Right-of- Way Office to determine if a proposed driveway or field entrance is justified. The location, design and method of surfacing of the field entrance or driveway must be in accordance with the previously mentioned Rules. If the landowner does not desire a driveway, then it will not be included in the project.

4. All public roads will be paved to a touchdown point.

PDN - CHAPTER 3

MULTIMODAL DESIGN

CHAPTER 3 MULTIMODAL DESIGN

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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** – Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the *Roadway Design -TDOT Documents* webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



Stages of Project Delivery Network

0. Planning
1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 – MULTIMODAL DESIGN OVERVIEW

3-100.00 GENERAL

It is TDOT's policy to create and implement access and mobility for users of all ages and abilities through the planning, design, construction, maintenance, and operation of new construction, reconstruction, and retrofit transportation facilities that are federally or state funded. Users include, but are not limited to, motorists, bicyclists, pedestrians, transit-riders, and freight carriers. Pedestrian facilities typically include sidewalks, shared-use paths, and walkways as well as all other features of the pedestrian route such as crosswalks, curb ramps, pedestrian signals and pushbuttons. Pedestrian facilities can either be immediately adjacent to streets and highways or separated from them by a buffer.

The intent of TDOT's policy is to promote the inclusion of multimodal accommodations in all transportation planning and project development activities at the local, regional, and statewide levels, and to develop a comprehensive, integrated, and connected multimodal transportation network. These guidelines have been developed to assist TDOT, local agencies, consultants, and others in providing multimodal facility design that fulfills the intent of this policy. TDOT's *Multimodal Project Scoping Manual* is an additional multimodal design resource.

3-101.00 APPLICABILITY

It is TDOT's policy to provide appropriate multimodal facilities along and across sections of State Routes as all travel modes are considered an integral part of the state's transportation system. Federal Highway Administration (FHWA) and TDOT policy is that bicycle, pedestrian, and transit facilities be given full consideration in the planning and design of any transportation facility except where those modes may be prohibited or unlikely to be provided in the future. All pedestrian facilities shall meet all ADA and TDOT standards.

The design guidelines contained in this chapter apply to the planning and design of all project types, including the following designations:

- projects on new alignment
- reconstruction projects
- resurfacing projects

Both TDOT and Local Government projects fully or partially funded with state or federal funds or projects within TDOT's transportation network or right-of-way are required to adhere to these *Design Guidelines*. Local agencies managing projects that include state or federal funding must also comply with this chapter pursuant to TDOT's *Local Government Guidelines for the Management of Federal and State Funded Transportation Projects*.

3-102.00 RESPONSIBLE AGENCY

Proposed projects in public rights-of-way must address ADA compliance as described in this chapter and elsewhere in TDOT standards. On Local Program projects, the public agency that is sponsoring the project is responsible for ensuring that Americans with Disabilities Act (ADA) and TDOT standards are compliant and fully addressed.

SECTION 2 – MULTIMODAL ROADWAY DESIGN PROCESS

3-200.00 GENERAL

Designing a multimodal roadway is not a one-size-fits-all approach. It requires an analysis of various site conditions to determine appropriate treatments and solutions. Factors that should be considered include the physical and operating characteristics of the street, general land use type (urban, suburban, rural), adjacent and surrounding land use context (retail, office, residential, industrial, etc.), community goals, crash history, and expected pedestrian volume, bicycle volume, transit use, and current and future motor vehicle demand.

3-201.00 LAND USE CONTEXT CONSIDERATIONS

The appropriate design and operation of a street must consider the existing and future surrounding land use. The design professional should evaluate conditions beyond simply urban and rural conditions and, where available, use local agency land use, transportation, and community plans to understand potential future needs and project demand for all modes. Concerning land use context, the design professional should take these steps early in the Transportation Management Plan if this information is not available from previous project planning efforts:

- Consider both the existing conditions and the plans for the future by reviewing the area's planning documents and zoning
- Identify current levels or project future travel demand for all modes within the project limits. Recognize that streets often last longer than adjacent development
- Acknowledge when a project travels through multiple context zones that the street's design characteristics, including its typical section, may need to be varied accordingly (i.e., a corridor that transitions from suburban to urban, or residential to retail)
- Understand that a contextual corridor often extends beyond an individual project's limits, and therefore a project's study corridor may need to extend beyond its limits of design
- Identify current levels of pedestrian, bicycle, and transit activity or estimate future levels based on the type, mix, and proximity of planned future land uses

3-202.00 DESIGN FLEXIBILITY

Designing roadways that effectively serve all modes can be a challenging process, especially along major state facilities in urban, suburban, and small-town areas. Using design elements, criteria, and dimensions typically used for motor vehicle-focused facilities may not be appropriate or even possible in these contexts that are often in constrained right-of-way. Applying flexibility in the geometric design process requires knowledge of roadway design standards and guidelines, a recognition of the range of options available, and an understanding of how deviating from these may impact safety and mobility for each mode being served. A flexible approach uses existing tools in creative and varied ways to solve design challenges. It requires a holistic understanding of variables, thresholds, and available alternatives to achieve multiple objectives.

TDOT's *Roadway Design Guidelines* support flexible design and recognize that this flexibility is often necessary to apply in multimodal project design. TDOT's design guidance is primarily based on policy and guidance in AASHTO's *A Policy on Geometric Design of Highways and Streets* (Green Book) and the supplemental guides for pedestrian, bicycle, and transit facility design. The Green Book emphasizes the need for a holistic design approach and the use of engineering judgment and highlights how good street design involves balancing preservation of scenic, aesthetic, historic, cultural, and environmental resources while maintaining safety and mobility using flexibility in the application of sound principles by the knowledgeable design professional.

3-203.00 BALANCING MULTIMODAL SAFETY, LEVEL AND QUALITY OF SERVICE

There is no single set of design criteria or templates that can be used to create a multimodal street. The appropriate design accommodation for each mode of travel is dependent on many factors as discussed earlier in this chapter. The goal is to understand and then balance the needs of each mode with design solutions that are appropriate throughout the project's design period.

For larger, complex projects, the *Highway Capacity Manual: A Guide for Multimodal Mobility Analysis* (HCM2016) should be used in an effort to quantitatively assess and balance the level and quality of performance for each mode. This analysis could result in independent levels of service for pedestrians, bicyclists, transit users, and motor vehicle drivers, with a solution that is designed to provide equivalent levels of safety and service for each mode. Another approach is to emphasize safety by prioritizing the needs of the most vulnerable users of the street. The safety of pedestrians, as the most vulnerable street users, would receive priority in this case.

Traditional measures of effectiveness that include motor vehicle speed, delay, and crash rate will always be important when assessing the performance of a street. However, as multimodal consideration and community livability have become an emphasis of transportation policy within TDOT, it should be understood that urban streets also serve as economic engines. Investments in the character of a street in lieu of its throughput have been shown to increase retail rents, residential property values, and livability of an area. The goal of a successful multimodal design

is to balance the needs of all modes using the roadway, while being good stewards of limited financial resources.

3-204.00 ALLOCATING RIGHT-OF-WAY FOR MULTIMODAL FACILITIES

Multimodal design involves identifying minimum and desired safety and service levels for all modes over the life of the project, and then performing an analysis of modal trade-offs for various design solutions. Descriptive cases for a range of multimodal accommodation solutions are provided on the following pages to demonstrate approaches that may be applicable in a variety of contexts. The first three cases describe roadway sections bounded by curb and sidewalk. These cases are most likely to be found in more densely developed areas such as rural town centers, suburban, and urban context zones. The remaining two cases are for areas without curb and sidewalk and are most likely to be found in less developed rural areas.

The TDOT multimodal facility design process should begin with an assessment of minimum accommodation for each mode, and the relationships between those accommodation alternatives, similar to the examples provided on the following pages.

3-204.01 SEPARATE ACCOMMODATION FOR ALL USERS

Separate accommodation for all users provides the optimum accommodation for all modes of travel in many settings. See *Figure 3-1, Separate Accommodation for All Users*. Key attributes include the following:

- Often the preferred option to provide safer, convenient, and comfortable travel for all users
- Appropriate for areas with moderate to high levels of pedestrian and bicycle demand or activity
- Appropriate for streets with moderate to high motor vehicle speeds
- Appropriate in areas without substantial environmental or right-of-way constraints
- Pedestrians are provided with a sidewalk separated from the roadway by a raised curb and preferably a landscaped buffer
- A bicycle lane, off street path, cycle track, or shoulder suitable for bicycle use is provided

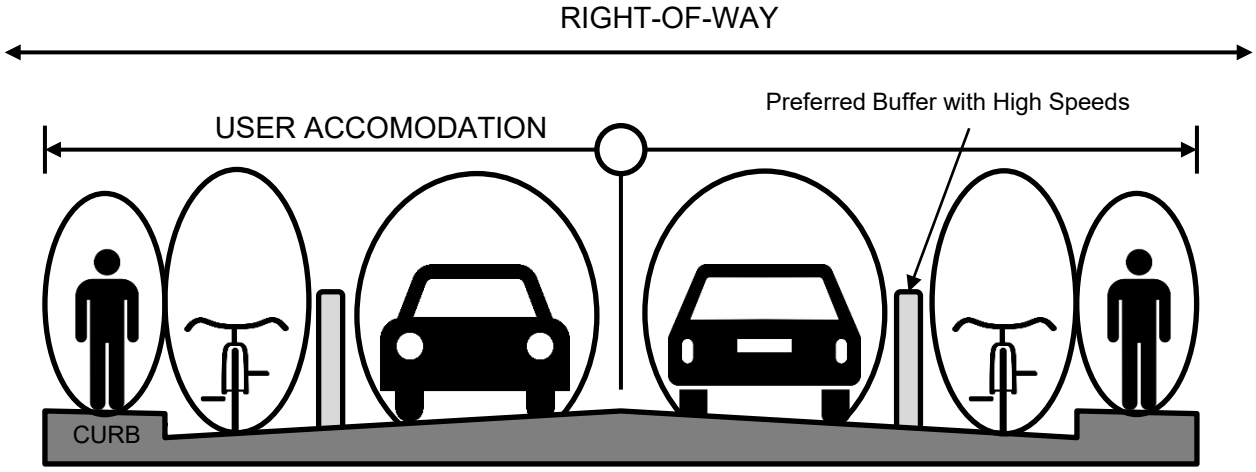


Figure 3-1: Separate Accommodation for All Users

3-204.02 PARTIAL SHARING FOR BICYCLES AND MOTOR VEHICLES

There are instances in which the width necessary to provide optimal accommodation for all users is not available. There are also instances where some sharing and overlap between bicyclists and motor vehicle traffic is acceptable to achieve other environmental or design objectives. Partial sharing for bicycles and motor vehicles is an approach to multimodal accommodation in these situations. See *Figure 3-2, Partial Sharing for Bicycles and Motor Vehicles*. Key attributes include the following:

- Used in areas where the width necessary to provide separate accommodation for all users is not available
- Pedestrians are provided with a sidewalk while space for bicyclists and drivers overlaps somewhat
- Appropriate in areas with low motor vehicle speeds and low to moderate motor vehicle volumes
- Pedestrians are provided with a sidewalk separated from the roadway by a raised curb and preferably a landscaped buffer
- Typical travel lanes combined with narrow shoulders provide maneuvering width for truck and bus traffic within the travel lane; however, bicyclists may be forced to ride along and over the pavement markings
- Narrow travel lanes combined with wide shoulders provide greater separation between motor vehicle and bicycle traffic, but may result in motor vehicle traffic operating closer to the center line or encroaching into the opposing travel lane

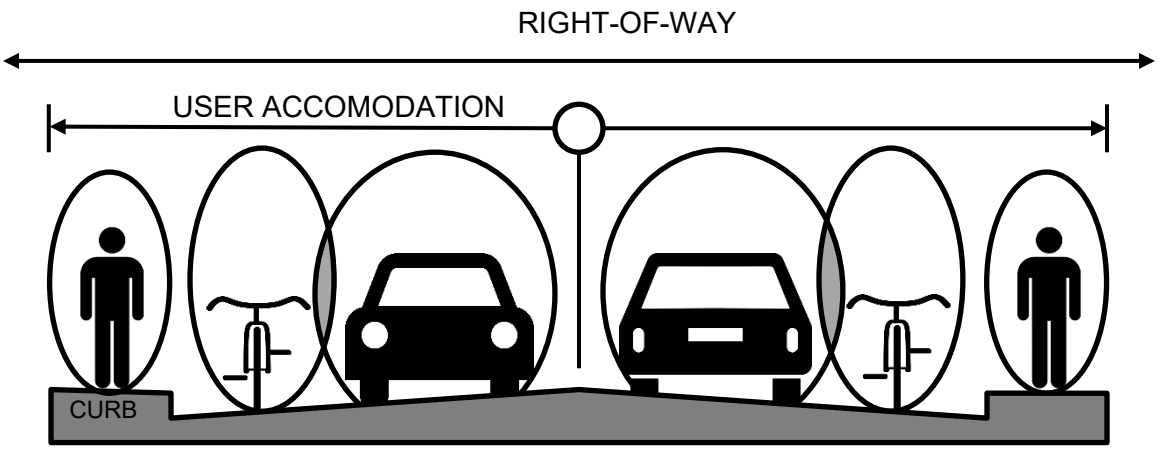


Figure 3-2: Partial Sharing for Bicycles and Motor Vehicles

3-204.03 SHARED BICYCLE/MOTOR VEHICLE ACCOMMODATION

With this option, the accommodation of bicycles and motor vehicles is shared and separate pedestrian accommodation is maintained. See *Figure 3-3 Shared Bicycle/Motor Vehicle Accommodation.* Shared bicycle/motor vehicle accommodation is most likely to be found in the most densely developed urban areas where right-of-way is most constrained. Key attributes include the following:

- Pedestrians remain separate but bicycle and motor vehicle space is shared
- Used in densely developed areas where right-of-way is constrained
- Primarily applicable to local streets where speeds and traffic volumes are low
- Pedestrians are provided with a sidewalk separated from the roadway by a raised curb and preferably a landscaped buffer
- Signs and pavement markings indicating that the roadway is shared between cyclists and motor vehicles should be provided.

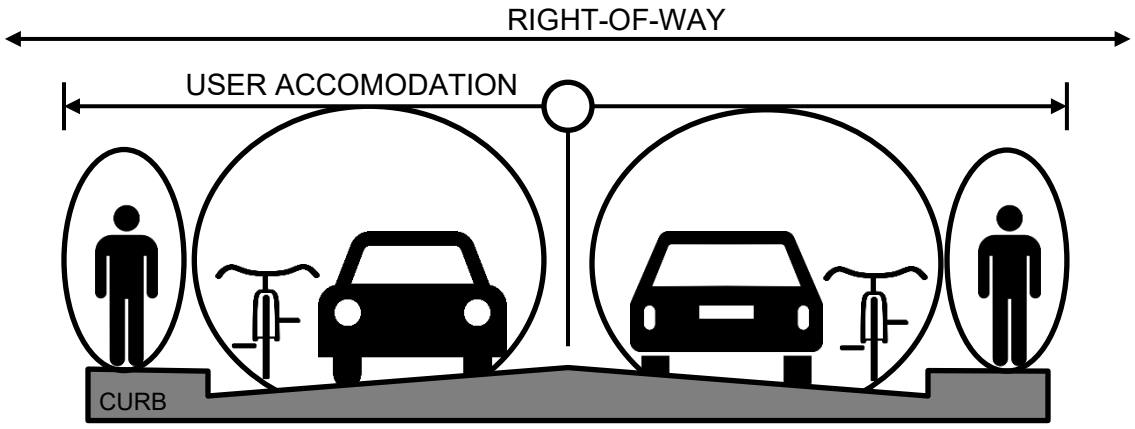


Figure 3-3 : Shared Bicycle/Motor Vehicle Accommodation

3-204.04 SHARED BICYCLE/ ACCOMMODATION

In sparsely developed rural and low-density suburban areas, curbed roadway sections bounded by sidewalk are less common. In these areas, cyclists and other personal transportation device users may use the roadway shoulder (see *Figure 3-4, Shared Bicycle Accommodation*). Shoulder with a typical four (4) percent cross slope is not considered an acceptable ADA compliant pedestrian route. Key attributes include the following:

- A preferred shared bicycle accommodation is to provide an off-street shared-use path
- Bicyclists share the shoulder
- Common in rural or sparsely developed areas
- Appropriate for areas with infrequent bicycle use
- Typical travel lanes combined with wide shoulders provide for increased separation between bicyclists, and motor vehicles. Wider shoulders also provide clearance for emergency stopping and maneuvering
- Typical travel lanes combined with narrow shoulders provide maneuvering width for truck and bus traffic within the travel lane, reducing encroachment into opposing lanes and the shoulder.
- Narrow travel lanes combined with wide shoulders provide greater separation for bicyclists, but may result in motor vehicle traffic operating closer to the center line or encroaching on the shoulder

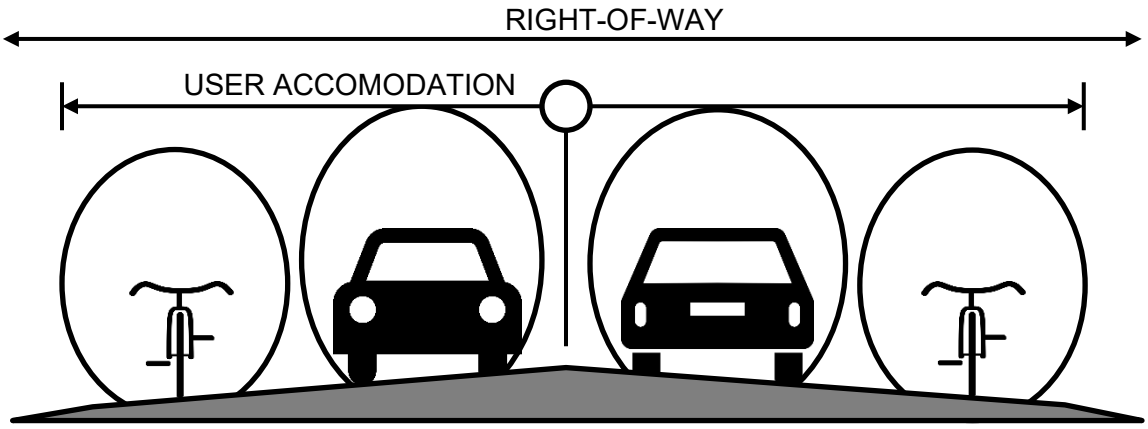


Figure 3-4: Shared Bicycle Accommodation

3-204.05 SHARED ACCOMODATION ALL USERS

Vehicles, bicycles, and pedestrians are sometimes accommodated in one shared travel lane. See Figure 3-5, *Shared Accommodation for All Users*. This condition occurs when there is low user demand and speeds are very low (i.e., local streets), or when severe constraints limit the feasibility of providing shoulders. Key attributes include the following:

- All users share the roadway
- Appropriate where user demands and motor vehicle speeds are very low or when severe constraints limit the feasibility of providing separate accommodation

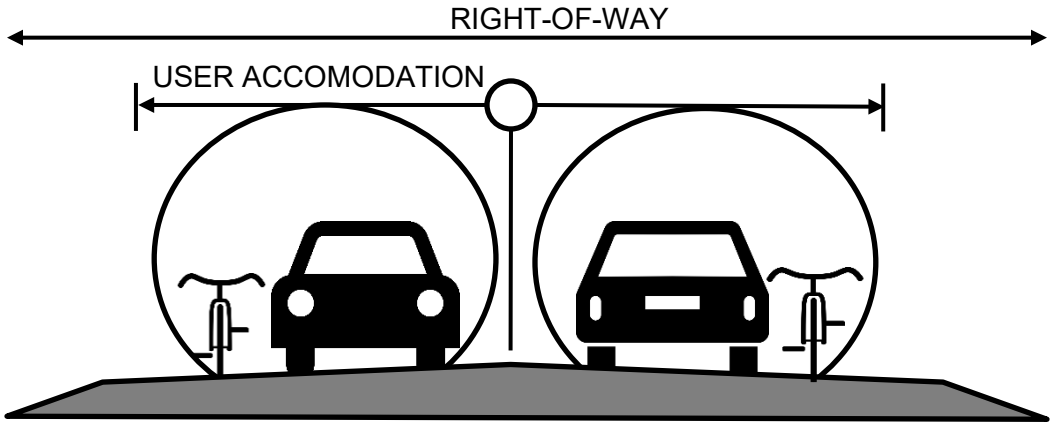


Figure 3-5: Shared Accommodation for All Users

3-205.00 FACILITIES NOT GENERALLY WARRANTING MULTIMODAL ACCOMMODATIONS

Some transportation facility designs may not warrant the provision of dedicated multimodal accommodations for pedestrians, bicyclists, and/or transit riders. Typical exclusions for separate multimodal accommodations include:

- Low-speed, low-volume residential context streets where pedestrians and bicyclists can comfortably share the roadway with motor vehicles
- Rural streets where shoulders provide space for the occasional pedestrian or bicyclist
- On side road tie-ins where there is no existing sidewalk or bicycle accommodation and widening of construction limits for sidewalk or bicycle accommodation would result in disproportionate impacts to adjacent property
- High-speed controlled access highways would not typically warrant sidewalks or bicycle use
- Sidewalks may not be required in rural areas where curb and gutter are placed at the back of the useable shoulder solely for the purpose of reducing construction limits and/or meeting drainage/ storm sewer requirements

SECTION 3 – TDOT ACCESSIBILITY GUIDANCE

3-300.00 GENERAL

As noted in TDOT's *Multimodal Access Policy*, pedestrian facilities shall be designed and built to accommodate persons with disabilities in accordance with the access standards required by the ADA to the maximum extent feasible or to the extent that it is not structurally impracticable or technically infeasible. Sidewalks, shared-use paths, street crossings, and other infrastructure shall be constructed so that all pedestrians, including those with disabilities, can travel independently.

Furthermore, on November 7, 2014, TDOT adopted the United States Access Board's *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (2011)*. These guidelines serve as the *Public Rights-of-Ways Accessibility Guidelines*, or PROWAG.

TDOT's *Roadway Design Guidelines* are intended to meet or exceed current ADA and PROWAG guidance.

3-301.00 ACCESSIBILITY REQUIREMENTS BY PROJECT TYPE

Wherever pedestrian facilities are intended to be a part of a transportation system, federal regulations (28 CFR Part 35) require that those pedestrian facilities meet or exceed ADA guidelines. All new construction or alteration of existing transportation facilities must be designed and constructed to be accessible to and usable by persons with disabilities. FHWA is one of the federal agencies designated by the Department of Justice to ensure compliance with the ADA for transportation projects.

All projects shall review and evaluate the existing pedestrian access and connectivity within the scope of the project to address and correct identified deficiencies not meeting ADA, PROWAG, and TDOT requirements.

All **new construction** projects will be constructed to meet current accessibility requirements.

All **alterations** funded and developed by or for the Department on state right-of-way shall evaluate the existing pedestrian circulation, accessibility and connectivity. Any deficiencies should be identified (i.e., Maintenance Division's Resurfacing PS&E report or Strategic Transportation Investment Division's Report) and included with the project scope. All other projects developed by or for Divisions other than Roadway Design shall follow the same scoping requirements regardless of funding type, funding percentage, or letting type.

Roadway **maintenance** activities do not warrant addressing and correcting ADA deficiencies. Resurfacing is not considered maintenance, but as an alteration.

All **Local Program projects** administered by the Program Development and Administration Division shall follow the same guidance based on project type. Projects developed and let by local agencies shall follow the same guidance since all local agencies are obligated to fulfill FHWA required ADA elements. Projects within TDOT right-of-way shall comply with all TDOT standards, regardless of funding.

3-301.01 NEW CONSTRUCTION PROJECTS

New construction projects address the construction of a new roadway, interchange, or other transportation facility where none existed before. For these projects, pedestrians' needs shall be assessed and included in the project. All pedestrian facilities included in these projects must fully meet the accessibility criteria when built to the extent that it is not structurally impracticable.

TDOT's design development process will assess and ensure that accessibility requirements are addressed during the earliest stages possible to reduce or prevent potential conflicts with various planning, right-of-way, environmental, utilities, or other highway design-related issues. Project scopes may also need to be expanded to meet pedestrian needs.

3-301.02 ALTERATIONS

A roadway alteration is a change to any portion of an existing facility (site, structure, or improvement of a pedestrian or vehicular route) located in the right-of-way that affects or could affect usability, access, circulation, or use of the facility. Alterations could affect the structure, grade, function, and use of the roadway. Any project that affects or could affect the usability of a pedestrian facility is classified as an alteration.

- All new pedestrian facilities included in an alteration that is put in place within an existing developed right-of-way must meet applicable ADA, PROWAG, and TDOT requirements to the maximum extent feasible.
- All existing pedestrian facilities disturbed by or triggered by an alteration must be replaced. The replacement facilities must meet current ADA, PROWAG, and TDOT requirements to the maximum extent feasible.
- If pedestrian facilities are present, curb ramps are required at signalized intersections and other pedestrian crossings.
- Installation of crosswalk markings and applicable signs will be required at pedestrian crossings at signalized intersections, midblock crossings, and other uncontrolled crossings deemed necessary.
- Project shall not have the effect of decreasing the accessibility of a pedestrian facility or an accessible connection to an adjacent building or site below the ADA accessibility requirements in effect at the time of the alteration. Decreasing accessibility for all pedestrians may be required under extreme safety concerns.
- Within the construction limits of an alteration, any existing connection from a pedestrian access route to a crosswalk (marked or unmarked) that is missing a

receiving curb ramp must have a curb ramp installed that meets ADA, PROWAG, and TDOT accessibility requirements to the maximum extent feasible.

- At any intersection in the public right-of-way that has at least one corner served by a public sidewalk or a pedestrian access route, all corners should be evaluated for need of pedestrian landings and crosswalk marking.
- Within the construction limits of an alteration, evaluate all existing curb ramps to determine whether curb ramp design elements meet the current accessibility criteria. Curb ramps that do not meet the accessibility criteria must be modified or replaced to meet applicable accessibility requirements. This may also trigger modification of other adjacent sidewalk facilities to incorporate transitional segments to ensure specific elements of a curb ramp will meet the accessibility criteria. Resurfacing projects are always considered alteration projects and require ADA compliance. Within the construction limits, evaluate all existing crosswalks (marked or unmarked) to determine whether crosswalk design elements meet the accessibility criteria for a legal pedestrian access route. Modify crosswalk slopes to meet the required accessibility standards to the maximum extent feasible.

RESURFACING PROJECTS

Resurfacing PS&E reports should identify all ADA deficiencies. The typical resurfacing project limits may include only 2 legs of an intersection however resurfacing work on any leg of an intersection requires upgrading the entire intersection to meet ADA, PROWAG, and TDOT requirements. Existing pedestrian signals and pushbuttons do not require upgrade during resurfacing; however, the facilities must be accessible. Any curb ramp or sidewalk upgrades must consider locations of existing pedestrian signals and pushbuttons. If there are no existing pedestrian facilities on any approach, installing curb ramps are not required. If pedestrian facilities are installed in a future project, the future project shall meet ADA, PROWAG, and TDOT requirements. If there are any pedestrian signals present during the resurfacing, the corners must all have curb ramps and provide refuge for pedestrians to the maximum extent feasible. Resurfacing the full intersection will trigger ADA requirements.

The following pavement restoration and rehabilitation projects are typically not considered alterations: spot pavement repair; liquid-asphalt sealing, slurry seal, chip seal (Bituminous Surface Treatment- BST), or crack sealing; or lane restriping that does not alter the usability of the shoulder. However, activities such as microsurfacing and Cape Seal (combine chip seal w/ slurry seal) are considered an alteration.

SIGNALIZATION PROJECTS

New Signalization projects generally involve **construction** (signal poles, signal heads, controller box, etc.) of a traffic signal system where an un-signalized intersection previously existed to improve the existing intersection traffic operations. **Signal Improvements** are projects on existing signalized intersections.

Any **new signal** or **signal improvement** projects involving alterations to pedestrian facilities or changes to the intersections function that impact pedestrian facilities (adding lanes or turn islands, etc.) must upgrade all pedestrian facilities. If any portion of the pedestrian facilities

are altered or disturbed, the entire intersection shall evaluate and upgrade to meet ADA compliance (sidewalk, curb ramps, pedestrian signals / pushbuttons, etc.).

ADA improvements are triggered when the pedestrian signal operations, and pedestrian software (the internal logic of the controller), or ITS software effecting pedestrian signal operations are altered. Replacement of pedestrian signal head, permanent signal timing adjustments will trigger ADA if the modification effects pedestrian intervals, signal Phases, cycle length, or sequence to include larger walk times, larger clearance times, or to program parameters to extend the walk indication (Rest in walk) when coordinated signalization used. Project must bring all pedestrian facilities, including curb ramps, pedestrian pushbuttons, and pedestrian signal heads into full ADA compliance per PROWAG R209.2.

Vehicular signal controller alterations and vehicular software alterations as well as vehicular signal head replacement does not trigger the requirement to bring all pedestrian facilities at the intersection into full ADA compliance (PROWAG R209.2).

Intersections that do not currently have nor are proposed to install sidewalks and curb ramps shall not install pedestrian signals as part of signal projects. If there are plans for future development to include sidewalk installation, pedestrian signals should be installed at that time. If an existing intersection has pedestrian signals but no sidewalks or curb ramps, accessible curb ramps and landing shall be installed to make the pedestrian pushbutton accessible and give pedestrians safe refuge to the maximum extent feasible.

Project cost is not an acceptable reason to fail to construct or delay completing ADA required improvements for accessibility compliance when existing pedestrian facilities are present. ADA improvements must be installed prior to or during the project, not after.

Projects that do not alter or disturb any existing pedestrian facilities (curb ramps, crosswalks, pedestrian signals, pedestrian signal timing, sidewalks, etc.) and do not involve upgrades to the *signal controller and software as per* PROWAG R209.2 are not required to improve their existing facilities.

Projects developed by other agencies should follow the above guidance.

EXCEPTIONS

It may not always be possible to fully meet the applicable accessibility requirements during alterations of existing facilities. If such a situation is encountered, consult with the TDOT ADA Coordinator to develop a workable solution to meet the accessibility requirements to the maximum extent feasible. Cost is not to be used as a justification for not meeting the accessibility criteria. Physical terrain or site conditions that would require structural impacts or environmental impacts to achieve full compliance with the accessibility criteria are some of the factors that might be used to determine that the maximum extent feasible is achieved. If it is determined to be virtually impossible to meet the accessibility criteria for an element, complete the Design Waiver Form (See Chapter 2-201.00) and submit for approval. Documentation for the decision, along with the signed waiver form, shall be included in the project folder.

If there is uncertainty as to whether a project meets the definition of an alteration project, consult with the TDOT ADA Coordinator at TDOT.ADA@tn.gov.

3-301.03 MAINTENANCE PROJECTS

Roadway maintenance activities are not considered alterations and do not require simultaneous improvements to pedestrian accessibility under the ADA. Maintenance activities include actions that are intended to preserve the roadway system, retard future deterioration, and maintain the functional condition of the roadway without increasing the structural capacity. Typical maintenance activities consist of re-tracing existing pavement markings, pothole patching, mowing, roadside ditch cleaning, guardrail repair, and trash pickup, and do not warrant addressing and correcting existing ADA deficiencies.

Signal maintenance activities are those that are due to damaged or outdated technology. Maintenance activities are limited in nature and generally do not alter or disturb the facilities or function of the intersection. As such these activities generally do not trigger ADA upgrades. In instances where portions of sidewalk or curb ramps are disturbed as part of maintenance activities, good judgment should be used to ensure that any replacement of these disturbed facilities are in accordance with all applicable ADA guidelines.

SECTION 4 – ACCESSIBLE PEDESTRIAN TRAVEL

3-400.00 GENERAL

Pedestrian travel is a vital transportation mode. It is used at some point by everyone and is a critical link to everyday life for many. Designers must be aware of the various physical needs and abilities of pedestrians to ensure facilities provide universal access.

Under Tennessee law, pedestrians have the right-of-way at all unmarked crosswalks, driveways, and marked crosswalks. However, pedestrians must act responsibly, using pedestrian signals and sidewalks where they are available. **TCA 55-8 Series**

Section 504 of the Rehabilitation Act and the Americans with Disabilities Act of 1990 (ADA) requires pedestrian facilities to be designed and constructed so they are readily accessible to and usable by persons with disabilities. This chapter provides accessibility criteria for the design of pedestrian facilities that meet applicable state and federal standards.

The pedestrian facilities included in a project shall be determined during the project planning phase based on access control of the highway, local transportation plans, comprehensive plans and other plans (such as Safe Route to School Plans developed by schools and school districts), the roadside environment, existing and projected pedestrian volumes, user age group(s), and the continuity of local walkways along or across the roadway.

If a project scope proposes to exclude curb ramps, they can be funded and installed separately. However, all work must be completed **before** the project (i.e., resurfacing) or at the same time, **not after**. See the Supplement to the 2013 DOJ/DOT Joint Technical Assistance on the Title II of the Americans with Disabilities Act Requirements to Provide Curb Ramps when Streets, Roads, or Highways are Altered through Resurfacing. For any project in which this applies, add a special note that specifies the project number under which the curb ramps will be installed.

If a project is a maintenance project, curb ramps are not required at the time of the improvement. Alteration and maintenance projects are defined in the Department of Justice/Department of Transportation Joint Technical Assistance on the Title II of the Americans with Disabilities Act Requirements to Provide Curb Ramps when Streets, Roads, or Highways are Altered through Resurfacing document.

3-401.00 PROVISION OF PEDESTRIAN FACILITIES

Pedestrian facilities typically include sidewalks, shared-use paths, and walkways as well as all other features of the pedestrian route such as crosswalks, curb ramps, pedestrian signals and pushbuttons. Pedestrian facilities can either be immediately adjacent to streets and highways or separated from them by a buffer. Pedestrian demand and accommodation are usually aligned

with surrounding land uses and should ideally be evaluated in the planning process to provide ample pedestrian space and roadside elements. For example, recommended sidewalk widths along urban commercial streets in dense areas should be wider than on urban collectors in residential areas with five (5) feet being the minimum width for either.

Designing pedestrian facilities extends much further than the TDOT Standards and ADA/PROWAG design criteria discussed in this chapter. Similarly, comfortable and convenient pedestrian access to and from transit stops and stations presents important opportunities to strengthen and expand the transportation system and provide more travel options for the public.

3-402.00 PEDESTRIAN ROUTE SELECTION

Where pedestrian routes are provided along roadways, they shall, to the extent it is not structurally impracticable, meet the minimum widths shown in *Table 3-1, Minimum Pedestrian Route Widths for Various Roadway Functional Classifications and Context*. Accommodation can be provided by either dedicated pedestrian sidewalks or shared-use paths, which are facilities that serve pedestrians, bicyclists, and other users such as skaters. Sidewalks are typically provided on both sides of the street, where a shared-use path is typically provided on only one side. A sidewalk may be provided on the opposite side of the street from the shared-use path.

The sidewalk widths listed are minimum widths. The widths provided for design should be determined in consultation with the local agency and based on the expected volume of pedestrians at build-out of the land use along the project corridor. Locally adopted sidewalk standards may differ and should be coordinated with local agencies understanding that five (5) foot wide is the minimum. Shared-use paths that are not adjacent to or serving a roadway shall have a maximum running grade of five (5) percent. Additional guidance on the design of shared-use paths is provided in Section 6 of this Chapter.

Minimum Pedestrian Facilities Design Guidelines (When Provided)		
Roadway Classification / Context	Sidewalk / Walkway	Width
Rural Roadways (< 2,000 ADT)	Sidewalks on both sides	SW (5 ft)
	Shared-Use Path	SUP (10 ft)
Rural Roadways (> 2,000 ADT)	Sidewalks on both sides	SW (5 ft)
	Shared-Use Path	SUP (10 ft)
Suburban Roadways	Sidewalks on both sides	SW (5 ft)
	Sidewalk + Shared-Use Path	SUP (10 ft)
Major Arterials (Residential)	Sidewalks on both sides	SW (6 ft)
Minor Arterial and Urban Collector (Residential)	Sidewalks on both sides	SW (5 ft)
All Commercial Area Urban Streets	Sidewalks on both sides	SW (6 ft)
All Industrial Area Streets	Sidewalks on both sides	SW (5 ft)
SW = Sidewalk, SUP = Shared-Use Path		

Table 3-1: Minimum Pedestrian Route Widths for Various Roadway Functional Classifications and Context

Pedestrian routes should be separated from the roadway curb to provide a pedestrian buffer, to serve as a place to locate mailboxes, to serve as a planting strip or furnishing zone, to serve as a place for transit stops/shelters, and to benefit driveway slopes. *Table 3-2, Pedestrian Route Buffer Requirements by Vehicle Operating Speed* provides minimum and preferred separations, or buffers, from the edge of the traveled way to the nearest edge of the sidewalk or shared-use path. Note the buffer can be paved, but its width is not included in the minimum pedestrian facility width listed in *Table 3-1, Minimum Pedestrian Route Widths for Various Roadway Functional Classifications and Context*. Shoulders, bicycle lanes, or parking lanes on the road-side of the curb can be included in the buffer width, however some separation from the curb to the edge of the sidewalk is still recommended as a place to locate mailboxes and benefit driveway slopes. If a buffer equal to the minimum separation guidance is not feasible on higher speed routes, the Designer should consider the placement of a positive protective device (i.e., a barrier).

Pedestrian Route Separation Requirements (ft.)		
Posted Speed	Buffer (Min.)	Buffer Preferred
≤ 35 mph	0 *	5
40 mph	4.5	8
45 - 55 mph	12.5	16.5

*A sidewalk buffer is not required at this speed range. However, a 5-foot buffer (min.) shall be provided between the travel lane and a shared-use path, see *Chapter 3 Section 3-606.00* for additional guidance.

Table 3-2: Pedestrian Route Buffer Requirements by Vehicle Operating Speed

On rural sections with a paved shoulder, the minimum pedestrian facility buffer is either five (5) feet from the edge of the traveled lane or the dimensions listed in *Table 3-2, Pedestrian Route Buffer Requirements by Vehicle Operating Speed*, whichever is greater. Under constrained conditions, a seven (7)-foot minimum buffer from the edge of the traveled lane for speeds of 45 mph and above may be allowed with completion of a *Design Waiver Form* and subsequent approval by TDOT. See *Chapter 3-908.00*. Where a ditch is present, the sidewalk should be placed on the far side of the ditch. If the appropriate buffer cannot be attained, a physical barrier is needed.

3-403.00 SIDEWALK DESIGN ON CURBED ROADWAYS

Most sidewalks are located along streets with curb and gutter in urban, suburban, and rural town center contexts. In suburban settings, the sidewalk is normally not adjacent to building frontages as it may be in more densely developed urban and town settings. In more densely developed locations, sidewalks may be closely integrated with other roadside functions such as street trees/landscaping, street furniture, bicycle racks, sidewalk café seating, and building frontages. The portion of the roadside area behind the curb that is dedicated to pedestrian travel is typically referred to as the pedestrian access route and must be designed to meet ADA and other pedestrian needs. PROWAG guidelines require a pedestrian access route be provided within sidewalks and other pedestrian circulation paths located in the public right-of-way. A pedestrian access route is defined as a continuous and unobstructed path of travel provided for pedestrians with disabilities.

Pedestrian access routes that provide direct routes, with few meanders, are typically preferred by those with visual impairments. Additional guidance concerning the pedestrian access routes width, cross slope, grade, and pavement markings is provided below.

Width - The pedestrian access route is intended for pedestrian travel. Its width should vary by context and the pedestrian activity generated by the adjacent and area land use. A minimum continuous and clear pedestrian access route width of five (5) feet must be maintained. In constrained conditions, it is permissible to have a clear width of four (4) feet, with a *Design Waiver Form* approval. This minimum width of four (4) feet must be maintained around items

commonly placed within the sidewalk area, including signposts, luminaire supports, signal poles, etc. In commercial areas, the minimum recommended width for pedestrian access routes is six (6) feet, due to the anticipated higher level of pedestrian activity.

Cross Slope – TDOT's standard cross slope for pedestrian access routes is 1.5 percent to allow for construction tolerances. If necessary due to design constraints or in spot locations, a cross slope between one (1) and two (2) percent is allowable. The one and a half (1.5) percent maximum cross slope applies across driveways. A cross slope of less than one (1) percent would not shed water well after a rain event. Ponded water can become slippery, obscure surface discontinuities, freeze in cold weather, and degrade the sidewalk, increasing the need for maintenance. Sidewalks typically slope and drain towards the roadway, where the stormwater is collected in the roadway's curb and gutter network. In unique situations, the sidewalk may slope and drain away from the roadway. In these instances, the Designer must ensure the stormwater will not pond and collect on the throughway zone.

Grade - Longitudinal grades, which run parallel to the pedestrian path of travel, can be challenging for pedestrians if they are too steep. PROWAG, TDOT, and ADA requires that longitudinal grades not exceed five (5) percent for pedestrian access routes outside of a street or highway right-of-way, such as a shared-use path. Pedestrian access routes within street crossings are also at five (5) percent. This maximum does not account for construction tolerances. Pedestrian access routes adjacent to roadways with grades steeper than five (5) percent may match, but not exceed, the general grade of the roadway.

Pavement Markings – Pavement markings are typically not applied to the pedestrian access routes, except at certain crosswalk locations. Marked crosswalks are designed to keep pedestrians together where motorists can see them, and where they can cross more safely across the flow of vehicular traffic. They also aid visually impaired users to remain within the crosswalk area. Marked crosswalks are required at designated school crossings and at signalized intersections that have sidewalks with curb ramp access. Marked crosswalks should be considered at other unsignalized locations that have high pedestrian activity. Refer to standard drawing T-M-4 and MUTCD Section 3B.18 for additional guidance on marked crosswalks. The longitudinal crosswalk (piano key) markings are used on all TDOT routes.

3-404.00 SIDEWALK DESIGN ON NON-CURBED ROADWAYS

Most sidewalks are along streets with curb. However, sidewalks can and do exist along streets without curb, typically in rural and some suburban areas. When the street does not have curb, the sidewalk should be placed a minimum of five (5) feet measured from the outside edge of shoulder to the inside edge of the sidewalk. If a roadside ditch is present, the sidewalk should be placed on the far side of the ditch from the roadway for added lateral separation. When the sidewalk is parallel to a roadway with a posted speed limit of 45 mph or more, greater lateral offset is recommended from the edge of the travel lane. If the sidewalk is located within the clear zone of a high-speed roadway, consideration should be given to a crash-worthy barrier to protect the users of the sidewalk.

The design guidance provided in the previous section on curbed roadways also applies to sidewalk design without curbs. For example, the standard cross slope of the sidewalk is 1.5 percent, to allow for construction tolerances not to exceed two (2) percent and must be at least one (1) percent. Cross slopes less than one (1) percent can lead to ponding and mud accumulation on the sidewalk. Additionally, the graded areas adjacent to the sidewalk must allow water to drain off and away from the sidewalk.

3-405.00 PEDESTRIAN CROSSINGS AND CROSSWALK MARKINGS AT INTERSECTIONS

In Tennessee, TCA 55-8-101(16) provides that both unmarked and marked crosswalks may exist as described below, respectively:

1. That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or, in the absence of curbs, from the edges of the traversable roadway

AND/OR

2. Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface

Additionally, pedestrians are given right-of-way at locations where pedestrian signals exist (TCA 55-8-111).

An unmarked crosswalk is created only when a sidewalk on one side of the roadway continues in that same direction on the opposite side OR if there are pedestrian signals. Designers have flexibility at many intersections to determine if and where to place pedestrian crossings but should also be aware of unmarked crosswalks that are not currently ADA Accessible. Designers should consider impacts at intersections with incomplete or asymmetrical pedestrian circulation. Certain intersection legs may not meet the definition of unmarked crosswalks. The most common examples may be at “T” intersections, where there would be no pedestrian right-of-way given for crossing from the stem of the “T" across to the top of the “T” unless the pavement is marked OR a pedestrian signal is provided OR a pedestrian path continues in the same direction, extending the stem of the “T”. In other words, sidewalks that are perpendicular to each other (at 90 degrees) interrupted by a roadway do not automatically create legal crosswalks. See *Figure 3-6, Unmarked Crossing* below for intersection examples showing where marked or unmarked crosswalks exist.

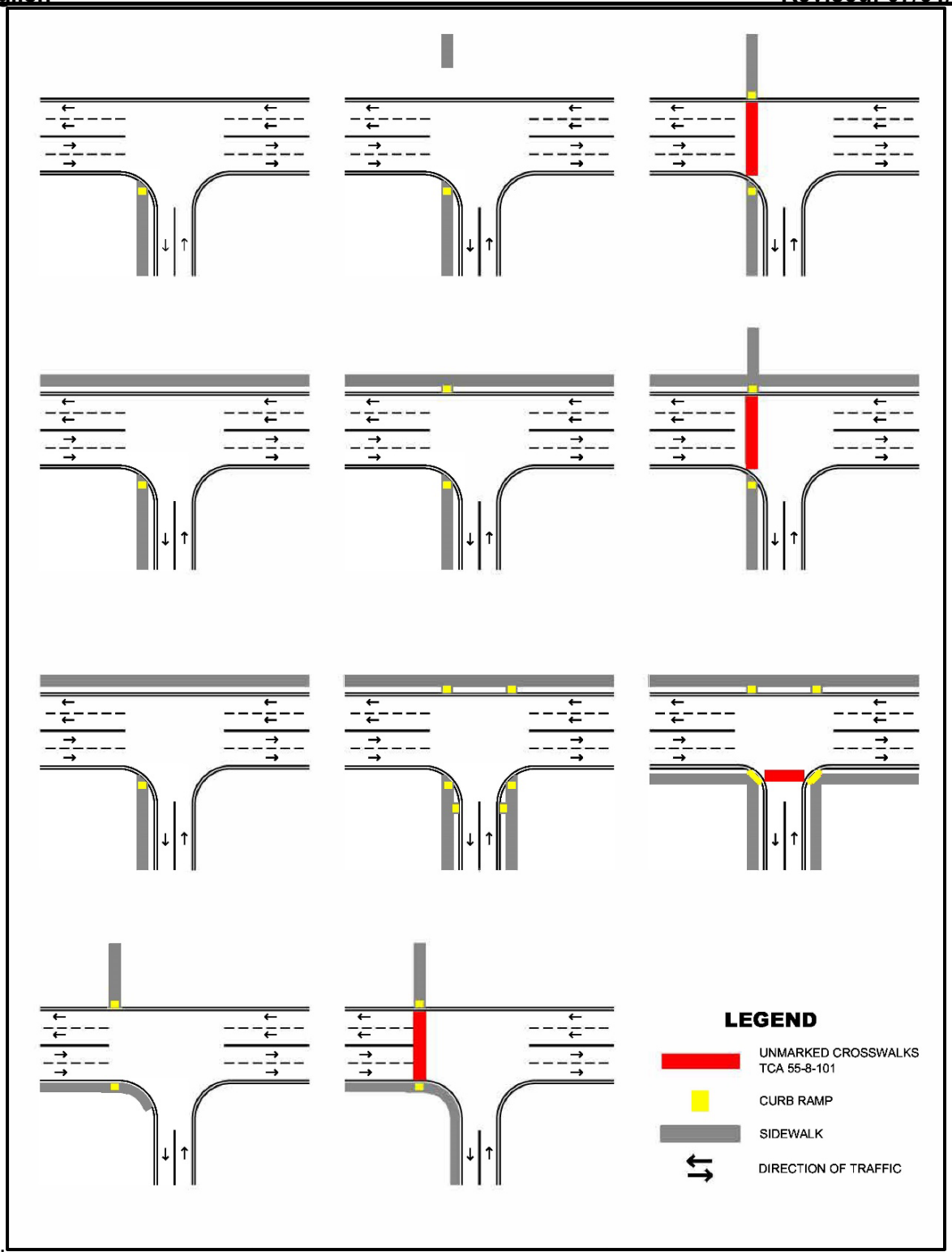


Figure 3-6 – Unmarked Crosswalk

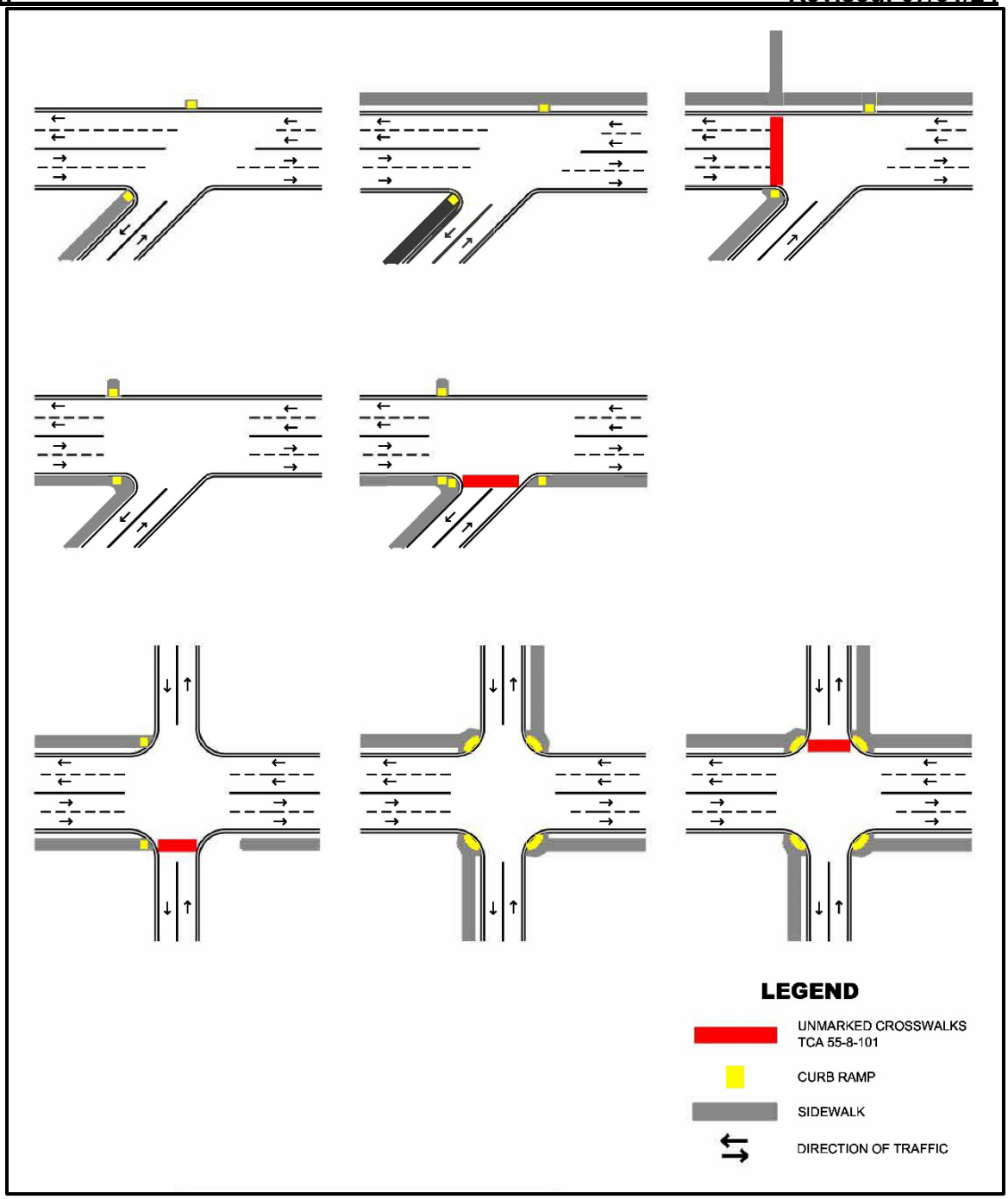


Figure 3-6 – Unmarked Crosswalk - Continued

Note: If the pavement is marked at any location OR if there are pedestrian signals installed, the crossing is a crosswalk with pedestrians having the right-of-way. Additionally, the manner in which the intersection is controlled (yield, stop, or signal w/o ped signals) or the presence of a curb ramp does not automatically create a crosswalk. A particular intersection may be signal controlled, stop/yield controlled, or uncontrolled.

Intersections without pedestrian facilities on opposite corners do not require crosswalk pavement markings, ADA ramps, or other considerations for pedestrians. If a project includes the construction of new or alterations to existing pedestrian facilities, such as sidewalk or shared-use path, the designer should evaluate the existing roadway and intersection conditions to provide safe and reliable crosswalks for all users. At intersections where there are pedestrian facilities at some corners, designers should evaluate pedestrian need and safety in choosing whether to mark a crosswalk and provide accessibility on opposite sides. If an intersection does not have sidewalk but does have other existing pedestrian facilities such as pedestrian signals; then, the pavement shall be marked and accessible pedestrian refuges installed. Finally, if the presence of two curb ramps across an intersection leg does not currently meet the definition of a crosswalk as shown in *Figure 3-6, Unmarked Crossings* designers should mark the crossing to remove any confusion on the part of pedestrians or vehicles as to the legality of that crossing. These steps will remove any possible confusion regarding the use of the crossing.

During the development of 3R projects the designer should evaluate the existing roadway conditions and study all existing controlled or uncontrolled crossings to provide a safe access to pedestrians and reliable transportation for motorists. At a minimum all crosswalks are required to have curb ramps installed.

Controlled (signal, stop or yield) pedestrian crossings on state routes require crosswalk pavement markings, along with stop bar or yield marking with signs in accordance with MUTCD. It is recommended but not mandatory to have marked crosswalks at all controlled pedestrian crossings on non-state routes. See *Figure 3-6, Unmarked Crossings.*

3-405.10 UNCONTROLLED PEDESTRIAN CROSSINGS

Uncontrolled Pedestrian Crossings are those crosswalks across legs of an intersection without signal, stop, or yield control. Most common would be intersecting minor street with stop control along a major roadway with no traffic signals or stop control. At these **uncontrolled pedestrian crossings,** crosswalks exist at all locations that meet the definition of crosswalks under TCA 55-8-101. These crosswalks could pose an

increased risk for vehicles and pedestrians; therefore, sound engineering judgement/principles and behavior of pedestrians should be considered.

Existing uncontrolled pedestrian crossings may not have existing marked crosswalks or compliant ADA curb ramps. During the development of 3R projects the designer should identify and study all existing uncontrolled crossings to provide a safe access to pedestrians and reliable transportation for motorists. *At a minimum all pedestrian crossings are required to have curb ramps installed.*

The decision to mark an uncontrolled crosswalk, provide signs or other safety measures is one that is based on sound engineering judgement, that considers the demands (crash history, etc.) and behavior of pedestrians and drivers at specific locations. The MUTCD states the following on crosswalk marking at uncontrolled locations.

Section 3B.18 Crosswalk Markings

> *Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.*
>
> *New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either:*
> *A. The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater: or*
> *B. The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.*

Additionally, in 2018 the FHWA issued a comprehensive document "Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations" to assist Designers on what countermeasures can be installed to increase driver awareness and pedestrian safety and when it is most appropriate to use those measures.

It is important to note that when using this table, the TDOT AADT ranges for the three columns are **AADT<10,000**; **10,000<AADT>15,000**; **AADT>15,000**. At certain

types of uncontrolled crossings, such as roundabouts, single-lane entries and exits are preferred for pedestrian crossings. Splitter islands should be designed to fully accommodate pedestrians as a refuge location.

3-405.15 CLOSING CROSSWALKS

Existing crosswalks may be present which pose an excessive safety concern for pedestrians. When this happens, designers should first look to improve safety at the crossing utilizing proven countermeasures such as pavement marking, advance signs, improved street lighting, and reducing speed limits. In rare circumstances, a particular pedestrian crossing should be closed. Closing a sidewalk is a last resort and should be pursued only when the crosswalk has a history of safety issues and when other efforts at safety improvement were attempted and found to be ineffective. The act of removing crosswalk pavement marking or choosing not to install ADA Curb Ramps is insufficient to consider a crossing as closed. The following requirements apply when it is determined that closing the crosswalk is the only safe alternative:

- Provide a physical barrier and signs to indicate that the crossing is closed for all users.
- Provide a reasonable alternate route that all pedestrians can use. The route should include multiple countermeasures for safe pedestrian crossing. Most importantly, the route should be located within a reasonable distance from the closed crossing.

3-405.20 CROSSWALK MARKING AND TYPES

Crosswalk pavement marking shall be provided along state routes at signal-controlled intersections at pedestrian crossings, at all stop/yield controlled pedestrian crossings, and any mid-block crossings.

Marked crosswalks can be one of two pavement marking configurations: 1) Longitudinal, which is sometimes referred to as “piano keys”, or 2) transverse. Longitudinal (piano keys) markings should be used where added emphasis is needed for the crosswalk, and on high speed and/or high ADT facilities to improve the visibility of location for motorist. Longitudinal and transverse crosswalks are shown in Roadway Standard Drawing T-M-4. Longitudinal and transverse crosswalks are the only crosswalk markings adopted by the department. If any deviation from the standard is proposed, the Designer is required to adhere to crosswalk design requirements contained in the MUTCD Section 3B.18 as well as PROWAG.

3-405.30 PEDESTRIAN CROSSING SAFETY CONSIDERATIONS

Designers should evaluate existing and proposed crosswalk locations on any new construction or rehabilitation project. Assuring the safety of both pedestrians and vehicles is the priority of every facility designed. Designer should evaluate, stopping sight distance, line of sight, turning movements to determine if pedestrian crossings warrant crosswalk, pavement marking, flashing beacons, advanced signs etc. It is important to evaluate illumination need and placement options since the practice offers great safety benefits.

It is critical to note that the decision to not mark a pedestrian crossing does not eliminate the requirement of a designer to make that crosswalk accessible, as it does not eliminate the legal right of pedestrians to cross or of vehicles to yield to those pedestrians.

3-405.40 CROSSWALK MARKING ARCHITECTURAL FEATURES

Asphalt or concrete are the proper materials to be used for the walking surface. A different look can be achieved by using stamped patterns. The placement of stamped patterns should meet Roadway Drawing T-M-4. Crosswalks may be textured on the edges but should maintain a five (5)-foot smooth section in the middle and must be marked with transverse (parallel) reflective pavement marking. Brick, granite, and cobblestones should not be used in accessible pathways. A reasonable pathway shall be provided approaching to crosswalks free of permeant obstructions i.e., light, ped, signal poles, guy wires, tree, sign supports, traffic control box, as well as other utilities such as fire hydrant, pay parking stations, ballads, planters.

3-405.50 UNMARKED CROSSWALKS

While having ADA accessible crosswalks is mandatory, leaving some crosswalk locations unmarked may be acceptable and even preferred on some roadways per engineering decision. While all controlled crossings (stop, yield, or signal) should have marked crosswalks, uncontrolled crossings may not require marked crosswalk treatment if conditions meet the minimum safety standards.

3-405.60 ACCESSIBLE CROSSWALK DESIGN ELEMENTS

Crosswalk surfaces should be even, free of joints (less than ½”), lips (less than1/4”) and not slippery. Designer should avoid utility structures such as manholes, drainage grates and place crosswalks to minimize the walking distance across the vehicle traveled way. This could include applying pedestrian focused design treatments such as reducing lane widths, minimizing turning radii, providing pedestrian refuge islands, constructing

curb extensions, and limiting the use of turn lanes. Designer should confirm the roadway running slope and cross slope is in accordance with PROWAG 302 where crosswalks are proposed and when project scope would permit the altering of the roadway geometry. Where on-street parking is present and minimum radii can be met at the intersection, the Designer should consider curb extensions to further minimize the distance required to travel by pedestrians. The lateral offset of the curb extension should be at least one (1) foot from any through movement traffic such as motor vehicles or bicycle lanes. Refer to *Chapter 3-703.00* for additional information on curb extensions.

3-406.00 CURB RAMPS AND DETECTABLE WARNING SURFACES

Functional Design Plans for new construction or reconstruction, and repaving projects shall accommodate the appropriate curb ramp and truncated dome surface details shown on the current Standard Drawings. TDOT standards shall be used on all projects funded by federal or state. Curb ramps shall have only a broom finish. The curb ramp Standard Drawings detail multiple layouts of curb ramps and blended transitions that can be used at intersections depending upon the site layout, topography, and right-of-way constraints. Perpendicular design curb ramps are the preferred type to be used. Parallel, blended transition, and lowered corner curb ramps are appropriate for areas with right-of-way constraints. Designers shall indicate the type of ramp (TDOT Standard Drawing number) and all ramp features (landings, ramp/transitions, detectable warnings, pushbutton locations, etc.) to be used at each corner on the plans. Designers should use the estimated quantities for a 90-degree intersection on a 0.0 percent grade when calculating quantities for intersections other than 90 degrees or with grades other than 0.0 percent. Limits of payment for curb ramps are shown on the Standard Drawings.

Detectable warning surfaces (truncated domes) shall be used with all curb ramps and blended transitions. Detectable warnings shall extend the full width of any flush transition from a ramp to the curb or roadway.

Refer to the MM-CR-Series Roadway Standard Drawings for details. Additional information concerning curb ramps and truncated domes is provided in the following paragraphs.

Curb ramps and blended transitions shall connect the pedestrian facility at each pedestrian street crossing. Perpendicular curb ramps have a running slope that cuts through or is built up to the curb at right angles or meets the gutter break at right angles at the tangent of the curb radius. Parallel curb ramps have a running slope that is in-line with the direction of sidewalk travel and lowers the sidewalk to a level turning space where a turn is made to enter the pedestrian street crossing. Blended transitions are raised pedestrian street crossings, depressed corners, or similar connections between the pedestrian access route at the level of the sidewalk and the level of the pedestrian street crossing that have a grade of less than five (5) percent.

In general, perpendicular design curb ramps are preferable when geometric conditions allow their use. Curb ramps are preferred for each crosswalk direction; most corners should therefore have two (2) ramps. In alterations where existing physical constraints prevent two (2)

curb ramps from being installed at a street corner, a single ramp or blended transition is permitted at the corner. Single or radial curb ramps shall be designed to avoid directing pedestrians into moving vehicular traffic in any direction. Detailed design information can be found in Roadway Standard Drawings MM-CR-1 through MM-CR-9.

The running slope of curb ramps shall be a minimum of five (5) percent and a maximum of 8.3 percent but shall not require the ramp length to exceed 15 feet. Blended transition curb ramps have a maximum running slope of less than five (5) percent.

Detectable warning surfaces indicate the boundary between pedestrian and vehicular routes where there is a flush connection and the curb is missing. They serve the need of people with vision impairments. Typical placement locations include at curb ramps, pedestrian refuge islands, and railroad crossings. However, detectable warning surfaces are not required at cut-through pedestrian refuge islands that are less than six (6) feet in length because detectable warning surfaces must extend two (2) feet (minimum) on each side of the island and be separated by a minimum two (2)-foot length of island without detectable warning surfaces. Installing detectable warning surfaces at cut-through pedestrian islands that are less than six (6) feet in length would compromise the effectiveness of detectable warning surfaces. Where a cut-through pedestrian refuge island is less than six (6) feet in length and the pedestrian street crossing is signalized, the signal should be timed for a complete crossing of the street.

Detectable warning surfaces should also not be provided at crossings of residential driveways since the pedestrian right-of-way continues across residential driveway aprons. However, two-way commercial driveways, driveways with yield or stop control, driveways that function like a roadway or contain other features that pose additional risk to pedestrians, may need detectable warning surfaces provided at the junction between the pedestrian route and the driveway vehicle route.

Detectable warning surfaces shall contrast visually with the adjacent gutter, street, or pedestrian facility surface. Detectable warning surfaces shall extend two (2) feet in the direction of pedestrian travel. At curb ramps, detectable warning surfaces shall extend the full width of the ramp. Five (5) foot wide curb ramps shall have five (5) foot wide truncated domes. At shared-use path crossing, detectable warning surfaces shall extend the full width of the path. Examples of TDOT-compliant detectable warning surfaces are shown in Roadway Standard Drawing MM-CR-1. Detectable warning surface shall be yellow, rigid composite, polymer plate. Cast-in-place are preferred to surface applied, bolted down detectable warnings with new curb ramps. Plates can be applied to compliant existing curb ramps; care is needed to assure the plates are flush. New curb ramps shall not have surface applied detectable warnings.

When a project’s limits begin or end at an intersection, all approaches to the intersection must be upgraded with similar multimodal features such that pedestrians of all abilities can traverse the intersection. Where curb ramps are installed, they must be installed in all quadrants of an intersection that are connected by pedestrian facilities.

3-407.00 MIDBLOCK PEDESTRIAN CROSSINGS

This section addresses several ways to facilitate non-intersection pedestrian crossings at medians and refuge islands and midblock crossings.

Wide multilane streets are often difficult for pedestrians to cross, particularly when operating speeds are high and there are insufficient gaps in vehicular traffic because of heavy volumes. Raised medians and traffic islands with a pedestrian refuge area should be considered on roadways with one or more of the following conditions:

- Two-way arterial with intermediate to high speeds (greater than 35 mph), moderate to high average daily traffic (ADT), and high pedestrian volumes
- Significant pedestrian crash history
- Near a school or other community center
- Crossing distance exceeds 30 feet
- Midblock transit stops
- Complex or irregularly shaped intersections

Median refuge islands should be considered in curbed sections of roadways in urban and suburban areas, particularly in areas where there are mixtures of significant pedestrian and vehicle traffic (more than 12,000 ADT) and intermediate or high travel speeds. On non-curbed sections of roadways, median refuge islands are applicable on roadways with posted speeds of ≤ 40 mph or design speeds ≤ 45 mph. *Table 3-3, Recommendations for Installing Midblock Crosswalks* provides guidance for when a location is a candidate for a midblock crosswalk (C), when a midblock crosswalk may be considered with additional pedestrian crossing enhancements (P), and when a midblock crosswalk should not be installed without additional enhancements (N). These additional enhancements could include median refuge islands (which reduce crossing distance along with increasing safety for pedestrians), raised crosswalks, and pedestrian signalization. Longitudinal crosswalk markings shall be used on all midblock crossings. For additional guidance, refer to the footnotes provided at the bottom of *Table 3-3, Recommendations for Installing Midblock Crosswalks* and Roadway Standard Drawings T-M-4A and T-M-4B.

Recommendations for Installing Midblock Crosswalks*					
Vehicle ADT	Speed Limit**	Roadway Type (Number of Travel Lanes and Median Type)			
		Two lanes	Three lanes	Multilane (four or more lanes) with raised median***	Multilane (four or more lanes) without raised median
≤ 9,000	30 mi/h	C	C	C	C
	35 mi/h	C	C	C	P
	40 mi/h	P	P	P	N
>9,000 to 12,000	30 mi/h	C	C	C	P
	35 mi/h	C	P	P	P
	40 mi/h	P	P	N	N
>12,000 to 15,000	30 mi/h	C	P	P	N
	35 mi/h	C	P	P	N
	40 mi/h	N	N	N	N
> 15,000	30 mi/h	C	P	N	N
	35 mi/h	P	N	N	N
	40 mi/h	N	N	N	N

* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.

** Where the speed limit exceeds 40 mi/h, marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft. wide and 6 ft. long to serve adequately as a refuge area for pedestrians, in accordance with MUTCD and AASHTO guidelines.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some

locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, and other factors may be needed at other sites. It is recommended that a minimum utilization of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) be confirmed at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

Adapted from Source: Safety Effects of Marked versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines, Table 11 FHWA, 2005

Table 3-3: Recommendations for Installing Midblock Crosswalks

MUTCD-compliant signing and pavement markings are to be provided to make the refuge island conspicuous to motorists. Overhead street lighting should also be considered. Median refuge islands typically have an open, flat cut and do not ramp up and down due to the short width. If the island is sufficiently large, then ramps that meet ADA requirements (8.3% maximum grade) can be used. It is best to provide a slight grade (1.5 percent or less) to permit water and silt to drain from the area. For roadway posted speeds above 40 mph/design speeds above 45 mph, clear zone criteria between the median and travel lane typically eliminates the applicability of median refuge islands. Recommended median design criteria includes:

- The desirable median width is at least eight (8) feet wide to allow the pedestrian to wait comfortably in the center, four (4) feet from moving traffic. A wider median is necessary if it must also serve the purpose of providing a left–turn bay for motor vehicle traffic at intersections.
- If the desired eight (8) feet cannot be achieved, a width of six (6) feet, or four (4) feet (minimum) will be sufficient. To provide the needed width, especially in a downtown or other commercial environment, consider narrowing travel lanes to an appropriate width (see *Table 3-3, Recommendations for Installing Midblock Crosswalks* for acceptable lane widths).
- Median island cut throughs shall be designed to have a minimum width of five (5) feet to ensure a passing space is provided.
- Detectable warning surfaces are to be separated by a minimum length of two (2) feet in the direction of pedestrian travel.
- Pedestrian access routes of shared-use paths through a median island must be a minimum of the same width as the shared-use path. The width of the island should be eight (8) feet to ensure a bicycle can fit within the island.
- Refuge islands must be raised and not simply a painted surface.

The placement of midblock signals is called for in some locations. The primary signalized treatment that should be considered at midblock or non-intersection crossings is the High intensity Activated crosswalk (HAWK) Pedestrian Hybrid Beacon:

- A HAWK Pedestrian Hybrid Beacon should be examined where the Pedestrians Per Hour (PPH) volume exceeds 20 and the 85th percentile motor vehicular speeds exceed 35 mph. When an engineering study finds that installation of a pedestrian hybrid beacon is justified, the following design guidelines should be met:
    - The pedestrian hybrid beacon should be installed at least 100 feet from side streets or driveways that are controlled by stop or yield signs.
    - Parking, landscaping, roadway alignment, and other sight obstructions can cause safety hazards for pedestrians. See Roadway Standard Drawing T-M-4A and 4B as well as RD11-SD-Series for design requirements.
    - The installation should include suitable standard signs and pavement markings.
    - If installed within a signal system, the pedestrian hybrid beacon should be coordinated.

3-408.00 CURB EXTENSIONS/BULB-OUTS

On streets with curb and on-street parking or shoulders, curb extensions can be used to extend the sidewalk or curb line into the shoulder or parking lane, which reduces the effective street width at the intersection. Curb extensions can:

- Reduce the crossing distance of pedestrians
- Improve the sight distance and sight lines for both pedestrians and motorists
- Create adequate space for curb ramps and landings where the existing sidewalk space is narrow
- Provide additional storage space for pedestrians waiting to cross
- Prevent parked cars from encroaching into the crosswalk area

In general, curb extensions should extend the width of the shoulder or parking lane, with the face of curb approximately one (1) foot from the edge line of the through travel lane. Curb extensions may not be needed or desirable on every leg of an intersection if the street leg is narrow, parking is not permitted, or the curb extension would interfere with a bicycle lane or the ability of the design vehicle to negotiate a right turn. Storm drainage from the street must also be considered by the Designer to ensure ponding does not occur. Low-level landscaping that does not conflict with sight distance or intersection sight triangle requirements is recommended on curb extensions to provide alignment cues for pedestrians with vision impairments and to increase the visibility of the extension to approaching motorists. Curb extensions are not typically appropriate at high-speed rural intersections or where channelized right turns are warranted.

3-409.00 PEDESTRIAN, BICYCLE, CONSIDERATIONS FOR ROUNDABOUTS

The number of conflict points between vehicles, pedestrians, and cyclists is reduced when a roundabout is used for intersection control. Since single lane roundabout will not have signalization to offer pedestrian phases or does not require vehicles to make a complete stop,

other measures must be designed to ensure drivers and multimodal users are clearly able to see each other. Proper roundabout design should produce the reduced vehicle speeds that are needed for vehicles to yield the right of way to crosswalk users. Multi lane urban roundabouts with sidewalk facilities at both sides requires a pedestrian push-buttons with RFRB to improve safety of users.

Crosswalk and/or bicycle facilities must be included at roundabouts in locations with existing pedestrian or bicycle infrastructure or that are connected to or planned to be connected to pedestrian or bicycle networks. At rural or urban locations where current pedestrian and bicycle traffic is not significant, the plans may include measures to accommodate future needs or demands. These may include:

- Rough grading the perimeter of the roundabout to accommodate future sidewalks, landscaping buffer strip, shared-use paths, etc.
- Installing pedestrian and bicycle curb ramps or lowered curb at logical “future” locations along perimeter curbing
- Providing cut-throughs (gaps) at the splitter islands for future crosswalks
- Obtaining adequate right-of-way to accommodate future measures, including lighting
- Installing conduit across all legs and splitter islands in the event that roadway lighting or accessible pedestrian beacons or signals are required

Sidewalk facilities at roundabouts should be designed following Section 4- Accessible Pedestrian Travel and TDOT standards; supplementary guidance for sidewalks that function as a shared path to carry bicycle traffic around a roundabout are discussed in Chapter 3-409.03.

3-409.01 CROSSWALK FACILITIES

Since a goal of any roundabout is to result in low and consistent speeds being maintained throughout the intersection, a properly designed roundabout will reduce the risk of vehicle-pedestrian collisions due to the slow speeds expected. In addition to speed control elements such as Entry Deflection and corresponding Fastest Path checks, there are design elements that may be beneficial to pedestrian safety when designing the crosswalks at a roundabout, most prominently the inclusion of median refuge islands (MM-CR-4) and reduction in vehicle speeds at the crosswalk compared to a free-flowing mainline at a side-street stop intersection or at a traffic signal during the green phase. The following general design criteria should be considered for crosswalks at roundabouts:

- Minimized crossing distance to reduce pedestrian exposure to traffic.
- Crosswalks should be designed to provide pedestrians a straight walking path across the traffic lanes (90 degrees to traffic flow preferred to minimize crossing distance), including any right-turn bypass lanes.
    - When a splitter island is provided, a Designer may need to “bend” crosswalk alignments at the splitter island to provide 90-degree crossings at the entrance and exit lane.
    - The exception to this guidance is when adequate pedestrian refuge is not provided within the splitter island, such as at a mini-roundabout. In these cases,

the crosswalk should proceed straight, crossing both lanes in one movement, and follow the shortest path across the roadway. In situations where the splitter island does not provide adequate refuge area, detectable warning surfaces should not be provided in the median.

- To minimize out-of-direction travel for pedestrians, crosswalks should be located as close as possible to the intersection while still maintaining required queue space for vehicles.
- Crosswalks should typically be located one vehicle length (approximately 20 feet minimum) behind the yield point, namely the wide dotted white line tangent to the ICD (Standard Drawing MM-CR-4A); this gives the driver at the yield line the ability to concentrate on entering the roundabout since they will have already traversed the crosswalk conflict point.
- Splitter islands should have a minimum width sufficient to provide an adequate pedestrian refuge area, as shown on Standard Drawing MM-CR-4A.
- The finished grade of the pedestrian crossing (refuge) areas within the splitter islands must be graded at a smooth slope which provides positive drainage in a manner that is compliant with pedestrian accessibility standards. The Designer should avoid elevating the refuge area except the minimal amount needed for proper drainage.

The design criteria noted above are illustrated on Standard Drawing MM-CR-4A, “Standard Construction Details for Roundabouts”. The general Standard Drawings for curb ramps provide details for ramps at the exterior curb cuts for crosswalks.

The Designer should note that additional design elements and crosswalk infrastructure may be necessary at roundabouts where accessible pedestrian crossings are required, as discussed in Chapter 3-409.02.

3-409.02 ACCESSIBLE PEDESTRIAN CROSSINGS

Care should be taken in the design of splitter island pedestrian refuge areas to ensure that visually impaired pedestrians are guided to and properly aligned with the second crosswalk of a two-stage crossing. Standard Drawing MM-CR-4A provides a detail of pedestrian refuge areas at splitter islands.

Supplementary guidance for Designers on accessible pedestrian infrastructure at roundabouts can be found in Section 4.1 of NCHRP Research Report 834, *Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Disabilities* (NCHRP, 2016).

Crosswalks at roundabouts can present risks for visually impaired pedestrians due to the uncertainty over gap detection and determining whether a driver will yield to pedestrian traffic. Where an accessible pedestrian crossing is required at a roundabout crosswalk, the Designer should assess whether a pedestrian traffic control device is appropriate to notify approaching drivers that a pedestrian is present and provide audible feedback to the pedestrian.

NCHRP Research Report 834, *Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Disabilities* (NCHRP, 2016), provides guidance on appropriate pedestrian traffic control devices for accessible crosswalks and builds upon the *Proposed Public*

Right-of-Way Accessibility Guidelines, or PROWAG (U.S. Access Board, 2011), which has been adopted by TDOT. According to these sources, pedestrian traffic control devices should be considered for crosswalks at multi-lane roundabout approaches. Crosswalks at single-lane roundabout entries and exits generally do not require advanced pedestrian accommodations beyond the provision of accessible crosswalk design and markings unless there are site-specific factors that merit the consideration of a pedestrian traffic control device, such as entry or exit speeds (*V1*, *V3*, *V4*, or *V5* per Section 2-1004.01) in excess of 30 mph.

Per NCHRP Research Report 834 and the associated FHWA Technical Report FHWA-SA-15-069, *Evaluation of Rectangular Rapid-Flashing Beacons at Multilane Roundabouts* (FHWA, 2015), the following pedestrian traffic control devices should be considered for installation at multi-lane roundabout approaches, listed from greatest to least impact:

- Pedestrian Signal
- Pedestrian Hybrid Beacon (PHB), also known as a High-Intensity Activated Crosswalk (HAWK) Beacon
- Rectangular Rapid-Flashing Beacon (RRFB)
- Raised Crosswalk

Recommended thresholds for Designers to consider the installation of a pedestrian traffic control device at a roundabout crosswalk are provided in *Figure 3-7, Recommended Pedestrian Traffic Control Device Treatments at Roundabouts.*

Raised Crosswalks may be considered in combination with RRFB or Pedestrian Signal/PHB traffic control if additional visibility and/or speed control is needed. Where used, the impacts of raised crosswalks on the approach/departure capacity should be assessed to verify that the selected roundabout laneage can handle the expected traffic volumes with raised crosswalks in place. Raised Crosswalks may not be desirable on some roadways, particularly those serve to truck traffic or emergency vehicle (fire truck or ambulance).

It should be noted that in high-noise environments, visually impaired pedestrians may not be able to distinguish between traffic at the crosswalk and background traffic or other conflicting noise. In these situations, the Designer should consider implementing a more impactful pedestrian traffic control device such as a pedestrian signal or PHB to ensure that vehicles stop for pedestrians and visually impaired pedestrians do not need to rely on listening for gaps in traffic.

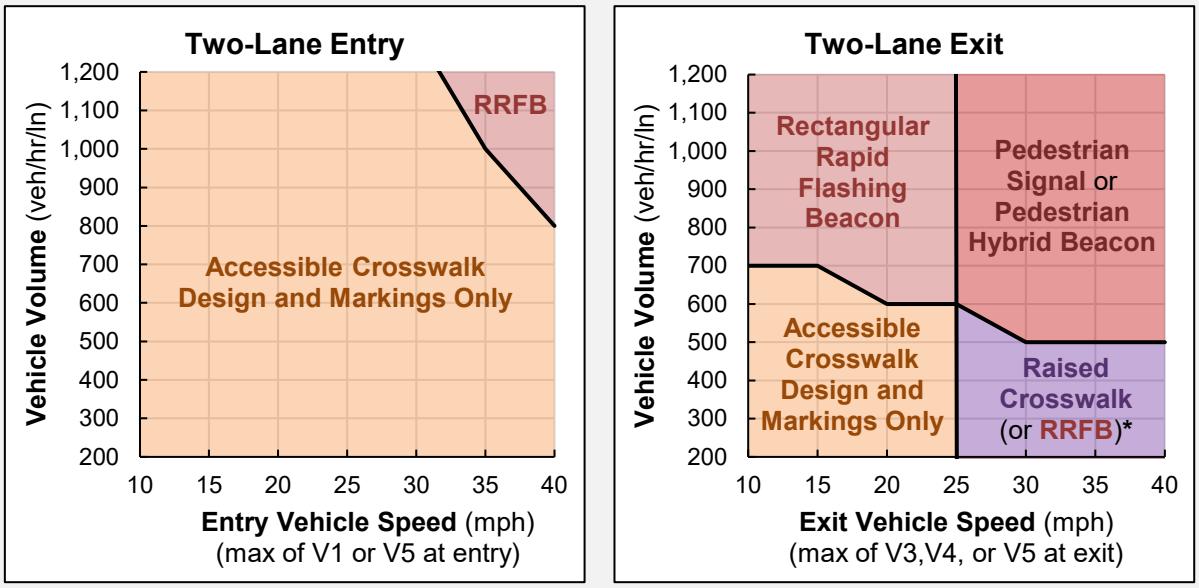
Supplementary guidance for Designers on pedestrian traffic control devices for accessible crossings at roundabouts can be found in Section 4.2 of NCHRP Research Report 834, *Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Disabilities* (NCHRP, 2016).

Single-Lane Entries and Exits

Treatment Selection:
Accessible Crosswalk Design and Crosswalk Pavement Markings Only

Note: In addition, consider using to Raised Crosswalk or RRFB treatment where entry/exit speeds exceed 30 mph)

Two - Lane Entries and Exits



Treatment Selection: The Designer should select the appropriate treatment indicated on either the entry or exit when needed in addition to **Accessible Design & Markings.** The guidance provided above may conflict with PROWAG section R306.3 which requires to have pedestrian signals at all multilane roundabouts. Designers should follow the above guidance.

Figure 3-7 – Recommended Pedestrian Traffic Control Device Treatments at Roundabouts

Adapted from: *Guidelines for the Planning and Design of Roundabouts* (MassDOT, 2020)

If a pedestrian traffic control signal or beacon is appropriate at an accessible pedestrian crossing, pushbutton-activated audible warnings should be provided to accompany the signal or beacon since visually impaired pedestrians generally rely on audio cues more than other pedestrians. Supplementary guidance on pushbutton design and audible warnings at pedestrian signals or beacons is included in Section 3-410.00 and Chapter 13 of the TDOT *Traffic Design Manual*.

Per FHWA-SA-15-069, *Evaluation of Rectangular Rapid-Flashing Beacons at Multilane Roundabouts* (FHWA, 2015), the audible warning message accompanying a RRFB should be "yellow lights are flashing" to accurately convey the nature of the visual beacon and avoid giving visually impaired pedestrians a false sense that vehicles will stop, despite the fact that pedestrians have the right of way at roundabouts.

3-409.03 BICYCLE FACILITIES

Consideration shall be given to integrating bicycle facilities into new construction and reconstruction of roadway projects as appropriate for the context and function of the transportation facility.

Bicyclists should be given a choice when approaching a roundabout of either going through the roundabout and mixing with the vehicles in the circulatory roadway or exiting the roadway prior to entering the roundabout and continuing around the roundabout on a shared-use path with pedestrians. For optimal safety, bicyclists should be provided with shared-use paths, typically in the form of a sidewalk, around the perimeter of the roundabout, although it should be noted that cyclists are legally allowed to choose to remain in the roadway where shared-use paths are provided.

A shared-use path adjacent to the roundabout should be a minimum of 10 feet wide to accommodate bicycle and pedestrian use. If the provided path is less than 8 feet in width, the path would be classified as a sidewalk and cyclists should be directed to dismount. Unless instructed otherwise by TDOT, the Designer should provide bicycle lane exit ramps on each approach for exiting the roadway to the shared-use path, and then bicycle lane entrance ramps for re-entering the roadway, bicycle lane, or roadway shoulder on the far side of the roundabout.

For locations with on-street bicycle facilities, such as urban areas with delineated bike lanes or rural locations where a roadway shoulder is being used for a bike route, the shoulder or bike lane must not continue through the roundabout. The bicycle facility must terminate prior to the roundabout and a bicycle lane exit ramp should be provided to allow cyclists the option of exiting the roadway to a multi-use path around the roundabout or remaining on the roadway. Riders choosing to continue through the roundabout will be required to merge with vehicular traffic in both position and speed.

Where a bicycle lane exit ramp (the ramp the bicyclist uses to exit the roadway prior to the roundabout) is provided, the ramp should be located at least 100 feet prior to the yield point, (Standard Drawing MM-CR-4A). A minimum of 50 feet after a pedestrian crosswalk, the bicycle lane entrance ramp should be provided to reenter the roadway downstream of the roundabout. A bicycle lane exit ramp detail is included in Standard Drawing MM-CR-4A.

If the roundabout is being designed at a location where there is a designated shared-use path, the design should include those geometric features detailed on Standard Drawing MM-TS-3. To minimize confusion between bicycle lane ramps and pedestrian ramps, bicycle ramps should be as physically distinct from pedestrian ramps in location and geometry as possible. Detectable warning surfaces should be placed at the top of the bicycle ramps rather than at the bottom as is the practice with pedestrian ramps.

Additionally, the Designer should refer to the latest version of the AASHTO Guide for the Development of Bicycle Facilities.

3-410.00 PEDESTRIAN ACCOMMODATION AT SIGNALIZED INTERSECTIONS

When designing pedestrian signals, consider the needs of all pedestrians, including older pedestrians and pedestrians with disabilities who might walk at a significantly slower pace than the average pedestrian. Determine whether there are pedestrian generators in the project vicinity that might attract older people and pedestrians with disabilities and adjust signal timing accordingly.

If pedestrian pushbuttons are used, they should be capable of easy activation and conveniently located near each end of the crosswalks. Pedestrian pushbuttons should be located to meet all the following criteria (see *Figure 3-8, Pedestrian Pushbutton Location Detail):*

- Unobstructed and adjacent to a level all-weather surface to provide access from a wheelchair with maximum 1.5% slope in all directions
- Where there is an all-weather surface, a wheelchair accessible route from the pushbutton to the ramp
- Between the edge of the crosswalk line (extended) farthest from the center of the intersection and the side of a curb ramp (if present), but not greater than five (5) feet from said crosswalk line
- Between 1.5ft and 10ft of the curb or shoulder line unless ramp is longer than 10ft
- With the face of the pushbutton parallel to the crosswalk to be used
- Reach Range: Pushbutton shall be located within 10 inches of clear ground space
- At a mounting height of approximately 3.5 feet, but no more than four (4) feet, above the sidewalk
- Placed in such location as not to reduce the pedestrian route below 4ft of horizontal clearance. Consider dimensions of pushbutton foundation width in design.

Where there are physical constraints that make it impractical to place the pedestrian pushbutton adjacent to a level all-weather surface, the surface should be as level as feasible.

See the TDOT Traffic Design Manual for determining the effective crosswalk length for pedestrian signal design.

Where there are physical constraints that make it impractical to place the pedestrian pushbutton between 1.5 and six (6) feet from the edge of the curb, shoulder, or pavement, it should not be farther than 10 feet from the edge of curb, shoulder, or pavement.

Where two pedestrian pushbuttons are provided on the same corner of a signalized location, the pushbuttons should be separated by a distance of at least 10 feet. However, where there are physical constraints on a corner that make it impractical to provide the 10-foot separation between the two (2) pedestrian pushbuttons, the pushbuttons may be placed closer together or on the same pole.

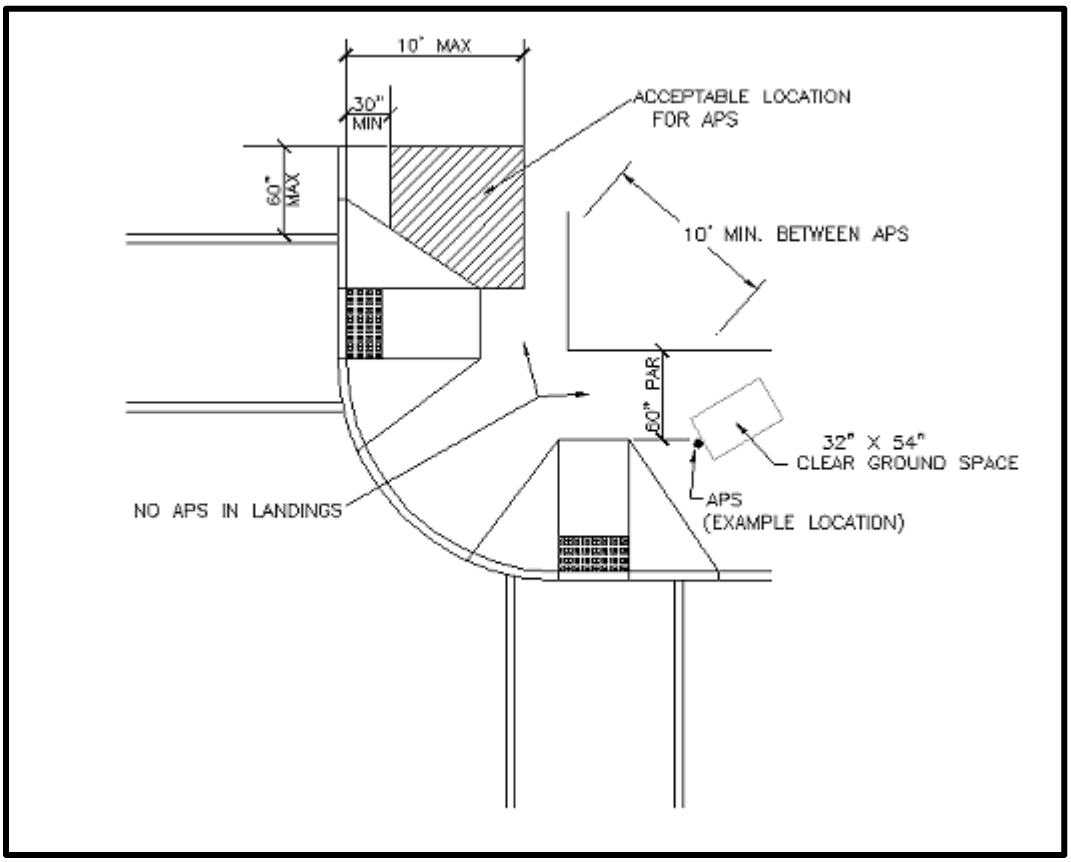


Figure 3-8: Pedestrian Pushbutton Location Detail
Source: PROWAG 2011 Edition Figure X02.5 A

APS - At all locations where pedestrian signals are newly installed, replaced, or significantly modified, the installation of accessible pedestrian signals (APS) and countdown pedestrian displays is required. When APS and countdown pedestrian display improvements are made, they are to be made for all locations associated with the system being improved. APS includes audible and vibrotactile indications of the WALK interval. Installation of these devices may require improvements to existing sidewalks and curb ramps to ensure ADA compliance. APS includes:

- APS pushbuttons shall have a locator tone that operates during the DON'T WALK and the flashing DON'T WALK intervals only
- APS pushbuttons must have both audible and vibrotactile indications of the WALK interval
- APS pushbutton controls and signs shall be installed facing the intersection and be parallel to the crosswalk served
- An APS pushbutton shall have a tactile arrow that indicates the crossing direction activated by the pushbutton

- An APS pushbutton provides high contrast (light-on-dark or dark-on-light) against its background
- If extended pushbutton press features are available, the APS pushbutton shall be marked with three braille dots forming an equilateral triangle in the center of the pushbutton
- If additional crossing time is provided by an extended pushbutton press feature, then an R10-32P (MUTCD) plaque shall be mounted adjacent to or integral with the APS pushbutton
- If the pedestrian clearance time is sufficient only to cross from the curb or shoulder to a median to wait for the next cycle, then an additional APS pushbutton shall be provided in the median
- The desirable spacing between the APS pushbuttons is 10 feet minimum (5 feet minimum spacing on medians and islands), if feasible
- If the spacing between the APS pushbuttons is 10 feet or greater, the audible WALK indication shall be a percussive tone
- If the spacing between the APS pushbuttons is less than 10 feet, the audible WALK indication shall be a speech walk message, and a speech pushbutton information message shall be provided

Refer to the MUTCD for further design guidance.

3-411.00 PEDESTRIAN TREATMENTS AT RAILROAD CROSSINGS

The design of pedestrian facilities that cross railroad tracks often presents challenges due to the conflicting needs of pedestrians and trains. Whenever practicable, align pedestrian crossings perpendicular to the tracks. Crossing surfaces may be constructed of timber planking, rubberized materials, or concrete. Concrete materials generally provide the smoothest and most durable crossing surfaces. When detectable warning surfaces are used at railroad crossings, place them per the MUTCD stop line placement criteria.

3-412.00 BARRIERS AND RAILINGS FOR PEDESTRIAN FACILITIES

When safety rails are needed to protect a pedestrian or bicyclist from steep slopes, drop-offs, or other non-vehicular hazards along a sidewalk or shared-use path, Roadway Standard Drawing MM-BPR-1 or MM-BPR-2 should be referenced.

3-413.00 SIGHT DISTANCE TRIANGLES

The visibility of all users is to be evaluated at intersections. Vehicle operators and bicyclists need to be able to see crossing pedestrians, and pedestrians need to be able to see both motor vehicles and bicyclists. Identifying sight triangles can help determine the optimal configuration of

pedestrian crossings. See the Roadway Standard Drawing RD11-SD-Series for determining sight distance at an intersection.

Visibility is impacted by both speed and the configuration of the intersection. There are multiple benefits in multimodal intersection configurations to proactively manage motorized vehicle speeds at intersection locations. The primary objective at intersections and interchanges is to create a clear, distinct, and predictable travel path for all users through the intersection.

3-414.00 INTERCHANGE CONSIDERATIONS

Crossing pedestrian facilities through an interchange functional area has a greater potential for conflict because of higher travel speeds, possibly higher volumes, and more complex lane configurations. Interchange crossings designed in a manner like intersection crossings are more compatible to pedestrians. For new construction projects where pedestrian (and bicyclist) activity are expected to be high, the Designer should consider an interchange configuration that is more accommodating to these users. These types include diamond interchanges and partial cloverleaf (Parclo) interchanges that do not have free flow turn lanes on the arterial. Examples are shown in *Figure 3-9, Pedestrian and Bicyclist Accessible Interchange Configurations*. If a diverging diamond interchange configuration is selected, current guidance recommends placing pedestrians and bicyclists in the median between the ramps.

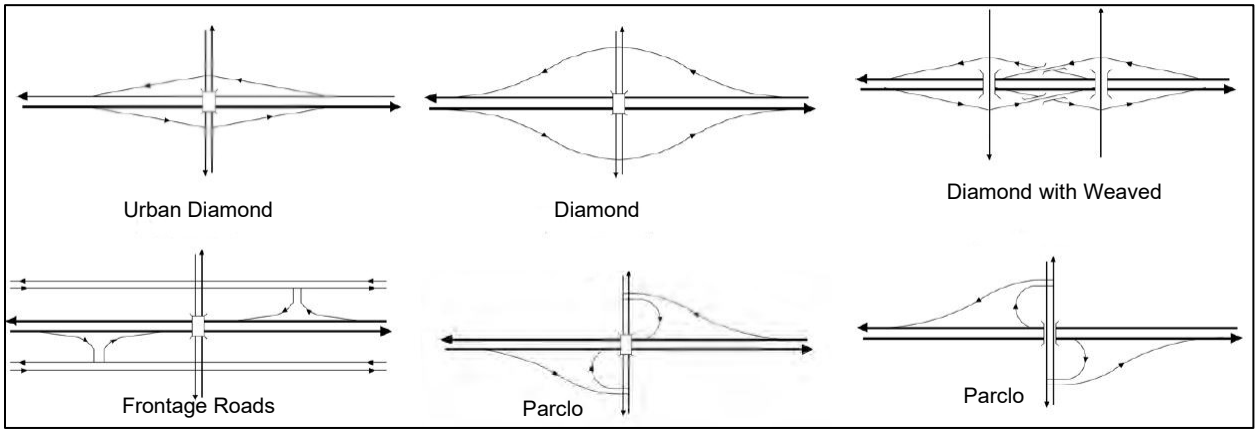


Figure 3-9: Pedestrian and Bicyclist Accessible Interchange Configurations

Examples of interchange configurations that are more difficult to accommodate pedestrians and bicyclists include trumpet interchanges, partial and full cloverleaf interchanges with free flow turn lanes, and single point interchanges (SPUI). Examples are shown in *Figure 3-10, Pedestrian and Bicyclist Challenging Interchange Configurations*.

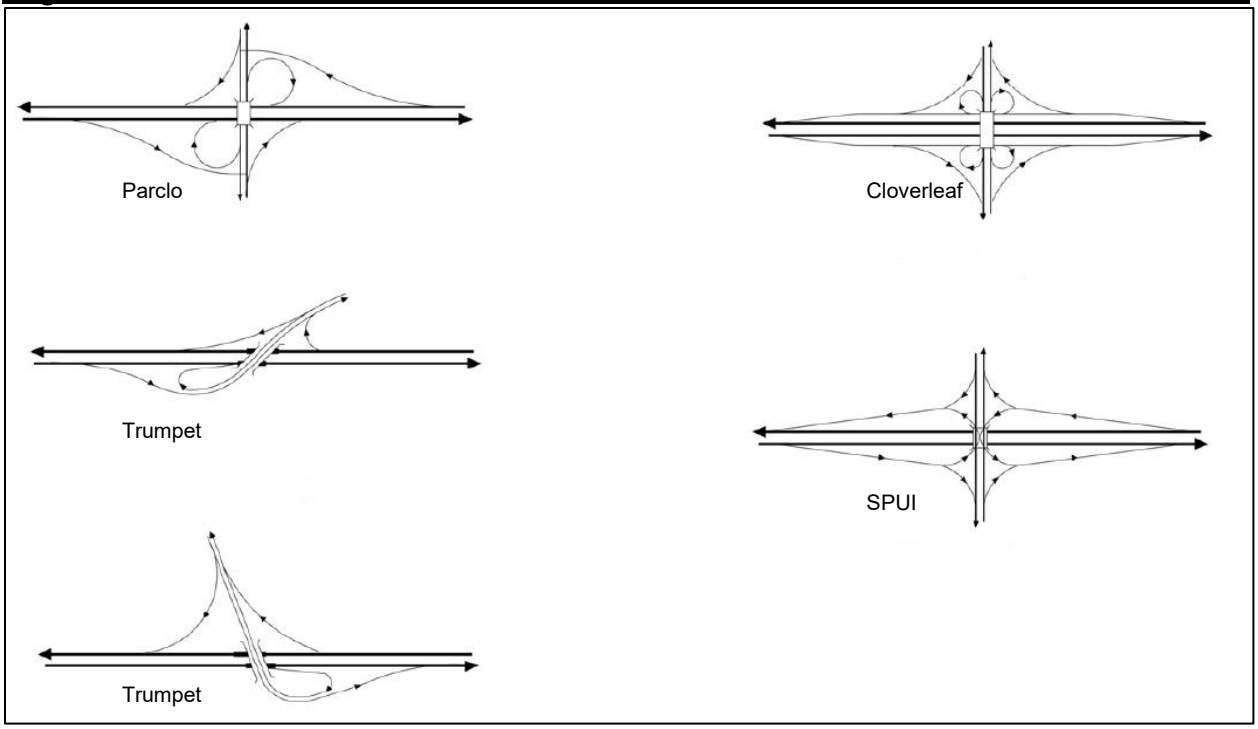


Figure 3-10: Pedestrian and Bicyclist Challenging Interchange Configurations

Figure 3-11, Interchange Ramps illustrates options for pedestrian facilities design through an interchange functional area. The preferred configuration for improved pedestrian safety in an interchange will not provide the motor vehicle free right turn and will realign ramps to intersect perpendicular to the crossroad (see off-ramp terminal in *Figure 3-11, Interchange Ramps*). However, given the modal priorities and operational performance needs of those priorities, this configuration may not always be practicable. In some cases, it is possible to align the pedestrian facility to cross an off-ramp with a more direct path for the crossing.

Consider the inclusion of a refuge island when there are multiple travel lanes. This configuration may also require additional speed management, signing, or pavement marking treatments on the ramp.

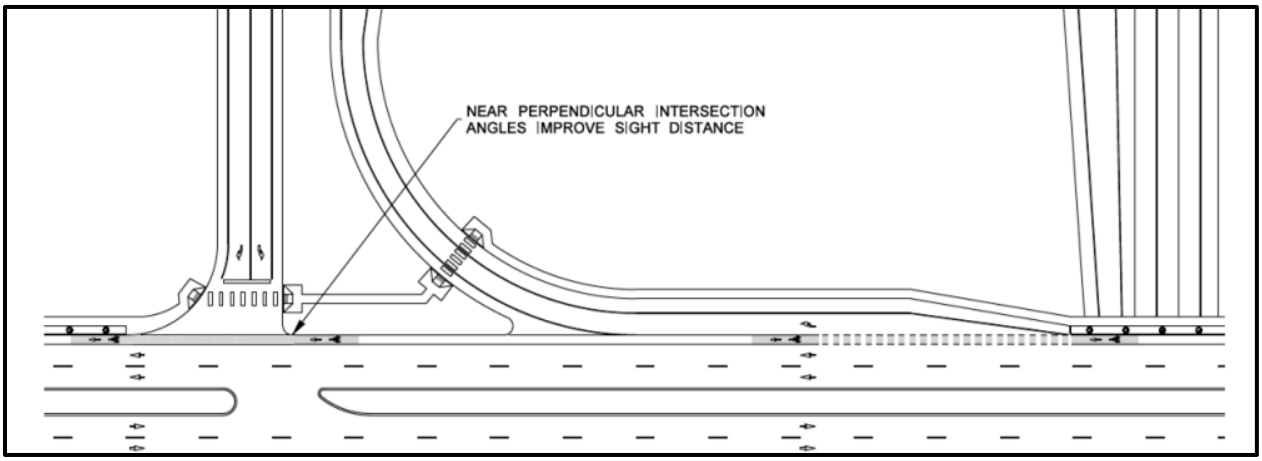


Figure 3-11: Interchange Ramps

3-415.00 BRIDGE CONSIDERATIONS

Bridge projects can be used to make critical new connections in pedestrian networks. In some locations, a truly cohesive network may only exist with bridge connections for non-motorized users. In others, a new bridge may provide a more direct route than the ones currently available. For bridges that already exist, improving both the safety and comfort of non-motorized users may require that the bridge be retrofitted with more appropriate, separated facilities.

Pedestrian accommodations should be provided on bridges whenever possible. Bridges should also accommodate pedestrian facilities traveling under them, so they do not create a barrier. Providing pedestrian accommodation during initial construction generally costs less than retrofitting later. Current design guidance generally provides adequate flexibility on how to best accommodate these users in bridge design projects.

3-416.00 ILLUMINATION AND SIGNING

Illumination of pedestrian crossings and other walkways is an important design consideration because lighting has a major impact on a pedestrian's sense of security. Illumination provided solely for vehicular traffic is not always effective in lighting parallel walkways for pedestrians.

Consider pedestrian-level (mounted at a lower level) lighting for pedestrian circulation paths, intersections, and other pedestrian crossing areas with high nighttime pedestrian activity, such as shopping districts, transit stops, schools, community centers, and other major pedestrian generators or areas with a history of pedestrian crashes.

3-417.00 WORK ZONE PEDESTRIAN ACCOMMODATION

The ADA requires that a public entity maintain its pedestrian facilities in operable working condition, including maintenance of their accessibility features. Construction and maintenance activities often temporarily disrupt these facilities. When this occurs, provide access and mobility for pedestrians through and around work zones. Address this in the temporary traffic control plans if the project occurs in a location accessible to pedestrians. The Designer must determine pedestrian needs in the proposed work zone during the public input process and through field visits. The Work Zone Design Manual should be utilized when addressing pedestrian accommodation.

Some work zone considerations include:

- Project phasing to keep a pedestrian route open at all times (one side of roadway at a time, or working on individual corners at intersections, etc.)
- Separate pedestrians from conflicts with work zone equipment and operations
- Separate pedestrians from traffic moving through or around the work zone
- Provide pedestrians with alternate routes that have accessible and convenient travel paths that duplicate, as closely as feasible, the characteristics of the existing pedestrian facilities

Provide walkways that are clearly marked and pedestrian barriers that are continuous, rigid, and detectable to vision-impaired persons who navigate with a cane. Also, keep:

- The pedestrian head space clear
- Walkways free from pedestrian hazards such as holes, debris, and abrupt changes in grade or terrain
- Access along sidewalks clear of obstructions such as construction traffic control signs
- A minimum clear width path throughout, four (4) feet for pedestrians or 10 feet for pedestrians and bicyclists

- Consider the use of flaggers if pedestrian generators such as schools are in the work zone vicinity. Consider spotters who are prepared to help pedestrians through the work zone.
- Provide for advance public notification of sidewalk closures in the contract special provisions and plans.
- Where transit stops are affected or relocated because of work activity, provide an accessible route to temporary transit stops.

Refer to *Roadway Design Guidelines* Chapter 4-712.00, MUTCD Chapter 6D "Pedestrian and Worker Safety", and TDOT *Work Zone Safety and Mobility Manual* for additional guidance.

3-418.00 PEDESTRIAN ACCESS TO TRANSIT STOPS

The location of transit stops is an important element in providing appropriate pedestrian facilities. Newly constructed transit stops must conform to ADA requirements. Locate and design newly constructed transit stops so that they are accessible from the sidewalk. A transit stop on one side of a street usually has a counterpart on the opposite side because transit routes normally function in both directions on the same roadway. Provide adequate crossing facilities for pedestrians. When locating a transit stop, consider transit ridership and land use demand for the stop. Also, consider compatibility with the following roadway/traffic characteristics:

- ADT
- Traffic speed
- Crossing distance
- Crash history
- Sight distance
- Connectivity to a pedestrian access route
- Traffic generator density

If any of these elements suggests an undesirable location for a pedestrian crossing, consider a controlled crossing or another location for the transit stop.

SECTION 5 – BICYCLE FACILITIES

3-500.00 GENERAL

This chapter is a guide for designing bicycle facilities within state highway right-of-way or for projects using state or federal-aid funds under TDOT's control. Guidance in this chapter includes options for intersection and interchange design. Unique design challenges are resolved using expertise and guidance from the Statewide Bicycle and Pedestrian Coordinator and others involved in the design process.

Bicycle facilities come in a variety of designs that vary by separation from motorized vehicular travel and other users. Except for on very low-speed, low-volume residential streets where pedestrians and bicyclists can comfortably share the roadway with motor vehicles, total physical separation is recommended to increase bicyclists' safety. This can be accomplished with shared-use paths and cycle tracks.

Proposed multimodal facilities must allow sufficient width to allow all users to adhere to the Tennessee Bicycle Laws contained in TCA 55-8-175, which covers expectations of cyclists as well as motor vehicles in regard to occupying public space and safely passing cyclists in a motor vehicle.

3-501.00 TYPES OF BICYCLE FACILITIES

TDOT has adopted the following types of bicycle facilities, generally considered from least protected to most protected from vehicle conflicts. Each is discussed in more detail in the sections that follow.

- On-street shared-use lanes
- Bicycles on shoulders
- Striped on-street bicycle lanes
- Buffered on-street bicycle lanes
- Separated bicycle lanes / cycle tracks
- Shared-use paths

3-501.01 ON-STREET SHARED-USE LANES

A shared lane is a combined motor vehicle and bicycle lane. Shared lanes are generally appropriate on local roads and streets, preferably with lower traffic volumes, and only with posted speed limits of 35 mph and below. Shared lanes employ pavement markings and signage to indicate the combined use. Shared lane markings (aka "sharrows") are pavement markings

specifically used to indicate a shared lane or intersection space. The position of the marking is detailed in Roadway Standard Drawing MM-PM-2.

The speed of cyclists can vary significantly between users and depends on the experience, fitness level of the user, bicycle technology, and roadway grade. If a shared lane is proposed on a hill, a conventional bicycle lane should be considered in the upgrade direction of travel allowing for slower bicycles to climb outside of motor vehicular operation.

3-501.02 BICYCLES ON SHOULDERS

Many rural state highways are used by bicyclists for commuting between cities or for recreation/touring. Providing and maintaining paved shoulders can significantly improve convenience and safety for both bicyclists and motorists along such routes.

Accommodating bicycle users on the shoulder is common on state highways, particularly on rural facilities with posted speeds of 40 mph and above. Shoulder improvements to facilitate bicycle travel include widening the shoulders, improving roadside maintenance (including periodic sweeping), and removing surface obstacles such as drain grates that are not compatible with bicycle tires. A four (4)-foot usable shoulder must be present when the Average Daily Traffic is 1,000 or more and the posted speed limit is 40 mph or above to designate a roadway as a bike route (with signage). If shoulder rumble strips are present, provide for at least four (4) feet of usable shoulder between the rumble strip and the outside edge of shoulder. If guardrail or other barrier is located adjacent to the shoulder, increase the dimension to five (5) feet of usable shoulder. Refer to *Chapter 3-502.00* for further guidance.

Accommodating bicycle use on shoulders is appropriate at many locations. Note, however, that bicycle-on-shoulder accommodations are not dedicated bicycle facilities, and bicycle users do not have the same operating privileges as with striped on-street bicycle lanes. In rural to suburban/urban transition areas, consider converting the shoulder to a protected buffered bicycle lane, both to encourage speed management of motor vehicle users through the transition and to establish a dedicated special-use lane for cyclists to tie into the local bicycle network.

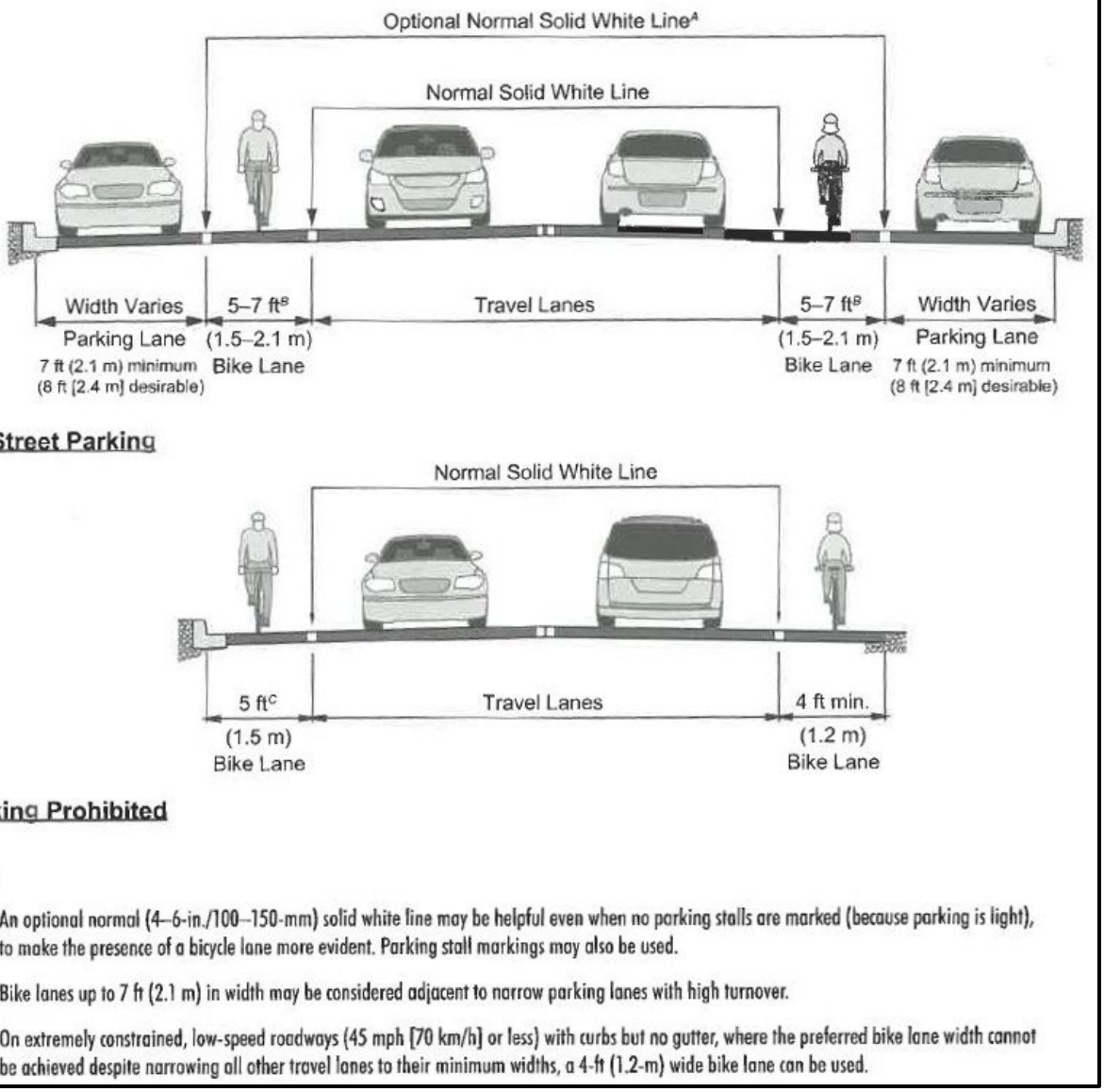
3-501.03 STRIPED ON-STREET BICYCLE LANES

Conventional striped on-street bicycle lanes are at-grade, all-weather pavement and adjacent to motor vehicle traffic lanes. They are designated by a single six (6)-inch solid white stripe between the motor vehicle lane and bicycle lane and supplemented with signs. The following geometric design criteria for bicycle lanes are summarized below.

- Typical bicycle lane width (rideable surface) is five (5) feet on roadways with curb and gutter
- Minimum width is four (4) feet
- Maximum width is eight (8) feet, but should typically be buffered so that they are not mistaken for a motor vehicle or parking lane

- Along sections of roadway with curb and gutter, a usable width of four (4) feet measured from the longitudinal joint between the gutter and bicycle lane to the center of the bicycle lane pavement marking line is recommended; in areas where four (4) feet cannot be achieved due to constraints, the absolute minimum width is three (3) feet
- Buffered or separated bicycle lanes are preferred to non-buffered or non-separated lanes and required on facilities with speed limits above 40 mph
- Minimum bicycle lane width adjacent to on-street parking is five (5) feet unless there is a marked buffer between the bicycle lane and on-street parking. Bicycle lane widths of six (6) or seven (7) feet are preferred adjacent to on-street parking lanes. Where on-street parking is permitted, delineating the bicycle lane with two stripes, one on the street side and one on the parking side, is preferable to a single stripe
- For bicycle lanes four (4) to five (5) feet wide, an additional two (2)- to one (1)-foot offset (respectively) from the edge of the paved shoulder is required to vertical elements over six (6) inches in height (such as guardrail)
- Gutter seams, drainage inlets, and utility covers should be flush with the pavement and oriented to prevent conflicts with bicycle tires (perpendicular to direction of travel)
- Bicycle lanes on one-way streets should generally be on the right side of the traveled way and should always be provided on both legs of a one-way couplet. The bicycle lane may be placed on the left side of a one-way street if it decreases the number of conflicts (e.g., those caused by driveway openings, heavy bus traffic, or parking) and if bicyclists can safely and conveniently transition in and out of the bicycle lane. If sufficient width exists, the bicycle lanes can be striped on both sides of a one-way street
- Where on-street parking is provided, bicycle lanes are generally striped on the left side of the parking lane

Refer to *Figure 3-12, Striped On-Street Bicycle Dimensions* and *Chapter 3-502.00* for further guidance. Additionally, Roadway Standard Drawings MM-PM-2 through MM-PM-5 should be referenced concerning signing and pavement markings for bicycle lanes. Any deviation from these Standard Drawings requires approval by the TDOT Roadway Design Division. Refer to *Chapter 3-908.00* for additional information concerning the Design Waiver process and forms.



Notes:

A An optional normal (4–6-in./100–150-mm) solid white line may be helpful even when no parking stalls are marked (because parking is light), to make the presence of a bicycle lane more evident. Parking stall markings may also be used.

B Bike lanes up to 7 ft (2.1 m) in width may be considered adjacent to narrow parking lanes with high turnover.

C On extremely constrained, low-speed roadways (45 mph [70 km/h] or less) with curbs but no gutter, where the preferred bike lane width cannot be achieved despite narrowing all other travel lanes to their minimum widths, a 4-ft (1.2-m) wide bike lane can be used.

Source: AASHTO Guide for the Development of Bicycle Facilities, 4th Edition

Figure 3-12: Striped On-Street Bicycle Dimensions

3-501.04 BUFFERED ON-STREET BICYCLE LANES

Buffered bicycle lanes are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. The buffer space is created with pavement markings. When a buffer is placed between the traveled way and a bicycle lane, it improves safety by separating bicyclists from moving motor vehicles. A buffer can also be placed between on-street parking lanes and bicycle lanes. When that configuration is selected, bicyclists have less risk of being hit by a car door being opened from a parked car. Both locations are acceptable, and the preferred placement of the buffer(s)

depends upon local conditions. Buffered bicycle lanes provide the following advantages when compared to conventional bicycle lanes.

- Provide greater distance between bicyclists and motor vehicles
- Provide space for faster moving bicyclists to pass slower moving bicyclists without having to encroach into the motor vehicle travel lane
- Provide a greater space for bicycling without making the bicycle lane appear so wide that it might be mistaken for a travel lane or a parking lane
- Appeal to a wider range of bicyclists and encourages bicycling

3-501.05 SEPARATED BICYCLE LANES / CYCLE TRACKS

Separated bicycle lanes, also referred to as a cycle track or protected bicycle lanes, include bicycle lanes, a buffer area, and some type of vertical feature that reduces the likelihood of encroachment into the bicycle lane by motor vehicles and increases user comfort. The most common type of vertical separator used within the buffer area is a pavement-mounted flexible tubular marker or delineator. Use of dual-faced curbing, raised medians, or the parking zone adjoining the buffer area can also accomplish the same task.

For added separation between bicyclists and motorists, the bicycle lanes can be curb separated and raised (not at-grade with the street). When a raised and curb-separated bicycle facility is provided, it is considered part of the street-side zone; however, it cannot be combined with other zone areas because the intent is also segregation from pedestrians. The raised and curb-separated facility is dedicated for bicycle users and delineated with pavement markings and signing. In instances of multiple driveway entrances occurring across an elevated/separated bicycle facility, the Designer should strive to keep the bicycle facility elevated across entrances to yield a better user experience for cyclists.

Dimensions for separated bicycle lanes should typically follow the guidance provided for other bicycle facilities noted in *Chapter 3 - Sections 5 and Section 6*.

3-501.06 SHARED-USE PATH / SIDEPATH

Shared-use paths are designed for both transportation and recreational purposes and are used by pedestrians, bicyclists, skaters, and other users. Shared-use paths shall comply with all ADA standards. If a shared-use path is not serving the roadway, the running slope can be no greater than five (5) percent. Where a shared-use path is designed to parallel a roadway, the facility is a physical separation between the shared-use path users and the vehicular traveled way should be provided in accordance with this chapter.

As with any roadway project, shared-use path projects need to serve and fit into the context of multimodal activity along and across the corridor. When designing shared-use paths, the bicyclist may not be the critical design user for every element of design. For example, the crossing speeds of most intersections between roads and pathways should be designed for

pedestrians, as they are the slowest users. The design goal is to efficiently accommodate all intended users to minimize conflict potential between modes to the maximum extent possible.

Since shared-use paths serve both bicyclists and pedestrians, as well as other types of users, they are addressed separately in *Chapter 3 - Section 6.*

3-502.00 BICYCLE FACILITY SELECTION

Bicycle facility selection is influenced by the needs, range, connectivity, efficiency, and safety of cyclists. Roadway Standard Drawing MM-TS-1 provides the minimum bicycle accommodation guidance under various ADT volumes and posted speeds for rural and urban cross sections.

3-503.00 BICYCLES AT INTERSECTIONS

The principal objective when designing intersections for bicycle mobility and safety performance is to provide a visible, distinct, predictable, and clearly designated path leading to and through the intersection while managing potential conflicts between all other users and cyclists.

Several proven state-of-the-practice intersection treatments are presented within this section. However, pavement marking or aspects concerning the configuration may not currently be supported by the MUTCD. At the time of publication, bicycle boxes have received Interim Approval from FHWA and are allowed for use upon making the request to FHWA.

3-504.00 APPROACH THROUGH LANES

The approach to intersections needs to balance the bicycle user's safety needs with the mobility needs of other users. The conflict between right-turning vehicles and through bicyclists is a serious crash risk at many intersections. Clear delineation of user lanes and potential conflict areas is currently the treatment most commonly used to manage the approach to intersections. Dotted lines can be used to identify the conflict area. Colored pavement markings can be used to further enhance and delineate the conflict area. *Figure 3-13, Right Turn Movements Across Bicycle Lanes*, shows different applications of the approach through-lane marking treatment most likely to be encountered.

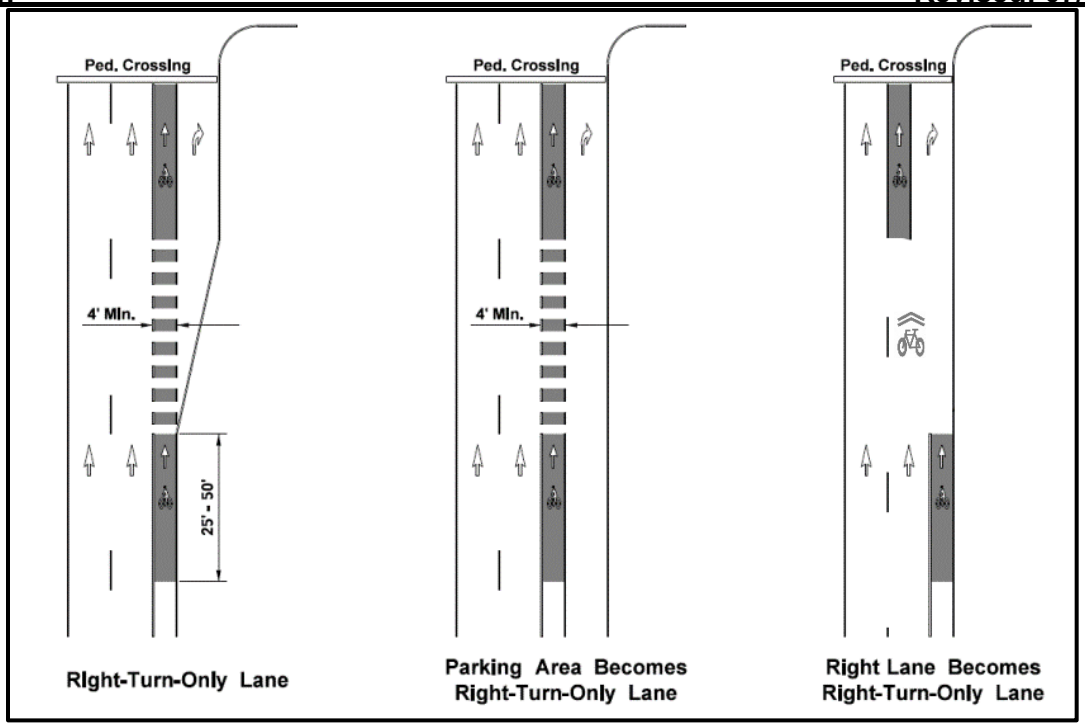


Figure 3-13: Right Turn Movements Across Bicycle Lanes

3-505.00 BICYCLE BOXES

Bicycle boxes are designated areas for bicyclists positioned across and in front of the bicycle and motor vehicle lanes as shown in *Figure 3-14, Typical Bicycle Box Application*. Bicycle boxes are used at signalized intersections and increase both mobility and safety performance for the bicycle mode. Applying a bicycle box assists mobility performance by prioritizing the bicycle movement at an intersection and enables a cyclist to more easily position for a left-turn movement. Bicycle boxes have also been found to prevent cyclist and motor vehicle encroachment into the pedestrian crossing, reducing conflicts with pedestrians at intersections. Bicycle safety performance is improved by increasing the visibility of the cyclist, and by reducing conflicts between motor vehicles making a right turn and the bicycle through movement (also known as “right-hook” conflict).

Bicycle boxes are not desirable on multi-lane streets. In situations where bicycle boxes are being considered across through and left-turn lanes, the bicycle box should extend across the entire intersection. The exception to this is if more than one left turn lane is present, then the bicycle box shall only extend across the right-most left-turn lane adjacent to the through lanes. Special accommodations should be made to allow the cyclists to potentially cross with a pedestrian movement to avoid cyclists crossing in front of through moving traffic during a phase change.

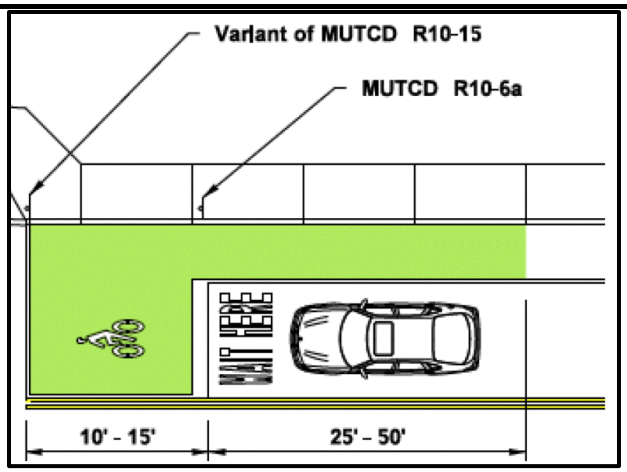


Figure 3-14: Typical Bicycle Box Application
Source: Washington State Department of Transportation, *Chapter 1520, Roadway Bicycle Facilities*

3-506.00 DRAINAGE GRATES / INLETS / JUNCTIONS

When drainage grates or manhole covers are in a bicycle lane, their effect on bicyclists can be minimized by providing three (3) feet of lateral clearance between the edge of a drainage inlet grate and the bicycle lane stripe. Grates and manhole covers should be installed and maintained level with the surface of the bicycle lane. Provide drainage inlet grates on bicycle facilities that have openings narrow enough and short enough that bicycle tires will not be caught by the grates. Replace existing grates that are not designed for bicycles with a TDOT-approved grate with an opening four (4) inches or less center to center and perpendicular to the direction of travel. Any grate that falls within the crosswalk must comply with ADA and the long dimension of the opening shall be perpendicular to the direction of the pedestrian travel.

Design considerations for usability of the bicycle lane should take into consideration the ability for cyclists to continue to utilize facilities during rain events with corresponding drainage gutter spreads.

3-507.00 PAVEMENT MARKINGS

All bicycle signing, marking, signalization and traffic control is governed by the MUTCD and TDOT Standards.

3-508.00 RAILROAD CROSSINGS

The design of bicycle facilities that cross railroad tracks often presents challenges due to the conflicting needs of bicyclists and trains. Whenever practicable, align bicycle crossings perpendicular to the tracks to minimize potential problems related to crossing the tracks (see *Figure 3-15, Bicycle/Railroad Crossings*). Crossing surfaces may be constructed of timber

planking, rubberized materials, or concrete. Concrete materials generally provide the smoothest and most durable crossing surfaces.

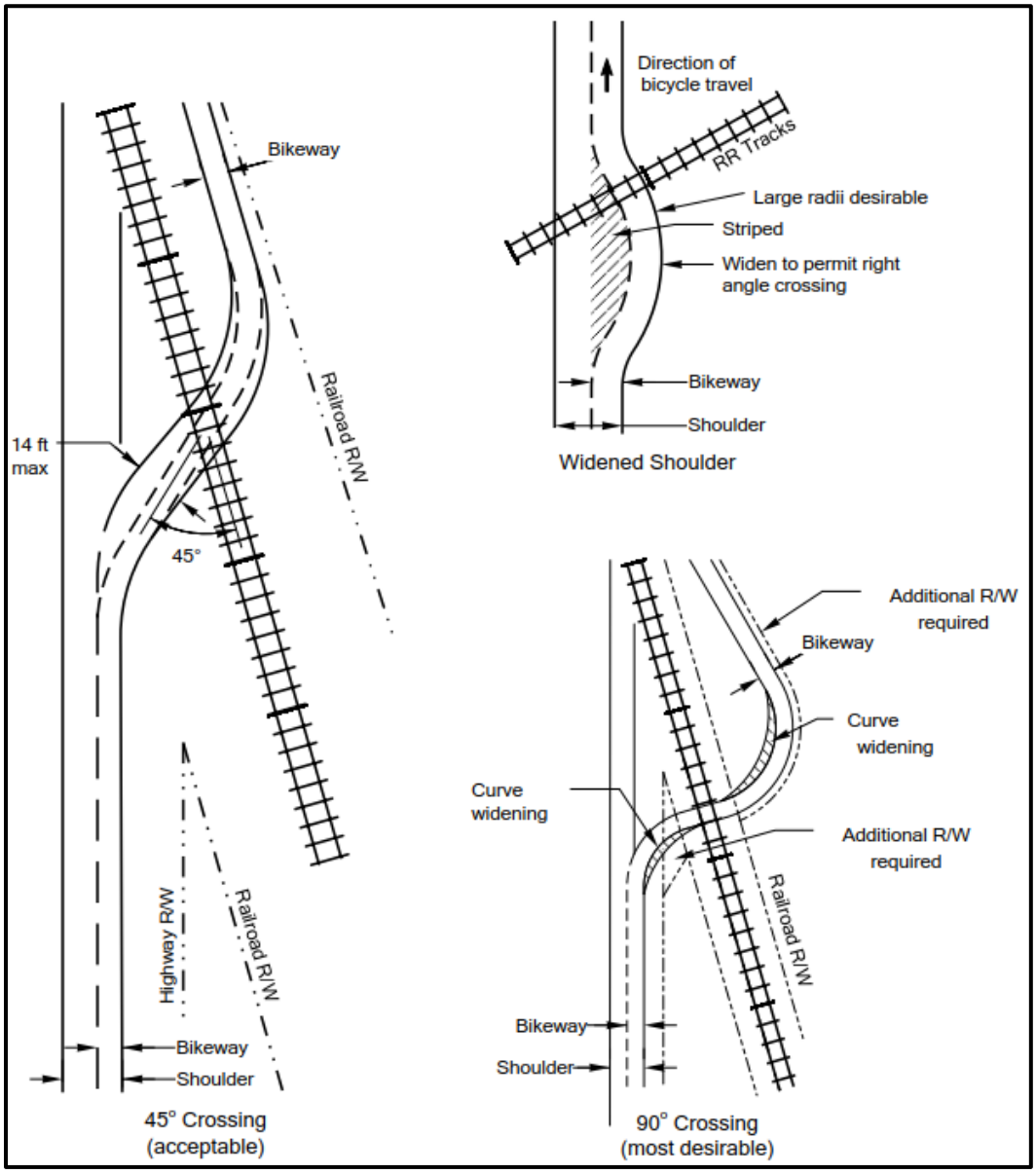


Figure 3-15: Bicycle / Railroad Crossings

Whenever a bicycle lane crosses railroad tracks, continue the crossing at least as wide as the bicycle lane. Wherever possible, design the crossing at right angles to the rails. Where a skew is unavoidable, widen the shoulder or bicycle lane to permit bicyclists to cross at right angles. See Roadway Standard Drawing MM-TM-1.

3-509.00 BRIDGE CONSIDERATIONS

Bridge projects can be used to make critical new connections in bicycle networks. In some locations, a truly cohesive network may only exist with bridge connections for alternate transportation. In others, a new bridge may provide a more direct route than the ones currently available. For bridges that already exist, improving both the safety and comfort of non-motorized users may require a bridge to be retrofitted with more appropriate, separated facilities.

Bridges should also accommodate bicycle facilities traveling under them, so they do not create a barrier. Providing bicycle accommodation during initial construction generally costs less than retrofitting later.

3-510.00 BARRIERS AND RAILINGS

When safety rails are needed to protect a bicyclist from steep slopes, drop-offs, or other non-vehicular hazards along a bicycle facility or shared-use path, Roadway Standard Drawing MM-BPR-1 should be referenced.

When the edge of the bicycle lane is within five (5) feet of a barrier or railing, provide a barrier height of 42 inches or more to reduce the potential for bicyclists to fall over the barrier (see *Figure 3-16 Barrier and Railing Application*). On a bridge or bridge approach where high-speed, high-angle impacts with a railing, fence, or barrier are more likely to occur (such as short radius curves with restricted sight distance or at the end of a long, descending grade) or in locations with site specific safety concerns, a higher, 48-inch or 54-inch railing should be considered. When the bicycle facility is adjacent to a barrier, consider a single slope barrier to mitigate for pedal movement conflicts. On structures, the bridge railing type and height are part of the structure design. Contact the TDOT Headquarters Bridge and Structures Office for additional information.

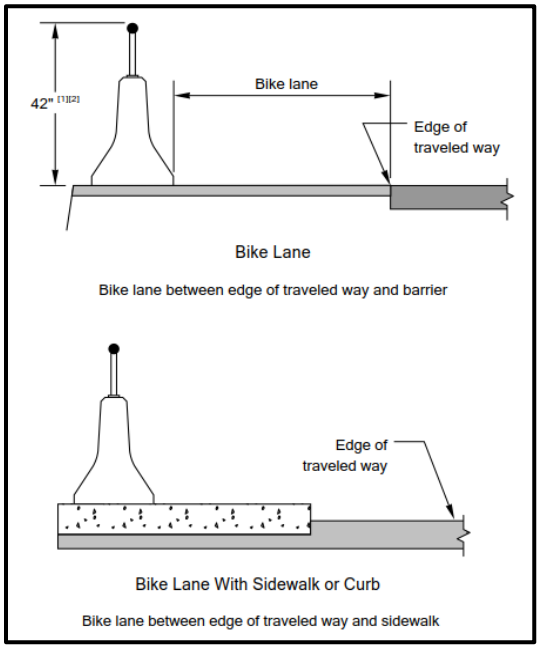


Figure 3-16: Barrier and Railing Application

3-511.00 SIGHT DISTANCE TRIANGLES

See *Chapter 3-413.00* for a discussion on sight distance triangles. The concepts are the same for pedestrian and bicycle facilities.

3-512.00 INTERCHANGE CONSIDERATIONS

See *Chapter 3-414.00* for a discussion on interchange considerations. Many of the concepts are the same for pedestrian and bicycle facilities. If the bicycle shifts onto the sidewalk cyclist must dismount

Additional pavement marking and separated path configurations for bicycle facilities through interchanges are provided in *Figure 3-17,Optional Separated Bicycle Facility Across Free-Flow Exit Ramp,* through *Figure 3-19, Separated Bicycle Facility Across Free-Flow Entrance Ramp.*

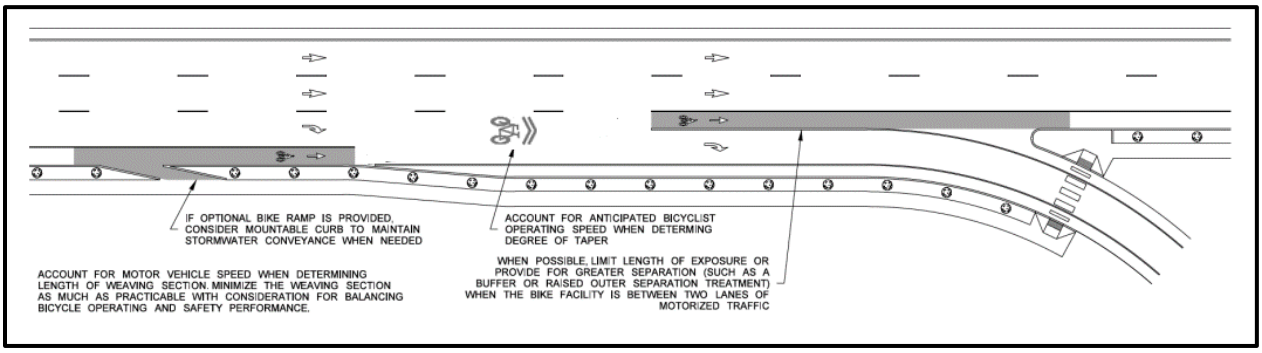


Figure 3-17: Optional Separated Bicycle Facility Across Free-Flow Exit Ramp

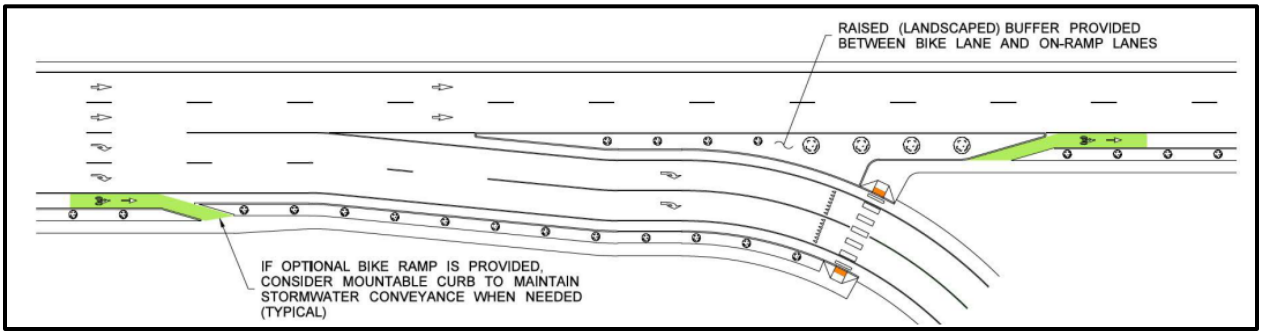


Figure 3-18: Non-Optional Separated Bicycle Facility Across Two-Lane Free-Flow Exit Ramp

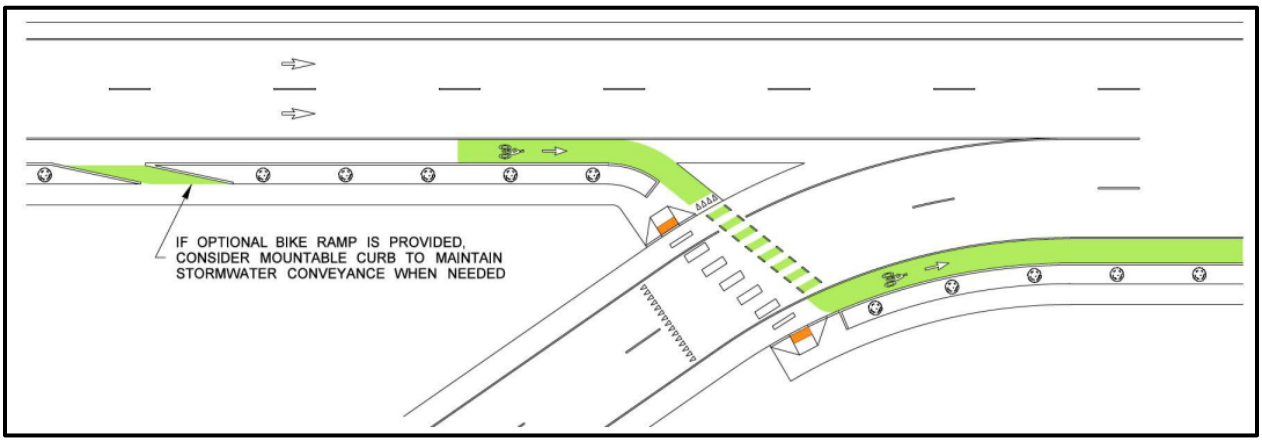


Figure 3-19: Separated Bicycle Facility Across Free-Flow Entrance Ramp

SECTION 6 – SHARED-USE PATHS

3-600.00 GENERAL

A shared-use path is a combined bikeway and pedestrian facility located within an independent right-of-way, or located within the street right-of-way, and physically separated from motor vehicle traffic by an open space or barrier.

Most shared-use paths are designated for two-way travel and are designed for both transportation and recreational purposes. Shared-use path design is similar to roadway design, but on a smaller scale and with lower design speeds. Shared-use paths shall comply to all ADA Standards. Shared-use paths are also to be used by pedestrians, skaters, and other non-motorized users and should be designed accordingly.

As with any roadway project, shared-use path projects need to serve and fit into the context of multimodal activity along and across the corridor. When designing shared-use paths, the bicyclist may not be the critical design user for every element of design. Shared-use paths have a maximum of five (5) percent running slope. The crossing speeds of most intersections between roads and pathways should be designed for pedestrians, as they are the slowest users. The design goal is to efficiently accommodate all intended users and minimize conflict potential between modes to the maximum extent possible. Additionally, when designing such facilities, wayfinding should be considered to ensure that all users have adequate information to direct them to their intended destinations.

3-601.00 DESIGN SPEED AND CAPACITY

The design speed for a shared-use path is based on the bicycle user and is dependent on the terrain and the expected conditions of use. The minimum design speed for shared-use paths is 18 mph. All design plan title sheets shall include proposed facility design speed and capacity.

3-602.00 GRADES

Where shared-use paths are contained within a roadway right-of-way, the grade shall not exceed the general grade established for the adjacent roadway. Where shared-use paths are not contained within a roadway right-of-way, the grade shall be five (5) percent maximum.

3-603.00 HORIZONTAL AND VERTICAL CURVES

Geometric design of horizontal curves, vertical curves, stopping sight distance, and horizontal sight distance shall generally follow the guidelines in the latest edition of the AASHTO Guide for the Development of Bicycle Facilities.

The minimum horizontal curve radius is 60 feet. At a location where a design waiver is granted for a curve with a radius less than 60 feet, a Curve or Turn Warning Sign shall be placed in advance of the curve (see MUTCD Chapter 9B for additional guidance).

When minimum radius curves cannot be obtained because of right-of-way, topographical, or other constraints, consider installing the following mitigation measures to slow bicyclists when approaching curves: intermittent curves to slow or maintain desired speeds, standard curve warning signs and supplemental pavement markings in accordance with the MUTCD, perpendicular stripes painted on the pathway in decreasing intervals to provide the perception of increased speed, and changes in pavement texture to encourage reductions in speed at tight curve approaches. The negative effects of tight radius curves can also be partially offset by widening the pavement through the curves. Shared-use paths shall not be super elevated in curves. A 1.5 percent cross slope shall be maintained. See Roadway Standard Drawing MM-TS-3.

3-604.00 PATH WIDTHS

The standard shared-use path width is 10 feet, with two (2)-foot clear zones on either side of the path. In constrained locations, the width can be reduced to eight (8) feet when severe constraints are present. However, it must be recognized that narrower widths will yield lower levels of service during peak hour use of the facility. A design waiver request must be made in order to utilize widths less than 10 feet. As part of the design waiver request, a level of service study demonstrating acceptable operations with the narrower widths may be required.

On bridges or in tunnels, it is common to pave the entire shared-use path, including clear zones. This usable width can be advantageous for emergency, patrol, and maintenance vehicles and allows for maneuvering around pedestrians and bicyclists who may have stopped. It also keeps the structure uncluttered of any loose gravel shoulder material.

3-605.00 ADA REQUIREMENTS

Shared-use paths must meet all applicable TDOT and ADA/PROWAG requirements to the maximum extent feasible or to the extent it is not structurally impracticable.

3-606.00 OFFSETS FROM ROADWAY

When the shared-use path is located parallel to a curbed roadway with a design speed of 45 mph or less, an eight (8)-foot minimum lateral offset from the edge of the adjacent travel lane is required including shoulder width. Additional separation beyond the minimum is preferred when feasible.

When the roadway does not have curb, the minimum buffer of eight (8) feet or the dimensions listed in *Table 3-2, Pedestrian Route Buffer Requirements by Vehicle Operating Speed* between traveled lane and the shared-use path should be maintained. Where a ditch is present, the shared-use path should be placed on the far side of the ditch. If the appropriate buffer cannot be attained, a physical barrier may be required.

When driveways are present, designing the two (2) feet grass strip is preferred. Gras strip allows the sloped driveway apron to be placed without interfering with the sidewalk or shared-use path longitudinal slope and maintains the facility at constant grade.

If the shared-use path is located within the clear zone of the roadway, consideration should be given to a crash-worthy barrier to protect the users of the path.

3-607.00 PATH CLEARANCES

A two (2)-foot wide clear zone, or lateral clearance, with maximum 6:1 fill slope on each side of the paved surface is to be provided. Sections bound by a structure, such as a pedestrian/bicycle rail, may reduce the lateral offset to one foot (see Roadway Standard Drawing MM-TS-3).

The minimum vertical clearance to obstructions shall be ten (10) feet to permit passage of maintenance and emergency vehicles and to provide adequate vertical shy distance. In locations with extreme limitations the clearance may be reduced to eight (8) feet.

3-608.00 CROSS SLOPES

TDOT's standard cross slope for shared-use paths is 1.5 percent in order to allow for construction tolerances to not exceed two (2) percent. A cross slope between one (1) percent and two (2) percent is allowable. A cross slope of less than one (1) percent would not shed water after a rain event. Graded areas adjacent to the shared-use path must allow water to drain off and away from the path.

At fill sections, the typical crown is placed on center with a maximum 1.5 percent cross slope. Cut and fill sections may use a single slope from the cut edge toward the fill section with a maximum 1.5 percent cross slope.

3-609.00 DRAINAGE

Shared-use paths in cut sections or adjacent to gravity/retaining walls need to consider additional drainage requirements to minimize ponding after a rain event. No concentrated offsite runoff over the shared-use path is allowed. TDOT Standard Drawing MM-SW-2 provides guidance for pedestrian-scale drainage structures adjacent to shared-use paths.

3-610.00 STRUCTURES ON PATHS

The proposed structure width must follow the above paved path guideline with an additional one-foot lateral clearance on both sides and proper safety rail (see Standard Drawing MM-TS-3).

3-611.00 INTERSECTIONS AND CROSSINGS DESIGN

At intersections with roadways, the path design should clearly define who has the right-of-way and provide sight distance for all users at shared-use path and roadway intersections. The common types of shared-use path/roadway at-grade intersection crossings are midblock and adjacent. Intersections with roadways require truncated domes the full width of the shared-use path. If a ramp is required, the ramp will be the width of the entire shared use path.

Midblock crossings are located between roadway intersections. When possible, locate the path crossings far enough away from intersections to minimize conflicts between the path users and turning motor vehicle traffic. It is preferable for midblock path crossings to intersect the roadway at an angle as close to perpendicular as practicable. A minimum 60-degree crossing angle is acceptable to minimize right-of-way needs.

The primary considerations when designing midblock crossings include traffic, right-of-way assignments, traffic control devices, sight distances for both path users and motor vehicle operators, refuge island use, access control, and pavement markings.

Adjacent path crossings occur where a path crosses an existing intersection of two roadways, a T intersection (including driveways), or a four-way intersection. It is desirable to integrate this type of crossing close to an intersection so that motorists and path users recognize one another as intersecting traffic. The path user faces potential conflicts with motor vehicles turning left and right from the parallel roadway and on the crossed roadway.

3-612.00 SIGHT DISTANCE TRIANGLES

See *Chapter 3-413.00* for a discussion on sight distance triangles.

3-613.00 BARRIERS AND RAILINGS

See *Chapter 3-412.00* and *Chapter 3-510.00*.

3-614.00 SIGNING AND MARKING

The public may confuse shared-use paths parallel to the roadway with sidewalks. Since bicycles are prohibited from use on sidewalks in many areas, pedestrian-scale signing should be considered to denote shared-use paths. Adequate signing is also needed where shared-use paths intersect roadways and other paths.

Pavement markings are considered optional on shared-use paths. Sections 9B and 9C of the MUTCD should be referenced for shared-use path signing and pavement marking guidance, along with TDOT Standard Drawing MM-PM-1.

Special attention should be paid to the bike route begin/end signs and intersection warning sign requirements in Standard Drawing MM-PM-1.

Additionally, curve and steep grade warning signs are recommended where applicable on shared-use paths. At a minimum, curve warning signs shall be placed in advance of curves with radii that are less than 60 feet. Grade warning signs shall be placed based on engineering judgement but should be considered when the grade exceeds five (5) percent.

Warning signs shall be placed a minimum of 50 feet in advance of locations where the curve radius is smaller than the required 60 feet. They shall also be placed two (2) feet (minimum) offset from paved surfaces. See Roadway Standard Drawing MM-TS-3). All path intersections with roadways shall have proper pavement marking and signage for both facilities. See Roadway Standard Drawing MM-PM-1. All signs shall adhere to the minimum sizes specified in the MUTCD, Section 9B.02.

SECTION 7 – TRANSIT FACILITIES

3-700.00 GENERAL

This chapter provides general site and design information for bus transit facilities. It is intended for TDOT engineering and planning staff, local transit providers, developers, and local agencies engaged in the collaborative development of transit facilities on or adjacent to state highways and state or federally funded projects. Facilities for more advanced Bus Rapid Transit (BRT), street trolleys, light rail, and heavy rail transit services and their vehicles/stations are not addressed in this chapter. Guidance for the design and operation of these facilities can be found in AASHTO's *Guide for Geometric Design of Transit Facilities on Highways and Streets.*

3-701.00 ACCOMMODATING TRANSIT USERS

Transit serves a vital transportation function by providing people with freedom of movement and access to employment, schools, community and recreational facilities, medical care, and shopping centers. Transit directly benefits those who choose this form of travel, as well as those who have no other choice or means of travel. Transit also benefits motor vehicle users by helping to reduce congestion on roadway networks. People with disabilities rely heavily on public transit.

A vital part of the success of a transit system depends on the availability of convenient and accessible facilities. Accordingly, transit user accommodations along and across roadways served by transit (and on streets that lead to transit corridors) shall provide ADA accessible pedestrian and bicycle facilities. Users also commonly access transit by personal car and taxi, as well as other modes of transit. Transit user accommodations are typically applicable:

- Within a 0.75-mile pedestrian and bicycle catchment area of an existing fixed-route transit facility (i.e., stop, station, or park-and-ride lot). A catchment area is defined by a radial distance from a transit facility per Federal Transit Administration (FTA) guidelines - this includes crossing and intersecting streets.
- Between transit stops/stations and local destinations. Midblock crosswalks should be considered at transit stops located more than 0.25 mile of a signalized or stop controlled intersection.

3-702.00 BUS STOP ACCESSIBILITY

Waiting for, boarding, and alighting from transit typically takes place in the sidewalk corridor. Transit stops should be located where boarding and alighting areas are accessible. Specific requirements for transit stops are provided in PROWAG, Section R308 *Transit Stops and Transit Shelters.*

Within the boarding areas, accessibility requirements mandate that slopes meet pedestrian access route standards: the grade parallel to the road must equal the roadway slope to the maximum extent practicable, while the cross slope (perpendicular to the road) shall be a maximum of 1.5 percent.

Each boarding and alighting area must provide a clear area five (5) feet wide (parallel to the roadway) by eight (8) feet long (perpendicular to the roadway) to accommodate the extension of assistive lifts from accessible buses and allow for wheelchairs to maneuver onto and off of the lift. This space should be clear of all obstructions. In constrained corridors with infrequent bus service and low sidewalk volumes, it may overlap other clear spaces, such as the pedestrian access route.

3-703.00 CURB EXTENSIONS / BUS BULBS

Bus bulbs are curb extensions utilized primarily for serving a bus stop. Curb extensions are typically applicable along curbed streets with on-street parking or shoulders. Curb extensions are typically six (6) feet in width. Their length should allow passengers to use the front and back doors of a bus. For reference, a standard bus is 40 feet long and an articulated bus is 60 feet long.

Besides reducing the pedestrian crossing distances, curb extensions can reduce the impact to parking compared to typical bus zones, mitigate traffic conflicts with autos for buses merging back into the traffic stream, make crossing pedestrians more visible to drivers, and create additional space for passenger queuing and amenities on the sidewalk, such as a shelter and/ or a bench.

3-704.00 BUS STOPS AND TURNOUTS

TDOT promotes public transportation services on state highways, including transit routes and stops. On limited access facilities, bus stops are only allowed at designated locations.

The bus stop is the point of contact between the passenger and the transit services. Bus stops may be located either within the travel lane, or outside the travel lane in a turnout (see *Figure 3-20, Bus Turnout Example*). The simplest bus stop is a location by the side of the road. The highest quality bus stop is an area that provides passenger amenities and protection from the weather. Bus stops are typically maintained by the transit agency. The bus boarding and alighting pad, the walkway to the shelter, and the area within the shelter must meet the requirements for ADA and TDOT Standards.

Transit agencies identify bus stop locations, including on State Routes and/or state right-of-way. Transit agencies shall ensure bus stops have adequate sight distance and universal access requirements at the proposed locations. TDOT strongly recommends that transit agencies coordinate with TDOT on new or updated bus stop locations, especially if passenger amenities and shelters are to be constructed within state right-of-way. Transit agencies shall contact the

TDOT Office of Community Transportation (OCT) for coordination and guidance purposes. The goal of this coordination and collaboration is to meet the needs of transit users and motorists while also improving pedestrian safety and connectivity. This collaborative development and planning of transit facilities is important not only for the Department, but also for the public transit agencies, to fulfill their ADA requirements. Since TDOT adopted PROWAG, all future projects using state or federal funds or TDOT right-of-way shall meet the requirements of PROWAG Section R308 "*Transit Stops and Transit Shelters*".

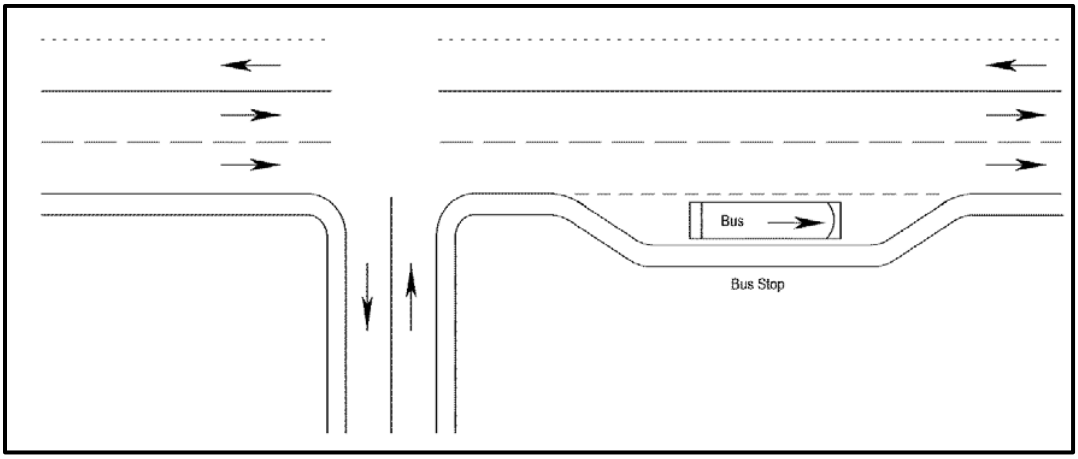


Figure 3-20: Bus Turnout Example

3-705.00 BUS STOP PLACEMENT GUIDANCE

The information in this section is offered as an example of good practice and is not intended to be binding by either the transit agency or TDOT. Placement of bus stops addresses the needs and convenience of transit providers, riders, and highway or street operations. Basic considerations include:

- The need for convenient service for patrons
- Access for people with disabilities
- Convenient passenger transfers to other intersecting bus routes or transfer points
- Connection to nearby pedestrian circulation systems
- Presence and width of sidewalks, crosswalks, and curb ramps
- Pedestrian activity through intersections
- Ability of the stop to accommodate transit dwell time and the loading/unloading of wheelchairs and bicycles
- Adequate curb space for the number of buses expected at the stop at one time
- Ease of re-entering traffic stream (if a turnout)
- Design characteristics and operational considerations of the highway or street

- Presence of on-street automobile parking and truck delivery zones
- Traffic control devices near the bus stop, such as signals or stop signs
- Volumes and turning movements of other traffic, including bicycles
- Proximity and traffic volumes of nearby driveways
- Street grade
- Proximity to rail crossings
- Accommodating transit priority equipment at signalized intersections
- Transit queue bypass at signalized intersections
- Often stops are paired on each side of a highway or street
- Proximity to intersections

Where blocks are exceptionally long or where bus patrons are concentrated well away from intersections, midblock bus stops and midblock crosswalks may be beneficial. *See Chapter 3-407.00* for more information on midblock crossings.

It is common to clearly mark the bus stop as a NO PARKING zone or as a BUS ONLY zone with signs and/or curb painting.

Typically, the preferred location for bus stops at an intersection is the near or far side of the intersection. Intersection stops provide the best pedestrian accessibility from both sides of the street and the cross streets. General considerations for locating stops near intersections include:

- Consider a near-side stop on two-lane streets where vehicles cannot pass a stopped bus
- Consider a far-side stop on streets with multiple lanes where vehicular traffic may pass uncontrolled around the bus
- On streets where vehicular traffic is controlled by a signal, the bus stop may be located either on the near side or on the far side, but the far side is preferable
- Where it is not desirable to stop the bus in a lane and a bus turnout is warranted, a far side or midblock stop is generally preferred
- When locating a bus stop in the vicinity of a driveway, consider issues related to sight distance, blocking access to development, and potential conflicts between automobiles and buses

Bus stops may be placed at midblock locations on long blocks or to serve a major transit generator. At midblock bus stops, crosswalks should be considered based on pedestrian and bicycle access patterns. If a midblock crosswalk is provided, it should be placed behind the bus stop, so passengers do not cross in front of the bus, where they are hidden from passing traffic. The sections that follow discuss these three types of bus stop locations in more detail:

- Far-side, with a stop located just past an intersection

- Near-side, with a stop located just prior to an intersection
- Midblock, with a stop located away from an intersection

3-705.01 FAR-SIDE BUS STOPS

Sight distance conditions generally favor far-side bus stops, especially at unsignalized intersections. A driver approaching a cross street on the through lanes can see any vehicles approaching from the right. With near-side stops, the view to the right may be blocked by a stopped bus. Where the intersection is signalized, the bus may block the view of one of the signal heads. Advantages of far-side bus stops include:

- Right turns can be accommodated with less conflict
- Minimum interference is caused at locations where traffic is heavier on the approach side of the intersection
- Stopped buses do not obstruct sight distance for vehicles entering or crossing from a side street
- At a signalized intersection, buses can often find a gap to enter the traffic stream, except where there are heavy turning movements onto the street with the bus route
- Waiting passengers assemble at less-crowded sections of the sidewalk away from the intersection corners
- Buses in the bus stop do not obscure traffic control devices or pedestrian movements at the intersection

Disadvantages of far-side bus stops include:

- Intersections may be blocked if other vehicles park illegally in the bus stop or if more buses than the stop can accommodate arrive at the same time
- If signal priority is not used, the bus stops at the red light and again at the far-side stop, interfering with traffic and efficient bus operations

3-705.02 NEAR-SIDE BUS STOPS

Advantages of near-side bus stops include:

- May be considered in cases where a far-side bus stop location does not provide a secure, convenient, or feasible boarding location for passengers
- Minimum interference is caused where traffic is heavier on the departure side than on the approach side of the intersection
- Less interference is caused where the cross street is a one-way street from right to left
- Passengers generally exit the bus close to the crosswalk
- There is less interference with traffic turning onto the bus route street from a side street

Disadvantages of near-side bus stops include:

- Can cause conflicts with right-turning traffic
- Buses often obscure sight distance to stop signs, traffic signals, or other control devices, as well as to pedestrians crossing in front of the bus
- Where the bus stop is too short to accommodate buses arriving at the same time, the overflow may obstruct the traffic lane
- If a queue bypass or bus lane is not used at a signalized intersection, then vehicles waiting at a red signal may block buses from accessing the bus stop, which will require the bus to wait through multiple signal cycles to enter and then depart the bus stop

3-705.03 MIDBLOCK BUS STOPS

Midblock stop areas are desirable under the following conditions: where traffic or physical street characteristics prohibit a near- or far-side stop adjacent to an intersection, or where large factories, commercial establishments, or other large bus passenger generators exist. Locate a midblock stop at the far side of a pedestrian crosswalk (if one exists), so that parked buses do not block an approaching motorist's view of pedestrians in the crosswalk.

Advantages of midblock bus stops include:

- Buses cause a minimum of interference with the sight distance of both vehicles and pedestrians
- Stops can be located adjacent to major bus passenger generators and attractors

Disadvantages of midblock bus stops include:

- Increases walking distance for passengers crossing at intersections
- Buses may or may not have difficulty reentering the flow of traffic
- Driveway access may or may not be negatively impacted

3-706.00 BUS TURNOUTS

A bus turnout is a recessed curb area located adjacent to the traffic lane. Bus turnouts are desirable only under certain conditions because of the delay created when the bus must reenter traffic. They should typically not be located on the near side of signalized intersections due to the difficulty for buses to reenter the traffic stream (queued vehicles block the turnout on the red cycle and moving traffic prevents reentry on the green cycle).

Bus turnouts have the following advantages:

- Allow traffic to proceed around the bus, reducing delay for other traffic
- Maximize vehicular capacity of high-volume vehicle mobility priority streets
- Clearly define the bus stop

- Passenger loading and unloading can be conducted in a more relaxed manner
- Reduce potential for rear-end crashes

Bus turnouts have the following disadvantages:

- Make it more difficult for buses to reenter traffic, increasing bus delay and average travel time for buses
- Difficulty of buses pulling parallel to curb, reducing accessibility
- Greater crash risk for buses pulling back into traffic than buses stopped in traffic lane
- Use additional space and might require right-of-way acquisition

Typical bus turnouts consist of a 40 to 60-foot long entrance taper, a stopping area that is 40 to 60 feet long (for a standard and articulated bus, respectively), and a 40 to 60-foot long exit taper.

SECTION 8 – VEHICLE FACILITIES SUPPORTING MULTIMODAL ACCOMMODATION

3-800.00 GENERAL

Multimodal roadway design requires consideration of all existing and planned modes in the design process. The design process often requires a flexible approach to applying conventional roadway design criteria for the vehicle traveled way in order to provide an appropriate level of accommodation for other users such as pedestrians and bicycles. This chapter addresses some of the elements of traveled way design that may require unique and creative designs.

3-801.00 VEHICLE TRAVEL LANE AND SHOULDER WIDTHS

Multimodal roadway design is often controlled or impacted by the required widths of vehicle travel lanes. *Table 3-4, Travel Lane Width Range by Context and Functional Classification* provides recommended lane width ranges for multimodal roadway design by functional classifications across a range of land use contexts. Lane width can affect the operation and safety of all modes along a roadway and should be carefully selected.

Travel Lane Widths (ft)					
Context/ Roadway	Rural	Rural (Town)	Suburban	Urban	Urban (Core)
Principal Arterial	11 to 12	11 to 12	11 to 12	10 to 12	10 to 12
Minor Arterial	11 to 12	10 to 12	10 to 12	10 to 12	10 to 12
Collector	11 to 12	10 to 12	10 to 12	10 to 12	10 to 12
Local	9 to 12	9 to 12	9 to 12	10 to 12	9 to 12

- Minimum 11-foot lanes are required for design speeds of 45 mph or greater. The values assume rural areas have design speeds of 45 mph or greater, except on local streets.
- Curbside lanes with fixed-route transit service should be 11 feet wide (min.).

Table 3-4: Travel Lane Width Range by Context and Functional Classification

Multimodal roadway design is also often influenced or impacted by the required widths of roadway shoulders where they are used. *Table 3-5, Paved Shoulder Width Range by Context and Functional Classification* provides recommended lane width ranges for multimodal roadway shoulder design by functional classifications across a range of land use contexts.

Recommended Minimum Paved Shoulder Widths (ft) for Multimodal Accommodations			
Context / Roadway	Rural & Rural (Town)	Suburban	Urban & Urban (Core)
Principal Arterial	4 to 10	4 to 10	4
Minor Arterial	4 to 10	4 to 10	4
Collector	4 to 6	4 to 6	4
Local	0 to 4	0 to 4	0 to 4

- Shoulders narrower than four (4) feet may be appropriate in constrained areas where separate pedestrian accommodation is provided and shared bicycle/motor vehicle accommodation is suitable. Examples of these conditions are where design speeds are less than 45 miles per hour and traffic volumes are relatively low (less than 4,000 vehicles per day), or where the design speed is 30 miles per hour or less.
- For shoulders four (4) to five (5) feet wide, an additional two (2)- to one (1)-foot offset (respectively) from the edge of the paved shoulder is required to vertical elements over 6 inches in height (such as guardrail).
- Five (5)-foot minimum width shoulders are recommended when the shoulder will be designated as a bicycle lane. Refer to Roadway Standard Drawing MM-TS-1 for further guidance.

Table 3-5: Paved Shoulder Width Range by Context and Functional Classification

For arterial and collector roadways, the combined width of the outside lane plus shoulder available for bicycle and motor vehicle travel is an important design element. Where there is bicyclist demand and no dedicated bicycle facility, a 14-foot outside lane/shoulder width combination will allow a motor vehicle to pass a bicyclist without needing to change lanes (on a multilane section) or swerve into the oncoming lane (on a two-lane section) and is the recommended combined width for collector and arterial streets under these conditions.

3-802.00 DESIGN VEHICLES AND CONTROL VEHICLES

The Design Vehicle influences the selection of design criteria related to turning radii such as curb-return radii and lane width. It is not always practical or desirable to choose the largest Design Vehicle that might occasionally use a roadway, because the larger turning radius negatively impacts pedestrian crossing distances, crosswalk design, speed of turning vehicles/pedestrian safety, right-of-way, etc. and may be inconsistent with the adjacent land use context and multimodal objectives for the street. In contrast, selection of a smaller Design Vehicle in the design of a facility regularly used by large vehicles will create frequent operational problems.

The Design Vehicle must be regularly accommodated without encroachment into the opposing traffic lanes. A condition that uses the Design Vehicle concept arises when large vehicles regularly turn at an intersection with high volumes of opposing traffic (such as a bus route).

The Control Vehicle is an infrequent user of a facility that must be accommodated, but encroachment into the opposing traffic lanes, multiple-point turns, or minor encroachment into the street-side is acceptable on roadways with lower speeds (35 mph and below) and lower volumes (generally 10,000 ADT and below).

The roadway should normally be designed for the largest Design Vehicle that will use the facility with considerable frequency (for example, a bus on bus routes, a semi-tractor trailer on primary freight routes), but not the largest vehicle that might occasionally be present. In urban environments, the largest frequent users of roadways are often buses (on bus routes) and package delivery trucks on non-bus routes.

3-803.00 DESIGN SPEED CONSIDERATIONS IN MULTIMODAL DESIGN

Design speed influences other design criteria such as horizontal and vertical alignment, lane width, shoulder width, grade, and stopping sight distance. The selected design speed should be a logical one with respect to the anticipated operating speed, topography, the adjacent land use, and the functional classification of the highway.

The boundary between high-speed design and low-speed design is in the range of 45 to 50 mph (design speed). On rural, high-speed roadways (50 mph design speed and above), above-minimum design criteria for specific design elements should be used, where practical. On lower speed facilities (45 mph design speed and below), use of above-minimum design criteria may encourage travel at speeds higher than the appropriate speed for the land use context.

Urban streets generally have operating speeds of 20 to 45 mph. The traditional design speed approach would propose design speeds of 30 to 60 mph. However, this may contribute to undesirably high travel speeds. As a result, a concept called target speed should be considered. Target speed is a concept that applies to urban and suburban environments; it is not applicable to high-speed rural roadways where designing a “forgiving” road for vehicles is a primary consideration.

The basis of target speed is that the current practice of creating a forgiving roadway for motor vehicles increases operating speed, creating a more dangerous street for all users including motorists, pedestrians, and bicyclists. Target speed reverses the use of operating speed in design. Instead of designing to current and sometimes undesirably high vehicle operating speeds, it promotes constraining operating speeds through design.

On roadways with existing or planned high levels of multimodal activity, the target speed concept should be considered as an element of the design process. Target speed should be set at the highest speed at which vehicles should operate on a roadway in a specific context,

consistent with the level of multimodal activity generated by adjacent land uses to provide both mobility for motor vehicles and a safer environment for pedestrians and bicyclists. The target speed is designed to become the posted speed limit.

Regardless of whether called “design speed” or “target speed”, urban roadways should have design elements that promote safer operating speeds consistent with the multimodal activity along the facility and the context of the project area.

3-804.00 ON-STREET PARKING CONSIDERATIONS

On-street parking should only be provided on low-speed streets with operating speeds of 35 mph or less. When a proposed project is to include on-street parking, parallel parking is typically recommended. Parallel parking serves as a good traffic calming tool and provides a buffer between the travel lane and the sidewalk (where a sidewalk exists). The allowance for on-street parking should be based on the function and width of the street, the adjacent land use, and traffic volume, as well as existing and anticipated traffic operations.

Most vehicles will parallel park within six (6) to 12 inches of the curb face and will occupy approximately seven (7) feet of actual street space. Therefore, the recommended minimum width of a parking lane is eight (8) feet, inclusive of the gutter pan. However, on urban collector streets within residential neighborhoods where only passenger vehicles need to be accommodated in the parking lane, seven (7)-foot wide parking lanes are acceptable. In many urban areas, a total width of 36 feet, consisting of two 11-foot travel lanes and seven (7)-foot parking lanes on each side, is frequently used.

In urban areas, central business districts, and commercial areas where significant pedestrian crossings are likely to occur, the design of the parking lane/intersection relationship must be considered. When the parking lane is carried through the intersection, motorists may utilize the parking lane as an additional lane for right turn movements. Such movements may cause operational inefficiencies and turning vehicles may mount the curb and strike such roadside elements as traffic signals, utility poles, or luminaire supports. One method to address this issue is to end the parking lane at least 20 feet in advance of the intersection and create a curb extension. Curb extensions also shorten the crossing width for pedestrians and improve safety by making the pedestrian more visible to the motorist. See *Chapter 3-408.00* for additional information related to curb extensions.

3-805.00 INTERSECTION CURB RADIUS CONSIDERATIONS

The curb radii used at both signalized and unsignalized intersections should be selected by the Designer based on safety, operations, and convenience for pedestrians, bicyclists, and motor vehicles. Curb radii should be appropriate for the largest Design Vehicle that regularly

makes a specific turning movement. Due to constraints of adjacent development and pedestrian/bicyclist considerations in urban areas, it is usually not practical to provide the full curb radii that would be necessary for the occasional Control Vehicle.

Larger intersection curb radii (over 25 feet) have disadvantages for pedestrians and bicyclists because they can increase pedestrian crossing distance and the speeds of turning vehicles, creating increased safety risks. Large radii also move pedestrians out of the driver's line of sight and make it more difficult for pedestrians to see approaching vehicles, and vice-versa.

Smaller curb radii allow for shorter pedestrian and bicyclist crossing distances, which reduces exposure to moving vehicles, decreases walk time, and increases signal efficiency. The trade-off is the infrequent Control Vehicle may need to encroach into the opposing traffic lanes, make multiple-point turns, have minor encroachment into the street-side to make the turn, or take a different route.

The Designer must ensure that infrastructure such as signal poles, signal cabinets, light poles, street furniture, etc. does not conflict with the Control Vehicle if areas outside the designated turn/travel lanes will be utilized. Additionally, on-street parking and bicycle lanes shall be considered when designing a curb radius, as they will increase a vehicle's effective turning radius, allowing the curb radius to be smaller than it would normally be.

At intersections of roadways where trucks make frequent right turns, a raised channelization island between the through lanes and the right-turn lane may be a better alternative than an overly large corner radius. If designed correctly, a raised island can achieve the following:

- Allow pedestrians to cross fewer lanes at a time
- Allow motorists and pedestrians to judge the right turn/pedestrian conflict separately
- Reduce pedestrian crossing distance, which can improve signal timing for all users
- Balance vehicle capacity and truck turning needs with pedestrian safety
- Provide an opportunity for landscape and hardscape enhancement

The following design practices for right-turn lane channelization islands should be used to provide improved safety and convenience for pedestrians, bicyclists, and motorists:

- The provision of a channelized right-turn lane is appropriate on signalized approaches where right-turning volumes are high or large vehicles frequently turn and conflicting pedestrian volumes are low
- Provide a yield sign for the channelized right-turn lane unless a continuous receiving lane is provided
- Tighter angles are preferred
- Provide at least a 60-degree angle between vehicle flows, which reduces turning speeds and improves the yielding driver's visibility of pedestrians and vehicles

- Place the crosswalk across the right-turn lane about one car length back from where drivers yield to traffic on the other street, allowing the yielding driver to respond to a potential pedestrian conflict first, independently of the vehicle conflict, and then move forward, with no more pedestrian conflict
- Provide raised, ADA compliant, islands for pedestrian refuge
- Curbed channelization islands must include curb ramps or at-grade cut-through paths for pedestrians. At-grade cut-through paths should be at least five (5) feet wide to provide room for two users of wheelchairs to pass in opposite directions. Cut-through paths should be designed to allow for water to drain from the island area to the travel lanes. Detectable warnings are required at the transition between cut-through paths and vehicular travel ways (assuming the island is at least six (6) feet wide)
- Unless the turning radii of trucks or buses need to be accommodated, the pavement of the channelized right-turn lane should be no wider than 16 feet; and to slow vehicles, the width of the travel lane should be restricted to 12 feet by marking the edge lines and using cross-hatching based on engineering judgment
- Signalization of the channelized right-turn lane can reduce vehicle-pedestrian conflicts and may be appropriate where:
    - There are multiple right-turn lanes
    - Crash data show a high frequency of vehicle-pedestrian crashes, or
    - There are other concerns such as restricted sight distance or vehicle speeds are high on the turning roadway

Figure 3-21, Preferred Right-Turn Island Design, shows the preferred channelized right-turn island design. When creating this design, it is often necessary to allow large trucks to turn into multiple receiving lanes or the opposing lane. This design is therefore often not practical for right-turn lanes onto roads with only one through lane.

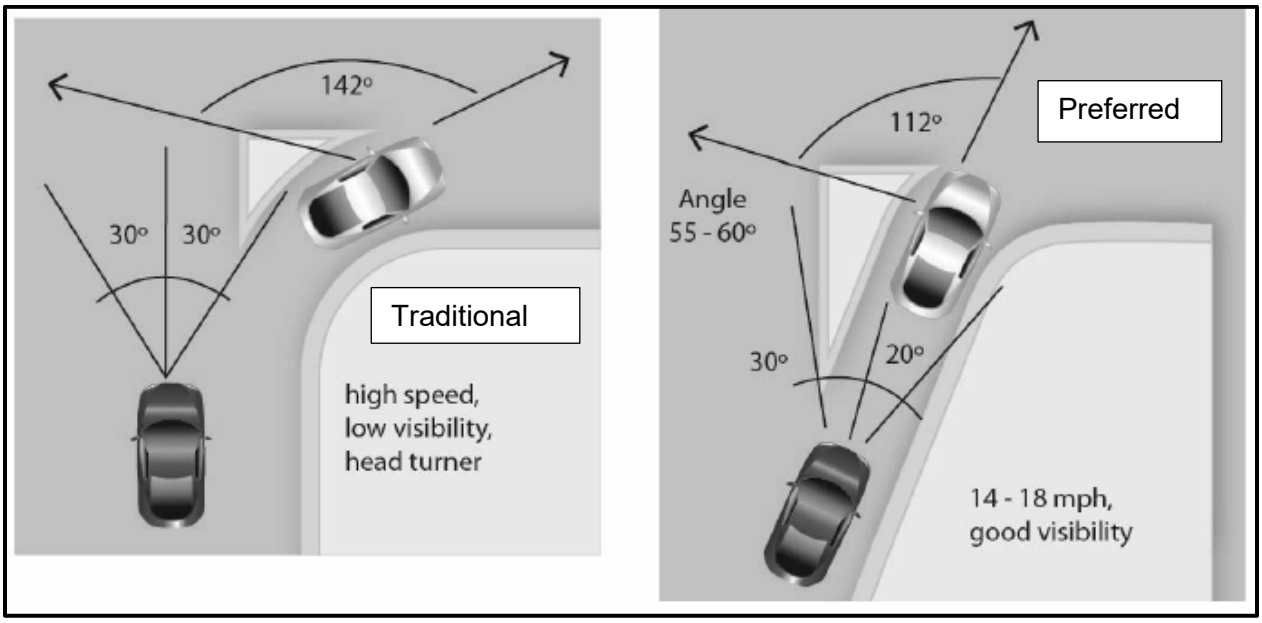


Figure 3-21: Preferred Right-Turn Island Design

3-806.00 CROSSWALKS AT MIDBLOCK LOCATIONS

See *Chapter 3-407.00.*

3-807.00 ROAD RECONFIGURATION AND ROAD DIETS

See *Road Diet Guidance Manual* for more information.

SECTION 9 – ADDITIONAL CONSIDERATIONS

3-900.00 GENERAL

The following information includes several roadway design considerations that a Designer may need to take into consideration when designing multimodal roadway facilities along a state roadway.

3-901.00 SAFETY CONSIDERATIONS FOR ALL USERS

Right-of-way and design constraints often pose challenges when retrofitting a multimodal design onto an existing street cross section. For low-volume and low-speed streets, many of the design modifications (narrow lanes, reduced lanes, adding sidewalks/walkways, adding bicycle lanes, etc.) are easy to make, requiring few trade-offs. Retrofitting multimodal street concepts on higher-volume or higher-speed streets is more challenging.

Speed is a primary consideration when evaluating potential adverse impacts of lane width on safety. On high-speed, rural two-lane highways, an increased risk of cross-centerline head-on or cross-centerline sideswipe crashes are a concern because drivers may have more difficulty staying within the travel lane. On any high-speed roadway, the primary safety concerns with reductions in lane width are crash types related to roadway departure.

In a low-speed urban environment, the effects of reduced lane width are different. On these facilities, the risk of roadway departure crashes is less. The design objective is often how to best distribute limited cross-sectional width to maximize safety for a wide variety of street users. Narrower lane widths may be chosen to manage or reduce speed and shorten crossing distances for pedestrians. Lane widths may be adjusted to incorporate other cross-sectional elements, such as medians for access control, bicycle lanes, on-street parking, transit stops, and landscaping.

3-902.00 SPEED CONSIDERATIONS IN MULTIMODAL DESIGN

All roadway users, particularly pedestrians and bicyclists, are safer when motorists' speeds are lower. The design of a roadway should be consistent with the level of multimodal activity generated by adjacent land uses to provide both mobility and a safer environment for all users.

On higher speed roads, the speed differential between vehicles and bicyclists or pedestrians should be a major factor in determining multimodal facility selection along a corridor. The likelihood of being killed or seriously injured increases exponentially with an increase in speed differential between motorized and non-motorized users, and between cyclists and pedestrians. For example, it is more difficult for pedestrians to judge gaps between vehicles when crossing a road, as well as for a motorist to judge the distance required to pass a cyclist.

Along corridors with large speed differentials between users, facilities separated by buffers or other physical elements for each user are recommended. Aside from increased safety, there is a direct correlation between speed differential and user comfort for all modes.

3-903.00 PEDESTRIAN SIGNAL CONSIDERATIONS IN MULTIMODAL DESIGN

The MUTCD, ITE's *Traffic Engineering Handbook*, and TDOT's *Traffic Design Manual* provide guidance for the warrants, design, and operation of traffic signals. Traffic signal design is complex and specific to the roadway corridor, as well as to each project intersection. However, supplemental recommendations for the Roadway Designer and operator to consider in multimodal environments are provided below.

Pedestrian pushbuttons, marked crosswalks, and pedestrian signals should be provided at all signalized locations with existing sidewalks, and within all suburban or urban land use contexts. Pedestrian pushbuttons and signals shall be used where there are existing pedestrian circulation paths at signalized intersections. On state or federally funded new signal installations, or where an existing signal is modified, the pedestrian pushbuttons and signals shall have audible guidance to meet the accessibility requirements in the United States Access Board's *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way* (PROWAG). For additional information on the installation of APS, see Chapter 3-410.00.

Signal cycle lengths of up to 120 seconds are typically acceptable to optimize vehicular traffic movements. The typical maximum cycle length is 150 seconds. However, short cycle lengths of 60–90 seconds are more appropriate for urban areas with high pedestrian and/or bicyclist activity. Expecting pedestrians or bicyclists to wait 120 seconds or more before receiving a walk signal is not preferred. When developing a signal cycle plan, the Designer should weigh the effects on all users, vehicular, pedestrian, and cyclists.

Concerning pedestrian signals, many municipalities in Tennessee place their signals under flash operation late at night and into the early morning. This practice should not be done, especially on multilane routes, if pedestrian activity is expected late at night. Such areas could include where late night events occur. Traffic controllers cannot accept a pedestrian push button call when in flash operation.

When a project's limits begin or end at an intersection, all approaches to the intersection must be upgraded with similar multimodal features such that pedestrians and cyclists can safely traverse the intersection. If curb ramps are installed, they must be installed in all quadrants of an intersection with curb. If vehicular lanes are modified, signal heads will typically need to be replaced or shifted, along with possible modifications to the signal cabinet.

3-904.00 MULTIMODAL ACCOMMODATIONS IN RESURFACING PROJECTS

TDOT's *Roadway Design Guidelines* specify certain pedestrian and bicyclist accommodations to be incorporated into resurfacing projects. Curb ramps shall be

installed/retrofitted where they are missing or are not compliant with TDOT Standards and ADA/PROWAG guidance, to the maximum extent feasible.

Additionally, TDOT promotes that when the existing shoulders are adequate, resurfacing projects provide a good opportunity to incorporate pavement markings for bicycle lanes. Also, where the existing catch basin grates adjacent to the curb are parallel-type grates, TDOT will install bicycle-friendly perpendicular-type catch basin grates.

3-905.00 MAINTENANCE CONSIDERATIONS

As an element of the design process, the Designer should consult with all local agencies to determine partnering opportunities for multimodal facility maintenance beyond routine activities of the Department. The purpose of this consultation would be to clearly understand which agency will be responsible for maintaining specific elements of the pedestrian, bicycle, and transit facilities within the design project.

Pedestrian and bicycle facilities, including shared-use paths, installed along State Routes are typically maintained by the state in unincorporated areas and by the local agency in incorporated areas. Transit access facilities, such as bus stops, are typically maintained by the local transit agency responsible for transit operations.

In incorporated areas, some local agencies may be better equipped to maintain these facilities than others. It may be advantageous to discuss the maintenance capabilities of the local agency and develop a special maintenance agreement. It is important to set elements and expectations of the required maintenance activity for the multimodal facility type and discuss the anticipated methods for maintaining the facility. Maintenance discussions should typically consider the following activities:

- Sweeping
- Pavement repair and rehabilitation
- Signing
- Pavement markings
- Special signalization
- Snow removal
- Lighting

3-906.00 PAVEMENT CONSIDERATIONS IN MULTIMODAL DESIGN

Different surface materials, patterns, and textures are useful tools to better establish zones for users and align with the context of a corridor. Along with ADA requirements, the following requirements must also be met when entertaining their use.

Surfaces should be smooth, free of rough textures, openings, and gaps. Expansion and contraction joints are allowed but must not create a level change of more than 0.25 inch.

Pedestrian zone surfaces should be as visually uniform as possible, as people with even minor levels of visual impairment may mistake visual contrast in the pathway with changes in grade. Along these lines, Designers are required to have clearly defined sidewalk edges to provide navigational cues for people with visual impairments.

Permeable pavement types are allowed in parking lots, but special considerations for maintenance should be included in any design to ensure that the riding or walking surface continues to function free from debris that might cause loose material, water, or ice to eventually collect on the surface. The walking surface of crosswalks will be smooth asphalt or smooth concrete with longitudinal markings. See *Chapter 3-405.00* for guidance on using patterns on the edges.

3-907.00 WORK ZONE MULTIMODAL MOBILITY REQUIREMENTS

When existing pedestrian, bicycle, and transit facilities are disrupted, closed, or relocated in a temporary traffic control zone, the temporary facilities should be easily detectable and include accessibility features consistent with the features present in the existing facilities.

An alternative route should be provided whenever the pedestrian or bicycle route is blocked. Warning signs should be provided when an alternative circulation path is provided, or a barricade is constructed. Signage must be compliant with the current edition of the MUTCD, Part 6 for Temporary Traffic Control.

Design of temporary facilities in the public right-of-way should typically conform to the requirements for permanent facilities where feasible. The Work Zone Design Manual should be utilized to provide more information.

3-908.00 DESIGN WAIVER FORM

Designing a multimodal facility/roadway is not a one-size-fits-all approach. It requires an analysis of various site conditions to determine appropriate treatments and solutions. Using standard design elements, criteria, and dimensions may not be possible in these contexts that are often in constrained right-of-way. Applying flexibility in the geometric design process is often justified. Despite the range of flexibility that exists with respect to the elements of design, there are situations in which the accepted criteria are not applicable to the project circumstances or could not reasonably be met. For such instances, when it is appropriate, the design waiver form allows for the use of criteria other than the normally accepted values.

TDOT's *Design Waiver Form* should be used whenever the Designer recommends the use of design elements, criteria or dimensions not in conformance with the standards outlined in the *Roadway Design Guidelines and/or TDOT Standard Drawings*. TDOT will review the design waiver request more favorably if guidance from another source is provided. Other sources could include, but are not limited to, AASHTO, ADA, PROWAG, DOJ, NACTO, FHWA, NCHRP, or design guidance from other states. See *Chapter 2-201.00* for additional guidance.

CHAPTER 4

CONTEXT & SCOPING

STAGE 1

CHAPTER 4 PRELIMINARY

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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, R.O.W., and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** –Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



4 Stages of Project Delivery Network

1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 – GENERAL INFORMATION

4-100.00 LINE AND GRADE PLANS REFERENCES

For information on Line and Grade plans project information, plans production, survey information, estimates, field reviews, and public hearings, see Chapter One of the Roadway Design Guidelines and the Project Delivery Network.

4-100.01 DRAINAGE MANUAL

In order to assist the Designer performing drainage and hydrologic design, the Engineering Division has developed a Drainage Manual to provide a collection of applicable drainage criteria, policies, and examples. Designers shall use the Drainage Manual for all projects designed or constructed by TDOT. The manual includes the following chapters:

Chapter 1	Introduction
Chapter 2	General Drainage Policies and Practices
Chapter 3	Drainage Plan Requirements
Chapter 4	Hydrology
Chapter 5	Roadside Ditches and Streams
Chapter 6	Culverts
Chapter 7	Storm Drainage Systems
Chapter 8	Stormwater Storage Facilities
Chapter 9	Energy Dissipaters
Chapter 10	Erosion Prevention and Sediment Control
Chapter 11	Natural Stream Design

The TDOT Design Division Drainage Manual is available to download from the Roadway Design Standards website.

4-101.00 SURVEY AND DESIGN ORD VERSIONING GUIDANCE

Based on the frequency of Bentley ORD updates, coinciding TDOT ORD workspace updates, and the duration of TDOT project schedules, it will not be uncommon for a project to have design deliverable files on one ORD version and survey deliverable files on an earlier ORD version. While ORD provides an uplift process for moving older files to newer schemas, the changes in both the software and the workspace updates (to align with compatibility in the new software) may affect the integrity of the original survey. There is no guarantee that the uplifting process will not fundamentally change an aspect of the survey deliverable files. Therefore, **survey**

deliverable files that have been uplifted to a different ORD version are not considered the same survey deliverable files that were previously qualified and accepted via the QA/QC process. Uplifted survey deliverable files, post QA/QC process completion, would need to be resubmitted to complete the QA/QC process again.

4-101.01 SURVEY AND DESIGN ORD VERSIONING BEST PRACTICES

The survey deliverable files will be shared with design. Designers will use the latest version of ORD adopted by TDOT (with an accompanying TDOT workspace release) at the time of creating initial design deliverable files. All design deliverable files will be created on this same version of ORD and the same TDOT workspace release. The ORD software and TDOT workspace versions used on the design deliverable files will be documented in the Project Notebook. The designer will reference the survey respective Model.dgn, Aerial Model.dgn (where applicable), Terrain.dgn, Alignment.dgn, and Utility.dgn files into the design respective deliverables. Older ORD version files can always be used as references in newer ORD version files without uplifting and without changes to the said reference files.

SECTION 2 - INFORMATION REQUESTS

4-200.00 LINE AND GRADE FIELD REVIEW SUBMITTAL

Refer to PDN 1RD1 and the Roadway Design Guidelines Chapter 1-105.01 for more information regarding the Line and Grade package and what is included in the field review submittal.

4-200.01 TRAFFIC REPORT REQUEST

The typical cross-section used when designing a project is largely dependent on the anticipated traffic. It is critical that the traffic data is current to the projected letting year of the project. The Concept Report includes traffic data. Generally, the report is distributed when approved by divisional heads and when funding is available. However, there are times when funding or other circumstances delay the distribution of the Concept Report, and the traffic data in the report is not current. If traffic data is three years old upon receipt of the Concept Report, a Traffic Report Request shall be submitted. Also, if one of the following applies to a project, a Traffic Report Request shall be submitted:

1. Turning movement or crossroad design traffic year data is needed.
2. Survey is updated and area shows growth (building of apartment complex, shopping center, or industrial complex, etc. along corridor or on side road).
3. Information becomes available that denotes areas of growth outside the survey limits that could easily affect traffic within the project limits (building of apartment complex, shopping center, or industrial complex, etc.).

To establish a uniform and systematic method of obtaining desired traffic data for the construction year of projects, use the following procedure:

1. Designers shall complete a title sheet. If crossroad volumes and/or turning movements on certain intersecting streets or roads are needed, this shall be clearly indicated on the title sheet or on an additional sheet if necessary due to limited space on the title sheet.

2. Designers shall submit the title sheet in PDF format along with a completed copy of the Traffic Report Request, to the Special Project Office of the Strategic Transportation Investments Division at the email address shown on the form. Consultants shall submit the information to the appropriate Design Lead for submittal.

To expedite a pavement design from the Pavement Design Section, the following applicable notes shall be included under comments on the Traffic Report Request Form.

1. Furnish the 20xx-20xx ADL for pavement design on a (*number of lanes*) lane roadway.

2. Furnish the 20xx-20xx ADL for pavement design on a (*number of lanes*) lane roadway and the present ADT on all crossroads within the limits of the project.

3. Furnish the 20xx-20xx ADL for pavement design on a (*number of lanes*) lane roadway and the present ADT on all crossroads outside the limits of the project. (Specify locations)

NOTE:
ADL (Average Daily Loading)
ADT (Average Daily Traffic)
DHV (Design Hourly Volume)
D (Directional Distribution)
T (Truck Percentage)

NOTE: For Bridge Replacement Projects, ADL are not required for ADTs of 1,000 or less and percentage trucks of 7 percent or less.

NOTE: ADTs and DHVs are not required for crossroads with ADTs of 1,000 or less.

4-200.02 PAVEMENT DESIGN RECOMMENDATIONS

The Materials and Test Division – Materials and Pavement Section shall furnish pavement designs on projects where concrete pavement or plant mix asphalt pavement is required. The Materials and Pavement Section does not provide pavement designs for metro-urban resurfacing projects and 100% state resurfacing projects.

For BRZE and BR-STP projects with an ADL (Average Daily Loading) of 150 or less, or an ADT (Average Daily Traffic) less than 1,000 and percent trucks less than seven, pavement sections shall be designed as in *Chapter 4-201.01, Pavement Design for Local Roads*.

When the Soils and Geology Report is received, the Designer shall forward the report to the pavement design email, TDOT.PavementDesign@tn.gov. This information is needed to analyze the needs of side roads, overlays, pavement alternates, and other pavement design features.

A preliminary pavement design is completed for the Functional Design phase. The Materials and Pavement Section reviews the recommendation upon receipt of the Plan-in-Hand Field Review plans and submits an updated pavement design, if applicable, to the Designer. If the traffic data is more than three years old or the recommendations are three years or older an updated Pavement Design Request shall be submitted. A copy of the email shall be placed in the project folder to document the resubmittal of a pavement design request.

4-200.03 SOILS AND GEOLOGY REPORT

On all new alignment, widening on existing alignment, and bridge projects, the Designer shall include the Materials and Tests Division – Geotechnical Engineering Section in the Line and Grade Field Review email. The Soils and Geology Report may include, but not limited to:

recommendations for slope design verification, embankment stabilization, earthwork shrink/swell characteristics for earthwork calculations, acid producing properties of earthwork, and subgrade evaluation (CBR) needed for pavement design.

If a Design Meeting is held and the comments resulted in a change in alignment, the Design Lead shall notify the Geotechnical Engineering Section immediately by email. Updated plan sheets and cross-section sheets are to be resubmitted to the Project Team.

All soils data shall be incorporated into the plans prior to distribution of the Functional Design Field Review plans. In the Line and Grade Field Review, the requested date for completion of the Soils and Geology report shall be determined based on the size of the project and the projected time the Designer would need to make adjustments to the plans based on changes in slope lines due to slope recommendations. If comments from the Functional Design Field Review deem additional soils information is needed, the Designer shall request an update. All soil comments shall be incorporated into the Functional Design plans to ensure sufficient R.O.W. is acquired to accommodate all slope requirements. If there are revisions to the plans after the Functional Design submittal, the Designer shall determine if the changes require re-evaluation by the Geotechnical Engineering Section, and if it does, the R.O.W. Revision shall be issued.

4-200.04 STRUCTURES GRADE APPROVAL

Structural grade analysis is needed for the vertical alignment of a proposed structure which may cross a waterway, railroad, or roadway. The Designer shall include the Structural Design and Hydraulics Sections on the Line and Grade Field Review email to request hydraulic and structural grade analysis and approval of the proposed vertical alignment. The Design Lead shall send the Structures Division all the material applicable to the project as specified in Sections 4.8, 4.11, 4.12, 4.13 of the TDOT Survey Manual.

4-200.05 RAILROAD CROSSING SAFETY REVIEW

A Railroad Crossing Safety Review is required for all projects at railroad crossings. Before Line and Grade plans are finalized, a collection of photographs of each impacted crossing within the zone of influence must be collected and submitted to the State Railroad Coordinator at HQRailroadCoordinator@tn.gov. The email subject line should be **Region X, County Name, Route Name, PIN nnnnnn-nn, Railroad Crossing Safety Review**. Ideally, the local district offices will be the ones collecting the photographs and submitting them to the design team. If the local district offices are not able to get the photographs, the design team must collect them at the site review. If the zone of influence needs defining, please contact the State Railroad Coordinator. TDOT Regional Geodetics will provide photos as required in *Figure 4-1, Railroad Safety Crossing Review Process*.

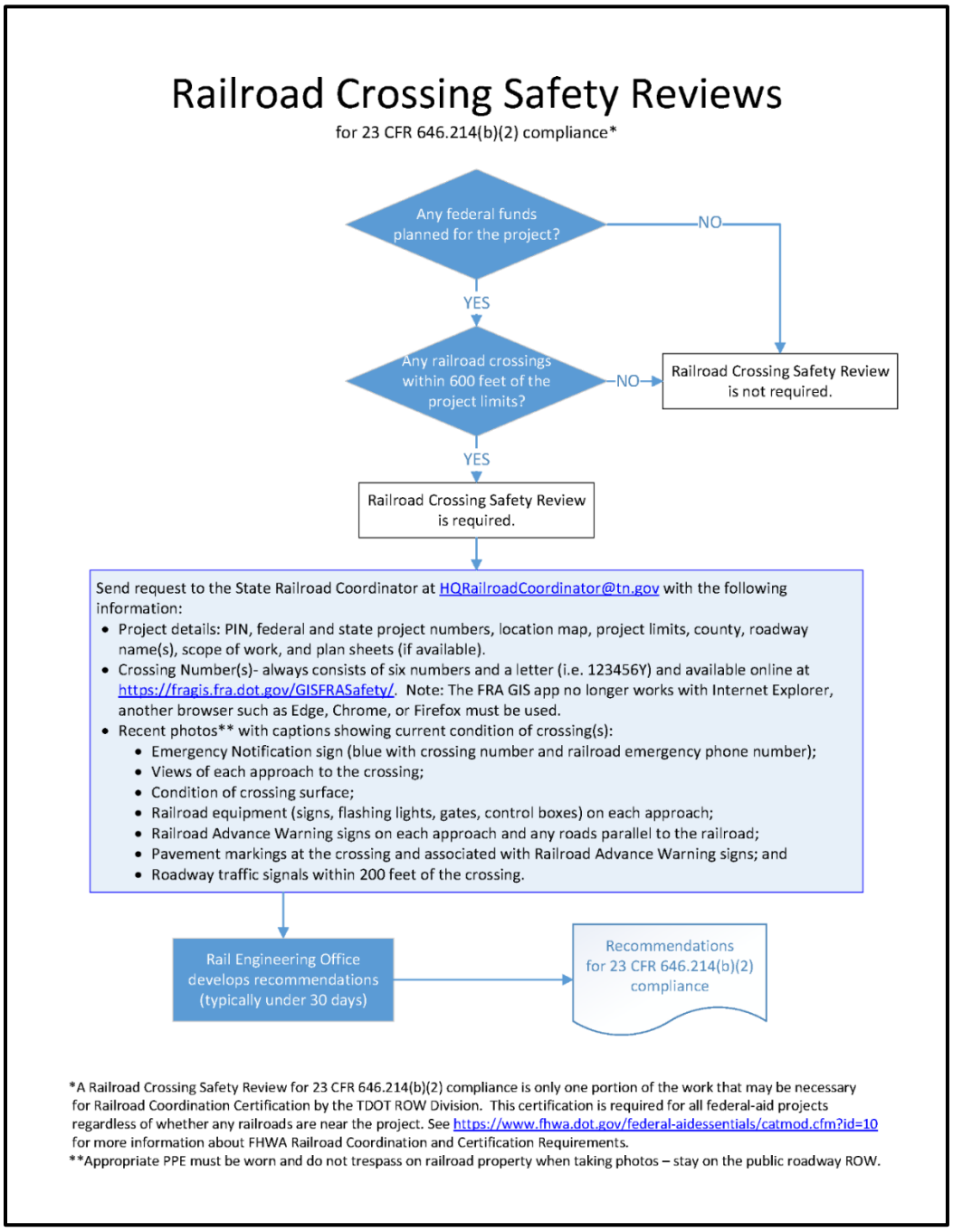


Figure 4-1
Railroad Safety Crossing Review Process

The Railroad Safety Crossing Review document shall have photographs for each crossing impacted by the project, within the zone of influence. These photos shall be arranged in a document with a short description of the perspective in which the photo was taken. The following is a list of crossing photos that are required as part of the Railroad Safety Crossing Review document:

- Emergency Notification sign with crossing number and railroad emergency contact information. This plaque will be on a pole or a railroad bungalow at the crossing.
- Views of each approach to the crossing
- Condition of the crossing surface
- Railroad equipment (signs, flashing lights, gates, control boxes) on each approach
- Railroad Advance Warning signs on each approach and any roads parallel to the railroad
- Pavement markings at the crossing and associated with Railroad Advance Warning signs
- Roadway traffic signals within 200 feet of the crossing
- NOTE: Safety should be considered at all times when around active railroad tracks and corridors. There should always be at least two (2) persons at the site when taking crossing photos. The first is to be watching for a train while the other takes the required photos. When taking photos up and down the track, it is not advisable to stand on the tracks. The photos can be taken offset from the tracks to ensure the photographer is as safe as possible.

Once the State Railroad Coordinator and the Multimodal Rail Safety Office concludes their review of the Line and Grade Package and Railroad Safety Crossing Review document, they will release their recommendations. The designer shall review the recommendations and implement them into the plans and the quantities of the project. Railroad crossing safety reviews are performed on resurfacing projects. However, Designers are not responsible for submitting the Railroad Safety Crossing Review document and plans for resurfacing projects.

If there are changes that result in the project being within 600 feet of a railroad, The Line and Grade Package will need to be resubmitted.

4-201.00 PAVEMENT DESIGN

The design of pavement structure takes into consideration many forms of input. Several of these are traffic loadings, soil characteristics (C.B.R. (California Bearing Ratio) tests from the Geotechnical Engineering Section), material availability, construction considerations, past performance, engineering judgement, quality control, and Departmental policy. Paving sections are analyzed for structural capacity and for life-cycle cost.

The Pavement Design Section shall review and approve all pavement designs for each phase of the project to ensure the proposed design is adequate for the specific project. The Pavement Design Section will review their original recommendation and submit the updated pavement design, if applicable, to the Designer two months prior to the schedule date of the Construction Field Review to ensure correct information is shown in the Construction Field Review plans.

If a Designer is asked to deviate from the pavement design at field reviews or by others in the Department, it shall be noted in the field review report or project file and then brought to the attention of the Pavement Design Section. If traffic data is three years or older, updated traffic

should be requested and the pavement design should be re-evaluated. **Under no circumstance is the pavement design to be altered without the written approval from the M&T Pavement Design Section.** After reviewing the requested change with the Designer, the Pavement Design Section will make the final decision on changes to be incorporated into the project plans relative to paving. Refer to PDN 2PV1 for more information regarding Pavement Design.

4-201.01 PAVEMENT DESIGN FOR LOCAL ROADS

Local Governments should use the following pavement design guidance for local roads. For projects with an Average Daily Load (ADL) of less than 150, or an Average Daily Traffic (ADT) less than 1,000 and percent trucks (T) less than seven, the pavement design can be obtained by using the County Soils Groupings, shown in *Table 4-1, County Soil Groupings*, and Tables 4-2 and *Table* 4-3.

ADL's shall not be provided when ADT's are less than 1,000 and T is less than seven percent. In this case, use Pavement Design No. IV for ADT less than or equal to 200 and Pavement Design No. I for ADT greater than 200 but less than or equal to 1,000.

Two examples are given as follows:

1.) The Designer has a project in Hamblen County. The ADL is 53. First, go to the *Table 4-1, County Soils Groupings* to obtain the Group No. which is 2. Then refer to *Table 4-2, Pavement Design Number* go to the column for Group 2 and down to the row containing 53 ADL. This determines that Pavement Design No. I shall be used. Refer to *Table 4-3, Pavement Design* to obtain the pavement design (1.25 inch "D" mix, 2.00 inch "B-M2", 3.00 inch "A" mix, and 8.00 inch mineral aggregate).

2.) The Designer has a project in Hamblen County. The ADT is 874 and the percentage of trucks is 5. No ADL is given because the ADT and T is low. As stated above, Pavement Design No. I shall be used. Refer to *Table 4-3, Pavement Design* to obtain the pavement design (1.25 inch "D" mix, 2.00 inch "B-M2", 3.00 inch "A" mix, and 8.00 inch mineral aggregate).

When the shoulders are 4 feet or less, the Designer shall determine during the Functional Design Field Review whether the shoulder shall be stone and double bituminous surface treatment or paved with 1.25 inches of 411 D-mix. When the existing road is crushed stone base only or base and double bituminous surface treatment, the roadway surface shall be replaced in kind. The proposed roadway pavement shall be a higher type or equal surface than that of the shoulders. When using ADT's for pavement design, use design year traffic.

Designers shall specify mineral aggregate, Item Number 303-01 Mineral Aggregate, Type A Base, Grading D, for projects located in Regions 1, 2, and 3. For Region 4 projects, Designers shall specify mineral aggregate, Item Number 303-02, Mineral Aggregate, Type B Base, Grading (Description) as the base stone layer.

COUNTY	GROUP	COUNTY	GROUP	COUNTY	GROUP
Anderson	2	Hamilton	3	Morgan	4
Bedford	3	Hancock	6	Obion	5
Benton	2	Hardeman	3	Overton	6
Bledsoe	6	Hardin	2	Perry	3
Blount	4	Hawkins	6	Pickett	5
Bradley	1	Haywood	4	Polk	5
Campbell	4	Henderson	3	Putnam	6
Cannon	4	Henry	3	Rhea	1
Carroll	4	Hickman	4	Roane	4
Carter	6	Houston	6	Robertson	4
Cheatham	3	Humphreys	5	Rutherford	6
Chester	4	Jackson	6	Scott	2
Claiborne	2	Jefferson	4	Sequatchie	3
Clay	6	Johnson	6	Sevier	1
Cocke	5	Knox	4	Shelby	5
Coffee	4	Lake	3	Smith	3
Crockett	4	Lauderdale	4	Stewart	5
Cumberland	5	Lawrence	5	Sullivan	4
Davidson	3	Lewis	4	Sumner	3
Decatur	3	Lincoln	3	Tipton	5
DeKalb	3	Loudon	6	Trousdale	4
Dickson	6	McMinn	3	Unicoi	6
Dyer	5	McNairy	4	Union	5
Fayette	5	Macon	4	Van Buren	5
Fentress	2	Madison	4	Warren	5
Franklin	4	Marion	3	Washington	4
Gibson	5	Marshall	4	Wayne	5
Giles	5	Maury	5	Weakley	4
Grainger	6	Meigs	3	White	4
Greene	5	Monroe	3	Williamson	3
Grundy	2	Montgomery	4	Wilson	2
Hamblen	2	Moore	3		

Table 4-1
County Soil Groupings

FLEX ADLs	COUNTY SOIL GROUP NUMBER					
	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6
1-19	I	I	III	III	III	IV
20 – 29	I	I	I	I	III	III
30 – 39	I	I	I	I	I	III
40 – 59	II	I	I	I	I	I
60 – 89	II	II	I	I	I	I
90 – 119	II	II	II	I	I	I
120 – 150	II	II	II	II	I	I

Table 4-2
Pavement Design Number

MIX TYPE	PAVEMENT DESIGN NUMBER			
	I	II	III	IV
"D"	1.25"	1.25"	1.25"	1.25"
"B-M2"	2.00"	2.00"	2.00"	2.00"
"A"	3.00"	3.00"	----	----
Mineral aggregate	8.00"	10.00"	12.00"	8.00"
Note: Remember to include Prime Coat should be included on concrete and rock surfaces and Tack Coat should be included on asphalt surfaces.				

Table 4-3
Pavement Design

4-201.02 PERFORMANCE GRADE ASPHALT ON PROJECTS

The type of performance grade asphalt used on all construction projects shall adhere to the following criteria:

Performance Grade PG64-22 Asphalt is to be used on all construction projects with current ADT less than 10,000. Performance Grade PG70-22 Asphalt is to be used on all construction projects with current ADT equal to or greater than 10,000, and on the NHS system, SR-15 (US-64), SR-5 (US-45W), SR-43 (US-45E), and SR-22 regardless of their traffic volume.

Performance Grade PG76-22 Asphalt is to be used on all interstate construction projects. It may also be used on state resurfacing and construction projects in cases of heavy truck traffic or severe rutting. However, in order to be used on these projects, prior approval by the Director of Materials and Tests must be given.

Performance Grade PG82-22 Asphalt is to be used on very select urban interstate projects with extremely high volumes. These projects shall always be designated by the Pavement Design Section.

SECTION 3 – ENVIRONMENTAL COORDINATION

4-300.00 ENVIRONMENTAL STUDY AREAS

The Environmental Division conducts studies for streams, wetlands, threatened and endangered species, air quality, noise, archaeology, hazardous material, permits, and historical preservation. The reports from these studies are used with other information to create the environmental documents required for the National Environmental Policy Act (NEPA). When a Concept Report is developed, Line and Grade Plans are developed based on the scope of project as defined in the document. The following are the boundaries of the study areas outside of the proposed R.O.W. limits:

Mainline

1. Study Area Extends a minimum of 300 feet before the project begins.
2. Study Area Extends a minimum of 300 feet after the project ends.
3. Width shall be a minimum of 50 feet beyond the proposed R.O.W. line.
4. If the project intent is to remain within the present R.O.W. with no proposed right-of-way or easements outside of the present R.O.W., the Environmental Study Area Boundary shall be the existing R.O.W. and shall be labeled as such.
5. Adjustments to the width shall be made as necessary based, on proposed concepts.

Side Roads

1. Study area extends a minimum of 150 feet past the proposed tie in point for the side road.
2. Width shall be a minimum of 50 feet beyond the proposed R.O.W. line.
3. If the project intent is to stay within the present R.O.W. with no proposed right-of-way or easements outside of the present R.O.W., the Environmental Study Area Boundary shall be the existing R.O.W. and shall be labeled as such.
4. Adjustments to the width shall be made as necessary, based on proposed concepts.

When changes occur to the Environmental Study Areas, as defined above for mainlines and side roads, a PDF of the Environmental Technical Studies Additional Area map shall be made and included in the R.O.W. or Letting revision. The PDF shall be made from a OpenRoads Designer file showing the additional areas as cross hatched. Including this map as part of the revision will aid the Environmental Division and Regional Environmental Technical Office in assessing what should be re-evaluated.

Figure 4-2, *Initial Environmental Technical Studies Area,* shows the original designated environmental study area as turned in for the Line and Grade Package. For this project, the study area is 300’ before the beginning of the project and the project intent is to remain within existing R.O.W. There is not any improvement on the side road. Notice the R.O.W. is labeled as existing and proposed R.O.W.

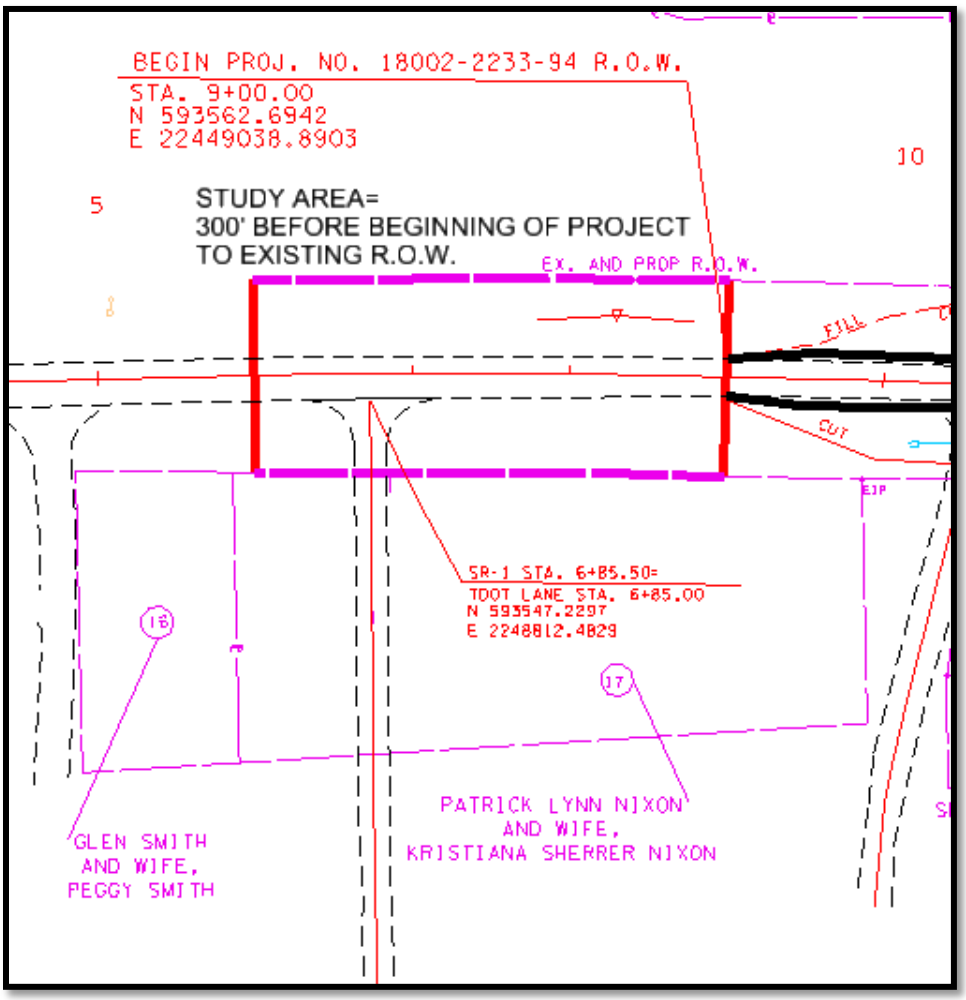


Figure 4-2
Initial Environmental Technical Studies Area

As the project developed, TDOT was contacted by the County. Since the original survey was completed, two (2) tracts were bought which will become the location of the county hospital off the side road TDOT Lane. The County requests that TDOT add a right turn lane on S.R. 1 to turn onto TDOT Lane. The right turn lane will drop at the intersection. The hospital also requested that TDOT add a left turn lane on TDOT Lane to turn onto S.R. 1. The request includes 200’ of storage for each turn lane. The requests were approved by the Department and Traffic Design personnel requested that a flashing beacon should be added at the intersection to warn traffic that emergency vehicles would be in the area. These changes moved the beginning of the project

back 523.78', and the additional lanes and area needed for the poles for the flashing beacon require R.O.W. acquisition. These changes are outside the original Environmental Technical Study area. A R.O.W. revision shall be distributed that includes a PDF of an Environmental Technical Studies Additional Area map. See *Chapter 1-101, Project Scope and Changes in Scope* for the change in scope process.

Figure 4-3, *Environmental Technical Studies Additional Area Map,* illustrates the additional area (cross hatched) where the study is needed. The labeling for "new" and "original" on the Begin Project Limits and the labels for the 300' station prior to the beginning of project station are for illustrative purposes only. Also, name changes and pavement markings are adjusted to better illustrate the changes.

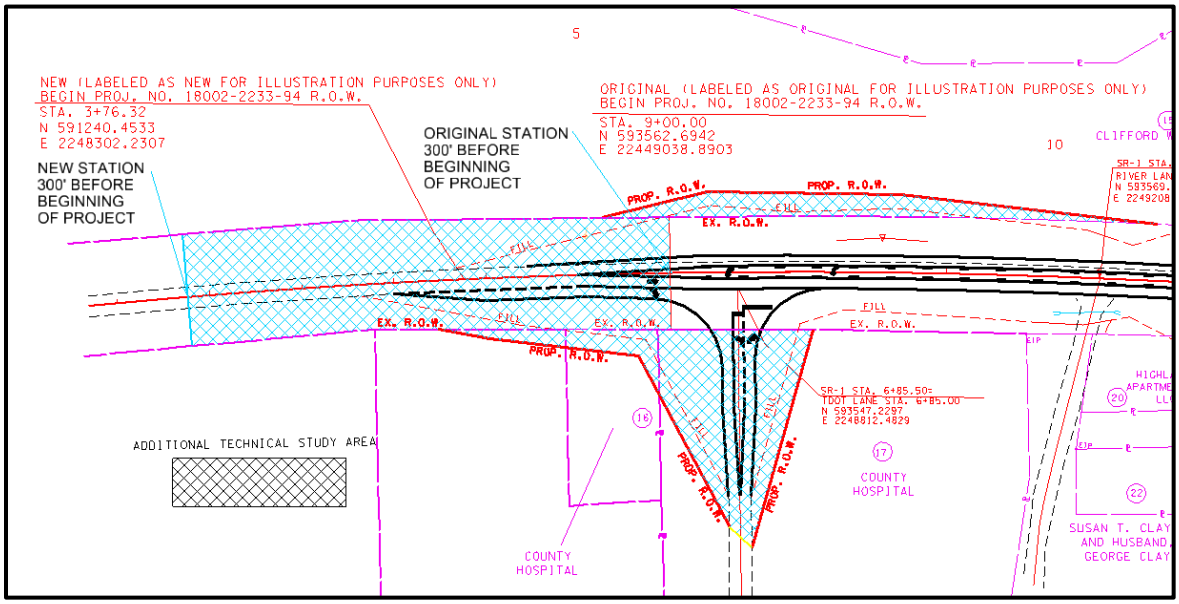


Figure 4-3
Environmental Technical Studies Additional Area Map

4-301.00 ENVIRONMENTAL IMPACTS AND MITIGATION

The following recommendations need to be followed in order to achieve an environmentally acceptable project as perceived by the United States Army Corps of Engineers (USACE), Environmental Protection Agency (EPA), United States Fish and Wildlife Service (USFWS), Tennessee Wildlife Resources Agency (TWRA), and Tennessee Department of Environment and Conservation (TDEC).

Although the Designer shall take all precautions to not impact an existing environmental feature, it is often unavoidable and encroachment occurs on features such as wetlands, streams, or other aquatic resources. The TDOT Environmental Mitigation Office is responsible for providing compensatory mitigation to offset unavoidable stream and wetland impacts. The office provides the required mitigation through use of restoration, establishment, enhancement, and/or preservation.

When encroachment occurs, the Designer shall evaluate the area to determine if any adjustments can be made to eliminate or lessen the impact without causing safety and drainage concerns. Possible solutions would be alignment shifts, steeper slopes that are acceptable by the Geotechnical Engineering Section as stated in the Soils and Geology Report or adding guardrail. When any of these impacts occur, the Designer shall contact the Regional Environmental Technical Office and Environmental Division during Stage 1 of the project to discuss measures for possible mitigation that may have to occur. Discussions may include the possibility of new stream alignments which shall be shown on the Functional Design plans to ensure sufficient R.O.W. acquisition and/or construction easement is acquired. For additional information regarding stream mitigation, see *Chapter 4-404.00, Stream Mitigation Right-of-Way.*

4-301.01 WETLAND IMPACTS

The Regional Environmental Technical Office or Environmental Division shall identify wetland boundaries in the Ecology Report and will use surveying instruments to record the area as a shape file to deliver to the Designer. The shape file can be imported into ORD. If a shape file is not available or does not reference in the correct coordinate system in the ORD file, the Designer shall request a survey update for the boundaries of the wetland.

Wetland boundaries shall be shown by the appropriate level feature in ORD, as shown on Standard Drawing RD-L-1. The wetlands shall be numbered (WTL-1, WTL-2, etc.) as indicated in the Environmental Boundary Report or Concept Report and placed within the wetland boundary in ORD. See *Figure 4-4*, *Wetland Impact* for an example. The plans shall also indicate locations where stormwater outfall discharges are modified and locations where the wetland receiving flows are redirected.

The area (in square feet or acres) and volume (in cubic yards) (assume a depth of 1 foot if a depth is not provided.) of any wetlands impacted by the project or any R.O.W. taken for wetland replacement shall be indicated on the Present Layout sheet. Impacts or alterations to a wetland may require an Aquatic Resources Alteration Permit (ARAP). See Roadway Design Guidelines Chapter 5-304.00*, Environmental Permit Requirements,* for additional information on permit sketch requirements.

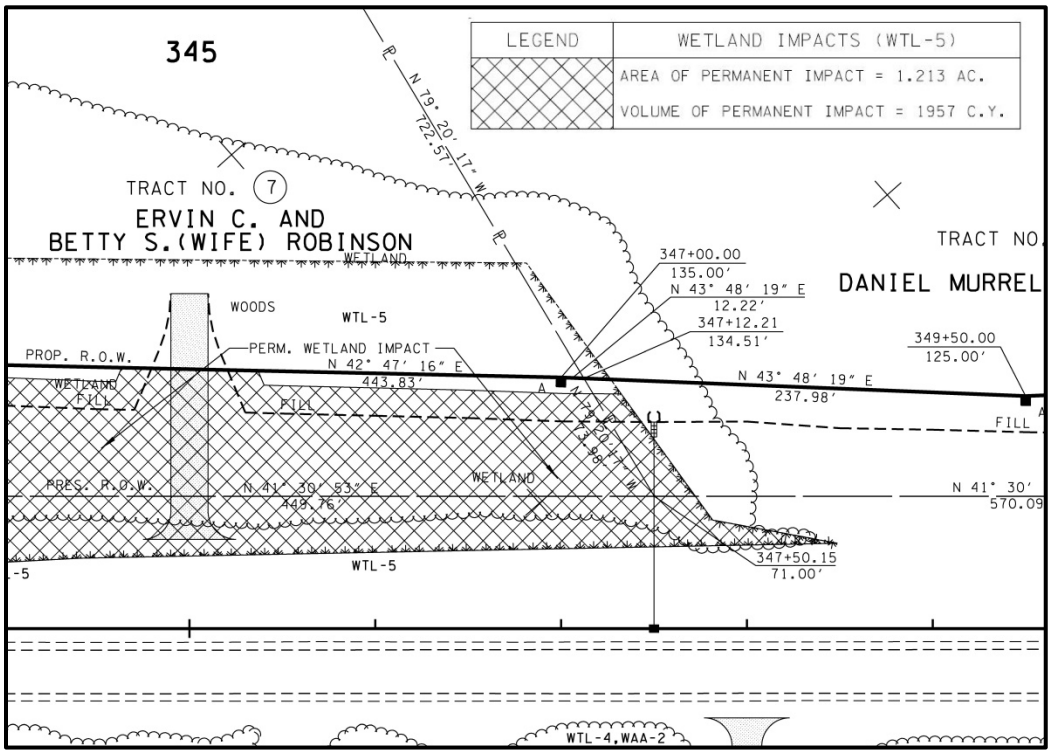


Figure 4-4
Wetland Impact

4-301.02 STREAM IMPACTS

As structures are proposed or changed on projects, the impacts to the environmental feature shall be considered. Early consideration for the type of structure and construction of the structure shall be considered, especially when there are restrictions in the water (such as piers) or time of year for construction in the water.

BOX/SLAB STRUCTURES

The following recommendations apply to box and slab impacts:

1. Any project which proposes long extensions of boxes and/or channel changes on streams (as indicated on the Environmental Boundaries Report) and/or wetlands involvement must be studied for alternate solutions; after which, a project coordination meeting between the involved TDOT Divisions, including the Regional Environmental Technical Offices must be held.

2. Where box and slab-type culverts and bridges are utilized, their length shall be held to a minimum. In the case of interchanges, intermittent boxes, rather than continuous boxes, are preferred.

3. Given the choice between long runs of boxes and channel changes, channel changes are generally preferred.

CHANNEL CHANGES

The following recommendations apply to channel impacts:

1. Concrete lined channels and rock lined (rip-rapped) channels are not acceptable for channel changes on blue-line streams.

2. In streams with enough flow to support aquatic life, a normal flow keyway within a channel change shall be considered if flood plain hydraulics dictates a channel larger than the natural channel is required. The normal flow keyway shall have approximately the same width (X) and height (Y) as the existing normal flow channel, as shown in *Figure 4-5, Channel Changes*.

3. Meanders must be included in channel changes on blue-line streams in order to maintain the natural stream length, sinuosity, and slope.

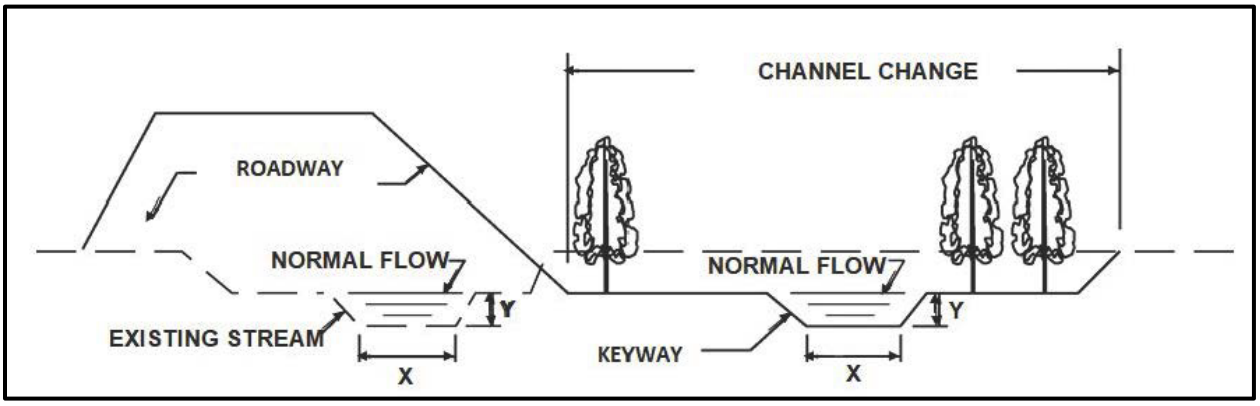


Figure 4-5 Channel Changes

For additional information on channel changes, see Drainage Manual, Chapter 5, *Section 5.05, Guidelines and Criteria for Stream Modifications*. For additional information on box and slab-type culvert and bridge lengths, see Drainage Manual, Chapter 6, *Section 6.04, Guidelines and Criteria*. For additional information on Natural Stream Design, see Chapter 11 of the Drainage Manual.

4-301.03 EMBEDDED PIPE CULVERTS

It is sometimes necessary to place a culvert bottom below a streambed. This is referred to as an embedded, sunken, or depressed culvert. Generally, when this is done, it is to eliminate the need to design specific hydraulic criteria for existing species of aquatic life. If an embedded pipe culvert is required, the Environmental Division or Regional Environmental Technical Office (R1.EnvTechOffice@tn.gov, R2.EnvTechOffice@tn.gov, R3.EnvTechOffice@tn.gov, R4.EnvTechOffice@tn.gov), shall notify the Designer of any stream with aquatic viability on the project in the Environmental

Boundaries Report. If Designers are instructed to embed a pipe culvert, the Designer shall follow the HEC 26 recommendations. The hydraulic capacity should be re-evaluated to ensure proper flow and capacity.

SECTION 4 – RIGHT-OF-WAY

4-400.00 RIGHT-OF-WAY (R.O.W.)

Once grade approval is received, both horizontal and vertical alignment are finalized, the R.O.W. process can begin. During the preliminary phase, the impacts to property owners can be identified and shown on the plans. At this point, the R.O.W. Division can start some of their Incidental activities. For additional information, refer to the TDOT R.O.W. Procedures Manual.

4-401.00 R.O.W. ACQUISITION TABLE

The R.O.W. Acquisition Table is provided by the Regional Survey in Excel format as part of the original survey documents for the project. The Excel file allows the Designer to insert measured areas into the table which in turn has pre-set formulas to calculate remaining areas, etc. If there are incorrect formulas, the acquisition tables need to be sent back to Regional Survey to revise. The Designer links the Excel file to a CADD file.

The R.O.W. Acquisition Table lists the property owners located on the project. Each property owner is assigned a tract number that **shall not** be altered or deleted. (See RDG Chapter *1-304.00, Tract Numbers on Plans*). The amount of land is shown as it appears in the CADD survey file with its location relevant to the centerline (left or right). The recorded deed documentation is obtained from a courthouse and shown in the table. The table shows the amount of existing land and the amount that is proposed to be acquired. There are formulas in the Excel file that calculate what remains of the original acreage.

Acquisition Areas and Easement Areas of 0.100 acre or more shall be shown in acres to 3 decimal places. Areas less than 0.100 acre shall be shown to the nearest square foot.

There are five columns for easements shown in the Excel Acquisition Table:

Column One: Permanent Drainage Easements
Column Two: Permanent Slope Easements
Column Three: Construction Easements
Column Four: Railroad - Permanent Highway Easements
Column Five: Railroad - Air Rights Easements

If the proposed centerline is changed during design, it shall be necessary to re-compute the areas left and right supplied with the survey and appearing in the TOTAL AREA columns of the table. The sum of all areas to be acquired and/or utilized as easements shall be totaled and shown at the bottom of the acquisition table. The survey file should be sent back to the Regional Survey Office for a file update.

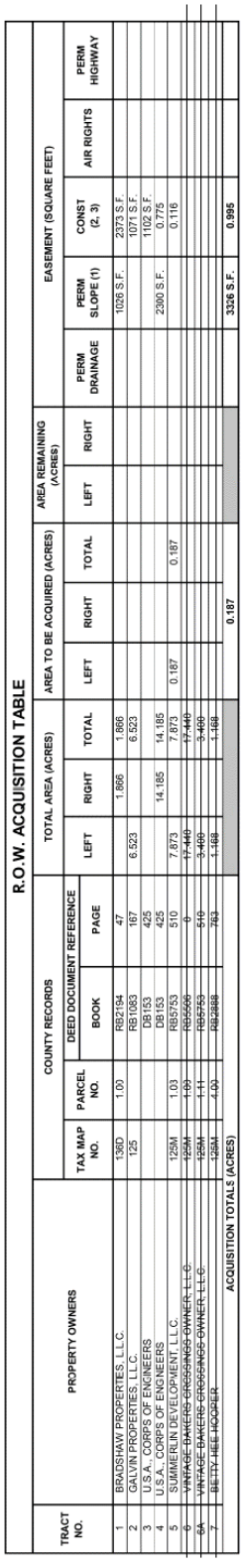
If a tract is not affected by the project, the tract shall have a line placed through the name and number along with associated entries in the Excel file. There shall also be a line placed through the tract number in the CADD file.

The disturbed area is shown under the table. The total project area should be provided and will include all disturbed and undisturbed areas. Footnotes are added to describe where and/or why some of the easements are needed. For example, they may be used to designate areas to be used for erosion control. See *Figure 4-6*, *Example R.O.W. Acquisition and Disturbed Area Tables.*

4-402.00 DISTURBED AREA BLOCK

Designers shall show both the total project area (total R.O.W., easements and disturbed plus undisturbed areas) and the total disturbed project area below the R.O.W. Acquisition Table. The total disturbed area shall be updated, and the plans revised for any change in the amount of disturbance. Disturbed Area is defined in Chapter 10 of the *TDOT Drainage Manual* as the total area of the site to be cleared, graded, or excavated within the life of the project, and shall be calculated as the area within the slope lines plus a 15-foot wide strip adjacent to the slope lines. For urban areas, the disturbed area may be calculated as the area within the slope lines plus the width of the Construction Easement. The disturbed area shall include the area for the construction of driveways. The designer should verify enough R.O.W. is available for construction activities.

See *Figure 4-6, Example R.O.W. Acquisition and Disturbed Area Tables,* for an example of how to show disturbed area below the R.O.W. Acquisition Table. Designers should contact the Regional Environmental Technical Offices if additional clarification is needed.



R.O.W. ACQUISITION TABLE

TRACT NO.	PROPERTY OWNERS	COUNTY RECORDS				TOTAL AREA (ACRES)			AREA TO BE ACQUIRED (ACRES)			AREA REMAINING (ACRES)		EASEMENT (SQUARE FEET)				
		TAX MAP NO.	PARCEL NO.	DEED DOCUMENT REFERENCE		LEFT	RIGHT	TOTAL	LEFT	RIGHT	TOTAL	LEFT	RIGHT	PERM DRAINAGE	PERM SLOPE (1)	CONST (2, 3)	AIR RIGHTS	PERM HIGHWAY
				BOOK	PAGE													
1	BRADSHAW PROPERTIES, L.L.C.	136D	1.00	RB2194	47		1.866	1.866							1026 S.F.	2373 S.F.		
2	GALVIN PROPERTIES, L.L.C.	125		RB1083	187	6.523		6.523								1071 S.F.		
3	U.S.A., CORPS OF ENGINEERS			DB153	425											1102 S.F.		
4	U.S.A., CORPS OF ENGINEERS			DB153	425		14.185	14.185							2300 S.F.	0.775		
5	SUMMERLIN DEVELOPMENT, L.L.C.	125M	1.03	RB5753	510	7.873		7.873	0.187		0.187					0.116		
~~6~~	~~VINTAGE BAKERS CROSSINGS OWNER, L.L.C.~~	~~125M~~	~~1.01~~	~~RB5586~~	~~0~~	~~17.440~~		~~17.440~~										
~~6A~~	~~VINTAGE BAKERS CROSSINGS OWNER, L.L.C.~~	~~125M~~	~~1.11~~	~~RB5753~~	~~510~~	~~3.460~~		~~3.460~~										
~~7~~	~~BETTY HEE HOOPER~~	~~125M~~	~~4.00~~	~~RB2388~~	~~763~~	~~1.168~~		~~1.168~~										
	ACQUISITION TOTALS (ACRES)										0.187				3326 S.F.	0.995		

1) SLOPE EASEMETNS TO BE USED TO CONSTRUCT SLOPES FROM STA. 624+55.34 TO STA. 627+31.01
2) CONSTRUCTION EASEMENTS TO BE USED TO CONSTRUCT PRIVATE DRIVES AND TO BE USED AS WORK AREA FOR SLOPE CONSTRUCTION
3) TRACT 4 0.230 AC TO BE USED FOR PRIVATE DRIVES & SLOPE CONSTRUCTION AND 0.545 AC TO BE USED FOR OFFSET BASIN

DISTURBED AREA

IN BETWEEN SLOPE LINES	3.319	(AC)
15 FOOT WIDE S TRIP (OUT SIDE SLOPE LINES)	1.110	(AC)
TOTAL DISTURBED AREA	4.915	(AC)
TOTAL PROJECT AREA	5.378	(AC)

Figure 4-6
Example R.O.W. Acquisition and Disturbed Area Tables

4-403.00 EASEMENTS

4-403.01 PERMANENT DRAINAGE EASEMENTS

Permanent Drainage Easements may be appropriate for channel changes and/or realignments or proposed ditches where no ditch existed before the proposed project. Permanent Drainage Easements shall be required for structures installed outside the proposed R.O.W. such as catch basins or cross drain pipes and headwalls that are needed to eliminate ponding. In these instances, it is not practical or economical to extend the proposed R.O.W. width to accommodate the structure. Any rip-rap or protection of these proposed structures shall also be included in the Permanent Drainage Easement. The Designer shall ensure that adequate drainage easement is obtained for placement of the structure, erosion protection, and maintenance of the structure.

The Permanent Drainage Easement shall extend from the R.O.W. and have precedence over other easements. Slope and Construction Easements shall not overlap Permanent Drainage Easements. A Permanent Drainage Easement should include stations/offsets and bearing/distances.

4-403.02 PERMANENT SLOPE EASEMENTS

Permanent Slope Easement is the area between the proposed R.O.W. and where the side slopes of the road meet the existing conditions. A Slope Easement is a permanent easement used to for the construction and maintenance of said slopes, but remains as a part of the property owner's R.O.W. The Permanent Slope Easement column in the R.O.W. Acquisition Table shall contain only that area outside the R.O.W. required to tie down the slopes.

4-403.03 CONSTRUCTION EASEMENTS

Construction Easement consists of the area between where the side slopes of the proposed road meet the existing ground and the width needed to construct the slope to that point (usually 10'). Construction Easement may also be used for building haul roads, improvements to a road that will be used as a detour on the project, area for construction behind a retaining wall, bridge, etc. It is also used in some drainage circumstances to provide a drainage ditch or channel improvement, such as widening or bank stabilization with rip-rap, for placement of sediment basins and other erosion prevention and sediment control devices during the construction phase, and staging/storing areas that will be used during construction for equipment, materials, etc.

Generally, a 10-foot Construction Easement is the width defined for working outside slope easements. This area must be shown on the appropriate plan sheets. The Construction Easement may be reduced or eliminated as necessary to avoid trees, buildings, etc. It may also be necessary to increase the easement width to allow for erosion control devices and areas that may be harder to construct such as steep slopes, rock slopes, rock catchments, etc.

An example of the three types of easements are shown in *Figure 4-7, Construction, Permanent Drainage, and Slope Easements in Plans.*

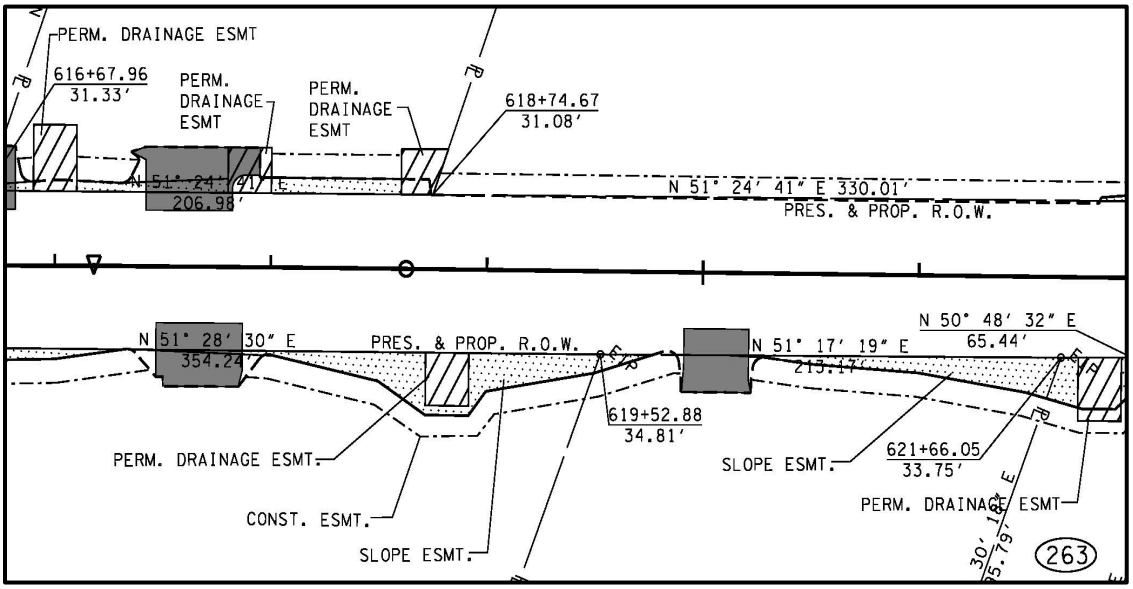


Figure 4-7
Construction, Permanent Drainage, and Slope Easements in Plans

4-403.04 RAILROAD EASEMENTS

PERMANENT AIR RIGHTS/AERIAL EASEMENT

When an overpassing structure impedes the Railroad's capacity to use their easements, rights, or property for Railroad purposes, the Department is required to compensate the Railroad for the encumbrance imposed on the Railroad. Air rights are a type of easement obtained by the Agency to compensate the Railroad for limiting the Railroad's use of their property or easement vertically or horizontally. Air rights are generally bounded by the abutments on either side of the Railroad Corridor and furthest dimensions of the superstructure – generally the parapet walls on either side of the structure. In some cases, the proposed structure does not span the Railroad R.O.W. but in all cases the Air Rights are limited to the dimensions of the superstructure. Air rights will never be acquired from the Railroad for at-grade crossings or crossing where the Railroad operates above a transportation facility, or crossing where the Railroad's ownership interest in its corridor is an easement for railroad purposes. See *Chapter 4-601.00 HQ Railroad Office Coordination* for more information on the types of easements needed for railroad projects.

PERMANENT HIGHWAY EASEMENTS

Permanent Highway Easements are obtained from the Railroad to include all properties the Railroad will no longer have rights to during and after construction of the project. Examples of Permeant Highway Easements are slope pavement and foundations for abutments, bents, and columns. The acquisition description should state that "the above-described property is hereby

conveyed as a permanent highway easement for the purpose of construction, maintenance, and operation of a highway facility. The title to the above-described land remains vested in the Grantor and may be used for any purpose, provided such use does not interfere with the State of Tennessee's use, construction, maintenance, or operation of the highway facility." Permanent Highway Easements can be used for both at-grade crossings and grade separated crossings.

Examples of these and other easements are shown in *Figure 4-8, Temporary Construction, Permanent Highway, and Air Rights Easements in Plans.*

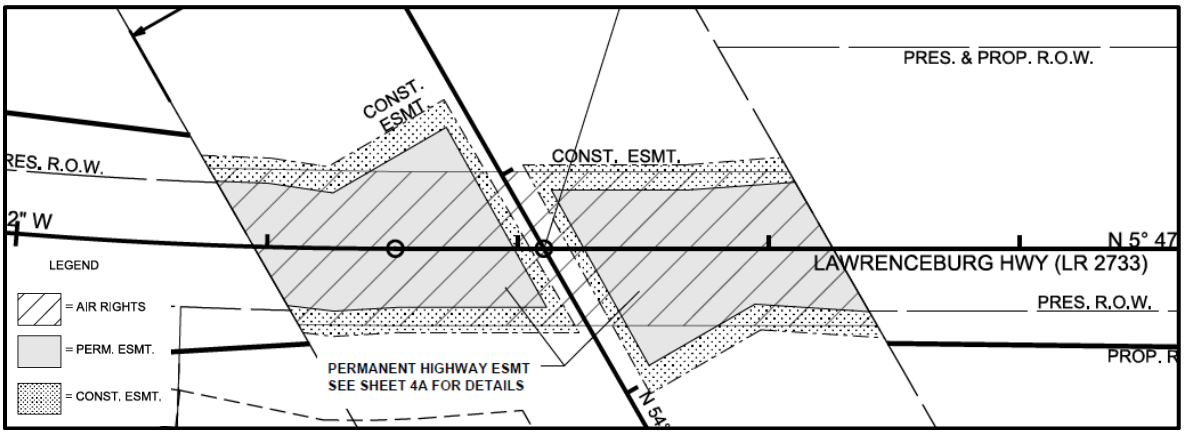


Figure 4-8
Temporary Construction, Permanent Highway, and Air Rights Easements in Plans

4-404.00 STREAM MITIGATION RIGHT-OF-WAY

Stream Mitigation Right-of-Way is land acquired for stream mitigation enhancements to help satisfy the Environmental Permitting requirements of roadway projects. Utilities cannot relocate into Proposed Stream Mitigation Right-of-Way and the requirement should be stated on both Present Layout sheets, Right-Of-Way Detail sheets, and in the Right-of-Way/Utility notes. If there are no feasible alternatives for existing utilities to relocate outside of the Proposed Stream Mitigation Right-of-Way, a solution will be determined on an individual basis.

4-404.01 OFF-SITE STREAM MITIGATION

Off-site stream mitigation is a stand-alone project that has a separate PIN and provides mitigation to one or more roadway projects. These projects will always have land use restrictions or conservation easements on them. In some rare cases, the off-site mitigation project might be directly adjacent to a roadway project it is offsetting. These projects are started with mitigation and once a NEPA document has been completed, the Regional Project Management Office holds a kick-off meeting to determine the schedule and next steps. The actual mitigation design is completed by an environmental consultant, but the designer will review and comment on the plans prior to field reviews.

4-404.02 ON-SITE STREAM MITIGATION

Most stream mitigation projects are on-site stream mitigation. This is where the Environmental Division determines a location within the project limits for a natural stream design and the environmental consultant completes a design to be incorporated into a roadway project. Trees and plantings included within the design cannot be cleared and the restriction must be incorporated into the plans.

4-405.00 PRELIMINARY R.O.W. ESTIMATE FROM LINE AND GRADE FIELD REVIEW PLANS

The Designer shall provide preliminary acquisition areas and all easement areas to the technical R.O.W. teams in Project Development (see *Distribution List* for email addresses) so that a preliminary R.O.W. estimate can be developed. Design Leads will be responsible for furnishing a copy of the R.O.W. Acquisition Excel File with acquisition areas, easement areas, and disturbed area after finalizing the Preliminary plans. R.O.W. Form 44A is for any estimates done prior to Functional Design Field Review.

Designers shall calculate preliminary areas using the following procedure:

1. Calculate acquisition and easement areas with the ORD's Measure Area tool using the Points or Flood methods. It is not necessary to store areas in the ORD file nor should time be spent defining shape elements in ORD for area calculations.

2. In the **R.O.W. Acquisition Excel File**, provided by Survey and includes owner and tract information, enter the calculated square foot areas on the "DES IN" worksheet.

3. Make a copy of the Excel file and rename it using the State Route Number, County, and PIN followed by the extension .xlsx. **Example: SR1Knox405132.00.xlsx**

4. Consultants shall provide the Excel file to the Design Lead. For projects developed in-house, the Designer should submit the Excel file to the email address listed below with a copy of the email being sent to the Design Lead and the Regional R.O.W. Manager.

5. Once the Line and Grade Field Review invitations are sent out, submit the Excel file via email as an attachment to Preliminary.acquistiontable@tn.gov. Subject line for email shall be Preliminary Areas-State Route #, County, PIN #/code. **Example: Preliminary Areas, SR 1, Knox County, PIN 405132.00.** A copy of the email shall be placed in the project folder to document the submittal of preliminary acquisition, easement areas, and disturbed area.

SECTION 5 – TRAFFIC DESIGN COORDINATION

The Designer shall include the Traffic Design groups in the Line and Grade Field Review email when requesting Signals, Lighting, Intelligent Transportation Systems (ITS), and/or Signs and Pavement Markings for a project. The ITS is also called TDOT SmartWay. The system uses live video cameras to monitor highways across the state and is monitored by TDOT personnel. The system also consists of live message boards which notify drivers of urgent traffic notices and provide safety messages to drivers.

Generally, the Concept Report will indicate if signals, lighting, ITS, and/or Signs and Pavement Markings are proposed on the project. However, in some instances, the report may have been distributed prior to significant land use changes within the project limits or there may be existing elements on a project that are not up to current TDOT standards. Distribution for the Line and Grade Field Review shall be sent to the Traffic Design Division for all projects except bridge projects located in remote locations with no indications of existing signals, nearby intersections, etc. If the Designer is unsure if any Traffic Design is needed, the Designer shall note in the email distribution that no signals, lighting, ITS, or signs and pavement markings were proposed in the Concept Report and a final determination review is requested by the Traffic Design Division. These studies shall be completed early in the plans production to ensure the Designer has pole locations and other items that may require additional R.O.W. acquisition and to avoid potential conflicts by utility companies when designing their plans.

The following steps shall be followed by TDOT and Consultant Designers in order to assist the Traffic Design Division in providing signalization, lighting, ITS, and/or signs and pavement marking designs in a timely manner, as well as to allow the Traffic Design Division to schedule workload.

4-500.00 TRAFFIC SIGNAL DESIGNS

The following steps are to be followed in order to assist the Traffic Design Division in providing signalization designs in a timely manner, as well as to allow the Traffic Design Division to schedule its work efficiently.

TDOT Designed Roadway Plans:

When the Concept Report indicates that signalization is required on a project, or if signalization is not included in the report, but there is suspicion that signals may be involved in a project, the Traffic Design Division – Signals and Lighting Section and the ITS section shall be notified by email, TDOT.TrafficOps.SNL-Reviews@tn.gov and TDOT.TrafficOps.ITS-Reviews@tn.gov, for the Line and Grade Field Review. Designers are reminded that all available design traffic data (including ADT's, DHV's, design speed, and traffic turning movements at all intersections) shall be included in the Line and Grade plans.

The Traffic Design Division – Signals and Lighting Section will respond to the Designer indicating where signalization is warranted, or if no signalization will be involved, give comments pertaining to geometric improvements that will provide better operations characteristics.

Consultant Designed Roadway Plans:

The Design Project Manager shall notify the Traffic Design Division – Signals and Lighting Section by email of the Line and Grade Field Review for projects which contain signalization. The Traffic Design Division – Signals and Lighting Section will provide comments for the Preliminary Field Review.

4-501.00 LIGHTING DESIGNS FOR ROADWAY PROJECTS

The following steps are to be followed in order to assist the Traffic Design Division in providing lighting designs in a timely manner, as well as to allow the Traffic Design Division to schedule its work efficiently.

TDOT Designed Roadway Plans:

When the Concept Report indicates that lighting is required on a project, the TDOT Designer shall furnish the Traffic Design Division – Signals and Lighting Section with a PDF of the preliminary plans and request a pole location layout. The PDF shall be furnished by the TDOT Designer at the Line and Grade Field Review of project development to ensure that the utility requirements will be shown on the plans for the Functional Design Field Review.

If there is no right-of-way acquisition required on the plans, but lighting is required, the TDOT Designer shall furnish the Traffic Design Division – Signals and Lighting Section with a PDF of the plans as soon as the Present and Proposed Layout sheets are drawn and request the light pole locations. This is to ensure that the utility requirements will be shown on the plans for Functional Design plans submittal.

The Designer shall notify the Traffic Design Division – Signals and Lighting Section by email of the Line and Grade Field Review submittal.

The proposed roadway lighting involves a design process which begins with a photometric layout after which the lighting design process can begin. Pole locations are dependent on the photometric layout and the complete roadway lighting design. Refer to Chapter 15 of the Traffic Design Manual for more information.

Consultant Designed Roadway Plans:

If a lighting design will be completed by the consultant, then the consultant designer will be responsible for providing the Traffic Design Division – Signals and Lighting Section with a PDF of the plans showing the light pole location layout. The Design Project Manager shall notify the Traffic Design Division – Signals and Lighting Section by email of the Line and Grade Field Review for projects which contain lighting. Traffic Design Division – Signals and Lighting Section will provide comments for the Line and Grade Field Review. **If a lighting design will not be completed by the consultant, then the in-house procedure shall be followed.**

4-502.00 INTELLIGENT TRAFFIC SYSTEM DESIGN

When the Concept Report indicates that ITS are required on a project or that elements may already be on the project, the TDOT Designer shall include the ITS Section of the Traffic Design Division when submitting the Line and Grade Field Review by emailing TDOT.TrafficDesign.ITS@tn.gov. **In addition to the Concept Report, for all projects that have signals and projects with roads classified as major arterials or higher, the ITS Section shall be emailed during the Line and Grade Stage.** This early notification will ensure that the ITS section reviews the plans for installation of fiber at signalized intersections or for installation parallel to major arterials. The requirements will be shown on the plans for the Functional Design Field Review.

4-503.00 SIGNS AND PAVEMENT MARKING DESIGN

TDOT Designed Roadway Plans:

When the Concept Report indicates that signs and/or pavement markings are required on a project, existing signs and/or pavement marking exists on the project, or if signs and/or pavement markings are not included in the report but there is suspicion that signals may be involved in a project, the Designer shall include the Signs and Pavement Marking Section of the Traffic Design Division (TDOT.TrafficDesign.SignsandMarking@tn.gov) with the Line and Grade Field Review. For all projects with signs and/or pavement markings, the Signs and Pavement Markings Section of the Traffic Design Division requests notification as well by email, TDOT.TrafficDesign.SignsandMarking@tn.gov. For bridge projects in remote locations with no indications of existing signs and/or pavement markings the Signs and Pavement Marking Section shall not be requested during PDN Stage 1.

Consultant Designed Roadway Plans:

If the project has roadway plans that are designed by a consultant who is also responsible for signs and pavement markings, email the Signs and Pavement Marking Section of the Traffic Design Division when submitting the Line and Grade Field Review. The Signs and Pavement Marking Section will review the plans and analysis and provide comments, if needed.

SECTION 6 – RAILROAD COORDINATION

4-601.00 HQ RAILROAD OFFICE COORDINATION

The State Railroad Coordinator is in the HQ Utility Office. This position is responsible for coordinating with any railroads on a project. It differs from the Multimodal Division Railroad program coordinator who generally has stand-alone Railroad Safety projects.

All railroad coordination and communication should be submitted through the State Railroad Coordinator to the railroad entities impacted by a State let project. Plans should be directed to the State Railroad Coordinator who will submit the plans and revised plans to the necessary railroad(s). When plan review comments are supplied by the railroad entity involved, the plan review comments will be submitted to the responsible Designer/Design Lead for the project.

During each project phase, an Excel file will accompany the plan review comments. Within the Excel file, under each plan review comment, there is a space titled: "*Agency Response*". In this section the Designer responds to how, if and where they have addressed the specific plan review comment. If the Designer disagrees with the request made by the plan review comment, the Designer may use the "Agency Response" area to state TDOT's position. Once all the plan review comments have been addressed, the completed Excel spreadsheet and the revised plans shall be submitted to the State Railroad Coordinator as a non-portfolio PDF set. The set will then be released to the railroad(s) involved.

Iterations of plan reviews will take place until the Railroad or their representative provides the following statement to the State Railroad Coordinator: *"(Railroad Entity) takes no further exceptions to the project plans."* When this statement is received by the State Railroad Coordinator, a request will be made of the Designer and the Point of Accountability for final plans. Once the final plans have been released to the Railroad(s), the coordination effort between the State Railroad Coordinator and the Designers is complete. If letting or construction revisions are made, the State Railroad Coordinator should be included in the revision notification email.

RAILROAD COORDINATION NOTES:

- By Agreement, the Railroad has thirty (30) days to review plans.
- A submission of revised plans without the completed Excel file will not be acknowledged as a submission by the Railroad. The completed Excel spreadsheet and the revised plans are both required.
- Revised sheets which only address the plan review comments are not permitted. Only full sets of plans will be transmitted by the State Railroad Coordinator to the Railroad.

4-602.00 SHOWING RAILROAD PROPERTIES ON PLANS

4-602.01 RAILROAD PROPERTY TYPES

Railroad property exists as corridors in the State of Tennessee by two means: easement or fee simple. Below is a short summary of the two cases. Inquiries regarding whether a Railroad's Right-of-Way is Easement or Fee Simple, should be sent to the State Railroad Coordinator at HQRailroadCoordinator@tn.gov.

Easement

Historically, the Government (Federal/State) condemned individual parcels of property in stretches of corridors in the name of the Government. The Government granted these corridors to individual railroad entities for railroad purposes. If the grantee railroad entity uses the corridors for railroad purposes, the railroads are granted certain rights to the Right-of-Way (R.O.W.) which facilitates the Railroad's needs. If the corridor is no longer used for railroad purposes, the Railroad must abandon the corridor at which time the Railroad Easement is relinquished and transferred to the current adjoining property owner up to the centerline of rail.

Fee Simple

Fee simple property is the highest order of ownership of property. This means the Railroad has acquired property from the individual parcel owners and paid for the acquisition which is accompanied by a deed of ownership. The Railroad has all rights to all fee simple properties they own and if a public project infringes on their rights, compensation must be made in accordance with the Uniform Act.

NOTE: If a fee simple corridor is discovered, the schedule for the project is increased by a minimum of nine months. Any modification will take an additional three to nine months. It is imperative that the information be presented correctly from the beginning.

4-602.02 RAILROAD ACQUISITION TYPES

Various easement types apply to Railroad acquisition. These include Permanent Highway Easement, Temporary Construction Easement, Permanent Air Rights/Aerial Easement, Permanent Slope Easement, and Permanent Drainage Easement. The following give a brief description of the type and methods often used in railroad acquisition. Permanent easement **CANNOT** overlap construction easement. Air Rights **CAN** overlap permanent easement and construction easement.

- **Permanent Highway Easement**
  - This would include all properties the Railroad has rights to prior to the project but will no longer have rights to during and after construction. Examples of

Permanent Easement are slope pavement and foundations of abutments, bents, and columns. No Permanent Easement can infringe on the Railroad's ability to use their current configuration of tracks (i.e., Permanent Easement cannot be atop the Railroad's tracks). See *Figure 4-9, Example of Permanent Highway Easement*.

- **NOTE:** When establishing the required square footage of Permanent Highway Easement, the required Permanent Highway Easement should extend one (1) foot beyond the furthest dimension of the proposed or actual footing. For example, if a footing is 4' x 4' or 16 square feet, the required permanent highway easement, which should be inserted within the Acquisition Table, will be 6' x 6' or 36 square feet. This note applies to abutment foundations and bent foundations which will permanently exist on the Railroad's Right-of-Way during and after construction. Slope pavements should be registered in the Acquisition Table by their actual dimensions. Slope pavements would include those constructed of concrete pavement, rip-rap, etc.

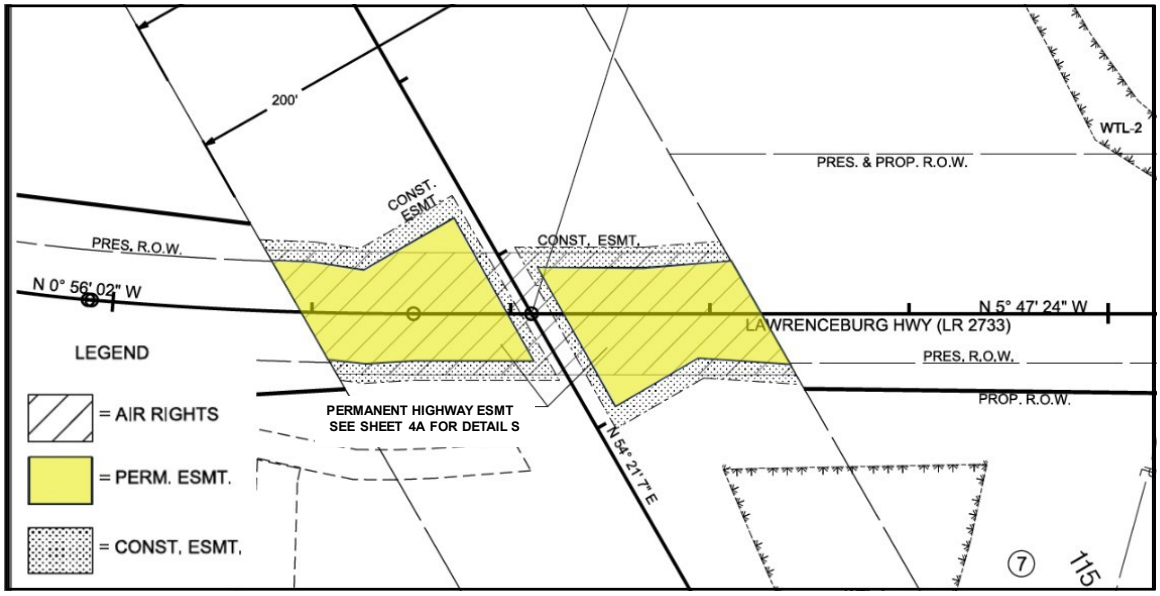


Figure 4-9
Example of Permanent Highway Easement

- **Temporary Construction Easement**

  - Any property necessary to construct the proposed project in which the Designer/contractor anticipates personnel or equipment on the Railroad's Right-of-Way during construction activities. A construction easement is generally obtained for haul roads, access roads, staging, or storage of materials for the proposed construction project. Once the project is complete and returned to its original condition, the original property owner assumes complete ownership, rights, and responsibility for maintenance.

- It is important to get adequate Temporary Construction Easement as there is a lengthy revision process if the corridor is Fee Simple. If necessary, consult with the Construction Division to ensure the initial amount of Temporary Construction Easement is enough to feasibly construct the project. See *Figure 4-10, Example of Temporary Construction Easement*.

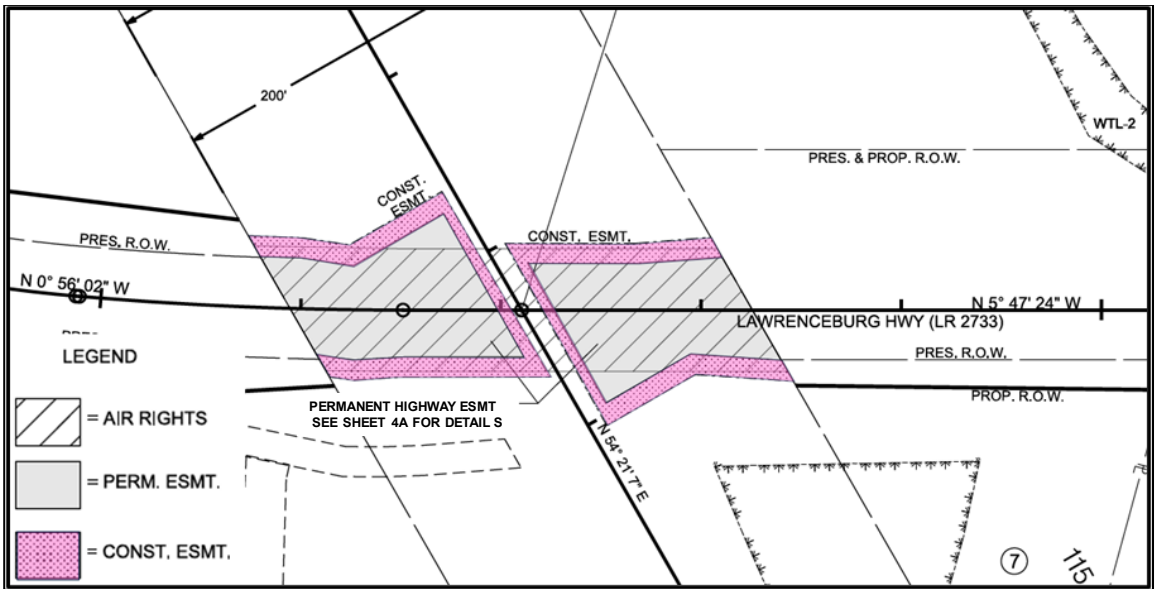


Figure 4-10
Example of Temporary Construction Easement

- **Permanent Air Rights/Aerial Easement**

  - This type of easement is reserved for future maintenance activities of the structure throughout its life. The required square footage is an envelope that includes the entire superstructure. This is bounded by the bridge abutments (or bridge piers immediately adjacent to railroad track(s)) and the outside dimensions of the proposed bridge parapet walls. See *Figure 4-11, Example of Permanent Air Rights Easement*.

  - Air rights will never be acquired from the Railroad for an at-grade crossing.

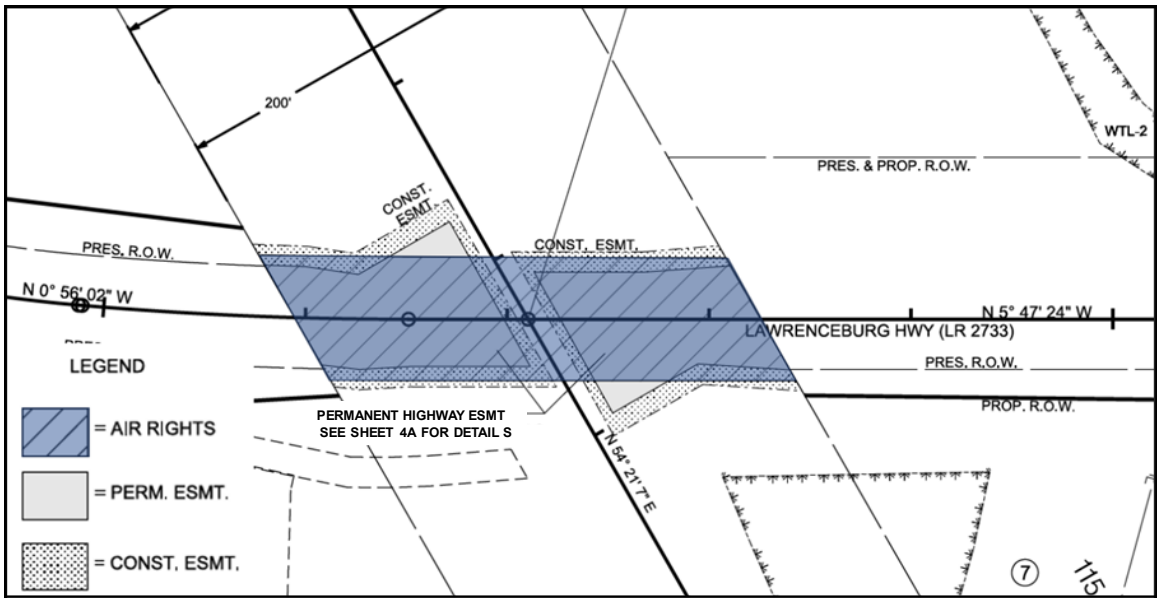


Figure 4-11
Example of Permanent Air Rights Easement

- **Permanent Slope Easement**

  - This type of easement is reserved for embankments which shall encroach onto the Railroad's property. These types of easements are rare, and if seen, will generally be on parallel encroachments. Often, the Railroad will request the Department to install a retaining wall to hold back the cut/fill materials frencroaching onto their right-of-way, however, in rare occasions, this type of easement will be used. The total square footage or acres shall be registered as the actual dimension on the Acquisition Table. See *Figure 4-12, Example of Permanent Slope Easement*.

  - Permanent Slope easements shall be reserved for earthen Slope Easements having to do with the embankments necessary to establish the vertical/horizontal alignments and cross-sections. All slope pavements (i.e., concrete pavement or rip-rap) shall be shown as Permanent Slope Easements.

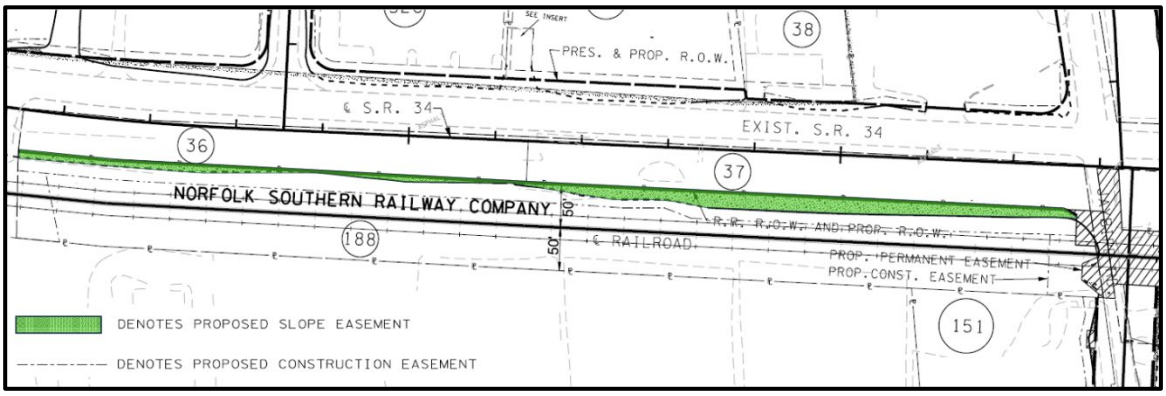


Figure 4-12
Example of Permanent Slope Easement

- **Permanent Drainage Easement**

  - This type of easement is also rare; however, it is utilized more often than a Permanent Slope Easement. Generally, the Railroad will request no additional water be released onto their corridor and request the additional water generated by the project be channeled away from the Railroad's corridor. In certain circumstances, this request is impossible to accommodate. In such a case, the necessary Permanent Drainage Easement shall be totaled as a square footage or acres and registered as the actual dimension on the Acquisition Table.

4-602.03 PROPERTY MAP REQUIREMENTS FOR RAILROADS

The property map for both Fee Simple and Easement property interests held by the Railroad will generally look the same. In addition to the items shown in the checklist, the Designer should add the following note to the Property Map for railroad corridors that are held as **Easement by the Railroad**. Refer to the following figures:

Figure 4-16, Grade Separated Easement Corridor Property Map
Figure 4-24 At-Grade Easement Corridor Property Map
Figure 4-34, Parallel Encroachment Easement Corridor Property Map
Figure 4-40, Norfolk Southern Property Map.

"The Agreement required for the Railroad crossing will be obtained by the R.O.W. Division's Utility Office Railroad Coordinator through negotiations and Special Provisions with the Railroad."

4-602.04 ACQUISTION TABLE REQUIREMENTS FOR RAILROAD FEE SIMPLE AND EASEMENT ACQUISITION TYPES

The Acquisition Table for both Fee Simple and Easement property interests held by the Railroad will generally look the same. The Acquisition Table, whether for Easement or Fee Simple railroad corridors, identifies properties impacted by the project and rights as easements. Refer to the following figures:

Figure 4-17, Grade Separated Easement Corridor R.O.W. Acquisition Table
Figure 4-25, At-Grade Easement Corridor R.O.W. Acquisition Table
Figure 4-35, Parallel Encroachment Easement Corridor R.O.W. Acquisition Table
Figure 4-41, Norfolk Southern R.O.W. Acquisition Table

Fee Simple and Easement Corridors

- All railroad entities impacted by a project will be identified along with their corresponding tract number(s) within the Acquisition Table.
- Each type of easement will be totaled as a square footage (or as acreage if the square footage number is greater than 0.1 acre) and inserted into the appropriate column.
- If the corridor is held in Fee Simple by the Railroad, there will be a Deed with a book and page reference. This information must be entered into the Acquisition Table. If the information is not provided by Geodetics, contact the State Railroad Coordinator at HQRailroadCoordinator@tn.gov for the required information.
- It is extremely rare that a Railroad entity will sell the underlying Fee of a Fee Simple Corridor to the State which is why we purchase easements from the Railroad. For this reason, the Total Area Acres, Area to be Acquired Acres, and the Area Remaining Acres columns of the Acquisition Table are very rarely filled out for a railroad tract. Instructions will be provided by the State Railroad Coordinator or the Special Acquisitions Agent at the Tennessee Department of Transportation (TDOT) Headquarters if these fields require inputs, otherwise they can be left blank.
- If not already inserted within the Acquisition Table, additional easement columns including: PERM. DRAINAGE (Permanent Drainage Easement), PERM. SLOPE (Permanent Slope Easement), CONST. (Temporary Construction Easement), PERM. (Permanent Easement), and AIR RIGHTS (Air Rights Easement) shall be inserted.

Acquisition Tables for Easement Corridors Only

Similar to the Fee Simple Acquisition Table, the Easement Acquisition Table will look exactly the same with the exception of two small additions:

- A double asterisk will be added to the left of the Railroad tract number(s).
- A footnote will be added to the bottom of the Acquisition Table referencing the double asterisk. The exact language to be inserted as a footnote will be provided by the State Railroad Coordinator.

4-602.05 PRESENT LAYOUT SHEET(S) REQUIREMENTS FOR RAILROADS

The Present Layout sheets for both Fee Simple and Easement property interests held by the Railroad will generally look the same. Additional information is shown in the checklists that should be added to the Present Layout sheets for Railroad involvement. Refer to the following figure:

Figure 4-18, Grade Separated Easement Corridor Present Layout
Figure 4-26, At-Grade Easement Corridor Present Layout
Figure 4-36, Parallel Encroachment Easement Corridor Present Layout
Figure 4-42, Norfolk Southern Present Layout

Whether a Railroad corridor is held in Fee Simple or Easement the Present Layout sheet(s) will look exactly alike with one simple difference:

FEE SIMPLE:

The Present Layout sheet(s) will be shown as described above and shall look similar to *Figure 4-8, Temporary Construction, Permanent Drainage, and Air Rights Easements in Plans*.

EASEMENT:

The Present Layout sheet(s) will be shown as described above and a boxed note will be placed on the sheet with the following statement:

"The Agreement required for the Railroad crossing will be obtained by the R.O.W. Division's Utility Office Railroad Coordinator through negotiations and Special Provisions with the Railroad."

4-602.06 RIGHT-OF-WAY DETAILS SHEET(S) and RAILROAD DETAILS SHEET(S)

Depending on the volume of information on the Right-of-Way Details sheet(s), the impacted railroad easements may need to be shown on multiple Right-of-Way Details sheets. Refer to the following figures for Easement Corridors:

Figure 4-19, Grade Separated Easement Corridor R.O.W. Details
Figure 4-27, At-Grade Easement Corridor R.O.W. Details (A)
Figure 4-28, At-Grade Easement Corridor R.O.W. Details (B)
Figure 4-37, Parallel Encroachment Easement Corridor R.O.W. Details
Figure 4-43, Norfolk Southern R.O.W. Details

The overall impacted railroad properties shall be shown in the Right-of-Way Details sheet(s) which would include: Permanent, Slope, Drainage, Air Rights, and Temporary Construction Easements. The Right-of-Way Details sheet(s) will include all the bearings/distances

and stations/offsets of the impacted easements. The Temporary Construction Easement and the Air Rights Easement shall be shown on one overlaid Right-of-Way detail.

4-602.07 PROPOSED LAYOUT SHEETS

The Proposed Layout Sheets for both Fee Simple and Easement property interests held by the Railroad will generally look the same. Additional information is shown in the checklists that should be added to the Proposed Layout sheets for railroad involvement. Refer to the following figures for additional information.

Figure 4-20, Grade Separated Easement Corridor Proposed Layout
Figure 4-29, At Grade Easement Corridor Proposed Layout
Figure 4-38, Parallel Encroachment Easement Corridor Proposed Layout
Figure 4-44, Norfolk Sothern Proposed Layout

4-602.08 PROPOSED PROFILE SHEETS

The Proposed Profile Sheets for both Fee Simple and Easement property interests held by the Railroad will generally look the same. Additional information is shown in the checklists that should be added to the Proposed Profile sheets for railroad involvement. Refer to the following figures for additional information.

Figure 4-21, Grade Separated Easement Corridor Profile
Figure 4-30, At Grade Easement Corridor Proposed Profile
Figure 4-39, Parallel Encroachment Easement Corridor Proposed Profile
Figure 4-45, Norfolk Sothern Proposed Profile

4-603.00 GRADE SEPARATED RAILROAD CROSSINGS

This section should only be referenced for crossing types which overpass or underpass the Railroad's corridor i.e., grade separated. All other crossing types are covered in subsequent sections of these guidelines. See *Figure 4-13, Example of Highway over Railroad* and *Figure 4-14, Example of Railroad over Highway*.



Figure 4-13
Example of Highway over Railroad



Figure 4-14
Example of Railroad over Highway

4-603.01 GENERAL DESIGN CRITERIA FOR GRADE SEPARATED CROSSINGS

- If designing under or over CSXT or Norfolk Southern Railway Company, use their published Public Projects Manual. If a copy of the Public Projects Manual is needed, please contact the State Railroad Coordinator for the latest version. For all other railroads, the publications of CSXT and Norfolk Southern Railway Company are a great rule of thumb to follow. If additional guidance is required, use the American Railway Engineering and Maintenance Association (AREMA) standards or contact the State Railroad Coordinator to determine if the railroad entity has some general standards.
- When possible, develop design plans concurrently with the structural plans.

- Starting with the Plan-in-Hand plans, indicate where modifications have been made to railroad plans.

4-603.02 PRELIMINARY PLANS FOR PROJECTS CONTAINING GRADE SEPARATED CROSSING(S)

In order to facilitate the Railroad's review of all future highway plans, including a highway-railroad grade separated crossing, the following information must be included on the preliminary plans, which are to be submitted to the State Railroad Coordinator as an info only set (non-portfolio PDF set) to be distributed to the Railroad(s) for comments and/or approval:

1. A minimum of five (5) railroad cross-sections shall be provided at the following locations:
    - The roadway grade at the proposed bridge
    - Both faces of the proposed bridge
    - Right-of-Way limits (minimum 100 ft.) from face of the proposed bridge (perpendicular to the railroad alignment)

    a. The proposed bridge toe of abutment fill slopes, existing railroad drainage structures and ditches, and roadside ditches should be shown on all applicable cross-sections.

    b. For any proposed structure (example: retaining wall, end wall), a cross-section view showing the location of such structures in relation to the location of the railroad centerline of track shall be shown.

    c. Cross-sections need to show any changes proposed during grading operations to the railroad embankment, drainage ditches, or sub-track structures.

    NOTE: If the distance between the subject cross sections exceeds fifty (50) feet, additional cross-sections are required to adequately depict conditions along the tracks. See *Figure 4-9, Example Cross Section Locations,* for cross-sections that are required to adequately depict conditions along the tracks.

2. Provide the Project Drainage Report with the Line and Grade Plans Field Review submission to the State Railroad Coordinator. An example can be found on the TDOT Engineering Production Support website.

    NOTE: The Railroad is concerned that no new water will be placed on their property as a result of the project and request proof to be provided by the State or their representative which confirms this as fact.

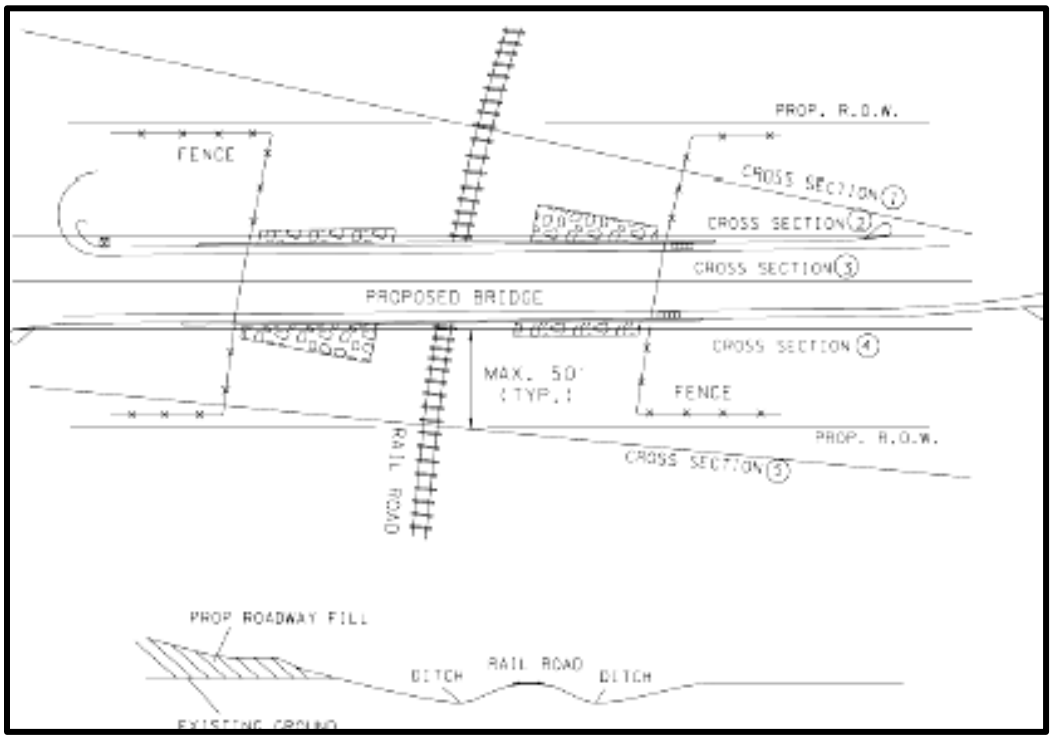


Figure 4-15
Example Cross Section Locations

3. The following information must be on the Line and Grade plans and carried through the subsequent phases of the project design,

    a. On the cover sheet, provide a call out with the Railroad Entity, the DOT crossing number, the type of crossing (Over/Under) and the railroad milepost for each crossing impacted by the project.
    b. Show the centerline of track on both the profile and plan views.
    c. Show and label the Railroad Right-of-Way as “ENTITY R.O.W.” on both the profile and plan views.
    d. Dimension the Railroad Right-of-Way from the centerline of track to the Right-of-Way limits and in total.
    e. Provide a call-out at the intersection of the centerline of rail and the centerline of the route/interstate that includes the DOT crossing number and the railroad milepost. If this information is needed, please contact the State Railroad Coordinator.
    f. Provide call-outs that include the minimum vertical clearance from the highest rail of the track(s) to the existing and new structures.
    g. Dimension the minimum horizontal clearance from the centerline of track(s) to any piers or bents on both sides of the track.
    h. On the plan views, dimension the minimum horizontal clearance from the centerline of track(s) to the proposed slope protection/pavement.

i. At skewed crossings, the plans must include a structure elevation view normal to the track.
j. Proposed distance from centerline of track(s) to toe of end slopes at their intersection with natural ground.
k. If end slopes are to be paved, indicate limits of paving.
l. Location of the railroad milepost on Railroad Right-of-Way.
m. Existing and proposed drainage structures.
n. Railroad station at highway-railroad intersection, or distance in feet from nearest railroad milepost.

In general, the information listed above is the minimum information needed by the Railroad to enable them to make a logical investigation of the proposed project. To furnish less information would only serve to delay the Railroad's approval of the plans.

See Chapter 4-602.03 through Chapter 4-602.07 and Figures 4-16 through 4-21 for how each sheet should look when a project contains a grade separated railroad crossing for both Fee Simple and Easement property type.

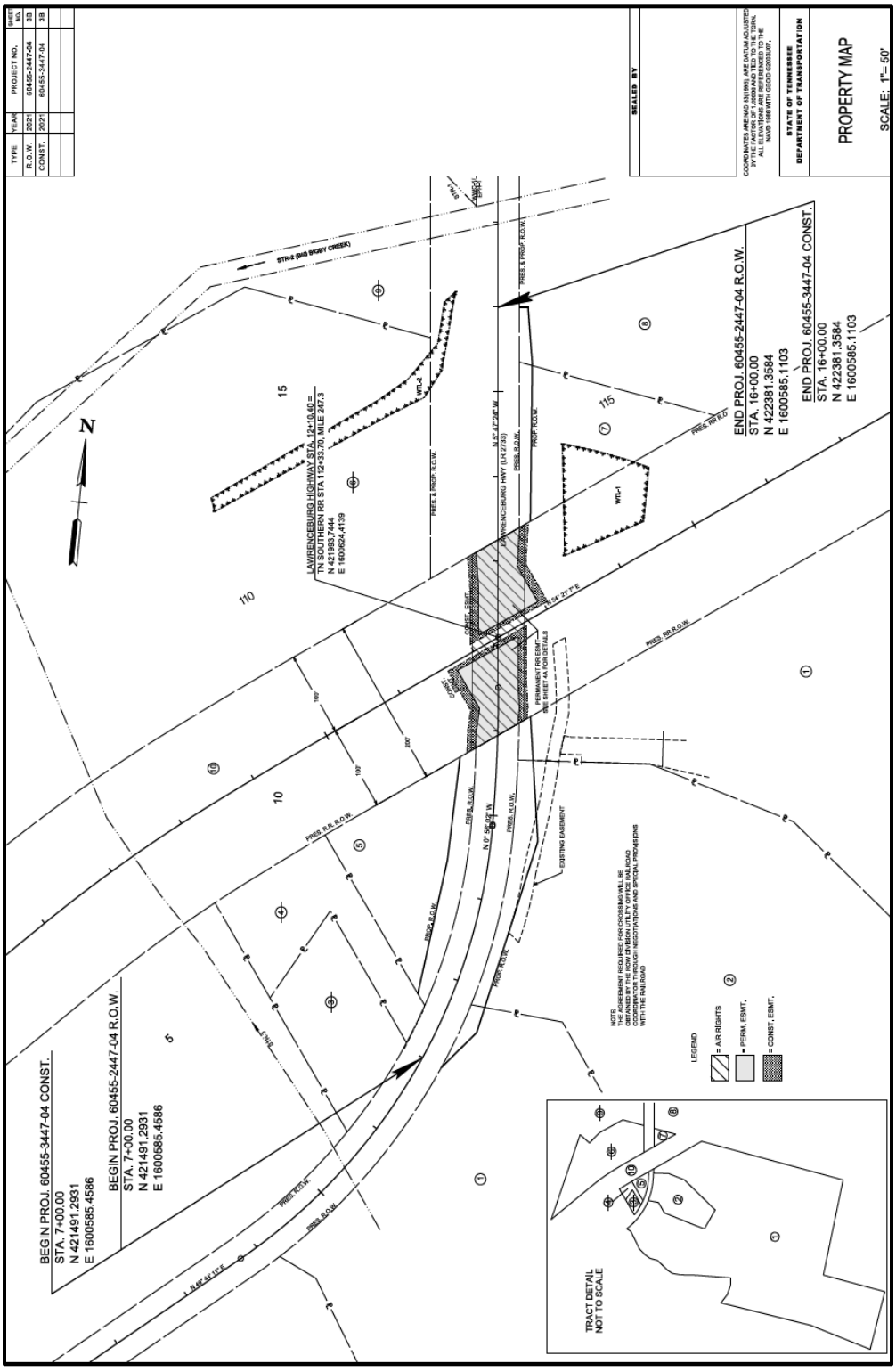


Figure 4-16
Grade Separated Easement Corridor Property Map

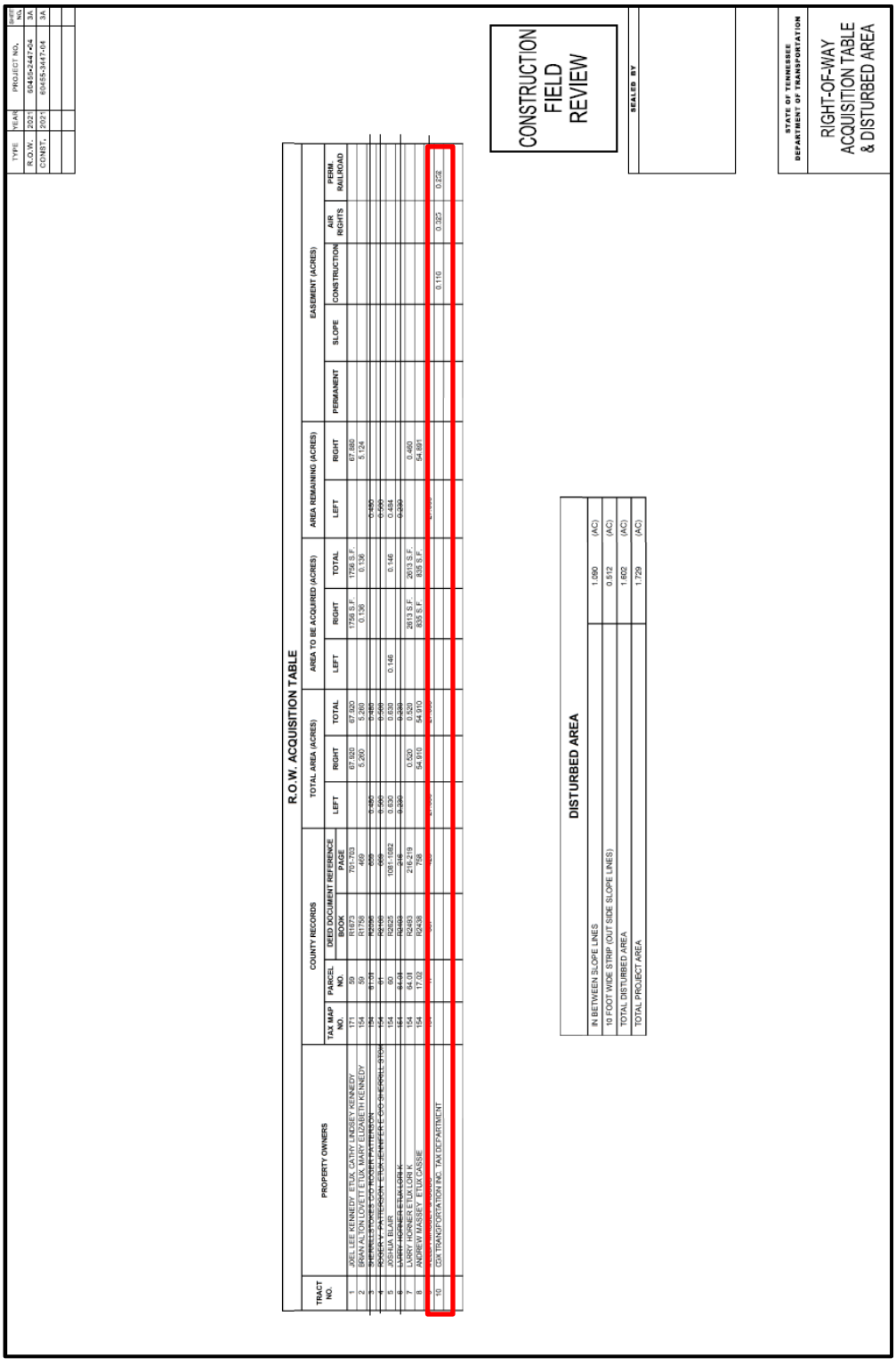


Figure 4-17
Grade Separated Easement Corridor R.O.W. Acquisition Table

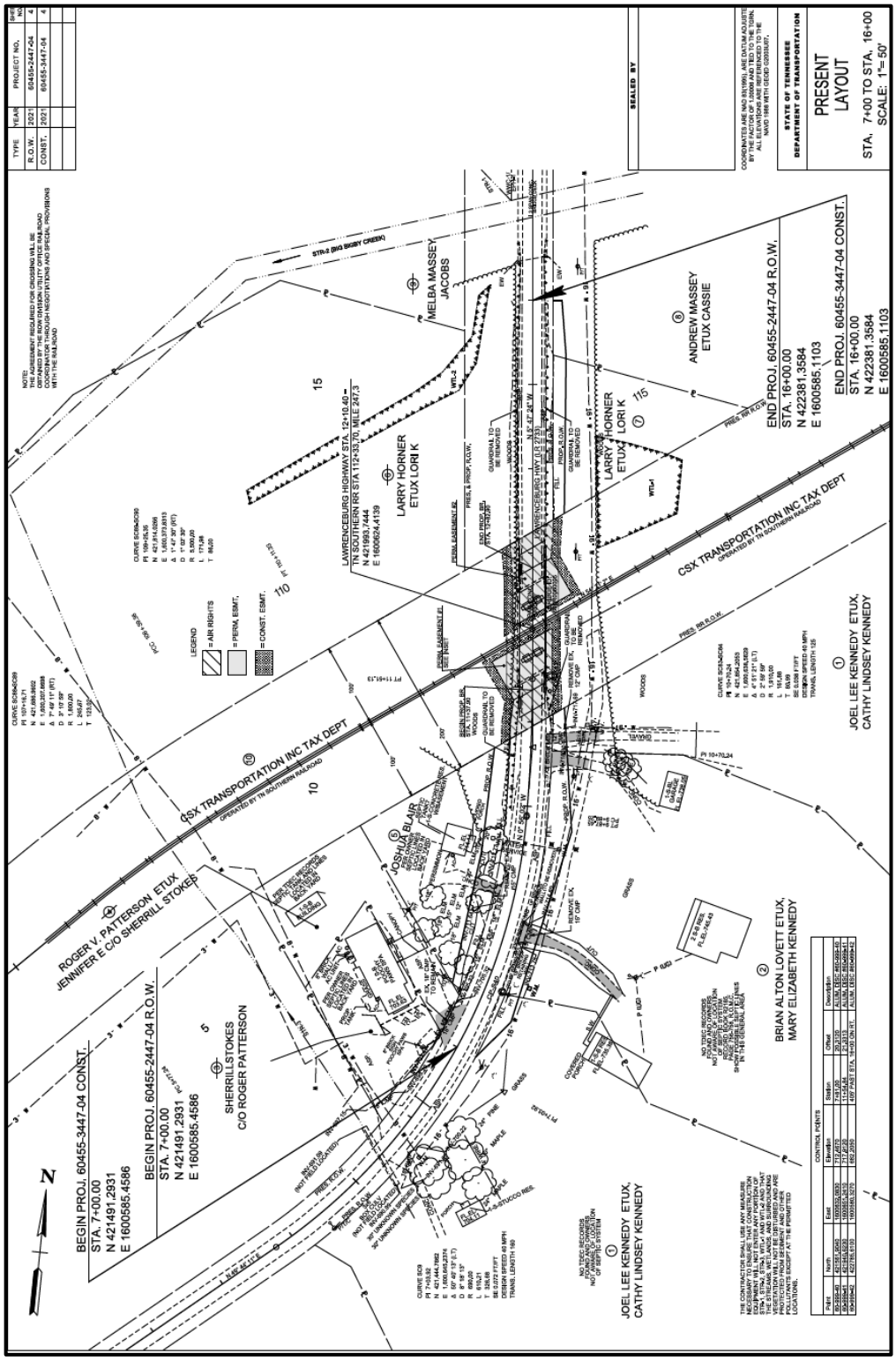


Figure 4-18
Grade Separated Easement Corridor Present Layout

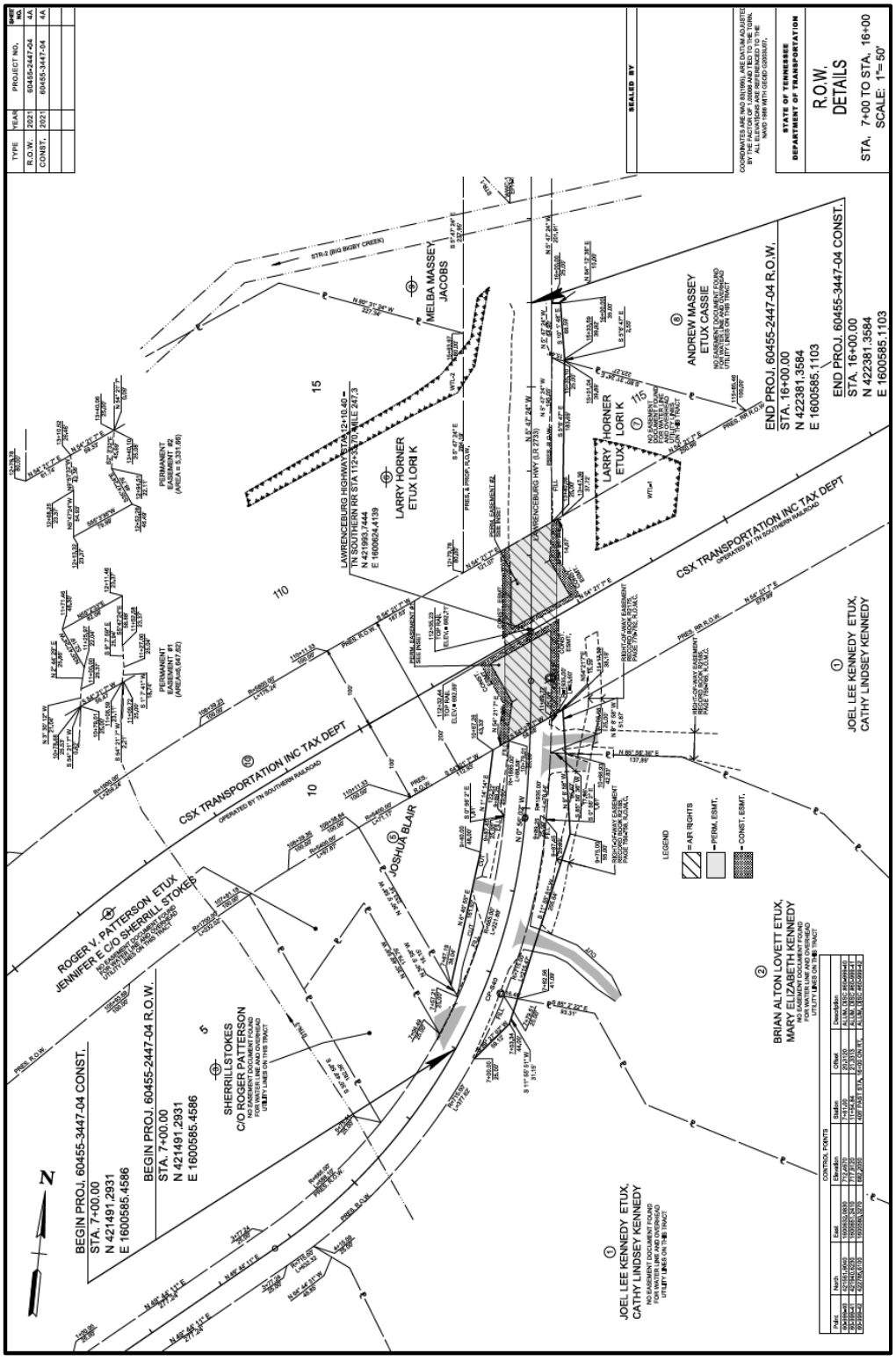


Figure 4-19
Grade Separated Easement Corridor R.O.W. Details

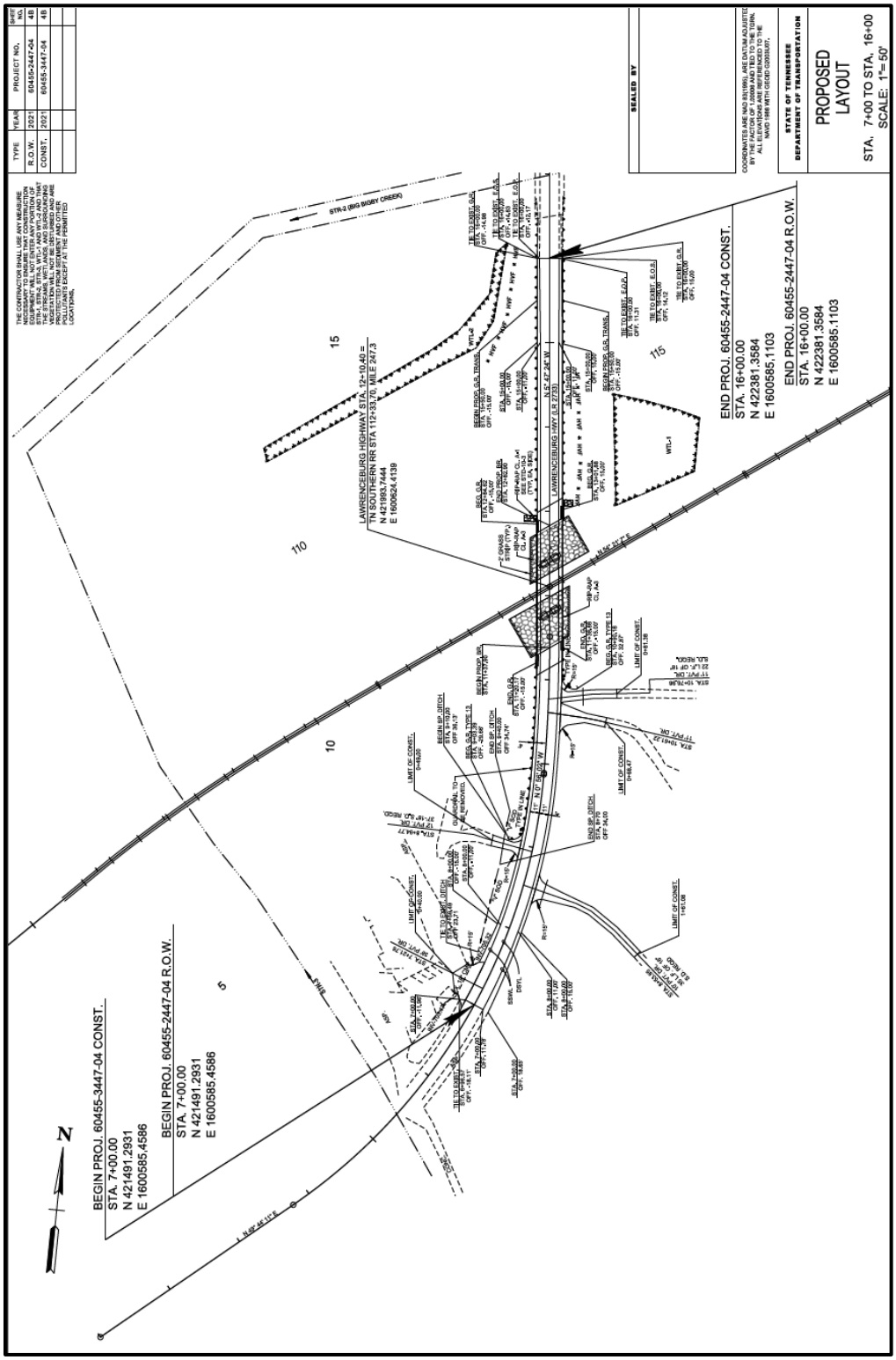


Figure 4-20
Grade Separated Easement Corridor Proposed Layout

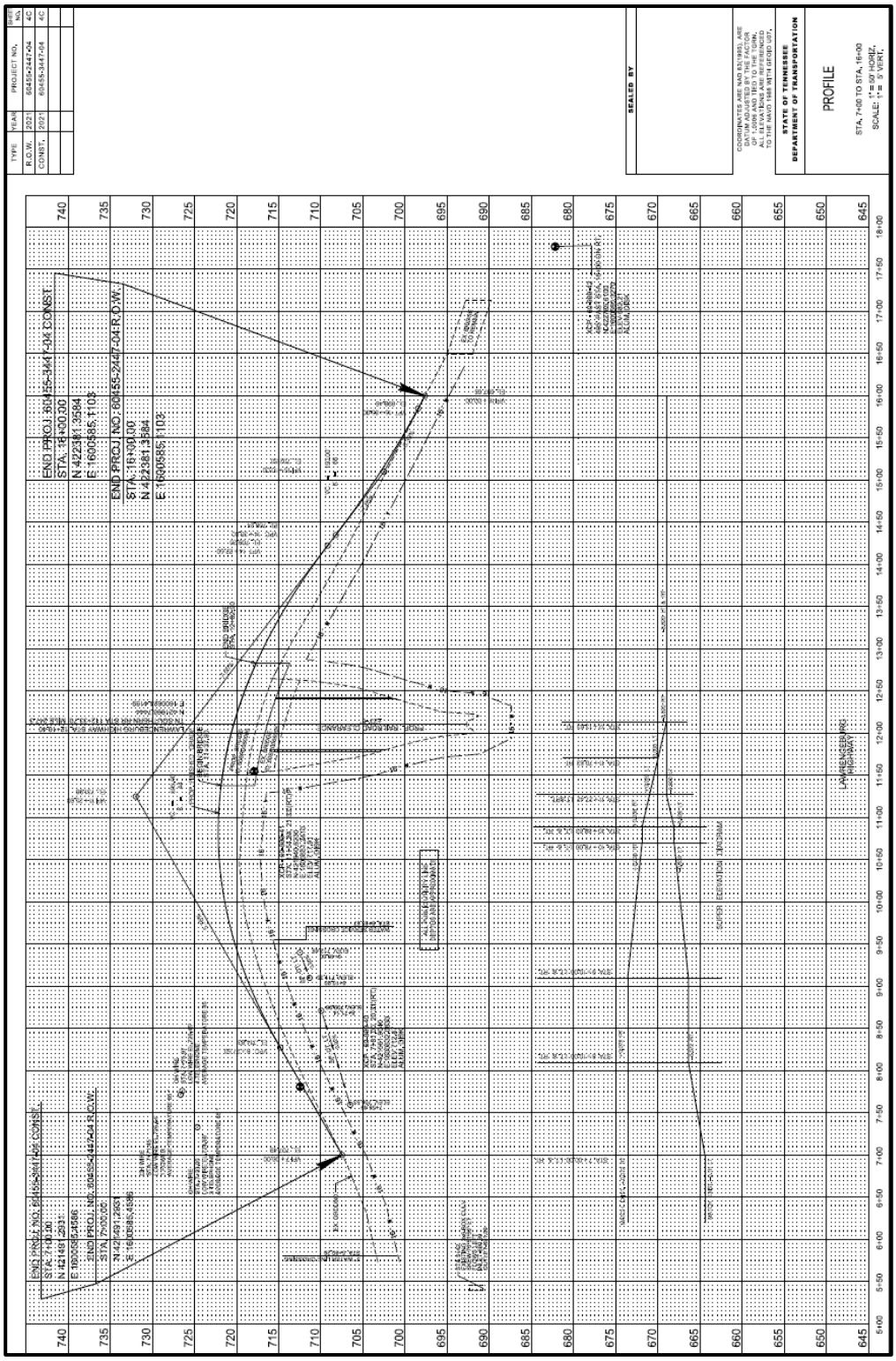


Figure 4-21
Grade Separated Easement Corridor Profile

4-604.00 AT-GRADE RAILROAD CROSSINGS

This section should only be referenced for at-grade crossings of the Railroad's corridor. All other crossing types are covered in previous or subsequent sections. See *Figure 4-22, Example of an At-Grade Railroad Crossing*.

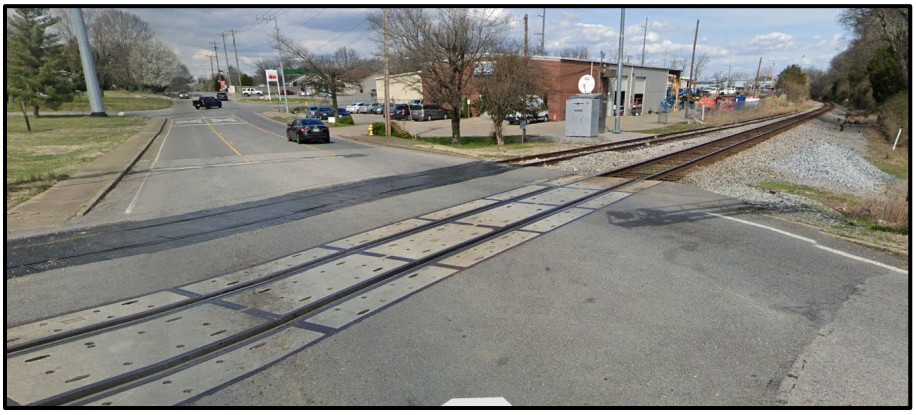


Figure 4-22
Example of an At-Grade Railroad Crossing

4-604.01 GENERAL DESIGN CRITERIA FOR AT-GRADE CROSSINGS

- If designing a crossing or designing up to or adjacent to a CSXT or Norfolk Southern Railway Company, use their published Public Projects Manual. If a copy of the Public Projects Manual is needed, please contact the State Railroad Coordinator for the latest version. For all other railroads, the publications of CSXT and Norfolk Southern Railway Company are a great rule of thumb to follow. If additional guidance is required, use the AREMA standards or contact the State Railroad Coordinator to determine if the railroad entity has some general standards.
- Starting with the Construction plans indicate where modifications have been made.
- At-grade crossing(s) can be impacted by a project in two manners:
    - The State Route or local road for which plans are being developed either directly intersects the railroad's corridor on the same plane or,
    - The railroad corridor runs parallel with the State Route or local street and one or more crossings are impacted by the zone of influence of the project.

4-604.02 PRELIMINARY PLANS FOR PROJECTS CONTAINING AT-GRADE CROSSING(S)

All Designers shall prepare plans for at-grade railroad crossings using the following design criteria where feasible:

Alignment: Ninety (90) degrees to the railroad desirable, seventy (70) degrees minimum, with good sight distance in both directions.

Grade: Profile adjustments to the at-grade railroad crossings should be avoided unless absolutely necessary per current design standards. Before designing profile modifications, the Designer should consult the State Railroad Coordinator to determine if the profile modification is necessary. The State Railroad Coordinator will consult with the TDOT Multimodal Rail Safety Office (TDOT.MultiModalAdmin@tn.gov) and the involved Railroad(s) to help make a determination as to whether or not the profile warrants adjustment. Once a determination has been made, the State Railroad Coordinator will inform the Designer.

If, in the rare occasion it is deemed necessary to change the profile of an at-grade crossing, use the following general guidelines:

Where crossings involve two (2) or more tracks, the top of rails for all tracks shall be brought to the same plane where practicable. The surface of the highway shall be in the same plane as the top of rails for a distance of two (2) feet outside of rails for either multiple or single-track crossings. The top of rail plane shall be connected with the grade line of the highway each way by vertical curves (if necessary) of such length as is required to provide riding conditions and sight distances normally applied to the highway under consideration. It is desirable that the surface of the roadway be not more than three (3) inches higher or six (6) inches lower than the top of the nearest rail at a point thirty (30) feet from the rail measured at right angles, thereto, unless track superelevation dictates otherwise. Desirable grades on the tangent immediately adjacent to the grade across the rails of the track shall be 5% or less but no steeper than 7%.

Curbs: Proposed roadway curbs and/or curb and gutter shall terminate no less than thirteen (13) feet from the centerline of the nearest tracks for at-grade railroad crossings.

The following information must be on the Line and Grade plans. See Figures 4-30 through 4-35.

a. On the Title sheet, provide a call out with the Railroad entity, the DOT crossing number, the type of crossing (at-grade), and the railroad milepost for each crossing impacted by the project.
b. Show the centerline of track(s) on both the profile and plan views.
c. Show and Label the Railroad Right-of-Way as “ENTITY R.O.W.” on both the profile and plan views.
d. Dimension the Railroad Right-of-Way from the centerline of track(s) to the Right-of-Way limits and in total.

e. Provide a call-out at the intersection of the centerline of track(s) and the centerline of the route that includes the DOT crossing number and the railroad milepost. If this information is needed, please contact the State Railroad Coordinator.
f. Location of the railroad milepost on Railroad Right-of-Way.
g. Existing and proposed drainage structures.
h. Railroad station at highway-railroad intersection, or distance in feet from nearest railroad milepost.

The roadway Right-of-Way lines will terminate at the railroad Right-of-Way as shown in *Figure 4-23, Method for Showing Right-of-Way at an At-Grade Railroad Crossing*.

Bearings and distances will be provided along both the Railroad Right-of-Way and the proposed roadway Right-of-Way lines. The distance to the nearest milepost will be shown at the intersection of the centerlines of the roadway and railroad.

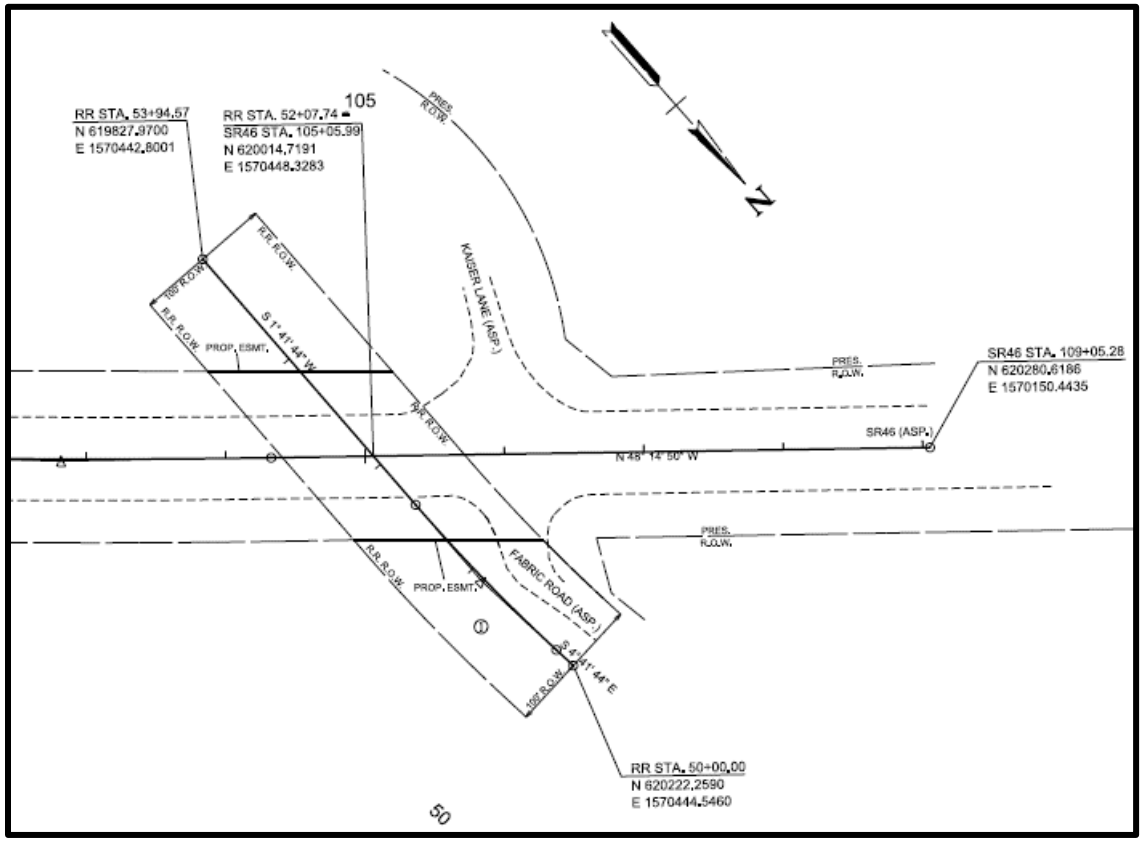


Figure 4-23
Method for Showing Right-of-Way at an At-Grade Railroad Crossing

See Chapter 4-602.03 through Chapter 4-602.07 and Figure 4-24 through 4-30 for how each sheet should look when a project contains an at grade railroad crossing for an Easement property type.

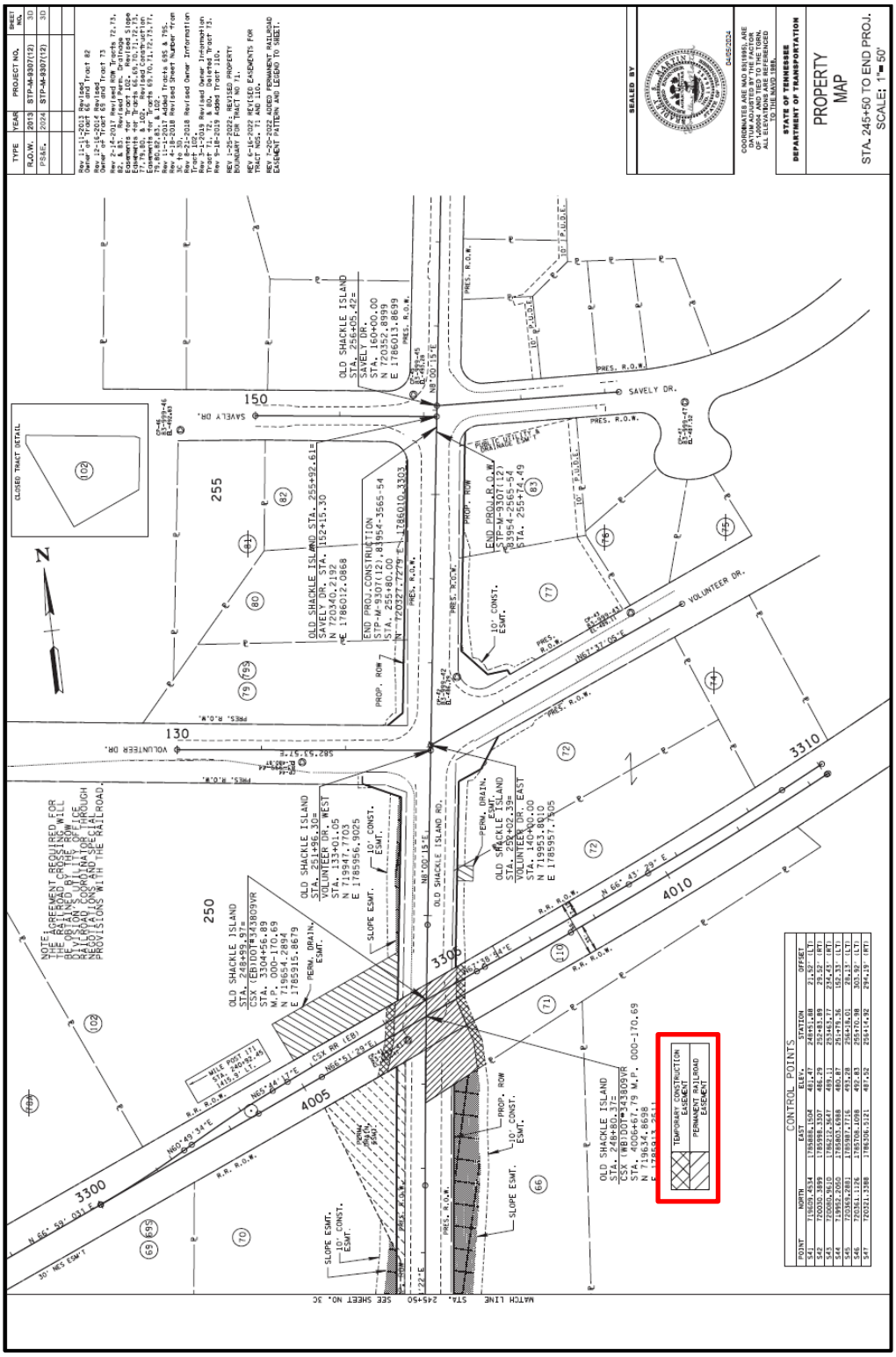


Figure 4-24
At-Grade Easement Corridor Property Map

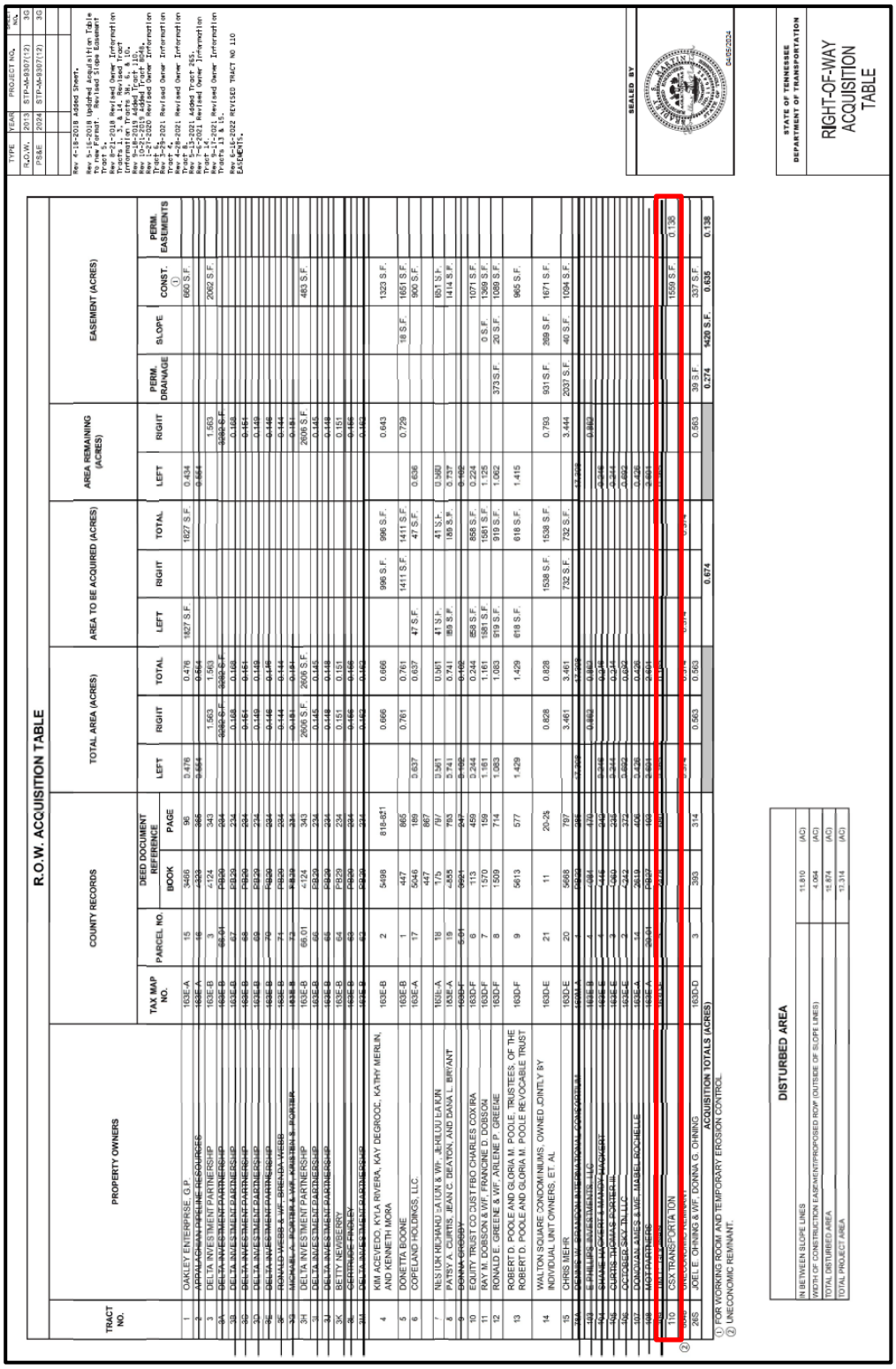


Figure 4-25
At-Grade Easement Corridor R.O.W. Acquisition Table

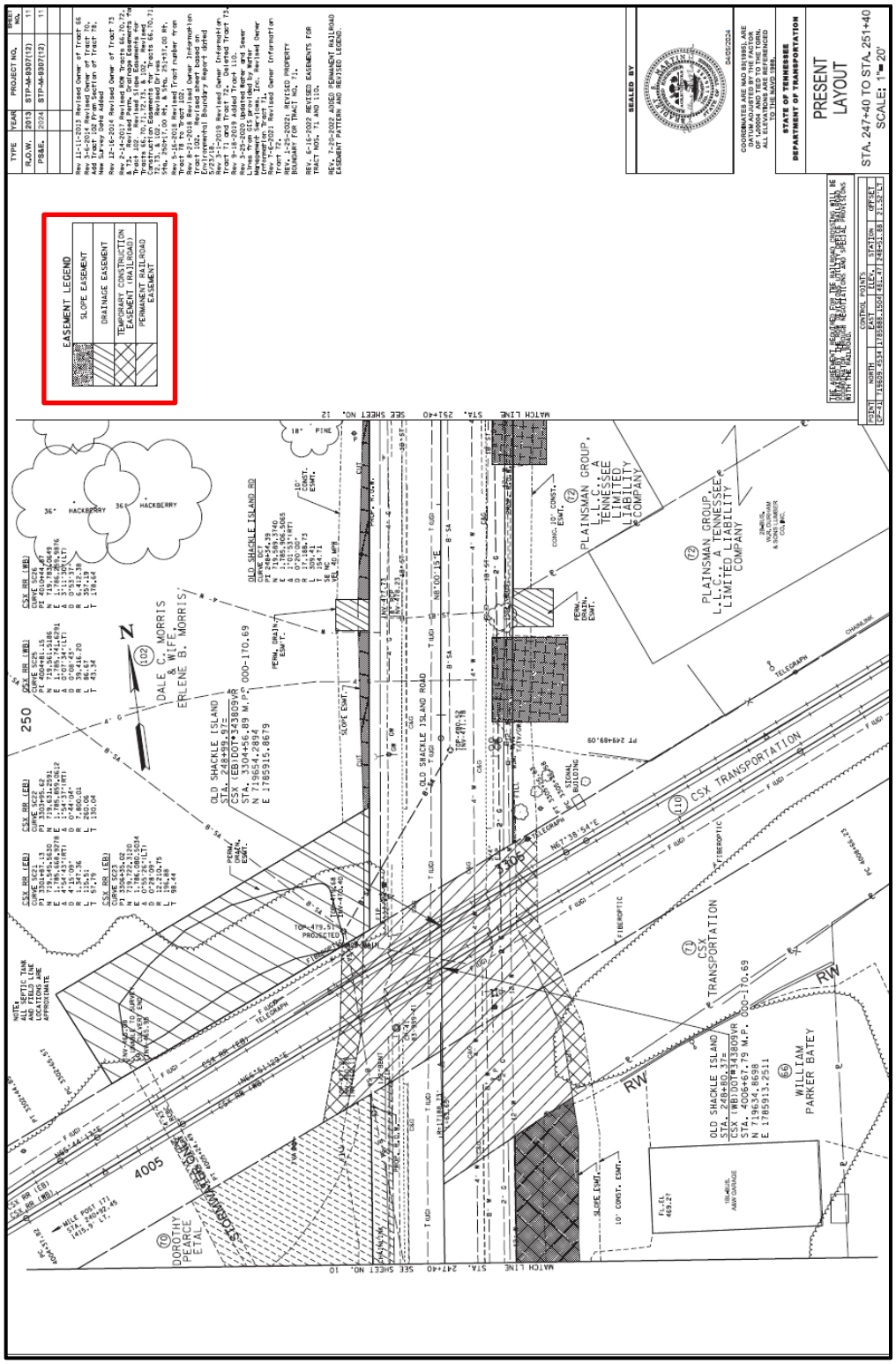


Figure 4-26
At-Grade Easement Corridor Present Layout

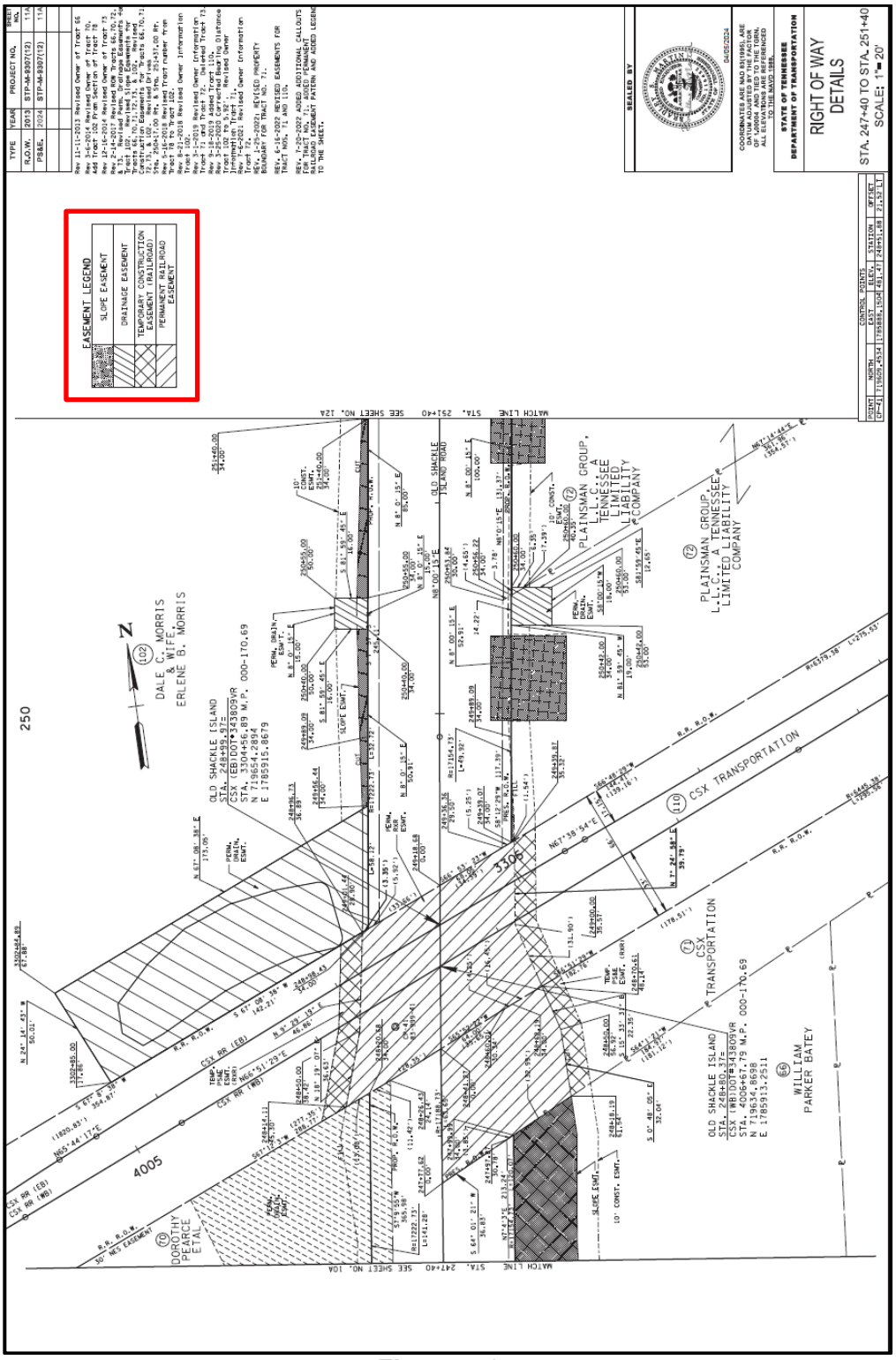


Figure 4-27
At-Grade Easement Corridor R.O.W. Details (A)

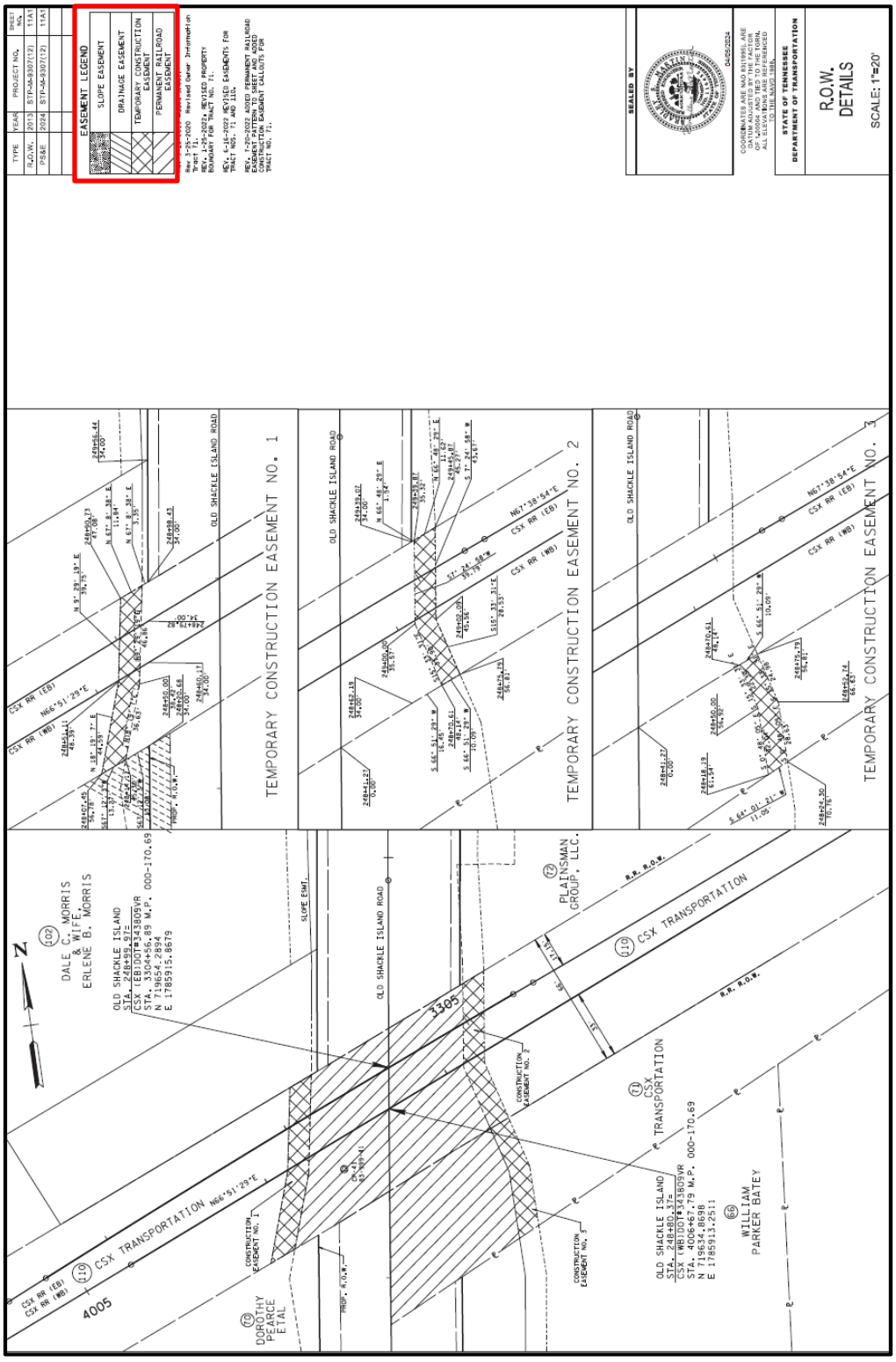


Figure 4-28
At-Grade Easement Corridor R.O.W. Details (B)

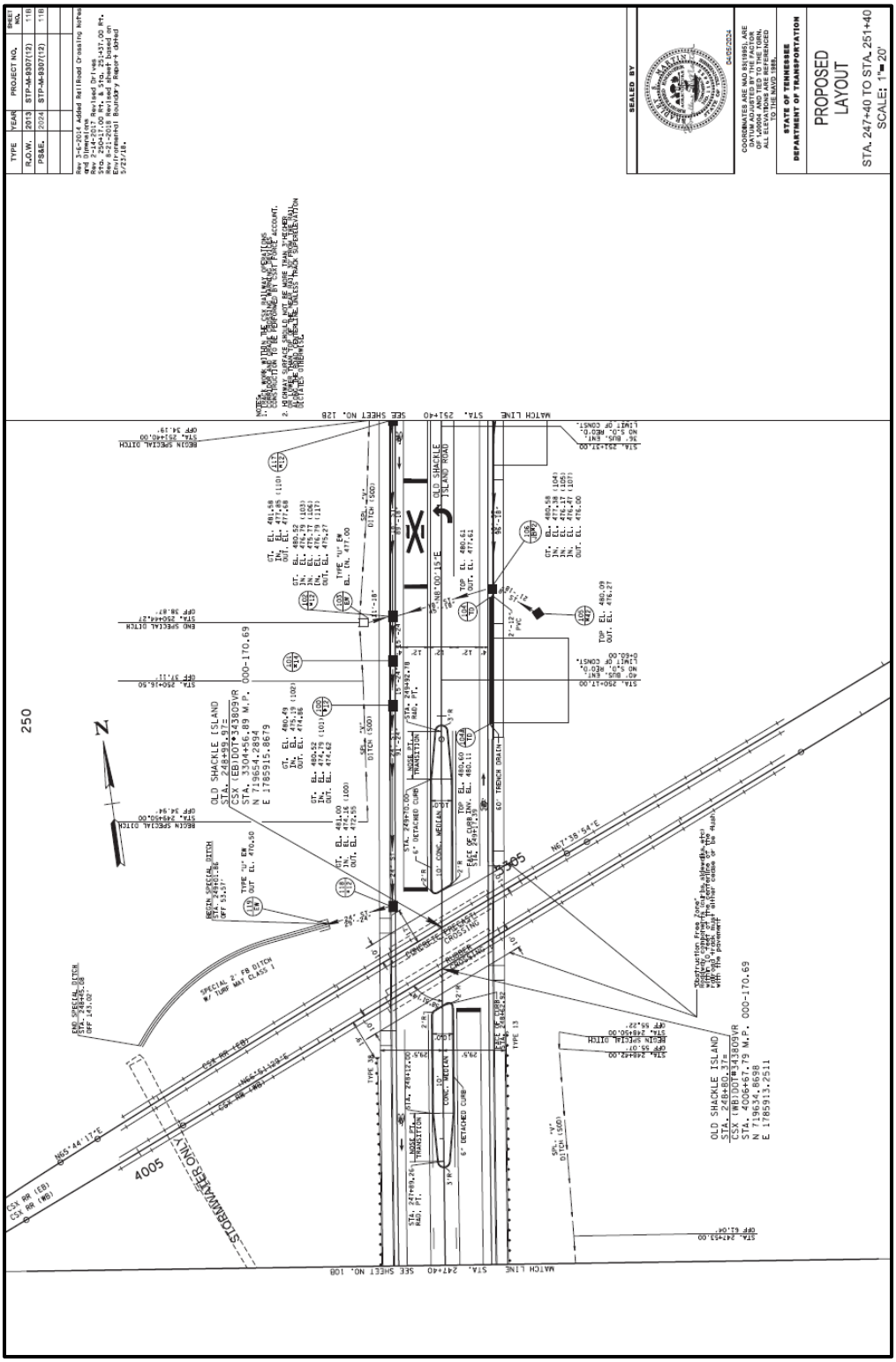


Figure 4-29
At-Grade Easement Corridor Proposed Layout

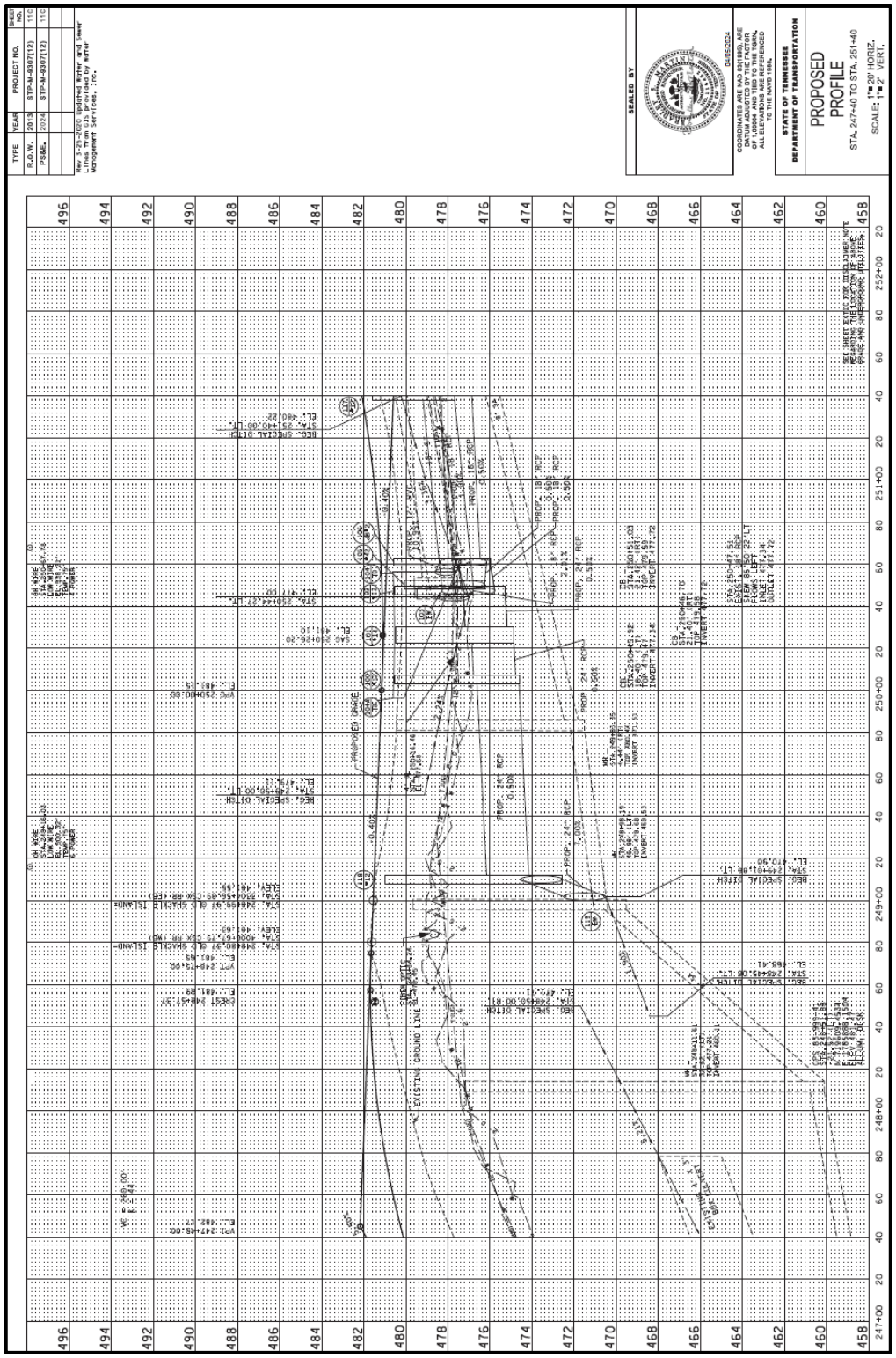


Figure 4-30
At-Grade Easement Corridor Proposed Profile

4-605.00 PARALLEL ENCROACHMENT OF RAILROAD RIGHT-OF-WAY

This section should only be referenced for parallel encroachments of the Railroad's Right-of-Way. This is when the State Route or Interstate runs parallel with the Railroad's corridor for a distance and construction limits encroach on the Railroad Right-of-Way. All other crossing types are covered in previous sections of these guidelines. See *Figure 4-31, Example of Parallel Encroachment*.



Figure 4-31
Example of Parallel Encroachment

4-605.01 GENERAL DESIGN CRITERIA FOR PARALLEL ENCROACHMENT PROJECTS

- If designing for a project which runs parallel with CSXT or Norfolk Southern Railway Company, use their published Public Projects Manual. If a copy of the Public Projects Manual is needed, please contact the State Railroad Coordinator for the latest version. For all other Railroads, the publications of CSXT and Norfolk Southern Railway Company are a great rule of thumb to follow. If additional guidance is required, use the AREMA standards or contact the State Railroad Coordinator to determine if the Railroad entity has some general standards.
- Starting with the Construction plans, use revision markers to indicate where modifications have been made.
- At-grade crossing(s) can be impacted by this project type in the following manner:
    - The proposed project runs parallel with the State Route or local street and one or more crossings are impacted by the zone of influence of the project.

4-605.02 PRELIMINARY PLANS FOR PROJECTS CONTAINING PARALLEL ENCROACHMENT

Refer to Figure 4-32, Encroachment is Parallel to the Railroad when the proposed roadway runs parallel to the railroad corridor and construction limits encroach on the railroad Right-of-Way. When constructing a roadway parallel to a track roadbed, if work is required inside the Railroad Right-of-Way, the preferred construction limit (toe of slope) shall be no closer than fifty (50) feet from the centerline of the nearest track.

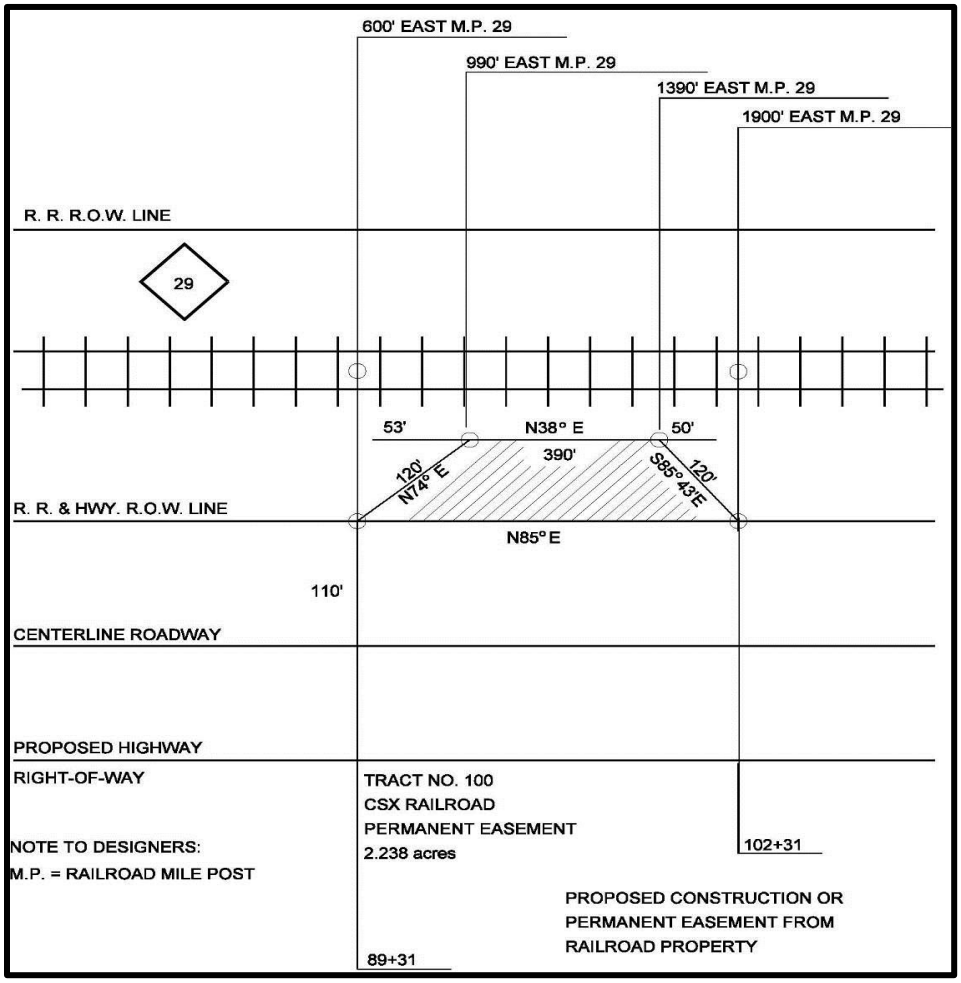


Figure 4-32
Encroachment is Parallel to the Railroad

If it is necessary to encroach nearer than the fifty (50) feet described above, a set of Preliminary plans, including cross-sections, showing how the proposed work ties to the existing railroad roadbed, are to be sent to the State Railroad Coordinator for review, comment, and submittal to the railroad. An example for Designers working inside Railroad Right-of-Way is shown in *Figure 4-33, Minimum Requirement for Railroad Typical Roadbed Section*.

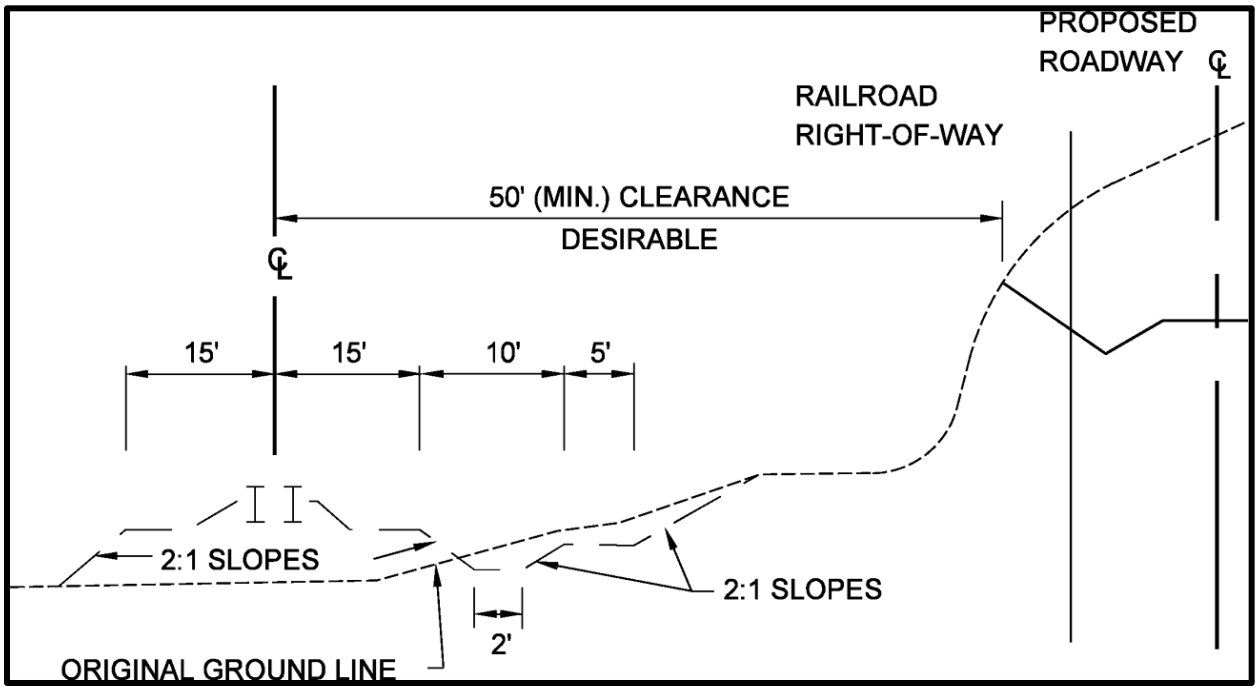


Figure 4-33
Minimum Requirement for Railroad Typical Roadbed Section

See Chapter 4-602.03 through Chapter 4-602.07 and Figure 4-34 through Figure 4-39 for how each sheet should look when a project contains a Parallel Encroachment of a Railroad for an Easement property type.

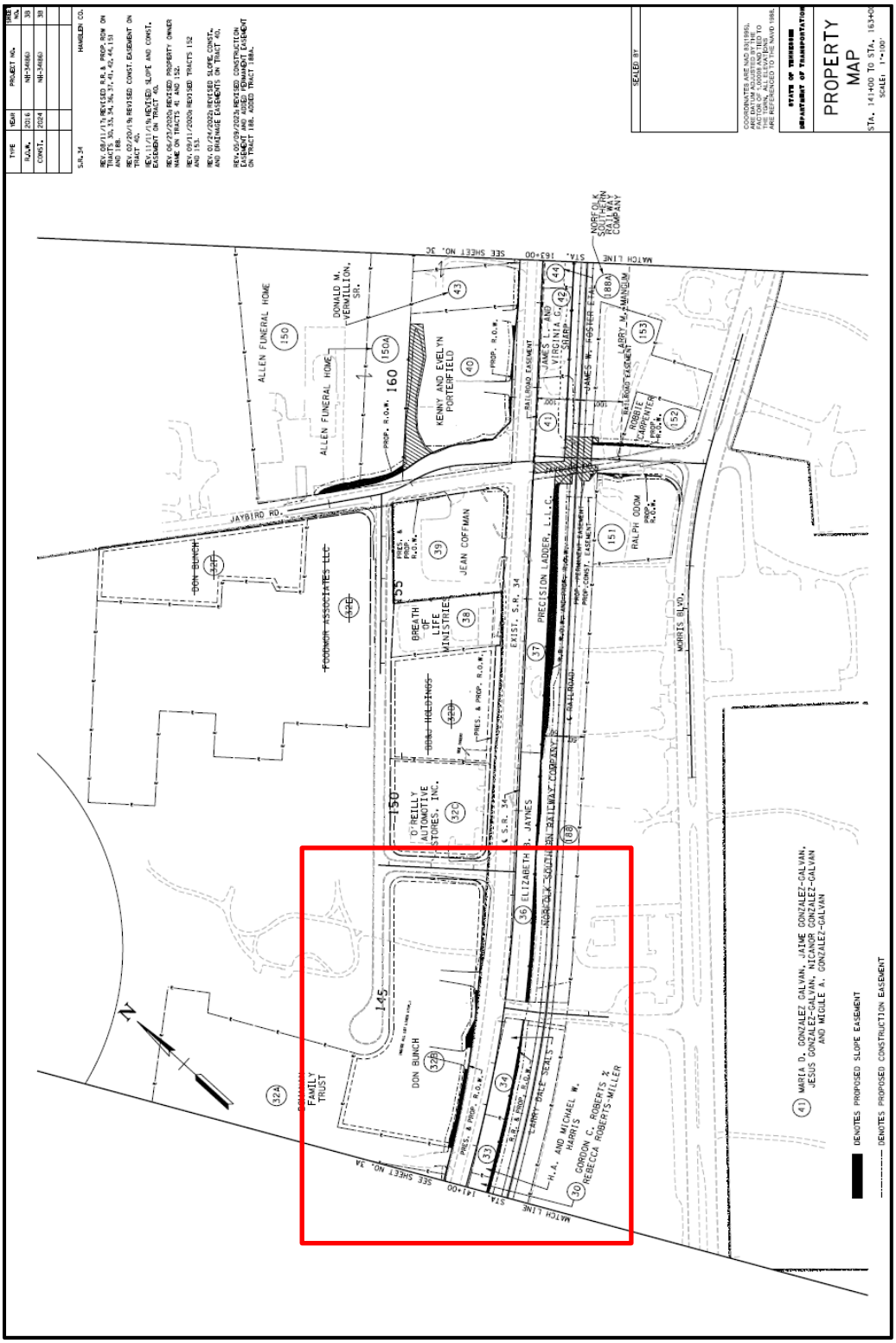


Figure 4-34
Parallel Encroachment Easement Corridor Property Map

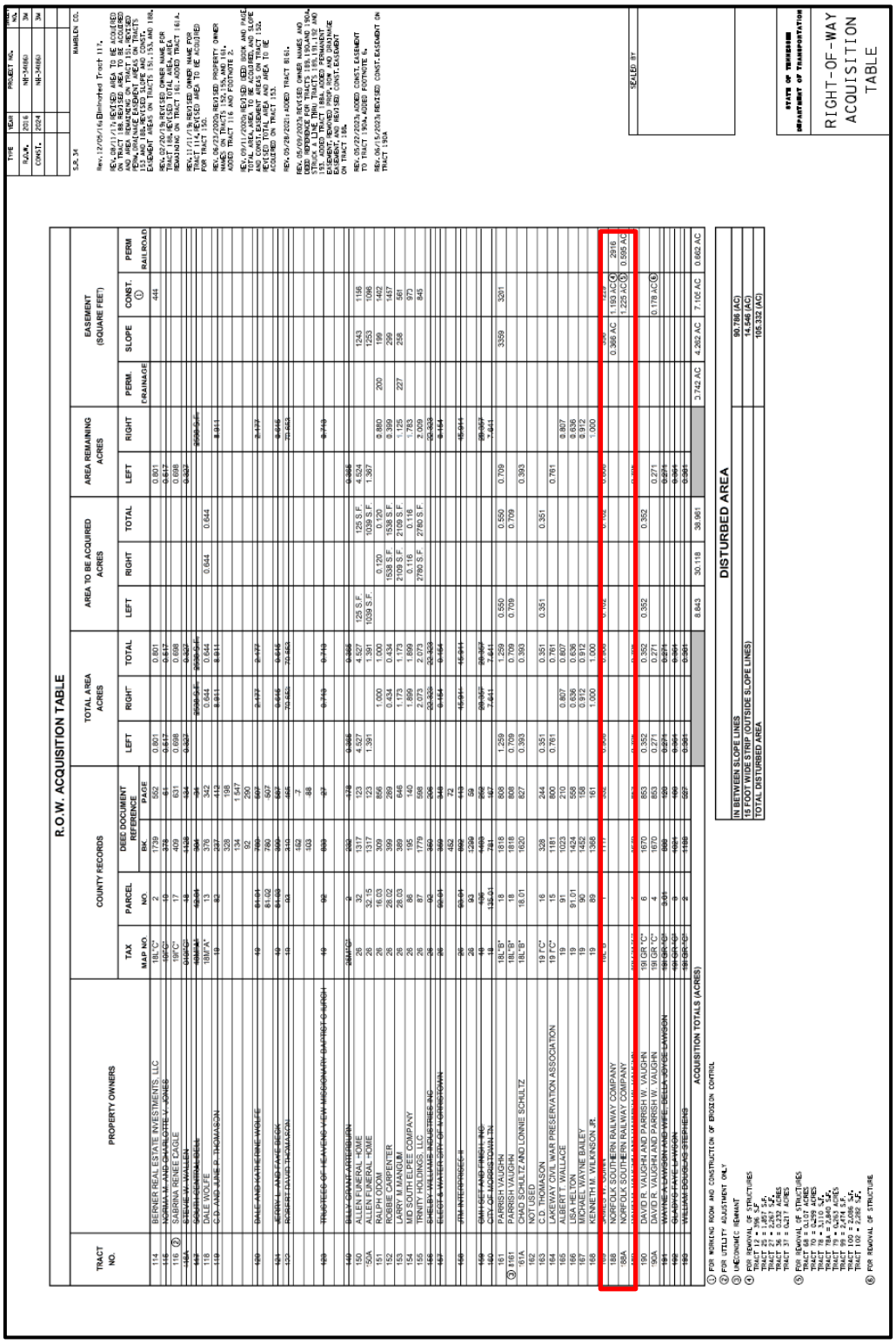


Figure 4-35
Parallel Encroachment Easement Corridor R.O.W. Acquisition Table

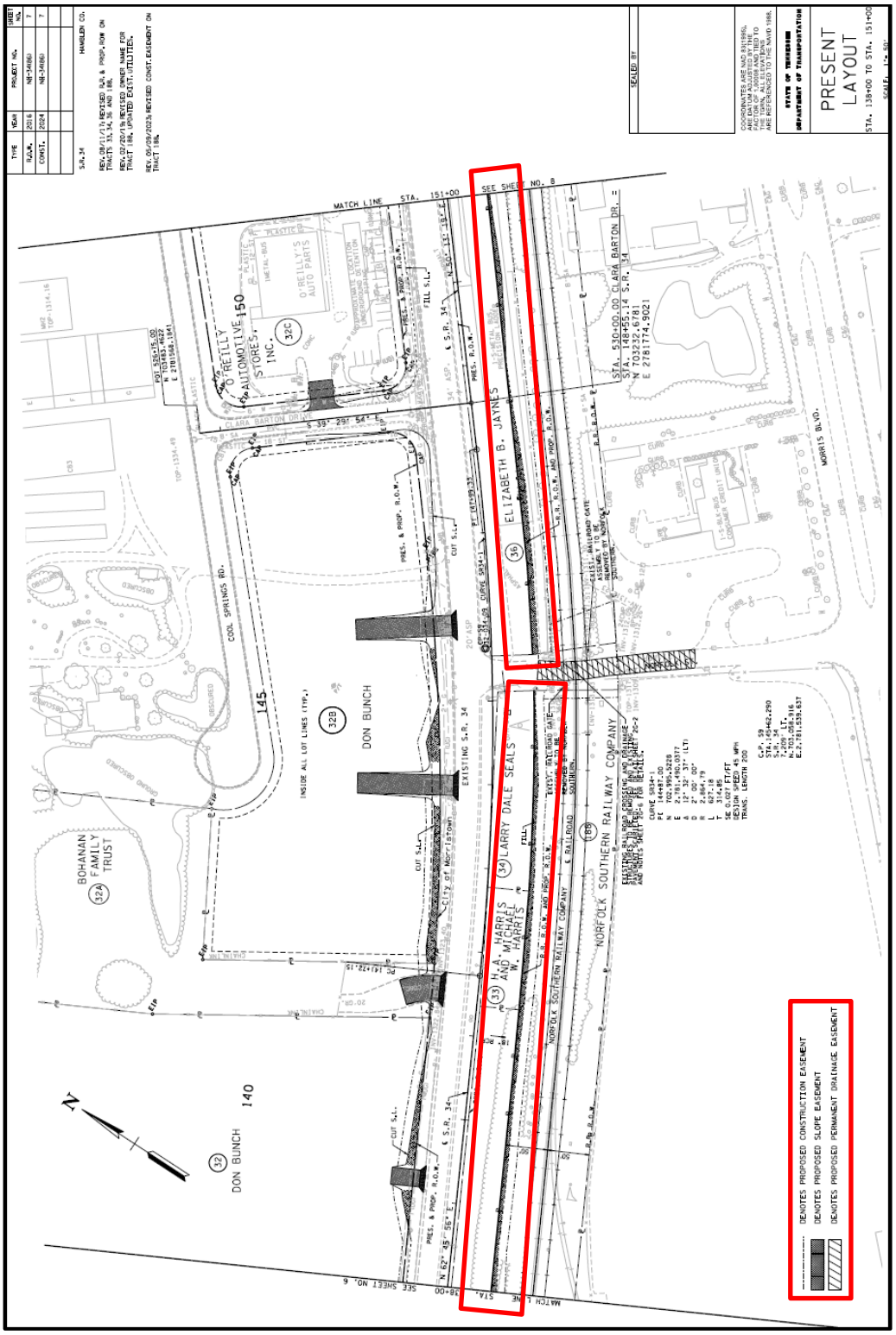


Figure 4-36
Parallel Encroachment Easement Corridor Present Layout

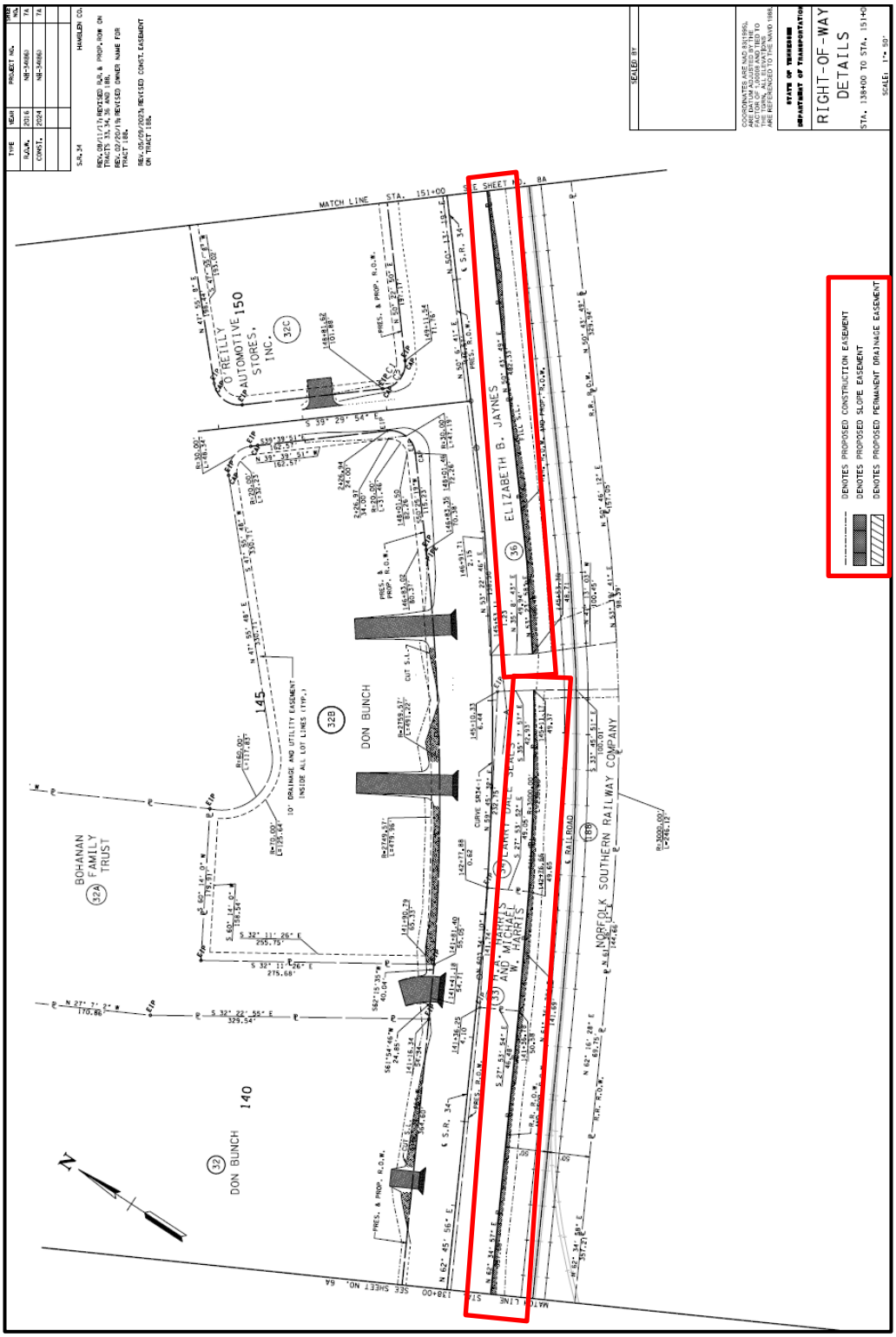


Figure 4-37
Parallel Encroachment Easement Corridor R.O.W. Details

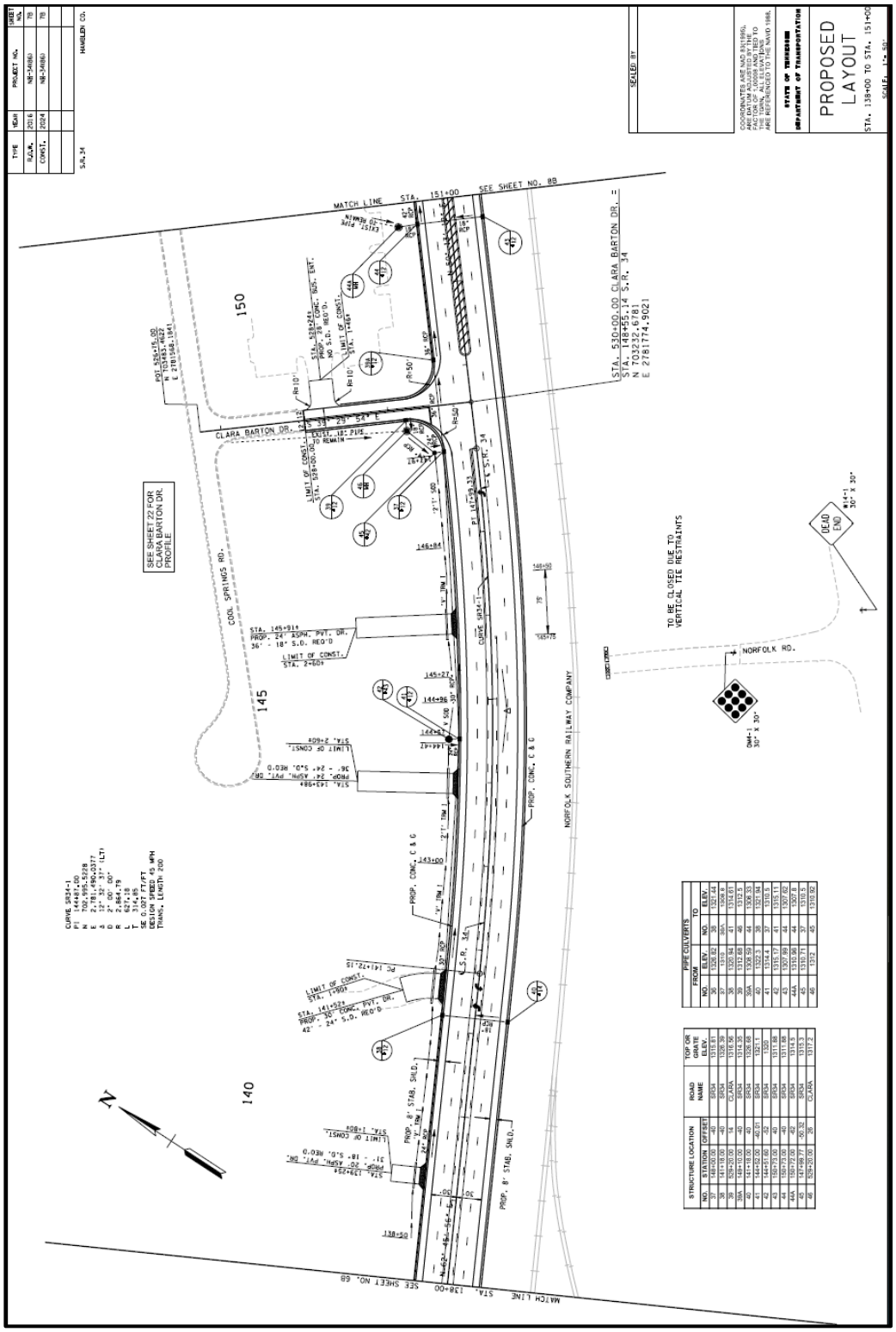


Figure 4-38
Parallel Encroachment Easement Corridor Proposed Layout

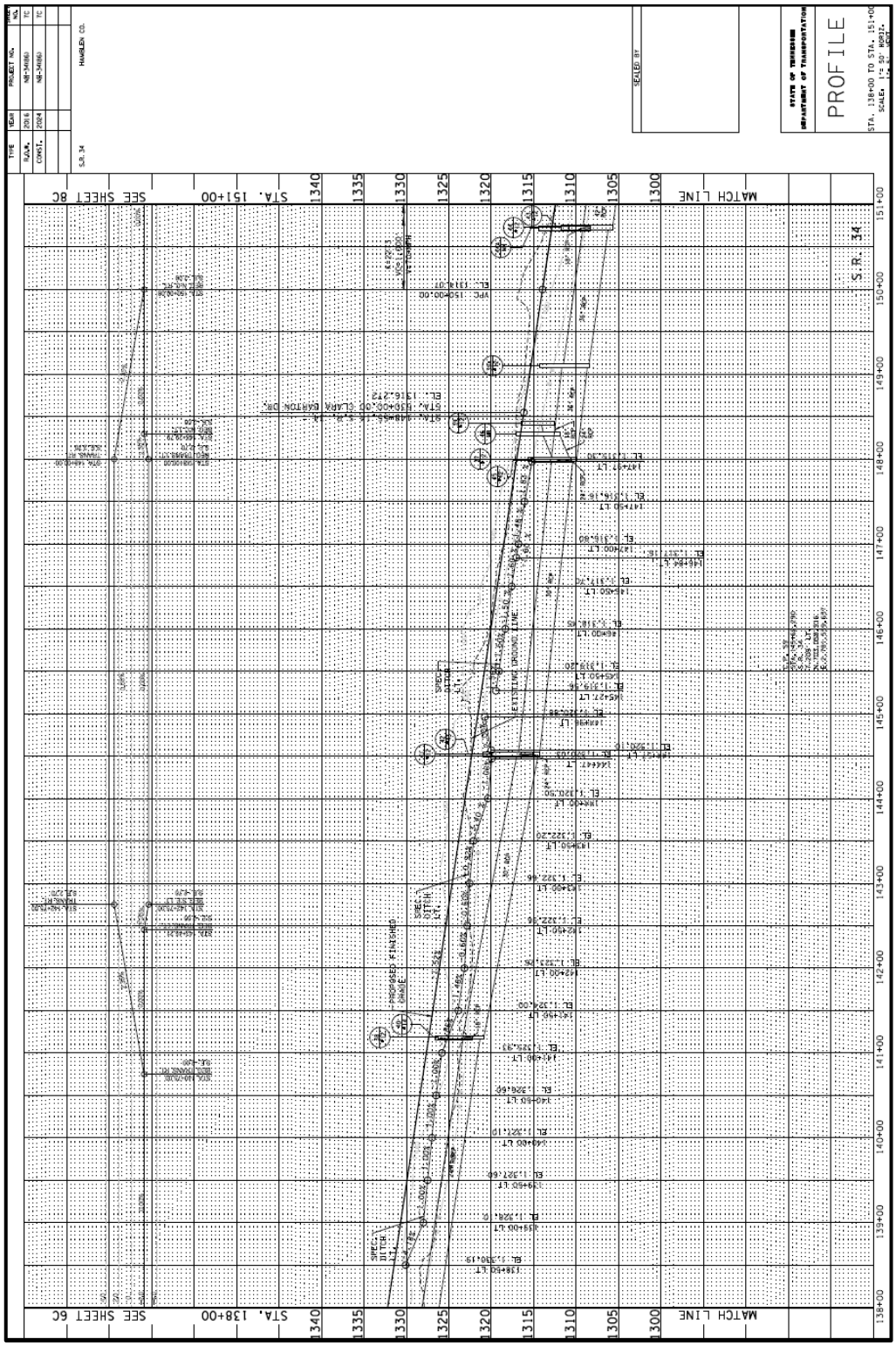


Figure 4-39
Parallel Encroachment Easement Corridor Proposed Profile

4-606.00 SPECIAL CASES

4-606.01 NORFOLK SOUTHERN RAILWAY COMPANY

REAL ESTATE ENGINEERING PLAT AND LEGAL DESCRIPTION REQUIREMENT

The Applicant must submit the following documents to **Norfolk Southern Railway Company**, or its appropriate subsidiary for review and approval:

1. The survey plat drawing must be presented in a recordable PDF format (Proper size, statements, medium, etc.) for the county in which the survey is conducted. The document must be sufficient for use as a conveyance document.
    a) The final survey plat submitted must contain a signed Surveyor's stamp. The surveyor's name, address and telephone number shall be printed on the plat along with the legal description in a legible manner.
    b) The surveyor must also submit a survey plat in digital format (AutoCAD or MicroStation convertible file). The CAD drawing must be translated and rotated according to the appropriate State Plane Coordinate Zone. Units of the CAD file shall be US Survey Feet. All adjoining property lines must be included on the CAD file.
2. A legal description must be submitted in PDF format and Microsoft Office Word format unless extenuating circumstances prevent the usage of that Word processing program for production of the legal description. The legal description may be used within a legal document or as referenced material. The legal description must indicate a distance to the nearest railroad mile post and the direction of increasing railroad mile posts where appropriate. The "**Point of Beginning**" must be identified with the appropriate State Plane Coordinates in the legal description were permitted by the local government agency.
3. A PDF document containing the appropriate State Plane Coordinates each of the Permanent Highway Easement area corners numbered beginning with the number 1 at the "**Point of Beginning**" must be submitted.
4. Note on the plat the appropriate State Plane Coordinate for the "**Point of Beginning**" of each parcel, as well as an opposing corner, or NGS Monument with bearing and distance to **POB.**

Requirements for Survey Plat and Legal Description are as follows:

- The survey plat and legal description must be presented in a form and manner that the local government agency will accept for filing. Knowledge of what is acceptable is the sole responsibility of the surveyor.
- The required accuracy for the survey shall meet or exceed an error of the most restrictive and/or appropriate of the following requirements and must be shown on the survey plat:
    - Closure of 1:10,000 for all urban property and rural property valued at or greater than $1,000.00 per acre.
    - Closure of 1:5,000 for rural property valued at less than $1,000 per acre.

  - ALTA-ACSM Allowable Positional Tolerance for Land Title Surveys of 0.07 feet per point.
  - Or minimum state requirements for surveys to be used in the conveyance of property.
- The surveyor will obtain copies of tax maps and deeds for property to be acquired and all adjacent properties. Adjoining property owners shall be identified by name and deed reference. All adjoining property lines are to be delineated on the survey plat.
- Norfolk Southern Railway Company, or its subsidiaries, will decide whether to attach the surveyor's plat and description to the deed.
- Monuments shall not be placed on the subject parcel until the survey plat is approved by the Norfolk Southern Real Estate Engineering Department. When monuments are laced they will be placed at the corners and changes in curves (PC & PT including PCC, TS, SC, CS and ST points where applicable).
- All monuments placed along the boundary of operating Right-of-Way, property owned by Norfolk Southern and/or subsidiaries shall bear an aluminum cap, provided by Norfolk Southern Real Estate Engineering Department. Said caps shall be stamped with a provided unique identifier, along with the RLS # of the supervising surveyor. A report including point ID, Northing, Easting, and Elevation shall be submitted. Caps are designed for use with 5/8-inch rebar.
- The survey must establish railroad valuation stationing where appropriate. This stationing must be delineated on the plat. The stationing will be established using the ties marked on the valuation map provided by the Real Estate Department. A bridge abutment or other fixed object or landmark where the location is reliable and has an established railroad valuation station shown on a valuation map may also be used to establish railroad stationing.
- The survey plat shall state what monuments (culverts, headwalls, etc.) were used to establish the railroad stationing.
- The surveyor should check with NS Real Estate Engineering to ensure that the correct owning Company (Norfolk Southern Railway Company, Alabama Great Southern Railway Company, Cincinnati Southern Railway Company, Central of Georgia Railroad Company, etc.) is shown on the survey plat.

See Figure 4-40 through Figure 4-45 for more information on what the plans should look like with a Norfolk Southern Railroad.

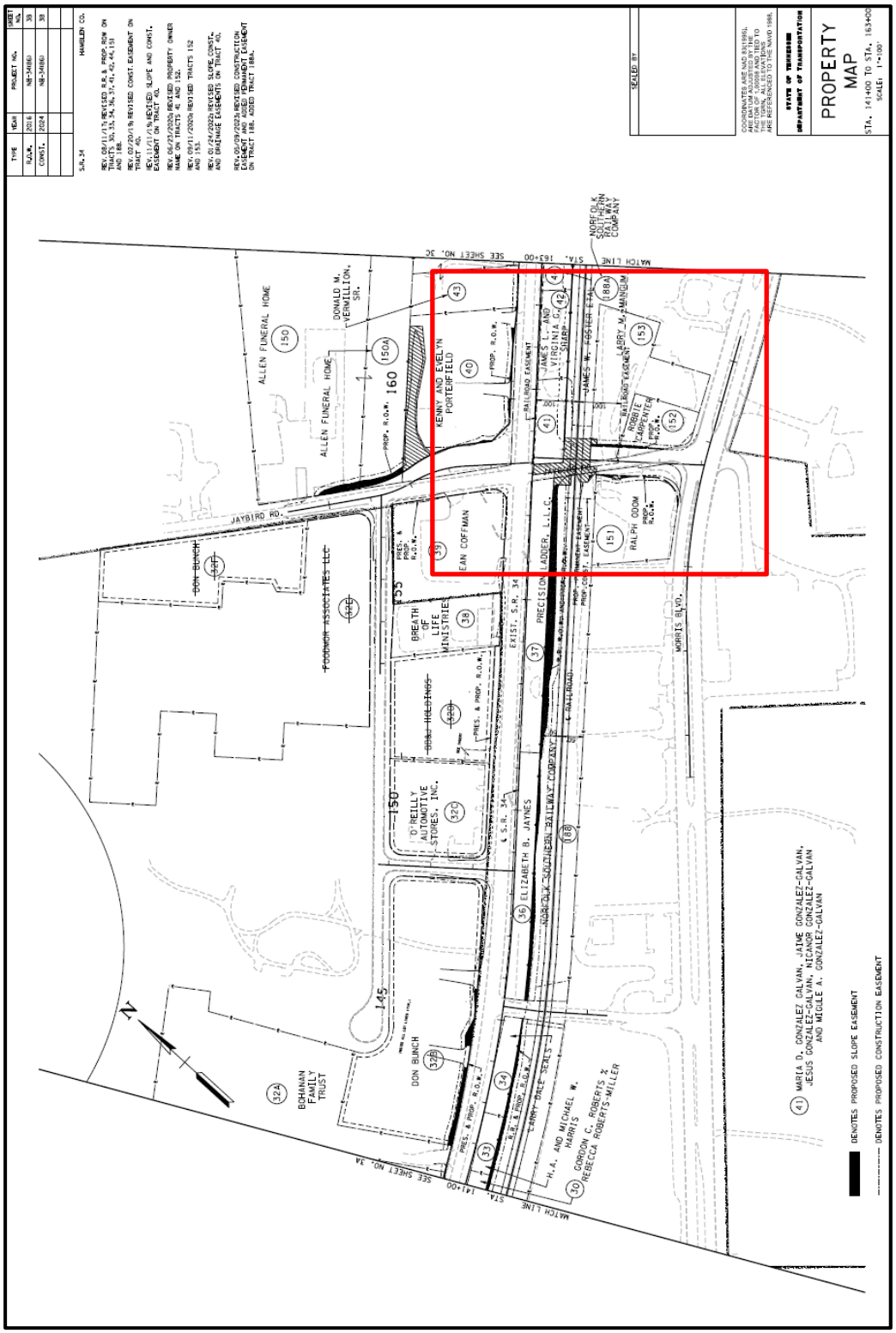


Figure 4-40
Norfolk Southern Property Map

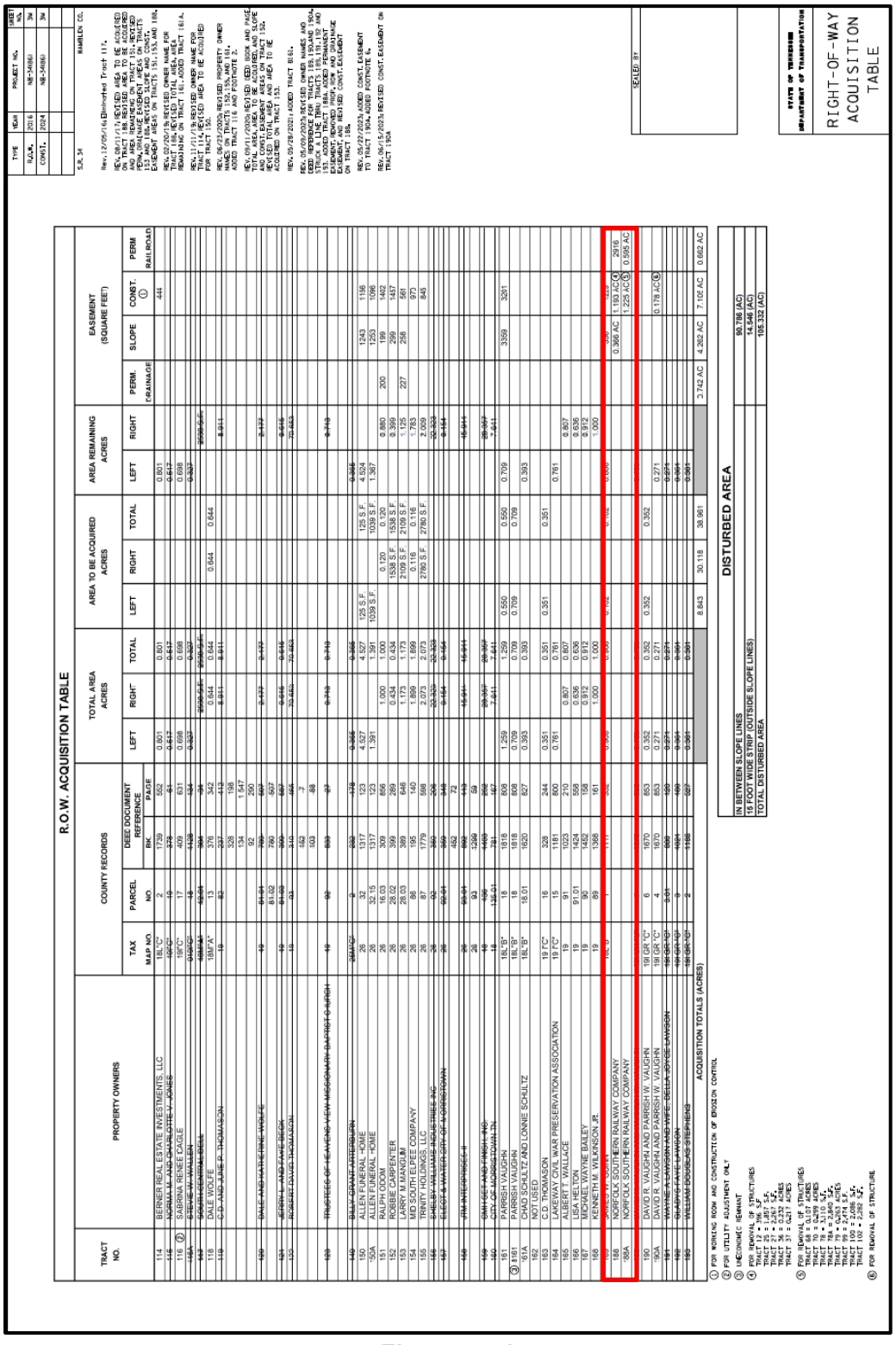


Figure 4-41
Norfolk Southern R.O.W. Acquisition Table

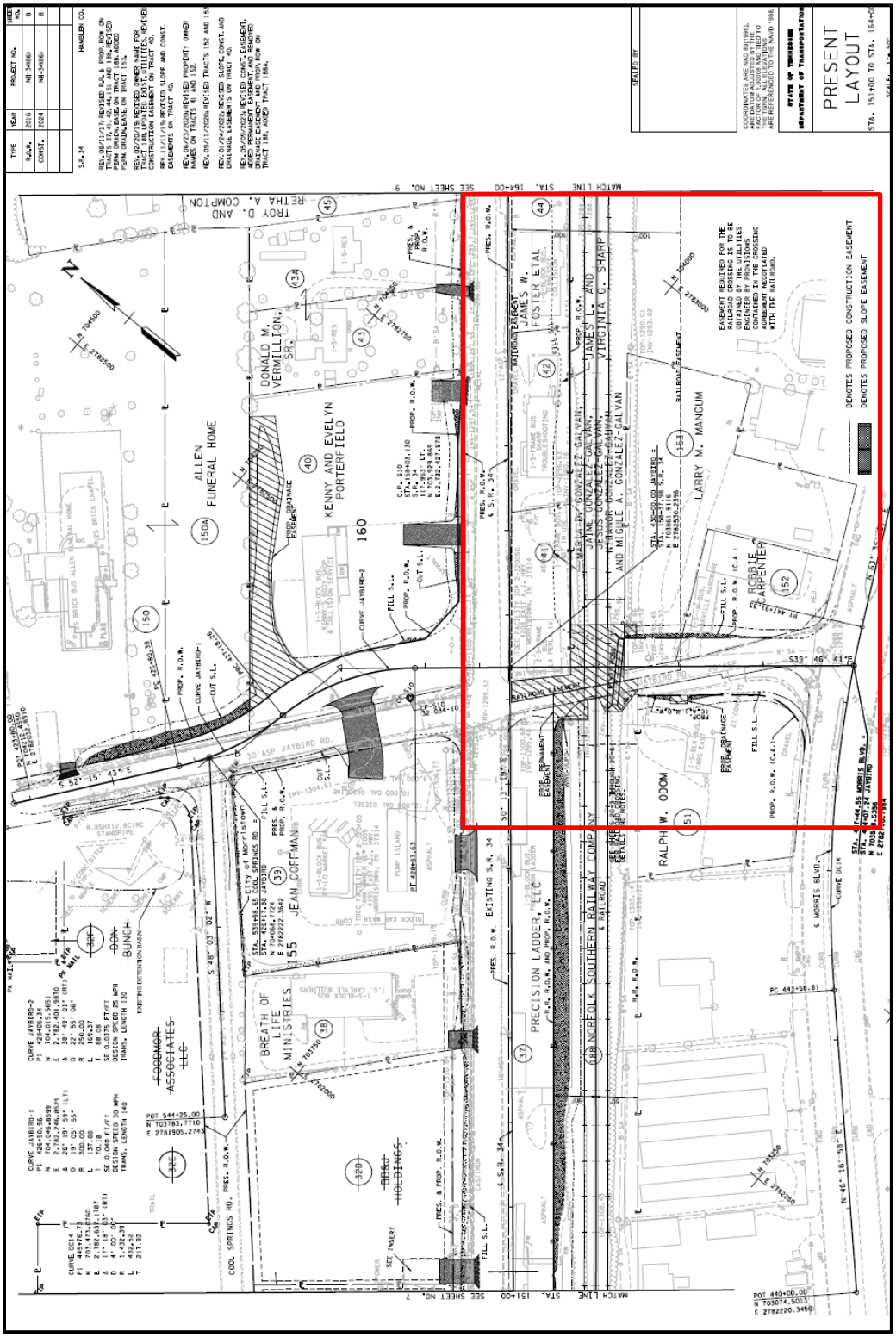


Figure 4-42
Norfolk Southern Present Layout

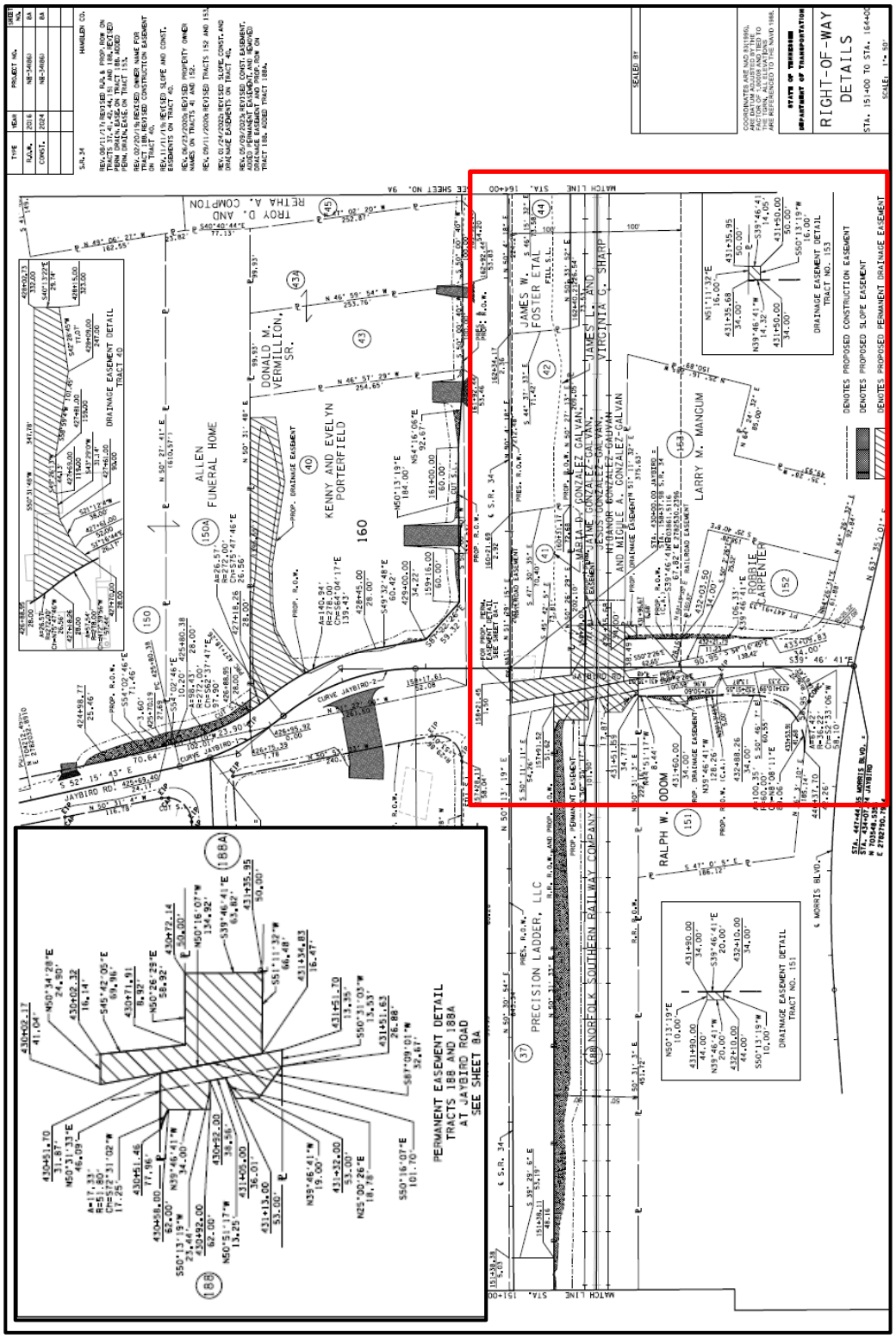


Figure 4-43
Norfolk Southern R.O.W. Details

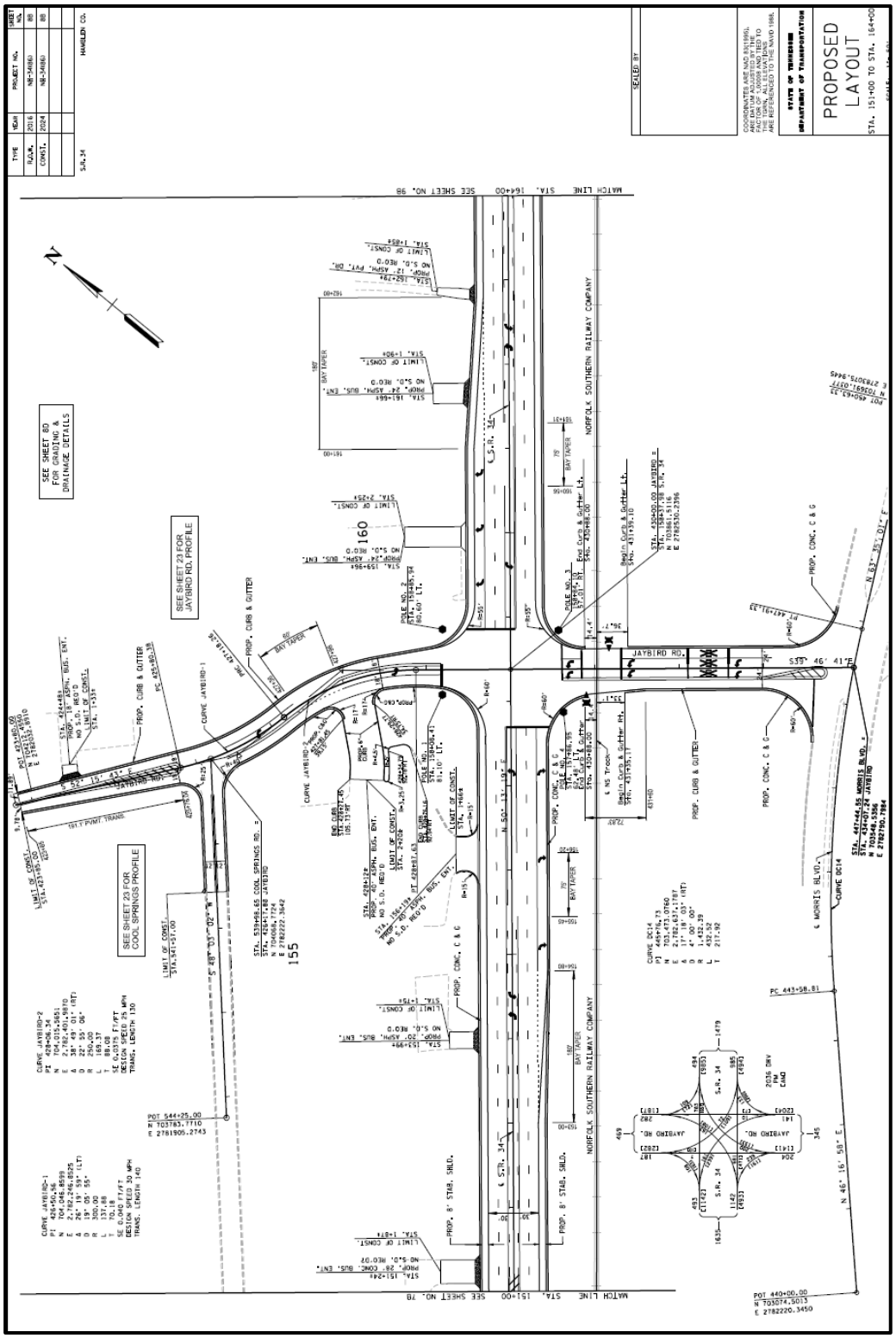


Figure 4-44
Norfolk Southern Proposed Layout

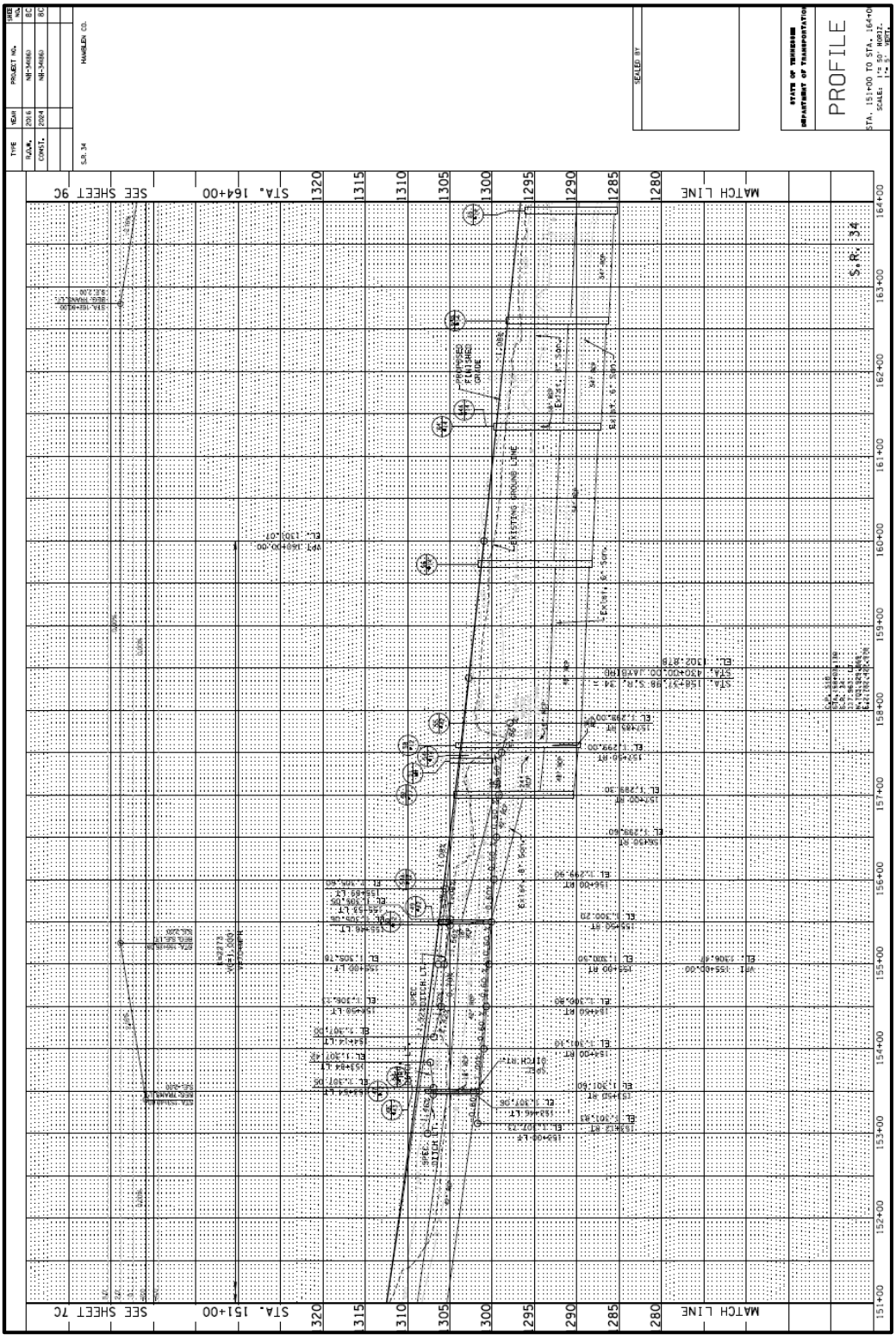


Figure 4-45
Norfolk Southern Proposed Profile

4-606.02 ILLINOIS CENTRAL RAILROAD

REAL ESTATE ENGINEERING PLAT AND LEGAL DESCRIPTION REQUIREMENT

See *Chapter 4-606.01 Norfolk Southern Railway Company*. The process for Illinois Central Railroad shall be the same as for Norfolk Southern Railway Company.

PDN - CHAPTER 5

FOOTPRINT

ESTABLISHED

STAGE 2

CHAPTER 5 FOOTPRINT ESTABLISHED

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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** –Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



4 Stages of Project Delivery Network

0. Planning
1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 – PREPARING FUNCTIONAL DESIGN PLANS

5-100.00 DEVELOP FUNCTIONAL DESIGN PLANS

See Project Delivery Network 2RD1 for the Functional Design Plan requirements.

5-101.00 FEDERAL TRACTS

Federal tracts should be marked as permanent easements on federal tracts in the right-of-way acquisition table when obtaining land rights from the Tennessee Valley Authority, the U.S. Corps of Engineers, other U.S. Government Agencies. Railroads, Cities and Counties. ((See TDOT Right-of-Way manual Chapter VIII-7)

5-102.00 RIGHT-OF-WAY NOTES FOR ALL RIGHT-OF-WAY PROJECTS

See Chapter 9 Section 3, Right-of-Way/Utility Notes, to determine which notes apply. These notes shall be placed on Plan Sheet 3 - Right-of-Way Notes, Utility Notes, and Utility Owners sheet of the Functional Design Plans.

5-103.00 UTILITY OWNER INFORMATION

Utility owner information is submitted in the Survey CADD file. All utility owner's names with contact information shall be confirmed by Project Development Utility personnel and shall be listed on Plan Sheet 3 – Right-of-Way Notes, Utility Notes, and Utility Owners. For format of Utility Owners see Figure 5-1, Typical Format for Utility Owner Information.

UTILITY OWNERS

FIBER:
AT&T
315 E. COLLEGE STREET
JACKSON, TN 38301
CONTACT: COREY BARTHOLOMEW
OFFICE PHONE: 731 423 5026
CELL PHONE: ___ ___ ____
Email: N/A

FIBER:
SPRINT
411 HUGER STREET
COLUMBIA, SC 29201
CONTACT: STEVE THOMPSON
OFFICE PHONE: 678 852 2726
CELL PHONE: ___ ___ ____
Email: N/A

WATER:
TOWN OF CAMDEN WATER DEPT.
110 HWY 641 SOUTH P.O. BOX 779
CAMDEN, TN 38320
CONTACT: JOHN BEASLEY
OFFICE PHONE: 731 584 4656
CELL PHONE: ___ ___ ____
Email: N/A

SANITARY:
TOWN OF CAMDEN WATER DEPT.
110 HWY 641 SOUTH P.O. BOX 779
CAMDEN, TN 38320
CONTACT: JOHN BEASLEY
OFFICE PHONE: 731 584 4656
CELL PHONE: ___ ___ ____
Email: N/A

GAS:
WEST TENNESSEE PUBLIC UTILITY
14055 PARIS STREET
HUNTINGDON, TN 38344
CONTACT: MIKE STAFFORD
OFFICE PHONE: 731 986 8289
CELL PHONE: ___ ___ ____
Email: N/A

RAILROAD:
CXS RAILROAD
500 WATER STREET, 15TH FLOOR
JACKSONVILLE, FL 32202
CONTACT: N/A
OFFICE PHONE: ___ ___ ____
CELL PHONE: ___ ___ ____
Email: N/A

Figure 5-1
Typical Format for Utility Owner Information

5-104.00 PROJECT COMMITMENTS SHEET IN FUNCTIONAL DESIGN PLANS

All commitments made during the planning and development of the project, shall be documented in the Project Commitment Document for each respective project. Those commitments shall be included on a separate Project Commitments sheet in the Plan-in-Hand plans. For an example of the Project Commitments sheet see *Figure 5-2, Example of Project Commitments Sheet.*

The Project Commitments sheet shall be developed using the Project Commitments template. The sheet shall be placed in the plans as sheet 1B.

The following procedures shall be used for identifying project commitments and developing the Project Commitments sheet:

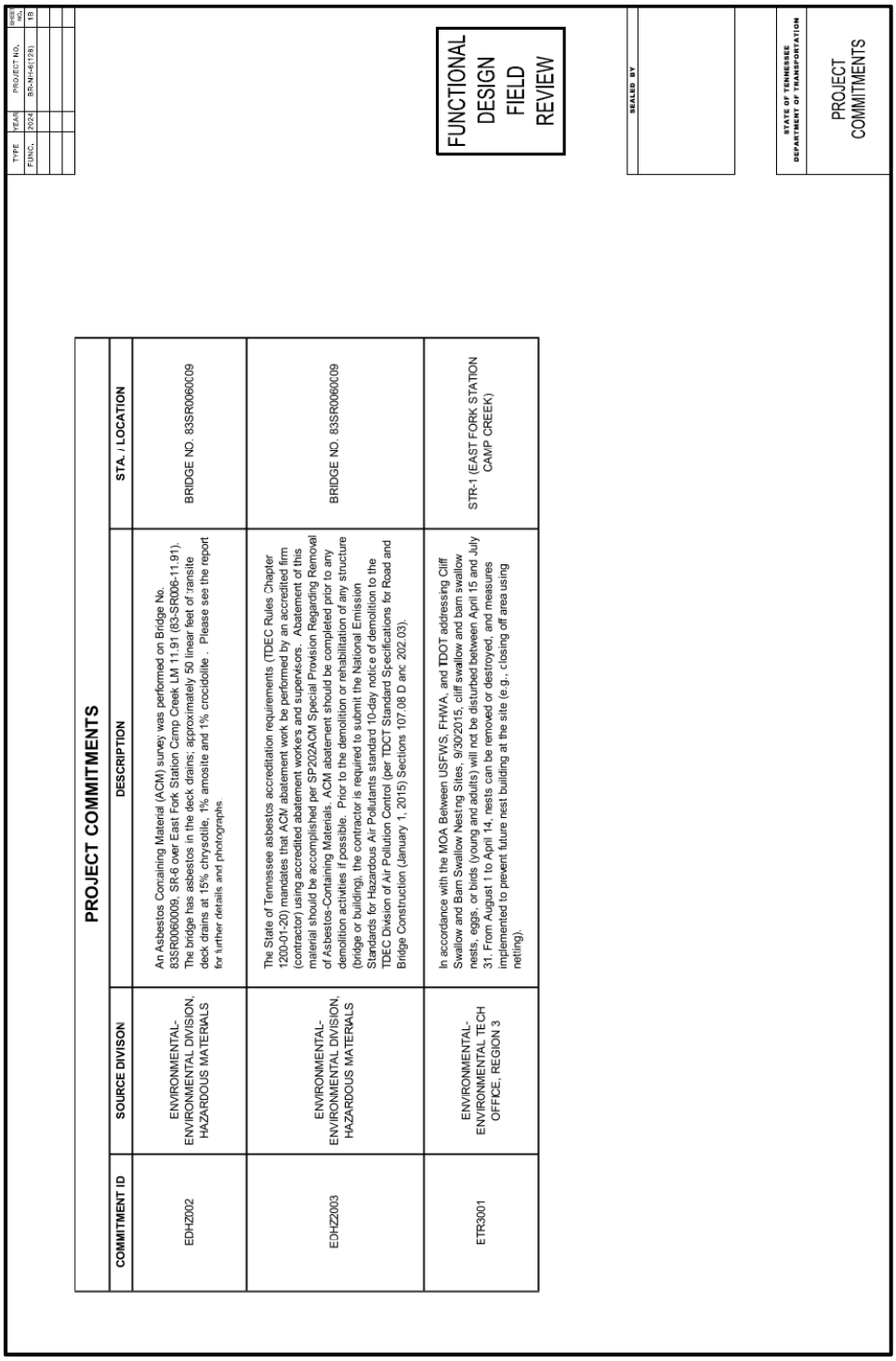
1. Each Division is responsible for placing their respective project commitments on the Project's SharePoint site under the discipline folder. The Division adding the commitments shall be defined. The commitment shall be well defined with stations and locations if applicable. Once the commitment is added, the program will define a commitment ID.

2. The Design Lead will be responsible for checking the Project Commitments page and developing the Project Commitments sheet at the beginning of Functional Design plans development and update as needed. Each commitment shown on the Project Commitment sheet shall contain the commitment ID, source division, commitment description, and the station/location.

3. For any pending commitments, Design Leads should contact the Division responsible for the commitment prior to issuing Right-of-Way plans to verify if the commitment may be active. If project commitments are added or revised after final Plan-in-Hand plans submittal, a plan revision may be necessary.

4. Design Leads shall be responsible for verifying that the commitment does not violate any of the 10 controlling elements of design or design standards. In the event a commitment requires a Design Exception and Justification Form or other documentation, it shall be the responsibility of the Design Manager to obtain a design exception or provide appropriate documentation needed to document the variance from the standard design practice prior to adding the commitment to the Project Commitments sheet. The Design Lead should also follow up with the Division responsible for the commitment.

5. Project commitments are intended to include commitments made during the development of the environmental document, to mitigate environmental impacts, to address issues related to the project design, or Right-of-Way acquisition that the Department has agreed to during project planning and development. Commitments should not include items normally included as part of a set of construction plans, covered under standard specifications, supplemental specifications, or other contract documents. If the Design Lead/Project Manager believes a commitment has been added that is not warranted, the Project Manager will follow up with the appropriate person or persons in the Division which added the commitment to determine if the commitment is appropriate.



TYPE	YEAR	PROJECT NO.	SHEET NO.
FUNC.	2024	BR-NH-6(128)	18

FUNCTIONAL DESIGN FIELD REVIEW

SEALED BY

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

PROJECT COMMITMENTS

PROJECT COMMITMENTS

COMMITMENT ID	SOURCE DIVISON	DESCRIPTION	STA. / LOCATION
EDHZ002	ENVIRONMENTAL-ENVIRONMENTAL DIVISION, HAZARDOUS MATERIALS	An Asbestos Containing Material (ACM) survey was performed on Bridge No. 83SR0060009, SR-6 over East Fork Station Camp Creek LM 11.91 (83-SR06-11.91). The bridge has asbestos in the deck drains; approximately 50 linear feet of transite deck drains at 15% chrysotile, 1% amosite and 1% crocidolite. . Please see the report for further details and photographs.	BRIDGE NO. 83SR0060C09
EDHZ2003	ENVIRONMENTAL-ENVIRONMENTAL DIVISION, HAZARDOUS MATERIALS	The State of Tennessee asbestos accreditation requirements (TDEC Rules Chapter 1200-01-20) mandates that ACM abatement work be performed by an accredited firm (contractor) using accredited abatement workers and supervisors. Abatement of this material should be accomplished per SP202ACM Special Provision Regarding Removal of Asbestos-Containing Materials. ACM abatement should be completed prior to any demolition activities if possible. Prior to the demolition or rehabilitation of any structure (bridge or building), the contractor is required to submit the National Emission Standards for Hazardous Air Pollutants standard 10-day notice of demolition to the TDEC Division of Air Pollution Control (per TDOT Standard Specifications for Road and Bridge Construction (January 1, 2015) Sections 107.08 D and 202.03).	BRIDGE NO. 83SR0060C09
ETR3001	ENVIRONMENTAL-ENVIRONMENTAL TECH OFFICE, REGION 3	In accordance with the MOA Between USFWS, FHWA, and TDOT addressing Cliff Swallow and Barn Swallow Nesting Sites, 9/30/2015, cliff swallow and barn swallow nests, eggs, or birds (young and adults) will not be disturbed between April 15 and July 31. From August 1 to April 14, nests can be removed or destroyed, and measures implemented to prevent future nest building at the site (e.g., closing off area using netting).	STR-1 (EAST FORK STATION CAMP CREEK)

Figure 5-2
Example of Project Commitments Sheet

SECTION 2 – TRAFFIC CONTROL PLAN DESIGN

5-200.00 TRAFFIC CONTROL IN CONSTRUCTION ZONES

TDOT's policy is to plan, design, construct, maintain, and operate safe and efficient work zones. The control of all road users through a work zone is an essential part of highway construction, utility work, maintenance, and right-of-way use permits. All projects shall follow TDOT's Traffic Operations Division Work Zone Safety and Mobility (WZSM) manual. Consideration and management of work zone impacts begin at project inception and continue through all phases of design.

According to 23 CFR Part 630, Subpart J, all federally funded projects must have a Work Zone Significance Determination Evaluation and an appropriate Traffic Management Plan (TMP). TDOT's policy is to have a TMP for state-funded projects as well as federally funded projects. This is for all projects, including bridge repair, utility, or Local Program projects. All state/local projects shall include these three goals and objectives:

A. Maximize safety in all work zones having TDOT oversight by reducing fatality, injury, and property damage crashes statewide.
B. Minimize delay and other negative operational aspects of work zones.
C. Promote consistency in all phases of work zone development, including planning, design, implementation, and operation.

The first step is to determine whether the project is exempt according to the introduction of the TDOT Work Zone Safety and Mobility Manual. If it is not exempt, then the next step is to complete the TMP Cover Page and Work Zone Significance Determination form and develop a TMP. The TMP template should be completed for all projects, whether significant or non-significant. The template format is available in Chapter 1 of the Work Zone Safety and Mobility Manual. The TMP packet includes the items listed in Table 5-1, TMP Packet Item List. Local agencies should use the Local Program version of these forms, as TDOT personnel will not be approving Local TMPs.

Item #	Item Description
1	TMP Template
2	TMP Cover Page
3	Work Zone Significance Determination Form
4	Traffic Control Plans

Table 5-1
TMP Packet Item List

Consideration and management of work zone impacts begin at project inception and continue through all phases of design. The TMP shall at the minimum include a temporary traffic

control plan which shall either be a project specific temporary traffic control plan, approved TDOT standard drawings, or a reference to specific temporary traffic application in the MUTCD. The Design Lead shall use the Roadway Standard Drawing T-WZ series and the MUTCD to develop the traffic control plans. Additionally, all Operational Strategies agreed to at the Field Reviews and included on the TMP shall be shown as a special note on the Traffic Control Plan in the project plans.

The different responsibilities for Design Leads and Project Managers are specified in Appendix B of the WZSM. If the project type is not listed in the table, the Project Manager shall ensure that the significance determination and TMP are completed.

Prior to the Plan-in-Hand submittal, the Design Lead/Project Manager will submit the TMP packet to the Regional Traffic Engineer for approval and TMP cover sheet signature. The TMP packet with signed TMP cover sheet shall be uploaded to FileNet at the Plan-in-Hand plans submittal. Refer to *Chapter 1-105.07*. The naming convention shall be ***nnnnnn-nn*-TMP.pdf** where "nnnnnn-nn" is the project PIN. The revised, finalized, and signed TMP shall be uploaded to FileNet at the PS&E submittal. Refer to *Chapter 1-105.09*. Naming conventions shall be ***nnnnnn-nn*-TMP.pdf**, where "nnnnnn-nn" shall be the project PIN. For more detailed information, please see TDOT's Work Zone Safety and Mobility Manual.

At the Functional Design Plans Field Review, the Traffic Control Plan sheets shall be a draft version and printed for informational purposes only. The sheets will not be shown in the Index and shall be removed from the plan set prior to submittal. The sheet(s) shall have the *Info Only* stamp. Traffic control shall be discussed to ensure that all aspects of the traffic control and construction phasing are discussed during the Functional Design Plans phase. After the field review, changes shall be made to the Traffic Control sheets prior to Plan-in-Hand submittal. When Functional Design plans are submitted, the draft traffic control plans will be an independent pdf named ***nnnnnn-nn*-ConceptualTrafficControl.pdf** and placed on FileNet as a part of the Functional Design Plans submittal package. After the Plan-In-Hand submittal, these plans will not be updated. If traffic control plans change significantly from the Functional Design draft, the Regional Utility office will need to be notified. The TMP shall be reviewed, revised, and finalized at the PS&E Field Review or as deemed necessary by the Design Manager.

5-201.00 CONSTRUCTION SIGNING

Detour signs shall be used only when traffic is rerouted onto another road and not used for diversions (runarounds), lane shifts, etc. on the road under construction. A Road Work Next XX Miles sign shall be used on roads whose work zone is more than 2 miles in length or as instructed by TDOT Standard Drawings. Distances on the sign shall be rounded to the next mile up (example: 5.4 miles in road work shall be shown as 6 miles on the Road Work Next XX Miles sign).

5-202.00 BARRICADES AND DRUMS LIGHTING DEVICES

Plastic drums shall be used in lieu of Type II barricades due to better performance in terms of durability and target value.

1. Where plastic drums are used, there are certain situations where additional delineation provided by lighting devices is not necessary. Type C (steady burn) lamps are not recommended for use with plastic drums along tangent sections following a lane closure taper or along a line of drums delineating the edge of the traveled way. The large target area of reflective sheeting on drums has been shown to provide adequate delineation for these conditions. However, the use of Type C lamps is still recommended for use with drums on tapers. Also, Type C lamps on drums, including tangent sections, might be considered when climatic conditions (for example fog) dictate the need for additional delineation.
2. Where portable concrete barrier rails are used, portable barrier rail delineators are recommended in lieu of Type C lamps. These devices have provided adequate delineation at a much lower cost, while requiring much less maintenance effort as compared to Type C lamps.
3. The use of high intensity (Type B) lamps is optional according to the *MUTCD.* These lamps are frequently attached to the initial set of road work signs in advance of the work zone (Road Work Ahead, Road Work ½ Mile, etc.). These lamps do not add any significant degree of attention to these signs and are costly to provide and maintain. The use of Type B lamps shall be limited to just those situations where a "spot" hazard is anticipated, and additional delineation of a channelizing device is considered necessary.

5-203.00 MARKINGS

Wide (8 inch) solid lane lines are recommended for use as temporary marking at lane transitions and lane shifts. Wide lines provide better guidance through changes in alignment, especially where conflicting traces of removed markings may remain. Wide-edge line marking is also recommended for use next to portable concrete barrier rail. Review Roadway Standard Drawings - T-WZ Series for pavement marking requirements.

5-204.00 TEMPORARY RAISED PAVEMENT MARKERS

Raised pavement markers should be placed on lane lines for lane shifts on divided highways and freeways and 2-lane two-way diversion (run-arounds), as shown on the Roadway Design T-WZ-series Standard Drawings.

Temporary raised pavement markers should also be considered for use throughout construction projects on major facilities and locations where the lane visibility is an issue. The use of temporary raised pavement markers should be addressed at the Plan-in-Hand field review on projects involving major facilities.

Designers should ensure that the appropriate 716 series of pay items are included in the plans for temporary raised pavement markers.

5-205.00 PORTABLE BARRIER RAIL

Horizontal taper rates shall be 10:1 or flatter for designs where posted speeds are less than or equal to 45 mph and 15:1 or flatter for designs where posted speeds are greater than 45 mph (see standard drawings T-WZ series for more information). The approach ends of the portable barrier rail shall be located outside the clear zone or be shielded with a portable energy absorbing terminal. The energy absorbing terminals shall be paid for under Item Number 712-02.60 Temporary Crash Cushion (MASH TL-3) per Each, and footnoted as follows:

"This item shall be a portable energy absorbing terminal meeting the requirements of AASHTO MASH for Test Level 3. The pay item will include furnishing and installing all components as shown on the manufacturer's drawing."

5-206.00 BARRIER RAIL DELINEATORS

Barrier Rail Delineators (Item Number 712-04.50 Barrier Rail Delineator per Each) shall be used on portable barrier rail in accordance with the Roadway Standard Drawings T-WZ-Series and *Chapter 2-501.01, Temporary Pavement Marking for Use on Pavement Surface Other than Final*. The TDOT approved qualified product list will be used to identify acceptable products. Barrier rail delineators should meet the following specifications:

1. Portable barrier rail delineator reflective sheeting shall meet ASTM D4956, Type V specifications.
2. Delineator should have 4" x 3" dimensions. Delineators with dimensions other than 4" x 3" may be used if the product is on the approved products list. The variations in delineator dimension should not exceed ±10%.
3. Different types of barrier rail delineators should not be mixed in the same line.
4. Portable Barrier Rail Delineators shall be high impact, UV-stabilized, engineered thermoplastic or polycarbonate substrate.

5-207.00 DIFFERENCES IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS

To minimize the hazard to traffic where differences in elevations between adjacent roadway elements exist, the Designer shall follow the procedures listed in *Chapter 9 Section 5 Pavement Edge Drop-Off Traffic Control Notes*, unless otherwise shown on the plans or directed by the Engineer. The Designer is advised that the procedure listed in *Chapter 9 Section 5* shall be presented in the form of traffic control notes shown on the first sheet in the traffic control plans and not on the general notes sheet.

5-208.00 WORK ZONE SPEED CONTROL

WORK ZONE SPEED LIMITS

Speed limits in work zones shall be established based on the Work Zone Speed Control chapter of TDOT's Guidance on Setting Speed Limits manual. An evaluation for the need for a speed limit reduction shall be done for all freeway and expressway projects. If the criteria are met for a reduction, a written request shall be made to the State Traffic Engineer identifying the existing speed limit, proposed speed limit, whether it is to be variable or continuous, and which conditions and factor(s) necessitating the reduction are met. If approved, a pay item for portable, changeable speed limit signs shall be included. These signs shall be located at the beginning of the active construction work zone and every 1 to 1.25 miles on the right side of the roadway throughout the project length. These signs shall also be located at every on-ramp, if applicable. A static speed limit sign (R2-1) with the original speed limit shall be placed at the end of the work zone to establish that limit.

"WORKERS PRESENT" SIGN

A pay item for the "Workers Present" (TN-44) sign is to be used on all freeway and expressway construction projects if reduced speed limits for the construction zone are approved for use. This sign is to be placed 1,000 feet in advance of the reduced speed limit sign which is to be located at the beginning of the active construction work zone. These signs shall be located on the right side and on the median side of the roadway (except on the concrete median barrier wall sections). The signs shall be located only on the right side downstream of each interchange on-ramp within the active construction work zone.

The "Workers Present" sign will be paid for under Item Number 712-06.16 Signs (Construction) (Reduced Speed Warning) per Each. This item will be footnoted as follows:

"Item to be used only when a reduced speed limit is established within the project construction work zone limits. Item includes sign face, supports, and two type "B" flashers per the standard specifications. The contractor shall be responsible for turning on the type "B" flashers when workers are in the construction work zone and turning them off when workers are no longer in the construction work zone."

5-209.00 USE OF LANE CLOSURE WITH LEFT HAND MERGE

Controlled access projects which utilize left lane closure details shall be reviewed for the inclusion of Left-Hand Merge. Roadway Standard Drawing T-WZ-21 details Lane Closure with Left Hand Merge and Lane Shift. The layout and signage may require modification depending on site and field conditions. Freeway construction or maintenance projects where the left lane of traffic is closed through the work zone are the primary candidates.

The following criteria will be used for determining Merge Left use:

- Projects on rural freeways should include Merge Left

- Projects on urban freeways will be reviewed for Merge Left considering factors such as number of lanes, interchange spacing, and proximity to major splits
- Other controlled access facilities will be considered on a case-by-case basis

The State Work Zone Engineer should be notified by email (TDOT.WZ-Review@tn.gov) for any freeway or controlled access facility with lane closures not utilizing Left Hand Merge prior to finalizing the traffic control. The memorandum shall contain the reasons left hand merge would not be warranted.

5-210.00 WORK ZONE DESIGN DEVIATION FORM

All projects with Temporary Traffic Control plans that do not meet TDOT or MUTCD standards shall require the completion and approval of a Work Zone Design Deviation Form.

Despite the range of flexibility that exists with respect to the controlling elements of temporary traffic control design, there are situations in which Roadway Standard Drawings -T-WZ series or MUTCD Part 6 criteria are not applicable to the project circumstances or cannot reasonably be met. For such instances, the work zone design deviation process allows for the request, justification, mitigation, and acceptance of alternate design criteria.

The work zone design deviation process requires formal approval for exceptions relating to TDOT's and MUTCD's accepted standards. Work Zone Design Deviation requests shall be submitted to the State Work Zone Engineer (TDOT.WZ-Review@tn.gov) using the Work Zone Design Deviation Form. Designers shall keep a copy of the signed form in the Project Folder. Approved deviations shall then be described in detail within the Traffic Control Plan Notes.

SECTION 3 – ENVIRONMENTAL CONSIDERATIONS

5-301.00 KNOWN ENVIRONMENTAL CONSTRAINTS

Any known environmental constraints identified in environmental technical documents should be indicated on the plans and brought to the Project Team's attention as soon as the constraints are recognized. Constraints may include, but are not limited to the following: streams, wetlands, endangered or protected species, registered historical or archeological sites, etc. Ecology, permit assessment, and SWPPP review items encountered are to be addressed prior to the Functional Design Plan submittal.

5-302.00 ENVIRONMENTAL NOTE REQUIREMENTS

Design Leads should refer to *Chapter 9-400 Environmental General Notes* for Environmental Note requirements. The blue instructional text listed there will help guide as to whether notes are needed in the plans and the placement of those notes. These notes shall be part of the Plan-in-Hand Field Review and part of the official Plan-in-Hand plan submittal. The notes shown in Chapter 9-400 through 9-405 shall be placed in the Environmental Notes sheet series. This series comes after the General and Special Notes sheets. The notes shown in Chapter 9-410 through 9-415 shall be placed in the Erosion Prevention and Sediment Control (EPSC) Notes sheet series. This is the first sheet of the EPSC sheet series. For Resurfacing projects, these notes shall be placed after the Environmental Notes sheet.

Project Specific Notes requested by the Environmental Division should be included in the Environmental Notes or EPSC sheets as Special Notes except for special circumstances that require the note to be shown on the specific plan sheet for which the note applies. In these cases, a special note should be included in the Environmental or EPSC Special Notes indicating the location of the note.

The Design Lead should add any additional Special EPSC Notes which provide project specific information on requirements for the proposed EPSC measures as well as specific steps the contractor should take in the execution of the EPSC Plan. These notes should also be added to the first sheet of the EPSC Plans.

For notes added at the direction of the Environmental Division, the following sub-headers should be used:

A. Environmental - Air and Noise
B. Environmental - Archaeology
C. Environmental - Ecology
D. Environmental - Hazardous Materials
E. Environmental - Historic Preservation
F. Environmental - Mitigation
G. Environmental - Permits

5-303.00 ADDITION OF EPSC PLANS INTO FIELD REVIEW AND FUNCTIONAL DESIGN PLANS

EPSC Plans sheets shall be included in the Functional Design Field Review plans. Updates from comments at the field review should be made to the plans prior to submittal for Right-of-Way Appraisals and Acquisition. EPSC Plan sheets shall be named and follow the sequence as shown in *Chapter 1-204.01, Functional Design Index of Sheets* and include all listed items in the Functional Design checklist. Refer to the Drainage Manual *Chapter 10 Erosion Prevention and Sediment Control* for additional information on EPSC plans.

All projects require at least three (3) EPSC stages unless SWPPP staff member states otherwise:

1. Clearing and Grubbing Stage
2. Intermediate Stage (example: a widening project where traffic remains on existing roadway and portion of road is being constructed)
3. Final Construction Stage

In all cases, the plans will have the same number of EPSC stages as it has Traffic Control phases.

The Design Manager should contact the Regional Environmental Technical Groups when EPSC Plans are revised to determine if revised plan sheets or other information is needed.

5-303.01 ADDITION OF CONTOURS TO EPSC SHEETS

Contours shall be included in plans as part of the EPSC sheets for all projects submitted for Right-of-Way Appraisal and Acquisition except for resurfacing projects, projects where a survey is not required, and small projects or projects of limited scope where a surface is not developed. Contours should include existing (pre-construction), intermediate, and proposed contours. Contours shown on EPSC sheets should include all listed items in the Functional Design checklist.

Since site conditions and topography are unique to each project, Design Leads should seek input from Regional Environmental Technical Offices to determine contour intervals.

5-304.00 ENVIRONMENTAL PERMIT REQUIREMENTS

Several State and Federal Agencies issues permits for impacts to Waters of the United States and Waters of the State of Tennessee. These agencies have regulatory authority over the Tennessee Department of Transportation. These agencies and the permits the agencies issue are described in the Tennessee Environmental Procedures Manual.

Design Leads are responsible for preparing all requested information, permit sketches, and modifications to their plans that the Regional Environmental Technical Office and

Environmental Division – Permits Office use to apply for permits. This document assists in determining what is included in the packet and on the individual sketches. Once the Environmental Permit Package is complete and uploaded to FileNet, send a notification by email to the HQ Environmental Division (TDOT.Env.Permits@tn.gov) and the appropriate Regional Environmental Technical Office:

Region 1 – Environmental Technical Office R1.EnvTechOffice@tn.gov
Region 2 – Environmental Technical Office R2.EnvTechOffice@tn.gov
Region 3 – Environmental Technical Office R3.EnvTechOffice@tn.gov
Region 4 – Environmental Technical Office R4.EnvTechOffice@tn.gov

Once the application for water quality permits (which includes the permittable roadway plans and permit sketches) for a given roadway project has been submitted to the various permitting agencies (i.e. Tennessee Department of Environment and Conservation, U.S. Army Corps of Engineers, and Tennessee Valley Authority) by the Environmental Division, an email will be sent to the project's Project Manager notifying them of this application submittal. It should be noted that if agency review results in a Request for Additional Information (RAI) from the Environmental Division revisions to the roadway plans and/or permit sketches may be required from the Design Lead to satisfy the RAI comments. If revisions to the plans or sketches are required, this information will be coordinated by the Environmental Division to either the Environmental Technical Office or the Project Manager/Design Lead by email.

If the project does not require items submitted for permit evaluation, the Regional Environmental Technical Office or Environmental Division shall send an email to the Design Lead, copied to the Program Scheduling Office, stating that no environmental impacts will occur as a result of the project.

5-305.00 PLACEMENT OF TREES IN MITIGATION AREAS

Areas designated for tree planting for water quality impacts typically include restored or existing wetlands, channel changes, and when specified, areas around streams and the inlet and outlet areas at culverts. The Environmental Technical Office or TDOT Mitigation shall be consulted to determine which areas require tree planting. All required tree planting must be located within the permanent right-of-way rather than in a drainage easement. Sufficient room shall be designated for the placement of trees and seedlings near culverts, channel relocations, and along stream banks, or other mitigation features within the right-of-way boundaries. These trees should be protected from disturbance during construction and from maintenance activities after construction. Within the approved permit, the regulatory agencies will specify how long and what percentage of survival is needed to satisfy the conditions of the specific permit.

All notes required by the Technical Studies Office, Environmental Division, Regional Environmental Tech Offices, or specified in the Ecology report must be placed in the Plan-in-Hand plans for the permit applications. Email addresses are as follows:

TDOT.Env.Ecology@tn.gov
R1.EnvTechOffice@tn.gov
R2.EnvTechOffice@tn.gov
R3.EnvTechOffice@tn.gov
R4.EnvTechOffice@tn.gov

5-306.00 ABANDONMENT OF WATER WELLS

If during the Environmental Boundaries and Functional Design phase it is determined that a water well requires abandonment, the Project Manager/Design Lead shall request information after Functional Design plans have been submitted by notifying the Tennessee Department of Environment & Conservation, Division of Water Resources, Water Well Program at the Davey Crockett Tower, 9th Floor, 500 James Robertson Parkway Nashville, Tennessee 37243 or telephone 1-800-525-4873 or (615) 532-0176. The Project Manager/Design Lead shall also request an inspection of the well and recommendations concerning sealing. Quantities and bid items shall then be set up in the project plans for the contractor to perform the actual sealing of the well. The abandonment of water wells shall become a project commitment. See *Section 5-104.00 Project Commitments Sheet in Functional Design Plans*.

When requesting a well inspection and recommendations for sealing from the Water Management Division, the Designer shall provide the following:

1. A print of the title sheet and of the plan sheet showing the location of the well.

2. The name, address, and telephone number of the driller, the date the well was drilled, and the name and telephone number of the property owner at the time the well was drilled, if the information is available.

The Project Manager/Design Lead shall take the initiative to ensure that this information is returned in time to incorporate it into the project plans. The well shall be located on the proposed layout sheet and a note added as to whether the well is to be sealed by the contractor.

Every effort is to be made to ensure that this information is on the project plans before turning them in for the letting. All water wells shall be sealed in accordance with the standards set forth by the Tennessee Department of Environment and Conservation (TDEC).

5-307.00 ADDITION OF NATURAL STREAM DESIGN SHEETS TO FUNCTIONAL DESIGN PLANS

For a project involving a stream relocation the Environmental Division, Natural Resources Office will determine if a Natural Stream Design is required and will notify the Project Manager/Design Lead in the Permit Assessment. The Project Manager/Design Lead will not be responsible for developing the Natural Stream Design.

The Design Lead is not responsible for showing the natural stream design on the Proposed sheets; however, the Design Lead shall add the following note on each Proposed sheet in which the natural stream design would otherwise appear:

NOTE: NATURAL STREAM DESIGN IS NOT SHOWN, SEE SHEET NS SERIES PLANS FOR DETAILS.

SECTION 4 – FUNCTIONAL DESIGN PROCESS

5-401.00 FUNCTIONAL DESIGN FIELD REVIEW

See PDN 2RD1, 2PM1 and Chapter 1-105.02 for information regarding the Functional Design Field Review process.

5-402.00 FUNCTIONAL DESIGN PLANS FILENET SUBMITTAL

See PDN 2RD1, 2PM1 and Chapter 1-105.03 for information regarding the Functional Design Plans Submittal process. This submittal is required to allow for right-of-way purchases and acquisitions.

5-403.00 SUBMITTAL FOR "UTILITIES ONLY"

On any project, other than paving or resurfacing projects, that does not have right-of-way acquisition involved, the Design Lead shall submit Functional Design plans and stamp them Functional Plans (Utilities Only) (See *Chapter 1-402.02*). Submission of these plans will be treated as Functional Design Plans and follow the procedures listed in *Chapter 1-501.03* and *Chapter 5-402.00*.

It will be the responsibility of the Right-of-Way Office to print and distribute copies of the plans as needed.

5-404.00 SUBMITTALS OF RIGHT-OF-WAY APPRAISALS AND ACQUISTION

When submitting a project for Right-of-Way “appraisals and acquisition,” the Design Manager in charge of the project is to upload all required files to FileNet (see *Chapter 1-105.03*) and sending the submittal email of the Functional Design plans turn-in to the appropriate personnel listed in the *Distribution List*.

Refer to *Chapter 1-402.02* for Functional Design Estimate submittal. This estimate shall be completed and submitted to the Estimating and Bid Analysis Office prior to submitting plans for “appraisals and acquisition”. The date the information was submitted to the Estimating and Bid Analysis Section shall be included in the Functional Design submittal email.

It is important that the incidentals report data be incorporated into the plans before finalizing the Functional Design Plans to reduce Right-of-Way revisions (see Chapter 5-408.00). However, **if it is imperative** that Functional Design Plans be submitted before receiving the incidentals report data, the Regional Project Development Director will give the approval to proceed to the Design Manager in charge of the project. This approval shall be noted on the Right-

of-Way Funding Request approval transmittal letter to the Program Operations Office, Federal Aid Section. See *Chapter 5-406.00* for additional information.

When a consultant submits plans for Right-of-Way "appraisals and acquisition," the consultant's seal, signature, and date shall be placed on the right side of the title sheet above the Chief Engineer's signature as stated in Chapter 1.

All cross-sections will have the project number shown and be numbered in the upper right-hand project identification block. The sheet numbering will follow the numbering used on the plan sheets in the same manner used in the construction plans.

Before plans are submitted for Right-of-Way appraisals and acquisition, all information which might affect the existing or relocated utilities shall be shown on the plans. This includes, but is not limited to, the following:

1. Storm sewers, catch basins, manholes, cross drains, side drains, box culverts, channel changes, special ditches, and other drainage facilities
2. Preliminary bridge layouts and hydraulic data
3. Retaining walls and/or noise walls
4. Guardrails
5. Detour roads
6. Traffic signal pole locations including attachment heights and footing details
7. Street light pole locations
8. Erosion prevention and sediment control devices (EPSC Plan)
9. Other details which might affect utilities

5-405.00 SUBMITTAL OF FUNCTIONAL DESIGN PLANS ESTIMATE FOR FUNDING

See Chapter 1-402.02 for information regarding submitting the Functional Design Plans Estimate.

5-406.00 RIGHT-OF-WAY FUNDING APPROVAL REQUESTS

See Project Delivery Network 2PM1, 3PM1, 4PM1 for right-of-way funding approval request process.

5-408.00 RIGHT-OF-WAY REVISIONS

When the Functional Design Plans and the Right-of-Way appraisals and acquisition have been submitted for a project, and a change becomes necessary anywhere on the project, a Right-of-Way Plans revision is required. All Right-of-Way revisions will be submitted through the Project Manager responsible for the project in an accurate and timely manner. It is not necessary to re-seal the title sheet unless the revision is on the title sheet.

The Design Manager responsible for the project will upload the revised plan set to FileNet (See Chapter 1-105.04) and submit a notification to the appropriate personnel listed in the Distribution List. The plans revision distribution shall be sent by email for all Right-of-Way revisions regardless of whether they have been let to contract or not. The email will contain the revision letter and a PDF of the revised sheets only. See Chapter 1-105.04 and the FileNet Project Deliverables, for file naming convention. If the PDF is larger than the allowable email limit, then the PDF should be placed on FileNet and noted at the bottom of the email. It will be the responsibility of the Regional Right-of-Way Office to print and distribute copies of the plans as needed.

Once plans are formally submitted, any changes to the EPSC Plan sheets due to design revisions, right-of-way revisions, permit requirements, mitigation requirements, ecological evaluation requirements, EPSC notes revisions, addition or deletion of sheets, etc. will require a formal plan revision.

5-409.00 REVISIONS ON UNECONOMIC REMNANTS

A plan change request will be submitted by the division requesting to add the uneconomic remnant acquisition. The parent (original) tract will be left as it appears in the acquisition table. Place the uneconomic remnant in the table separately as an 8000 series number using the parent tract number as the last digits. For example, Tract 25 would be Tract 8025. The "Total Area Acquired" column for Tract 8025 will be the area remaining from Tract 25 as an uneconomic remnant. In order to identify the remnant properly, it shall be specially shown on the property map and the present layout sheets with broken single cross hatching and labeled as an uneconomic remnant. If there is a driveway associated with the uneconomic remnant and TDOT purchases the remnant (8000 series Tract), the driveway can be removed from the plans. If an uneconomic remnant is sold, the word "Sold" and the excess land request number shall be added to the acquisition table by footnote. The word "Sold", name of grantee, date of transfer, and the excess land request number shall be placed on the property map and present layout sheets adjacent to the remnant.

PDN – CHAPTER 6

PLAN-IN-HAND

STAGE 3

CHAPTER 6 PLAN-IN-HAND

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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** – Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



4 Stages of Project Delivery Network

1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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CHAPTER 6 – PLAN-IN-HAND

SECTION 1 – PREPARING PLAN-IN-HAND PLANS

6-100.00 GENERAL NOTES ON PLANS

A list of general notes frequently used on project plans is included in *Chapter 9 Section 1*. The Designer shall place these notes on the "General Notes" second sheet series of the plans. Designers shall keep the notes grouped together with the sub-headings shown. Good engineering judgment is required in the use of these notes and any other notes in the plans. Only notes that apply to the project shall be added to the plans.

These notes have been agreed upon by the various offices of the Department involved in the design, Right-of-Way acquisition, utility relocation and adjustment, construction, etc.; therefore, care shall be taken that the notes are reproduced on the plans exactly as they are shown in *Chapter 9 Section 1*.

6-101.00 SPECIAL NOTES ON PLANS

A list of special notes frequently used on project plans is included in *Chapter 9 Section 2*. Special notes also include notes written specifically for the project or notes that vary in any way from the standard list of general or special notes listed in *Chapter 9 General and Special Notes*. The Designer shall place these notes on the "Special Notes" second sheet series of the plans. The Designer should also be aware that individual notes may be required to be included on specific plans sheets as indicated in Chapter 9 General and Special Notes. Notes in the Design Guidelines and Instructional Bulletins specified to be placed in other locations in the plans should continue to be placed as directed.

Special Notes are to be placed and identified on the plans as follows:

1. Special Notes are to be placed in sheets immediately following the General Notes sheets in the plans.
2. The Index Sheet should include “Special Notes” when applicable.
3. General Notes that are modified are to be included as Special Notes.
4. Special Notes are to be grouped together and sub-headers used. For modified general notes, the same sub-header found in the general notes should be used in the Special Notes. Special Notes specific to the project should be placed under the appropriate sub-header or an appropriate sub-header should be created.

5. Project Specific Notes requested by the Environmental Division should be included in the Environmental Notes or EPSC sheets as Environmental Special Notes except for special circumstances that require the note to be shown on the specific plan sheet for which the note applies. In these cases, a special note should be included in the Environmental or EPSC Special Notes indicating the location of the note.

6-102.00 REVIEW OF PAVEMENT DESIGN

If the Pavement Design is more than 3 years old at the time of the Plan-in-Hand Field Review, the Designer shall submit a request for Pavement Design Review before the Plan-in-Hand Field Review. The Designer shall attach the Pavement Design Review form, the original pavement design, and updated traffic report in a single PDF file and email it to: TDOT.PavementDesign@tn.gov. The Materials and Pavement Section of Materials and Test Division shall review the original recommendation and submit the updated pavement design, if applicable, to the Designer before the scheduled date of the Plan-in-Hand Field Review to ensure correct information is shown in the Plan-in-Hand Field Review.

6-104.00 LANDSCAPING PLANS

The cost of landscaping and hardscaping for the purpose of beautification should not exceed 5% of the total project estimate. **This amount should not include any landscaping or vegetation required for environmental mitigation.** In addition, items that are considered common items used in construction including, but not limited to, sodding slopes on urban projects, stamped concrete, and decorative facing on retaining walls, bridge columns, parapets, and pedestrian curb ramps should not be included in the 5% of the total project estimate.

On projects where substantial landscaping is proposed or the Design Manager estimates that the cost of landscaping items may exceed 5%, the Design Manager will request the Bid Analysis and Estimating Office to verify the percentage of landscaping as a percentage of the total project using the latest estimate available.

Projects requiring landscaping and/or hardscaping due to a prior commitment where the cost of the landscaping and/ or hardscaping cost exceeds 5%, the Design Manager should notify the Director of Project Development for guidance.

The local government may include additional landscaping plans at the local government's expense. The proposed landscaping shall be within the NEPA studied boundary and such items will be included as non-participating items in the estimated roadway quantities. In this case, the local government is responsible for notifying the Design Manager by the Functional Design Plans Field Review of this intention and for providing a landscaping plan sealed and signed by a

Registered Landscape Architect. The Designer shall only be responsible for adding “Landscaping Plan Sheet, LSC-1” to the plans index and adding a note to the appropriate proposed sheets:

NOTE: LANDSCAPING PLAN NOT SHOWN, SEE LSC SERIES SHEETS”

Landscaping shall not cause a sight distance or clear zone conflict. See the Environmental Division – Beautification Office’s Landscape Design Guidelines for roadside landscaping details available on the Landscape Design Guidelines webpage.

SECTION 2 – PLAN-IN-HAND PROCESS

6-200.00 PLAN-IN-HAND PROCESS

The focus of this stage is to facilitate a multidiscipline plan set review. Upon completion of the Plan-in-Hand Field Review, the team has completed all design work and progressed or completed the obtaining of necessary environmental permits, securing of local municipality agreements relocating of impacted utilities, and acquiring of needed right of way.

The Plan-in-Hand process consists of developing ROW acquisition exhibits, advancing the Utility Coordination Plans, coordinating the permit application design/sketches, and finalizing the TMP. The Letting Division will utilize the plans for both advertising and letting the project.

6-201.00 PLAN-IN-HAND FIELD REVIEW

See PDN 3RD1 and Chapter 1-105.06 for information regarding the Plan-in-Hand Field Review.

6-202.00 PLAN-IN-HAND SUBMITTAL

See PDN 3RD1 and Chapter 1-105.07 for information regarding the Plan-in-Hand Submittal.

PDN – CHAPTER 7

PS&E

STAGE 4

CHAPTER 7 PS&E

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INTRODUCTION

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Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** –Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



4 Stages of Project Delivery Network

1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 – PREPARING PS&E PLANS

The roadway design should be finalized by this point in the design process. The goal in this stage is to compile the final set of design documents and plans, specifications, and the estimates to advertise and let the project. Refer to PDN 4RD1 for more information regarding PS&E plans.

SECTION 2 – SPECIAL PROVISIONS

7-200.00 SPECIAL PROVISIONS

As part of the Final PS&E Document submittal, or "Complete Package," the design team must complete the Special Provisions Order Sheet with the assistance of the Construction Division. Additional information regarding each special provision and when each is recommended to be used can be found in *Table 7-1 – Special Provision Details.*

Special Provision	Description	Usage Indicator	Related Item No.
105C	Railroad Agreement	Include if project contains railroad crossings. Provided by RR section.	
107C	Availability of ROW	Include if there are any ROW tracts not available at the time of letting. Requires PIJ. Provided by ROW Division	
107FP	Water Quality and Storm Water Permits	Included based on environmental commitments and obligations in the plans/special notes. Attach copies of all environmental permits. Provided by Environmental Division.	
107L	Potentially Acid Producing Materials	Likely presence of Acid Producing Materials Use when Geotech notes indicate grading operations	

		will likely encounter acid producing materials.	
108C	Liquidated Damage-CEI Contracts	Include if the contract will have oversight under a project specific CEI contract.	
109A	Payment Adjustment for Fuel	Include for any Road and Drainage Excavation, Borrow Excavation, Undercutting, Embankment, Aggregate Base, Treated Permeable Base/Concrete Base	411 Asphalt material, or 501 concrete pavements. (Ex: 411-02.10 ACS Mix (PG70-22) Grading D)
109B	Payment Adjustment for Bituminous Materials	Substantial bituminous material use over time Include anytime asphalt material is included in the plans for paving/resurfacing.	
109ETAS	Electronic Ticket Delivery System for Asphalt	Include on all interstate resurfacing projects. Consult with HQ Construction for use on additional state route resurfacing projects.	
109ETC	Electronic Ticket Delivery System for Concrete	Include on contracts with concrete items at discretion of HQ Construction.	
202ACM	Removal of Asbestos Containing Material (ACM)	See related item(s)	202-01.02
203E	Scaling And Trimming	See related item(s)	203-11
204CG	Compaction Grouting	See related item(s)	
204DC	Drilled Caissons	See related item(s)	204-02.1*, 204-02.2*
205A	Embankment (Compacted in Place)	See related item(s)	203-10

205IC	IC for Embankments and Aggregates Bases	See related item(s)	
205RSS	Reinforced Soil Slopes	See related item(s)	740-07.02
304FDR	Full Depth Reclamation (FDR) of Flexible Pavement	See related item(s)	304-01.04
307CAM	Crack Attenuating Mixture	See related item(s)	307-02.09
308CCPR	Cold Central Plant Recycled Bituminous Pavement	See related item(s)	308-02.10, 308-02.12, 309-10.01
308CIR	Cold In-Place Recycled Bituminous Pavement	See related item(s)	308-01.10, 308-01.12, 308-01.15, 309-10.01, 403-05.05, 403-05
405SS	Polymer Modified Asphalt Rejuvenating Scrub Seal	See related item(s)	414-04.03, 414-04.04
406HFST	High Friction Surface Treatments (HFST)	See related item(s)	406-04.02, 406-04.03, 406-04.04
407DEN	Bituminous Plant Mix Pavements (Hot Mix) Roadway Density	Acceptance of asphalt roadway density by use of core samples, and acceptance of asphalt longitudinal joint density Include in all interstate contracts when paving any mix other than OGFC. May also be included for high-volume traffic state routes at discretion of HQ Construction and regional resurfacing manager.	
407HRA	Hot In Place Recycled Asphalt - Remix Process	Typically noted in the plans	Include for all 311-03. ** Hot In Place Recycling of Asphalt items.

407IC	Intelligent Compaction (IC) for Hot Mix Asphalt (HMA)	Typically noted in the plans. Include on all resurfacing projects. Verify with HQ Construction and regional resurfacing manager.	
407SE	Asphalt Pavement Safety Edge	Typically used when 1" or more & no milling Include if called out in General Notes – Pavement/Paving	
411B	Section 411 - Asphalt Concrete Surface (Hot Mix)	Pavement smoothness requirements, usually noted on plans (Typically 4-lane & Interstate) Consult with Headquarters Construction to determine if included when paving. To be included on projects on interstates and controlled access freeways as necessary. Attach pre-ride information.	
411C	Section 411 - Asphalt Concrete Surface (Hot Mix)	Consult with Headquarters Construction to determine if included when paving. Generally, included for all resurfacing contracts unless region waives requirement due to curb & gutter, manholes in travel lanes, and other issues that significantly affect the overall ride and require exclusion during smoothness testing. Attach pre-ride information.	

502FRP	Hot Applied Fiber Reinforced Polymer Patching Material	See related item(s)	502-03.05
602	Section 602 - Steel Structures (Inspection Cost Only)	Reference in plans	602 LS items
604CR	Repair of Bridge Deck Cracks	See related item(s)	617-02, -04, -05
604FRP	Fiber-Reinforced Polymer Material	See related item(s)	604-10.83
604H	Bridge Deck Preparation Using Hydrodemolition	See related item(s)	604-08.01, 604-10.20
604HD	Bridge Deck Preparation, Repair, and Concrete Overlay using Hydrodemolition	See related item(s)	604-08.01, 604-10.20
607CS	Three Sided Pre-Cast Culvert Structures	See related item(s)	607-50.6*
610HD	Horizontal Drain Installation Specifications	Emergency repair contracts for rock slopes	
624	Retaining Walls	See related item(s)	604-07.**, 604-08.**
625	Drilled Shaft Specifications	See related item(s)	625-**
626	Aggregate Foundation System	See related item(s)	626-01.01
700SIG	Highway Signs, Luminaires, and Traffic Signals	Design of supports for overhead sign bridges and butterfly configurations, high mast lighting, luminaires, CCTV camera poles, and traffic signal strain poles and mast arm structures	713, 714 & 730 Various
707H	Rockfall Barrier Systems	See related item(s)	707-10.0*

707D	Rockfall Slope Drape	See related item(s)	707-10.0*
712DSL	Digital Speed Limit Sign Assembly (Variable Speed Zone)	See related item(s)	712-08.09
712PQWS	Portable Queue Warning System	See related item(s)	712-08.14
712PTQ	Traffic Queue Protection	See related item(s)	712-08.12
712SFS	Speed Feedback Sign Assembly	See related item(s)	712-08.08
714M	Roadway and Structure Lighting		
714N	Roadway and Structure Lighting		
716CPM	Contrast Pavement Markings	See related item(s)	716-09.**
716PTA	Profiled Thermoplastic Pavement Marking Audible System	See related item(s)	716-14.01, 716-14.02
716WR	Wet Retroreflective Pavement Marking	See related item(s)	716-09.**
715(x)	Technical Specifications	Project Specific on ITS projects. Provided by ITS Section.	
725SWZ	Portable Smart Work Zone System		
730A	Temporary Traffic Control (Signalization)	Utilized when there is the placement of traffic signals specific to a certain city as depicted on the Special Provision Order form.	730-40, -50

730C (Chattanooga)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730CLEV (Cleveland)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730FA (Farragut)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730FR (Franklin)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730JC (Johnson City)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730K (Knoxville)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730M (Memphis)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730MTOWN (Morristown)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730R (Murfreesboro)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or	

		County to see if they have a special provision	
730N (Nashville)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730PF (Pigeon Forge)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
730SV (Sevierville)	Section 730 - Traffic Signals	Permanent signals. Check with the respective City or County to see if they have a special provision	
740D	Geomembrane		
790	Electrical Utility Specifications	Placeholder for project-specific electrical utility special provisions, which must be obtained from the utility companies.	790- See Standard Utility Items.
909A	Powder Coated Guardrail		
930PDA	Dynamic Pile Testing		
940	Geofoam Backfill		

Table 7-1
Special Provision Details

SECTION 3 – PLAN SPECIFICATIONS AND ESTIMATE PROCESS

7-300.00 PS&E PROCESS

This stage is to compile the project's plans, specifications, and estimates (PS&E) and ensure all agreements, permits, and certifications are in place for letting. Upon completion of the PS&E Review, the project is advertised for letting.

7-300.00 PS&E FIELD REVIEW

See PDN 4RD1 and Chapter 1-105.08 for information regarding the PS&E Field Review process.

7-301.00 FINAL ROADWAY PS&E SUBMITTAL

See PDN 4RD1 and Chapter 1-105.09 for information regarding the Roadway PS&E FileNet Submittal process.

For all non-Roadway Design Plan Series to be included in the Final PS&E Submittal Package, the Designer shall include them in the Sheet Index category following the example in *Chapter 1 Figure 1-55*. More information on the types of plan sets that need to be included and warrants for inclusion can be found in the PS&E Checklist.

A Plans Assembly check needs to be completed prior to submitting final plans and each field review submittal. It is the responsibility of the Designer to review the final plans to ensure that sheet numbers are correct according to the index and are in order; pdf pages rotated correctly; PDF sheet sizes for pdfs created from OpenRoads Designer are 33" x 21"; PDF sheet sizes for scanned in sheets are 34" x 22"; and indexes set up correctly prior to turn in.

7-302.00 FINAL PS&E DOCUMENTS SUBMITTAL

To facilitate the requirements of *Chapter 1-105.10, Final PS&E Documents "Complete Package"*, all design plans will be submitted as PDF portfolios and then added to the zipped Complete Package. Refer to the document CADDV8.pdf for proper naming convention for OpenRoads Designer files from which the corresponding Adobe PDF (.pdf) files are created.

When the final PS&E Documents are turned in for the Letting process for PDN Activity 4RD1 Finalize PS&E Documents, the Designer or Design Manager shall upload the Final PS&E Submittal Package to FileNet (See *Chapter 1-105.10, Final PS&E Documents "Complete Package"*). The Designer or Design Manager shall email the Final PS&E Submittal Package to the addresses shown in the Distribution List using the Submittal Templates. A copy of the email shall be placed in the project folder to document the submittal of the PS&E estimate.

7-303.00 LETTING REVISION

The determination of a letting revision will be made by the Headquarters Letting Office. One week prior to the release of the Notice to Contractors, no letting revisions shall be submitted. Any change to plans at this point shall be issued as an addendum by the HQ Letting Division. If a Letting Revision is issued but no quantities were revised the Designer shall state "No Quantities Affected" in the body of the email. This information is necessary in order to maintain a current and accurate estimate**.** The completed form shall be attached to the letting revision notification email. For additional information on the Estimate Revision Process see *Chapter 1-402.07*.

The Designer or Design Manager responsible for the project will upload the revised plan as part of the Letting Revision Submittal Package to FileNet (See *Chapter 1-105.11*) and submit an email notification to the appropriate personnel shown in the *Distribution List*. Also, as a part of this submittal process, the Final PS&E Document or "Complete Package" shall be reuploaded with the updated plans (See Chapter 1-105.10)

7-304.00 PS&E REVISION

When a project has been let to contract and a change becomes necessary anywhere on the project, a PS&E Plans revision is required. All PS&E revisions will be submitted through the Design Manager responsible for the project in an accurate and timely manner.

The Design Manager responsible for the project will upload the revised plan set to FileNet according to the process documented in *Chapter 1-105.12* and submit an email notification to the appropriate personnel listed in the *Distribution List.* Also, as a part of this submittal process, the Final PS&E Document or "Complete Package" shall be reuploaded with the updated plans (See Chapter 1-105.10)

PDN - CHAPTER 8

ITEM NUMBERS

CHAPTER 8 ITEM NUMBERS

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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Design Lead / Technical Lead** – Preconstruction Discipline Designer, or Consultant Discipline Designer
- **Project Manager** – assigned from Project Management division to lead Project team in delivery of project within defined scope, schedule, and budget.
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Concept Report** – Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



Stages of Project Delivery Network

0. Planning
1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 – GENERAL

8-100.00 ITEM NUMBERS

This Chapter contains commonly used item numbers. It is not all inclusive, other item numbers are available, but the intent of this Chapter is to give Designers more understanding on an item, when it is used, and what special provision triggers their use. All item numbers are grouped to correspond with the specification or special provision provided for that item. If more information is needed, refer to the Standard Specification for Road and Bridge Construction to review the method of measurement and basis of payment.

There are special instances when different items are utilized. For instance, Local Program projects may have additional item numbers that are a 920 series. Alternative Delivery projects will use item numbers with lump sum quantities and traditional projects will require a calculated quantity be shown for the item number. Asset Management projects will list a specific type of item number to repair or replace. These items aren't intended to be used on a traditional project.

If a Roadway Design item number is needed, the Design Manager should contact the Engineering Production Support Division at TDOT.EngineeringProductionSupport@tn.gov. If a Traffic Operations item number is needed, the Design Manager should contact the Traffic Operations Division at TDOT.SignalsLighting@tn.gov. These divisions will determine if an item number will be assigned or included in another item. If a new item number is needed, they will contact the HQ Construction Office to get the new number.

Several sections of the Standard Specifications for Road and Bridge Construction refer to item numbers for other Divisions or are rarely used by Roadway Design. You will notice skips in the heading numbers that correspond to those sections. These sections are not included in Chapter 8: 605, 606, 608, 609, 612, 613, 615, 616, 619, 620, 622, 623.

When lump sum items are used, the quantity is typically 1. The lump sum payment will most often include all incidental items of work required to install or complete the work listed. See the Standard Specifications for Road and Bridge Construction or the Special Provisions to determine the specific requirements for the work listed. The Designer should footnote some lump sum items, such as haul roads, with an estimate on the amount of material that may be needed.

Item Numbers from the TDOT Item Lists have been incorporated in the OpenRoads Designer (ORD) software. However, designers should review all populated item numbers to ensure they are accurate.

8-105.00 CONTROL OF WORK

Item Number	Description	Unit of Measurement	Comment
105-01	Construction Stakes, Lines, and Grades	L.S.	

See Standard Specifications for Road & Bridge Construction Section 105 for additional information. Item No. 105-01 includes the furnishing, setting, maintaining, and resetting, when necessary, the stakes, and for providing all labor, equipment, materials, and incidentals to complete the work as specified. Designers should inquire at the Plan-in-Hand Field Review if this item number is to be used on a project.

SECTION 2 – EARTHWORK

8-201.00 CLEARING AND GRUBBING

Item Number	Description	Unit of Measurement	Comment
201-01	Clearing and Grubbing	L.S.	
201-01.03	Clearing and Grubbing	Acre	
201-05.30	Vegetation Removal	SY	
201-05.31	Vegetation Removal	L.S.	
201-07.01	Removal and Disposal of Brush & Trees	L.S.	Most commonly used with Bridge Repair Projects.

See Standard Specification for Road and Bridge Construction Section 201 for additional information. Clearing and Grubbing, Item Number 201-01, should be included on most projects. Exceptions would be 3R projects (Resurfacing, Restoration, and Rehabilitation projects) which typically involve pavement improvement work and targeted safety improvements.

8-202.00 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Item Number	Description	Unit of Measurement	Comment
202-01	Removal of Structures and Obstructions	L.S.	
202-01.02	Removal of Asbestos	L.S.	SP202ACM
202-01.03	Removal of Trash and Debris	L.S.	
202-01.04	Removal and Disposal of Trash and Debris	CY	
202-01.05 to 202-01.09	Removal of Asbestos (Description)	L.S.	SP202ACM
202-01.11	Removal and Disposal of Trash and Debris	TON	
202-01.13 to 202-01.15	Removal of Pipe (Size, Sta.)	L.F.	List the pipe and Sta. individually

202-01.50	Removal of Structures and Obstructions	Each	
202-02.01 to 202-02.20	Removal of Pipe (Size, Sta.)	L.F.	List the pipe and Sta. individually
202-02.21 to 202-02.32	Removal of Pipe (Description)	L.F.	List the pipe and Sta. individually
202-02.51	Remove Concrete Endwall & Pipe from Existing Driveway	L.S.	
202-03	Removal of Rigid Pavements, Sidewalk etc.	S.Y.	Used for all Rigid Pavements present (concrete surfaces)
202-03.01	Removal of Asphalt Pavement	S.Y.	This is used when asphalt will be removed from the site and not replaced. Most often will not be needed because the current surface will be broken up and left in place. May be used for a complete removal of an existing parking lot or driveway that could not be milled.
202-03.02	Removal of Rigid Pavement	C.Y.	The item provides the contractor with the depth of the existing surface to be removed. It would only be used on large

			projects with an abundance of rigid surfaces.
202-03.03	Removal of Asphalt Pavement	C.Y.	Will not be used often.
202-04.01 to 202-04.22	Removal of Structures (Description, Sta.)	L.S.	
202-04.50 to 202-04.65	Removal of Structures (Description, Sta.)	L.S.	Box Bridge Sequence
202-06.01 to 202-06.41	Removal of Buildings (Tract No.____)	L.S.	
202-08.10	Removal of Curb (Description)	L.F.	
202-08.15	Removal of Curb and Gutter (Description)	L.F.	
202-08.25	Removal of Median Barrier (Description)	L.S.	To be used when the exact quantity cannot be determined
202-08.28	Removal of Median Barrier (Description)	L.F.	When quantity can be determined, use this item number
202-09.11 to 202-09.20	Removal of Underground Tanks (Tract No.___)	L.S.	
202-13	Water Well Abandonment	Each	
202-13.01 to 202-13.06	Well Abandonment (Description)	L.S.	

See Standard Specifications for Road and Bridge Construction Part 202.

When Item No. 202-01, Removal of Structures and Obstructions, per Lump Sum, or Item No. 202-01.50, Removal of Structures and Obstructions, per Each, is used on a project, the Designer shall add a footnote to the estimated quantities block detailing exactly what major items are included in the item (this includes, but is not limited to catch basins, manholes, junction boxes, etc.). This is done so the Department's estimators and contractors bidding on a project will be able to more accurately estimate the cost of this item.

Generally, all removals that belong with Item Nos. 202-06.01 through 202-06.41 shall be listed as such and shall not be included in Item No. 202-01 or 202-01.50. See RDG Chapter 9-205.00 for additional information.

8-202.01 REMOVAL OF STRUCTURE

When the proposed structure is a box bridge, the removal item for the existing structure(s) shall be placed on the Estimated Roadway Quantities sheet (in the Box Bridge block). When the proposed structure is a box culvert, the removal item for the existing structure(s) shall be placed on the Estimated Roadway Quantities sheet (in the Roadway block). The removal items shall be numbered in sequence beginning with Item No. 202-04.50 and continuing through Item No. 202-04.65, as required.

The removal items shall be footnoted under the appropriate estimated quantities block as to whether the salvage shall become the property of the contractor, city, county or state.

8-202.02 REMOVAL OF BUILDINGS AND OBSTRUCTIONS

All existing buildings and/or obstructions to be removed within the project limits are to be paid for under the bid price for Item No. 202-06.01, Removal of Buildings (Tract No. __) through Item No. 202-06.41, Removal of Buildings (Tract No. _) per lump sum. All buildings and obstructions to be removed under these item numbers shall be so designated by the Regional Right-of-Way Office. The pay items in the estimated roadway quantities block shall be footnoted as follows:

"Bid price includes all salvage value of material. See tabulated quantities sheet No. 2___ for removal of buildings and obstructions description block."

An example of a Removal of Buildings and Obstructions Description Block is shown in *Figure 8-1*. Special notes may be required to be added to the plans. See RDG Chapter 9-205.00 for additional information.

REMOVAL OF BUILDINGS AND OBSTRUCTIONS DESCRIPTION BLOCK		
PAY ITEM	TRACT NO.	DESCRIPTION

NO ADDITIONAL COMPENSATION WILL BE MADE FOR THESE REMOVALS.

Figure 8-1
Removal of Buildings and Obstructions Description Block

8-202.03 ABANDONMENT OF WATER WELLS

Item No. 202-13, Water Well Abandonment per Each, shall be used any time a water well is abandoned. This will cover all items necessary for the sealing of the well, except for grout. Item No. 604-15.01, Portland Cement Grout per cubic yard, shall be used to seal wells, and for estimating purposes, shall be computed as shown below:

1. Wells with a diameter of 1 foot or less

- The grout fill material shall extend from the bottom of the well to within 5 feet of the final surface, where the well is in a roadway cut, or to within 5 feet of the existing ground surface, where the well is located under roadway embankment or where the well is located outside of the construction limits.

2. Wells with a diameter greater than 1 foot
   - The bottom 5 feet of the well, or a depth equal to the depth of the water, whichever is greater, shall be filled with cement grout.
   - Information necessary to make these computations shall be requested when coordinating with the TDEC – Division of Water Resources.

8-202.04 REMOVAL OF ASBESTOS

The Environmental Division will notify the Designer if Removal of Asbestos should be added to Roadway Estimated Quantities. If needed, utilize item numbers 202-01.05 to 202-01.09, Removal of Asbestos (Description).

8-203.00 EXCAVATION AND UNDERCUTTING

Item Number	Description	Unit of Measurement	Comment
203-01	Road and Drainage Excavation (Unclassified)	C.Y.	
203-01.05	Excavation	L.S.	
203-01.06	Road and Drainage Excavation (Unclassified)	L.S.	Used on Safety Projects to construct pedestrian facilities. Not commonly used.
203-01.07	RD & DRNG EXC (Acid Producing – Off Site Disposal)	CY	SP107L
203-01.08	RD & DRNG EXC (Acid Producing – On Site Disposal)	CY	SP107L
203-01.11	Presplitting of Rock Excavation	S.Y.	
203-02	Borrow Excavation (Solid Rock)	C.Y.	SP109A
203-02.01	Borrow Excavation (Graded Solid Rock)	Ton	SP109A
203-02.02	Borrow Excavation (Graded Solid Rock)	C.Y.	SP109A
203-03	Borrow Excavation (Unclassified)	C.Y.	SP109A
203-03.01	Borrow Excavation (Select Material)	C.Y.	SP109A

203-03.10	Select Granular Material	TON	
203-03.51	Borrow Excavation (Unclassified)	C.Y.	SP109A
203-03.56	Rock Buttress	Ton	
203-04	Placing and Spreading Topsoil	C.Y.	RDG 2-1007.00, RDG 9-105.00
203-05	Undercutting	C.Y.	SP109A
203-06	Water	MG	Not to be paid for Dust Control
203-07	Furnishing and Spreading Topsoil	C.Y.	RDG 2-1007.00, RDG 9-105.00
203-08	Channel Excavation (Unclassified)	C.Y.	
203-10	Embankment (Compacted in Place)	C.Y.	SP109A, SP205A
203-10.05	Settlement Plate / Monitoring Device	Each	SP203S
203-10.15	Waste Material	C.Y.	
203-10.16	Graded Solid Rock (In-Place)	C.Y.	
203-11	Scaling and Trimming	S.Y.	SP203E
203-15.03	Compacted Clay	C.Y.	D-NSD-31
203-20.01	Channel Substrate	C.Y.	D-NSD-30
203-30-01	Roadway Approaches	L.S.	
203-40.01 to 203-40.04	Rock Anchors (Description)	L.F.	
203-40.06 to 203-40.09	Anchor Blocks (Description)	Each	
203-40.10 to 203-40.20	Tie Back Anchors (See description from Roadway Item List)	L.F.	To be used by Geotech for Retaining walls
203-50	Construction of Haul Road	L.S.	RDG 2-1201.02
203-50.01	Construction of Haul Road	L.S.	Should not be used by designer unless an adjoining project contains 203-50

See Standard Specifications for Road and Bridge Construction Part 203. Also, see Chapter 8-203.02, Excavation and Undercutting.

8-203.01 EARTHWORK GRADING CALCULATIONS

See Chapter 2-1000.00 for a listing of the earthwork terms and definitions used in calculating earthwork. Generally, all earthwork for a roadway project will be paid for under Item 203-01, Road and Drainage Excavation (Unclassified), C.Y., except in situations where special or unique conditions exist that would warrant bidding earthwork as either separate bid items or embankment in place bid items. For projects which earthwork items other than Road and Drainage Excavation (Unclassified) may be appropriate, the Design Manager will consult with both the Soils and Geology Section of the Materials and Tests Division and the Headquarters Construction Division to determine if other pay items are appropriate and what material type breakdown will be shown on the grading tabulation and earthwork balances in the plans.

See *Chapter 9-200.00, Grading*, for notes which shall be added to the plans as Special Notes on **ALL** projects for which a Geotechnical Report is prepared unless otherwise directed by the Design Manager after consultation with the Soils and Geology Section of the Materials and Tests Division and the Headquarters Construction Division. All grading quantities on the Estimated Roadway Quantities Sheet should also be footnoted “See Grading Special Notes on sheet 2_.”

8-203.02 EXCAVATION AND UNDERCUTTING

Undercutting is the process of removing and disposing of unsatisfactory material below grade. See TDOT Specification Book Section 203.05 for additional guidance on the use of Item No. 203-05, Undercutting, per Cubic Yard, as a pay item.

All information regarding undercutting shall be clearly shown on the plans for the Plan-in-Hand Field Review if specified in the soils report. The Construction Engineer may increase, decrease, or shift such designated areas as conditions require during construction. The decision to use the undercutting item shall be made at the Plan-in-Hand Field Review.

8-203.03 CHANNEL EXCAVATION

Excavations to widen, deepen, straighten, or construct new channels which have a width at the bottom of 14 feet or greater shall be paid under item 203-08 Channel Excavation (Unclassified) per C.Y. If the channel bottom is less than 14 feet wide the excavation shall be paid for as item 203-01 Road and Drainage Excavation (Unclassified) per C.Y.

8-203.04 GRADED SOLID ROCK BORROW

On all projects requiring graded (sized) solid rock borrow for rock buttresses, revetment, etc., the unit of payment shall be per ton instead of per cubic yard, Item No. 203-02.01.

If graded solid rock borrow is needed in cubic yard, use a factor of 1.7636 tons per cubic yard for estimating quantities.

Item No. 203-02.02 – Borrow Excavation (Graded Solid Rock) per C.Y.

8-203.05 COMPUTATIONS FOR ITEM NO. 203-06 WATER

Water will be measured by the thousand gallons (M.G.).

Item Number 203-06 – WATER, should **NOT** be used for dust control purposes. The Standard Specifications for Road and Bridge Construction subsection **104.08** states dust control will be paid with grading items as an incidental item for dust control. Do not add extra quantities to 203-06 for dust control.

Embankment:

$$\frac{\text{Earth embankment (C.Y.)} \times 2.525 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Base material and granular backfill:

$$\frac{\text{Compacted volume (C.Y.)} \times 15.150 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Foundation preparation (Item No. 204-10.01 through 204-10.25):

$$\frac{\text{Width of subgrade (Ft) x 0.5 Ft} \times \text{Length of project (ft)} \times 4 \text{ Gal/C.Y.}}{27 \text{ C.F./C.Y.} \times 1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Subgrade treatment (hydrated lime) (Item No. 302-01.01):

$$\frac{\text{Subgrade treatment volume (C.Y.)} \times 40.400 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Soil-cement base (Item No. 304-01.02):

$$\frac{\text{Volume of base (C.Y.)} \times 15.150 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Aggregate-cement base (Item Nos. 309-01.01 and 309-01.02):

$$\frac{\text{Volume of base (C.Y.)} \times 15.150 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Lime fly-ash base (Item Nos. 312-01, 312-02, and 312-03):

$$\frac{\text{Volume of base (C.Y.)} \times 30.77 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

8-203.06 ROADWAY APPROACHES

On bridge replacement projects with a minimal amount of roadway work on the approaches, the Designer shall consider using Item No. 203-30.01, Roadway Approaches. This is a lump sum pay item to construct bridge approaches that have quantities that are too small to be accurately measured in the field. This item has been developed to replace those items, because of the small quantities, are uneconomical to measure and document for payment under present procedures.

Item No. 203-30.01 may include: road and drainage excavation, borrow excavation, channel and culvert excavation on box bridges, clearing and grubbing, topsoil, seeding, sodding and water. The required quantities need to be calculated and shown in a tabulated block for purposes of cost estimating and bidding. Other items may be included in this item, if appropriate, but shall be discussed and approved during the Plan-in-Hand Field Review before inclusion.

As a guideline, it is recommended that Item No. 203-30.01 be considered anytime that the total excavation is approximately 1500 C.Y. or less. However, other items and factors may influence the decision to use this item. Designers shall use their best judgment on a project-by-project basis to determine the need for Item No. 203-30.01.

Figure 8-2, shown below, shall be used to itemize the quantities included in Roadway Approaches. The note, "No change in compensation will be made for normal variations in estimated quantities." is required.

ALL COSTS OF THESE ESTIMATED QUANTITIES TO BE INCLUDED IN PRICE BID FOR ROADWAY APPROACHES ITEM NO. 203-30.01							
ROAD & DRAIN. EXC.(UNCL.) C.Y.	BORROW EXCAVATION (UNCL.) C.Y.	WATER M.G.	PLACING & SPREADING TOPSOIL C.Y.	CHANNEL EXCAVATION C.Y.	SEEDING W / MULCH UNIT	WATER SEEDING & SODDING M.G.	SODDING (NEW SOD) S.Y.

NO CHANGE IN COMPENSATION WILL BE MADE FOR NORMAL VARIATIONS IN ESTIMATED QUANTITIES.

Figure 8-2
Example of Estimated Quantities for Roadway Approaches Block

8-204.00 STRUCTURE EXCAVATION FOUNDATION PREPARATION AND BACKFILL

Item Number	Description	Unit of Measurement	Comment
204-01	Culvert Excavation (Unclassified)	C.Y.	
204-08.01	Backfill Material (Flowable Fill)	C.Y.	

See *Standard Specifications for Road and Bridge Construction Section 204.*

8-204.01 PIPE CULVERT EXCAVATION AND BEDDING

The cost of excavation for the installation of pipe culverts, sewers, conduits, all other culverts, all minor structures of any type and description are not to be measured and paid for directly but will be included in the price bid per linear foot of pipe.

Designers shall include both standard drawings D-PB-1 and D-PB-2 in plans on projects allowing HDPE as a pipe alternate. Designers are to refer to the Drainage Manual, Chapter 6, Section 6.04.2.2 and *Table 6A-1*, for pipe selection criteria and allowed alternates for roadway classes and fill heights.

Designers should include a footnote under the estimated roadway quantities block that the bedding material shall be included in the cost of the proposed pipe culvert.

"See Standard Drawing No. D-PB-1 and D-PB-2 for additional details."

8-204.02 EXCAVATION FOR CONCRETE BOX AND SLAB TYPE CULVERTS AND BRIDGES

All excavation required to place a box culvert or slab bridge will be considered culvert excavation. If culvert excavation is not computed for these structures, include the following Special Note in the plans:

"Culvert excavation for concrete box or slab type culverts or bridges will not be measured and paid for directly, but the cost will be included in the cost of other items."

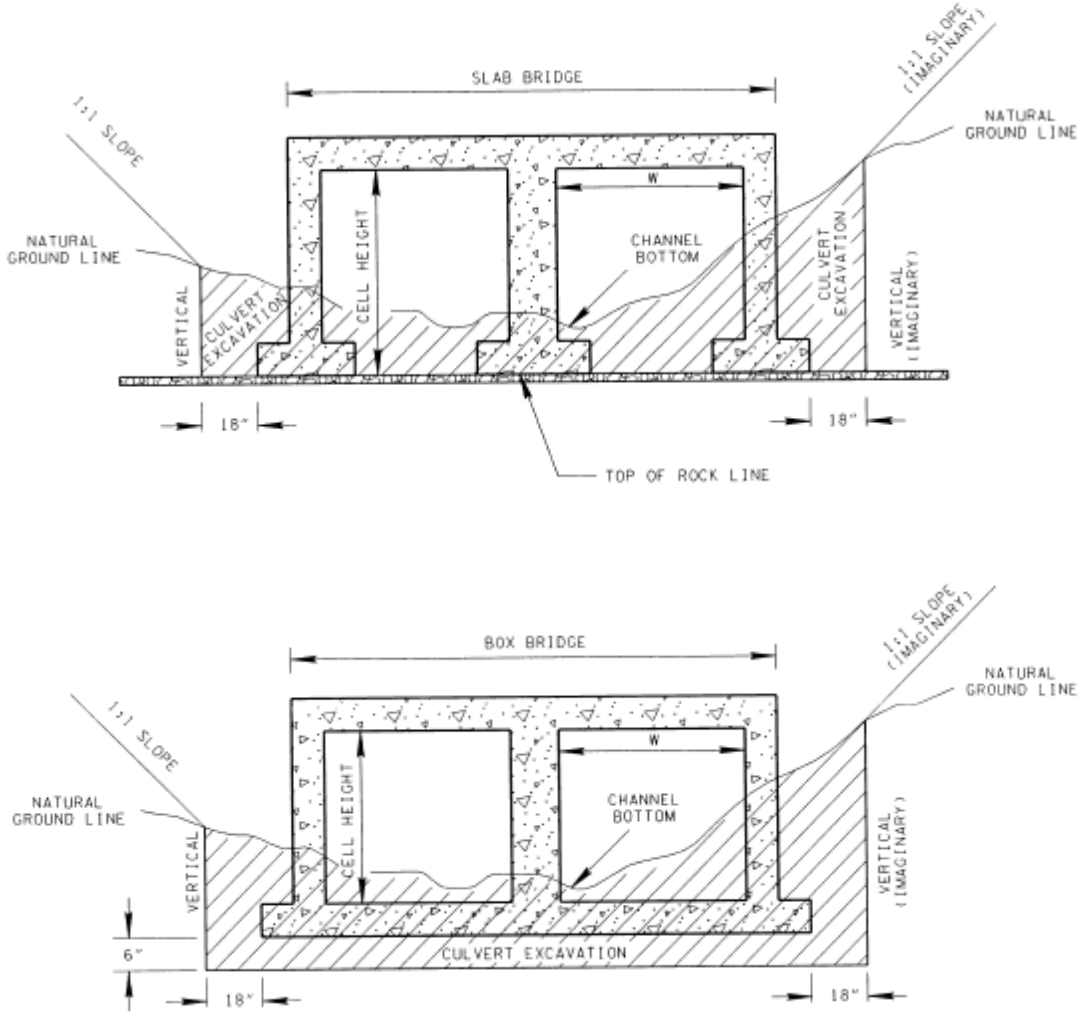


Figure 8-3
Quantities of Culvert Excavation for Slab Type and Box Culverts and Bridges

8-204.03 BACKFILL MATERIAL (FLOWABLE FILL)

Item Number, 204-08.01, Backfill Material (Flowable Fill), per C.Y. should be added to the Estimated Quantities when exiting pipes are to be left in place and plugged. See Chapter 9-115.00 for additional information.

8-208.00 SHOULDERS AND DITCHES

Item Number	Description	Unit of Measurement	Comment
208-01	Shoulders and Ditches	L.M.	
208-01.05	Brooming and Degrassing Shoulders	L.M.	NOTES 5, 6 RDG 9-135.02

See *TDOT Standard Specifications for Road and Bridge Construction* Part 208.

Item Number, 208-01 Shoulders and Ditches, per L.M. is used on 3R projects and should be added to the Estimated Quantities when shoulder and ditches are constructed to obtain proper drainage. See Section 9-135.02 for additional information.

Item Number 208-01.05, Brooming and Degrassing Shoulders, per L.M. is used on 3R projects and should be added to the Estimated Quantities when shoulders should be cleaned, and the work will not be done by Regional Maintenance Operations.

8-209.00 EROSION PREVENTION AND SEDIMENT CONTROL

See *TDOT Standard Specifications for Road and Bridge Construction* Part 209. See Chapter 10 of the *TDOT Drainage Manual* for further computation information.

The Designer shall **footnote** all applicable erosion prevention and sediment control (EPSC) pay items with the following notes:

"See Subsection 209.07 of the Standard Specifications for Maintenance Replacement. All quantities are to be used as directed by the Engineer."

Item Number	Description	Unit of Measurement	Comment
209-01.30	TEMPORARY COMPOST FILTER BERM	C.Y.	EC-STR-35; Drainage Manual Chapter 10
209-01.31	TEMPORARY MULCH FILTER BERM	C.Y.	EC-STR-35; Drainage Manual Chapter 10
209-02.02	6" TEMPORARY SLOPE DRAIN	L.F.	EC-STR-27
209-02.03	8" TEMPORARY SLOPE DRAIN	L.F.	EC-STR-27; Drainage Manual Chapter 10

209-02.04	10" TEMPORARY SLOPE DRAIN	L.F.	EC-STR-27; Drainage Manual Chapter 10
209-02.05	12" TEMPORARY SLOPE DRAIN	L.F.	EC-STR-27; Drainage Manual Chapter 10
209-02.07	18" TEMPORARY SLOPE DRAIN	L.F.	EC-STR-27; Drainage Manual Chapter 10
209-03.20	FILTER SOCK (8 INCH)	L.F.	EC-STR-8; Drainage Manual Chapter 10
209-03.21	FILTER SOCK (12 INCH)	L.F.	EC-STR-8; Drainage Manual Chapter 10
209-03.22	FILTER SOCK (18 INCH)	L.F.	EC-STR-8; Drainage Manual Chapter 10
209-03.23	FILTER SOCK (24 INCH)	L.F.	EC-STR-8; Drainage Manual Chapter 10
209-03.30	STREAM MITIGATION (RIVER ROCK)	TON	
209-03.31	STREAM MITIGATION-COCONUT FIBER ROLLS	L.F.	Drainage Manual Chapter 11; D-NSD-33
209-03.32	STREAM MITIGATION-BOULDER CLUSTERS	EACH	Drainage Manual Chapter 11; D-NSD-21
209-03.33	STREAM MITIGATION-LOG STRUCTURES AND DEFLECTORS	L.F.	Drainage Manual Chapter 11; D-NSD-26
209-03.34	STREAM MITIGATION-LOG VANES	L.F.	Drainage Manual Chapter 11
209-03.35	STREAM MITIGATION-LOG DROP STRUCTURE	L.F.	Drainage Manual Chapter 11

209-03.36	STREAM MITIGATION-STEP POOL	EACH	Drainage Manual Chapter 11; D-NSD-27
209-03.37	STREAM MITIGATION CROSS VANE STRUCTURE	EACH	Drainage Manual Chapter 11; D-NSD-22
209-03.38	STREAM MITIGATION -J -HOOK	EACH	Drainage Manual Chapter 11; D-NSD-25
209-03.39	STREAM MITIGATION - W - WEIR	EACH	Drainage Manual Chapter 11; D-NSD-24
209-03.40	STREAM MITIGATION - LOG RIFFLE	L.F.	Drainage Manual Chapter 11; D-NSD-28A
209-03.41	STREAM MITIGATION - BOULDER RIFFLE	L.F.	Drainage Manual Chapter 11; D-NSD-28
209-03.42	STREAM MITIGATION - LIVE BRUSH LAYERING	L.F.	D-NSD-32,32A
209-03.43	STREAM MITIGATION - VEGETATED RIP-RAP (DESCRIP)	C.Y.	Drainage Manual Chapter 11
209-03.44	STREAM MITIGATION - WILLOW POLES (SPECIES)	EACH	Drainage Manual Chapter 11
209-03.45	STREAM MITIGATION - LIVE FASCINES (SPECIES)	L.F.	Drainage Manual Chapter 11;D-NSD-35
209-03.46	STREAM MITIGATION - LIVE SILTATION (SPECIES)	C.Y.	Drainage Manual Chapter 11;D-NSD-34
209-03.47	STREAM MITIGATION - LONGITUDINAL STONE TOE (DESCRIP)	C.Y.	Drainage Manual Chapter 11;D-NSD-13
209-03.48	STREAM MITIGATION - VEGETATED GABIONS (DESCRIP)	C.Y.	Drainage Manual Chapter 11

209-03.49	STREAM MITIGATION - VEGETATED MSE WALLS (DESCRIP)	S.F.	Drainage Manual Chapter 11
209-03.52	STREAM MITIGATION - J-HOOK W/ STEP	EACH	Drainage Manual Chapter 11
209-03.53	STREAM MITIGATION - ARTICULATED CONCRETE MAT	S.Y.	Drainage Manual Chapter 11
209-03.54	STREAM MITIGATION - CROSS VANE STRUCTURE W/STEP	EACH	Drainage Manual Chapter 11; D-NSD-23
209-03.55 to 209-03.56	STREAM MITIGATION (DESCRIPTION)	EACH	
209-03.57 to 209-03.58	STREAM MITIGATION (DESCRIPTION)	L.F.	
209-03.59	STREAM MITIGATION - BRUSH MATTRESS	S.Y.	Drainage Manual Chapter 11; D-NSD-36
209-03.60	STREAM MITIGATION - ROCK VANE	EACH	Drainage Manual Chapter 11; D-NSD-25,26
209-03.61	STREAM MITIGATION - SPUR DIKES	EACH	Drainage Manual Chapter 11
209-03.62	STREAM MITIGATION - ROOT WAD	EACH	Drainage Manual Chapter 11
209-03.63	STREAM MITIGATION - RACK STRUCTURE (SIZE)	EACH	Drainage Manual Chapter 11
209-03.64	STREAM MITIGATION - FELLED TREE (SIZE)	EACH	Drainage Manual Chapter 11
209-03.65	STREAM MITIGATION - LOG REVETMENTS (DESCRIP)	L.F.	Drainage Manual Chapter 11
209-03.66	PLACING NATIVE STONE IN NEW CHANNEL	S.Y.	
209-03.67	STREAM MITIGATION - WOOD TOE W/REINFORCED EARTH	L.F.	D-NSD-32
209-03.68	STREAM MITIGATION - BOULDER TOE	L.F.	D-NSD-32A
209-03.69	STREAM MITIGATION (DESCRIPTION)	EACH	

209-03.70	BERM DITCH WITH SIDE SLOPE DRAINAGE	EACH	
209-05	SEDIMENT REMOVAL	C.Y.	EC-STR-1, 3B, 3C, 3D, 4, 4A, 6, 6A, 7, 8, 11, 11A, 12, 13, 17, 19, 35, 37, 39, 39A, 59; Chapter 9; Drainage Manual Chapter 9
209-06.01	PERMEABLE PLASTIC DITCH BERM	L.F.	
209-06.02	12" DIA COIR LOG (DESCRIPTION)	L.F.	
209-06.03	16" DIA COIR LOG (DESCRIPTION)	L.F.	
209-06.04	EXCELSIOR SEDIMENT LOG	L.F.	
209-06.05	BALED HAY OR STRAW	BALE	
209-06.10	20IN WATTLE (DESCRIPTION)	L.F.	
209-06.11	WATTLE (SIZE)	L.F.	
209-06.12	9IN DIA COIR LOG (DESCRIPTION)	L.F.	
209-06.13	20IN DIA COIR LOG (DESCRIPTION)	L.F.	
209-08.01	TEMPORARY FILTER BARRIER	L.F.	
209-08.02	TEMPORARY SILT FENCE (WITH BACKING)	L.F.	EC-STR-2, 3C; Drainage Manual Chapter 10
209-08.03	TEMPORARY SILT FENCE (WITHOUT BACKING)	L.F.	EC-STR-3B; Drainage Manual Chapter 10
209-08.04	TEMPORARY ENHANCED SILT FENCE	L.F.	EC-STR-3D; Drainage Manual Chapter 10
209-08.05	ENHANCED SILT FENCE CHECK (V-DITCH)	EACH	EC-STR-4A; Drainage Manual Chapter 10
209-08.06	ENHANCED SILT FENCE CHECK (TRAPEZOIDAL)	EACH	EC-STR-4; Drainage Manual Chapter 10
209-08.07	ROCK CHECK DAM PER	EACH	EC-STR-6; Drainage

			Manual Chapter 10
209-08.08	ENHANCED ROCK CHECK DAM	EACH	EC-STR-6A; Drainage Manual Chapter 10
209-08.09	FILTER SOCK CHECK DAM	EACH	EC-STR-6, 6A, 8; Drainage Manual Chapter 10
209-09.01	SANDBAGS	BAG	EC-STR-32, 33, 33A; Drainage Manual Chapter 10
209-09.02	TEMPORARY SEDIMENT FILTER BAG (14'6" X 2'0" X 13'3")	BAG	
209-09.03	SEDIMENT FILTER BAG (15' X 15')	EACH	EC-STR-2; Drainage Manual Chapter 10
209-09.04	SEDIMENT FILTER BAG (15' X 10')	EACH	EC-STR-2; Drainage Manual Chapter 10
209-09.14	FLOCCULANTS POWDER	LB.	
209-09.15	FLOCCULANTS LIQUID	GAL.	
209-09.16	TACKIFIER POWDER	LB.	Drainage Manual Chapter 10
209-09.17	TACKIFIER LIQUID	GAL.	Drainage Manual Chapter 10
209-09.18	SOIL BINDER POWDER	LB.	Drainage Manual Chapter 10
209-09.19	SOIL BINDER LIQUID	GAL.	Drainage Manual Chapter 10
209-09.20	POLYMER FLOCCULENT	LB.	
209-09.21	POLYACRYLAMIDE GEL LOGS	EACH	Drainage Manual Chapter 10
209-09.22	POLYACRYLAMIDE POWDER	LB.	Drainage Manual Chapter 10

209-09.23	POLYACRYLAMIDE LIQUID	GAL.	Drainage Manual Chapter 10
209-09.24	JUTE MESH FABRIC	S.Y.	
209-09.32	POLYMER BAFFLES (CATCHERS MITT)	EACH	
209-09.40	CURB INLET PROTECTION (TYPE 1)	EACH	EC-STR-39; Drainage Manual Chapter 10
209-09.41	CURB INLET PROTECTION (TYPE 2)	EACH	EC-STR-39; Drainage Manual Chapter 10
209-09.42	CURB INLET PROTECTION (TYPE 3)	EACH	EC-STR-39A; Drainage Manual Chapter 10
209-09.43	CURB INLET PROTECTION (TYPE 4)	EACH	EC-STR-39A; Drainage Manual Chapter 10
209-09.50	FLAT GRATE MS4 INLET PROTECTION W/STORM BOOM	EACH	
209-10.01	TEMPORARY DEWATERING STRUCTURE	C.Y.	EC-STR-1; Drainage Manual Chapter 10
209-10.02	8IN SKIMMER W/6IN HEAD	EACH	
209-10.03	PORTABLE WATER/SEDIMENT BARRIER	L.F.	
209-10.20	TEMPORARY SEDIMENT TRAP	C.Y.	EC-STR-7; Drainage Manual Chapter 10
209-11.01 to 209-11.09	SEDIMENT BASIN RISER(")	EACH	EC-STR-17
209-11.20	SEDIMENT BASIN BAFFLES	L.F.	EC-STR-17
209-13.04 to 209-13.08	TURBIDITY CURTAIN(DESCRIPTION)	L.F.	EC-STR-38; Drainage Manual Chapter 10
209-13.15	TURBIDITY CURTAIN (30FT DEPTH)	L.F.	
209-20.03	POLYETHYLENE SHEETING (6 MIL. MINIMUM)	S.Y.	EC-STR-32, 33, 33A; Drainage

			Manual Chapter 10
209-20.04	POLYETHYLENE SHEETING (10 MIL.)	S.Y.	
209-20.20	DETENTION POND OUTLET STRUCTURE (DISCR.)	EACH	
209-20.21	SEDIMENT POND OUTLET STRUCTURE (DISCR.)	L.S.	EC-STR-17, 18
209-20.50 to 209-20.51	SEDIMENT BASIN (DESCRIPTION)	EACH	
209-40.30	CATCH BASIN PROTECTION (TYPE A)	EACH	EC-STR-19; Drainage Manual Chapter 10
209-40.31	CATCH BASIN PROTECTION (TYPE B)	EACH	EC-STR-19; Drainage Manual Chapter 10
209-40.32	CATCH BASIN PROTECTION (TYPE C)	EACH	EC-STR-19; Drainage Manual Chapter 10
209-40.33	CATCH BASIN PROTECTION (TYPE D)	EACH	EC-STR-19; Drainage Manual Chapter 10
209-40.34	CATCH BASIN PROTECTION (TYPE E)	EACH	EC-STR-19; Drainage Manual Chapter 10
209-40.41	CATCH BASIN FILTER ASSEMBLY (TYPE 1)	EACH	EC-STR-41; Drainage Manual Chapter 10
209-40.42	CATCH BASIN FILTER ASSEMBLY (TYPE 2)	EACH	EC-STR-42; Drainage Manual Chapter 10
209-40.43	CATCH BASIN FILTER ASSEMBLY (TYPE 3)	EACH	EC-STR-43; Drainage Manual Chapter 10
209-40.44	CATCH BASIN FILTER ASSEMBLY (TYPE 4)	EACH	EC-STR-44; Drainage Manual Chapter 10
209-40.45	CATCH BASIN FILTER ASSEMBLY (TYPE 5)	EACH	EC-STR-45; Drainage

			Manual Chapter 10
209-40.46	CATCH BASIN FILTER ASSEMBLY (TYPE 6)	EACH	EC-STR-46; Drainage Manual Chapter 10
209-40.47	CATCH BASIN FILTER ASSEMBLY (TYPE 7)	EACH	EC-STR-47; Drainage Manual Chapter 10
209-40.48	CATCH BASIN FILTER ASSEMBLY (TYPE 8)	EACH	EC-STR-48; Drainage Manual Chapter 10
209-40.49	CATCH BASIN FILTER ASSEMBLY (TYPE 9)	EACH	EC-STR-49; Drainage Manual Chapter 10
209-40.50	CATCH BASIN FILTER ASSEMBLY (TYPE 10)	EACH	EC-STR-50; Drainage Manual Chapter 10
209-40.51	CATCH BASIN FILTER ASSEMBLY (TYPE 11)	EACH	EC-STR-51; Drainage Manual Chapter 10
209-65.01 to 209-65.02	TEMPORARY STREAM DIVERSION (DESCRIPTION)	L.S.	
209-65.03	TEMPORARY DIVERSION CHANNEL	L.F.	EC-STR-31; Drainage Manual Chapter 10
209-65.04	TEMPORARY IN STREAM DIVERSION	L.F.	EC-STR-30, 30A
209-65.14	TEMPORARY STREAM DIVERSION	L.S.	Drainage Manual Chapter 10
209-70.01	VACUUM TRUCK/SWEEPER FOR ROADWAY DEBRIS	HOUR	
209-70.02	DISPOSAL OF VACUUM TRUCK/SWEEPER DEBRIS	EACH	
209-99.91	EROSION CONTROL	L.S.	

SECTION 3 – BASE AND SUBGRADE TREATMENTS

8-302.00 SUBGRADE TREATMENT (LIME)

Item Number	Description	Unit of Measurement	Comment
302-01.01	HYDRATED LIME	TON	
302-02	BITUMINOUS MATERIAL (S.T. LIME)	TON	
203-06	WATER	MG	

See *TDOT Standard Specifications for Road and Bridge Construction* Part 302. If a lime subgrade treatment is needed, the Geotechnical Engineering Office will notify the Designer.

Item No. 302-01.01 Hydrated Lime

$$\frac{\text{Subgrade treatment volume (C.Y.)} \times \text{*Weight (Lb./C.Y.)} \times \text{**\%}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

* Weight to be supplied by the Pavement Design Section in Lb./C.Y.

** % to be supplied by the Pavement Design Section to be used in decimal form (for example, 5% = 0.05).

NOTE: To be used only when specifically recommended.

Item No. 302-02 Bituminous Material (S. T. Lime)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{0.20 Gal./Sq. Yd.}}{\text{231 Gal./ Ton}} = \text{Tons}$$

INFORMATIONAL: Subsection 302.08 of the Standard Specifications requires slurry application unless otherwise shown on plans. If dry application is specified by the Pavement Design Section, it shall be necessary to footnote pay items.

8-303.00 MINERAL AGGREGATE BASE

Item Number	Description	Unit of Measurement	Comment
303-01	Mineral Aggregate, Type A Base	TON	Use in Regions 1-3. SP109A; RP-PMR-1; MM-PS-1; S-PL-4
303-01.01	GRANULAR BACKFILL (ROADWAY)	TON	
303-01.02	GRANULAR BACKFILL (BRIDGES)	TON	
303-01.03	GRANULAR BACKFILL (RETAINING WALLS)	TON	
303-01.08	MINERAL AGGREGATE, TYPE A BASE,GRADING D GRAVEL	TON	For Region 4 use. SP109A
303-01.09	MINERAL AGGREGATE, TYPE A BASE, GRADING D LIMESTONE	TON	Use East of the TN River. SP109A
303-02	MINERAL AGGREGATE, TYPE B BASE, GRADING (DESCRIPTION)	TON	Use in Region 4 for resurfacing projects. SP109A
303-02.01 to 303-02.03	MINERAL AGGREGATE, TYPE B BASE, GRADING (DESCRIPTION)	TON	SP109A
303-03.01	INTELLIGENT COMPACTION FOR AGGREGATE BASES	L.S.	SP205IC

See TDOT Standard Specifications for Road and Bridge Construction Part 302.

Item Nos. 303-01, *303-01.08, *303-01.09 and 303-02

***** To be used normally when the blending of two or more materials (for example, gravel and chert, etc.) is specified.

Loose weight of material = 2,900 Lb./C.Y.

$$\frac{2{,}900 \text{ Lb./C.Y.} \times 1.4}{2{,}000 \text{ Lb./ Ton}} = 2.03 \text{ Tons/C.Y.}$$

Compacted volume (C.Y.) × 2.03 Tons/C.Y. = Tons

Item No. 303-01.01 Granular Backfill (Roadway)

Compacted volume (C.Y.) × 1.75 Tons/C.Y. = Tons

Item No. 303-01.03 Granular Backfill (Retaining Walls)

Compacted volume (C.Y.) × 1.75 Tons/C.Y. = Tons

Item No. 303-10.01 Mineral Aggregate (Size 57)

Loose weight of material = 2,619 Lb./C.Y.

$$\frac{2{,}619 \text{ Lb./C.Y.} \times 1.4}{2{,}000 \text{ Lb./ Ton}} = 1.34 \text{ Tons/C.Y.}$$

Uncompacted volume (C.Y.) × 1.34 Tons/C.Y. = *Tons

* To be used for fill material between concrete median barriers at areas requiring bridge pier protection in the median (See Standard Drawing No. S-SSMB-4).

$$\frac{2{,}619 \text{ Lb./C.Y.} \times 1.14}{2{,}000 \text{ Lb./ Ton}} = 1.49 \text{ Tons/C.Y.}$$

Compacted volume (C.Y.) × 1.49 Tons/C.Y. =** Tons

** To be used when called for with erosion prevention and sediment control structures.

Item No. 303-10.04 through 303-10.06 Mineral Aggregate (Specify Size)

Compacted volume (C.Y.) × 1.75 Tons/C.Y. = Tons

8-303.01 GRANULAR BACKFILL FOR STRUCTURES

Item No. 303-01.01 Granular Backfill (Roadway) per Ton and 303-01.03 Granular Backfill (Retaining Walls) per Ton will be used for backfilling structures that are included on the Estimated Roadway Quantities sheet only (such as box and slab type culverts and bridges, gravity type retaining walls, etc.). If there is a separate Box Bridge Quantities Block, do not list the item in that block.

For backfilling of structures, where the structure quantities are included in estimated structure items, Item No. 303-01.02 Granular Backfill (Bridges) per Ton will be used, and it will be listed on the Estimated Structures Quantity sheet only. **It cannot be used in the roadway quantities.**

8-304.00 SOIL-CEMENT BASE

Item Number	Description	Unit of Measurement	Comment
304-01.01	SELECT MATERIAL (SOIL-CEMENT BASE)	C.Y.	
304-01.02	CEMENT (SOIL-CEMENT BASE)	TON	
304-01.03	PROCESSING (SOIL-CEMENT BASE)	S.Y.	
304-01.04	PROCESSING (RECLAIMED BASE MATERIAL)	S.Y.	
304-01.08	PORTLAND CEMENT (FULL DEPTH PAVEMENT RECLAMATION)	TON	
203-06	WATER	MG	

Item No. 304-01.02 Cement (Soil-Cement Base)

Volume of New Material × 1.300 (Shrinkage Factor) = Volume of Select Material (C.Y.)

$$\frac{94 \text{ Lb./C.F.} \times 27 \text{ C.F./C.Y.}}{2{,}000 \text{ Lb./ Ton}} = 1.269 \text{ Tons/C.Y.}$$

Total Volume C.Y. × 1.269 Tons/C.Y. × 9% (Volume of Select Material) = Tons

12% (In-place Soil) = Tons

Item No. 304-02 Bituminous Material (Soil-Cement Base)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

8-307.00 COMPUTATIONS FOR BITUMINOUS PLANT MIX BASE (HOT MIX)

The computed quantity for asphalt base mixtures is as follows. Values for mixture density, Lb. per S.Y. per inch thickness, and item numbers are provided in *Table 8-1*.

$$\frac{\text{Compacted volume (C.Y.)} \times \text{Density (Lb./C.Y.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

OR

$$\frac{\text{Area (S.Y.)} \times \text{Density (Lb/SY-in)} \times \text{Compacted Thickness (in.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

VALUES FOR COMPUTATION OF 307 ASPHALT BASE MIXTURE QUANTITIES			
ITEM NUMBER	DESCRIPTION	DENSITY (LB/CY)	DENSITY (LB/SY-in)
307-01.01	PG 64-22 BASE MIXES (GRADING A)	4140	115
307-01.06	PG 64-22 BASE MIXES (GRADING B)	4068	113
307-01.07	PG 64-22 BASE MIXES (GRADING B-M)	4068	113
307-01.08	PG 64-22 BASE MIXES (GRADING B-M2)	4068	113
307-01.09	PG 64-22 BASE MIXES (GRADING C)	3960	110
307-01.10	PG 64-22 BASE MIXES (GRADING C-W)	3960	110
307-01.15	PG 64-22 BASE MIXES (GRADING CS)	4140	115
307-01.20	PG 64-22 BASE MIXES (GRADING A-S)	3825	106
307-01.21	PG 70-22 BASE MIXES (GRADING A-S)	3825	106
307-01.22	PG 76-22 BASE MIXES (GRADING A-S)	3825	106
307-01.23	PG 64-22 BASE MIXES (GRADING ACRL)	3825	106
307-01.24	PG 70-22 BASE MIXES (GRADING ACRL)	3825	106
307-01.25	PG 76-22 BASE MIXES (GRADING ACRL)	3825	106
307-02.01	PG 70-22 BASE MIXES (GRADING A)	4140	115
307-02.06	PG 70-22 BASE MIXES (GRADING B)	4068	113
307-02.07	PG 70-22 BASE MIXES (GRADING B-M)	4068	113
307-02.08	PG 70-22 BASE MIXES (GRADING B-M2)	4068	113
307-03.01	PG 76-22 BASE MIXES (GRADING A)	4140	115
307-03.06	PG 76-22 BASE MIXES (GRADING B)	4068	113
307-03.07	PG 76-22 BASE MIXES (GRADING B-M)	4068	113
307-03.08	PG 76-22 BASE MIXES (GRADING B-M2)	4068	113
307-03.09	PG 76-22 BASE MIXES (GRADING C)	3960	110
307-03.10	PG 76-22 BASE MIXES (GRADING CS)	4140	115
307-03.11	PG 76-22 BPMB-HM (GRADING C-W)	3960	110
307-04.01	PG 82-22 BASE MIXES (GRADING A)	4140	115
307-04.02	PG 82-22 BPMB-HM (GRADING A-S)	3240	90
307-04.08	PG 82-22 BASE MIXES (GRADING B-M2)	4068	113

TABLE 8-1
COMPUTATION OF 307 ASPHALT BASE MIXTURE QUANTITIES

8-309.00 AGGREGATE-CEMENT BASE COURSE

8-309.01 COMPUTATIONS FOR AGGREGATE-CEMENT BASE COURSE – LIMESTONE

Item No. 309-01.01 Mineral Aggregate (A-CBC)

Compacted volume (C.Y.)× 1.9456 Tons/C.Y.= Tons

Item No. 309-01.02 Portland Cement (A-CBC)

Compacted volume (C.Y.)× 0.0751 Tons/C.Y.= Tons

Item No. 309-02 Bituminous Material (A-CBC)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

8-309.02 COMPUTATIONS FOR AGGREGATE-CEMENT BASE COURSE – GRAVEL

Item No. 309-01.01 Mineral Aggregate (A-CBC)

Compacted volume (C.Y.)× 1.8145 Tons/C.Y.= Tons

Item No. 309-01.02 Portland Cement (A-CBC)

Compacted volume (C.Y.)× 0.0884 Tons/C.Y.= Tons

Item No. 309-02 Bituminous Material (A-CBC)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

8-312.00 COMPUTATIONS FOR AGGREGATE-LIME-FLY ASH STABILIZED BASE COURSE

Item No. 312-01 Mineral Aggregate (ALFSB)

Compacted volume (C.Y.)× 1.690 Tons/C.Y.= Tons

Item No. 312-02 Lime

Compacted volume (C.Y.)× 0.0643 Tons/C.Y.= Tons

Item No. 312-03 Fly-Ash

Compacted volume (C.Y.)×0.2019 Tons/C.Y.= Tons

Item No. 312-04 Bituminous Material (ALFSB)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

SECTION 4 – FLEXIBLE SURFACES

8-401.00 MINERAL AGGREGATE SURFACE

Item Number	Description	Unit of Measurement	Comment
401-01	AGGREGATE FOR MINERAL AGGREGATE SURFACE (MAS)	TON	Local Program Use - Gravel Roadway

8-402.00 PRIME COAT

Item Number	Description	Unit of Measurement	Comment
402-01	BITUMINOUS MATERIAL FOR PRIME COAT (PC)	TON	
402-02	AGGREGATE FOR COVER MATERIAL (PC)	TON	
203-06	WATER	MG	ONLY NEEDED TO DAMPEN SURFACE

8-402.01 COMPUTATIONS FOR PRIME COAT

Item No. 402-01 Bituminous Material for Prime Coat (PC)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{\text{**231 Gal./ Ton}} = \text{Tons}$$

* Rate 0.30 – 0.35 Gal./Sq. Yd.

Note: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the pavement schedule in the plans.

Item No. 402-02 ** **Aggregate for Cover Material (PC)**

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

* Rate 8 – 12 Lb./Sq. Yd.

** Item number 402-02 shall be footnoted on the estimated roadway quantities sheet with: “Item to be used as directed by the engineer.”

Note: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the pavement schedule in the plans.

8-403.00 TACK COAT

8-403.01 COMPUTATIONS FOR TACK COAT

Item No. 403-01 Bituminous Material for Tack Coat (TC)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

*Rate = 0.05 – 0.10 Gal/Sq. Yd. (General Use)

*Rate = 0.08 – 0.12 Gal/Sq. Yd. (Milling – Cold Plane)

Note: Designers should estimate based on 0.075 or 0.10 respectively for smooth or milled surface. Do not show a rate on the Pavement Schedule, but place note: “See 403.05 for determining application rate in the field.” In the pavement schedule.

Item No. 403-02 Asphalt Cement for Tack Coat (TC)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.05 \text{ (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

Note: Should rarely call this out. TDOT’s preferred method would be a commodity Emulsion (403-01) or for a premium a Trackless Tack (403-03). If we are overlaying a concrete surface, a Hot Applied Trackless Tack (403-02.02) should be called out, using this calculation.

Item No. 403-02.01 Trackless Tack Coat

Calculations and rates are similar to Item No. 403-01. Use Trackless Tack Coat only if deemed necessary on the resurfacing checklist or at field review due to a large number of cross traffic or other reason as determined by the Operations Engineer. When paving asphalt over a scrub, trackless tack shall be calculated at 0.05 GAL/SY.

NOTE: Tack coat shall not be applied on top of either Grading AS or Treated Permeable Base mixtures.

8-403.02 COMPUTATION FOR FOG SEAL

Item No. 403-05.01 Bituminous Material (Fog Seal) Shoulder

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.5 \times \text{*Rate (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

*rate = 0.10 to 0.15 Gal/SY

NOTE: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the proposed pavement schedule in the plans.

8-405.00 BITUMINOUS SEAL COAT

8-405.01 COMPUTATIONS FOR BITUMINOUS SEAL COAT (CHIP SEAL)

Item No. 405-01.01 Bituminous Material for Bituminous Seal Coat (BSC)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

* Rate 0.17 - 0.45 Gal./ Sq. Yd.

Note: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the pavement schedule in the plans.

Item No. 405-01.02 Mineral Aggregate for Bituminous Seal Coat (BSC)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

* Rate 17 - 30 Lb./Sq. Yd.

Note: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the pavement schedule in the plans.

After the bituminous seal coat is placed, a tack coat (see *Section 8-403.01 Computations for Tack Coat*, Item No. 403-01) is to be used prior to the placement of the first lift of proposed pavement. If a specific aggregate size is intended to be used, use the coordinating midpoint of the ranges identified in Table 405.06-1 of Standard and Supplemental Specifications 405.06 and footnote this item on the estimated roadway quantities sheet in the plans to indicate which rate and aggregate size should be used.

8-405.02 COMPUTATIONS FOR DOUBLE BITUMINOUS SURFACE TREATMENT

Item No. 405-01.01 Bituminous Material for Double Bituminous Surface Treatment (DBST)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{\text{231 Gal./ Ton}} = \text{Tons}$$

* Rate 0.30 – 0.38 Gal./ Sq. Yd. (First Application)

* Rate 0.20 – 0.35 Gal./Sq. Yd. (Second Application)

NOTE: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the proposed pavement schedule in the plans.

NOTE: See Subsection 405.06 of the *Tennessee Department of Transportation Standard Specifications* for more information regarding the application of Double Bituminous Surface Treatment

Item No. 405-01.02 Mineral Aggregate for Double Bituminous Surface Treatment (DBST)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

* Rate 24 - 30 Lb./ Sq. Yd. (First Application)

* Rate 16 – 28 Lb./Sq. Yd. (Second Application)

NOTE: Designers shall assume the mid-point of the rate ranges when calculating quantities. If a different value is used, footnote this item on the estimated roadway quantities sheet in the plans to indicate the rate used. Designers shall show the rate range on the proposed pavement schedule in the plans.

NOTE: See Subsection 405.06 of the *Tennessee Department of Transportation Standard Specifications* for more information regarding the application of Double Bituminous Surface Treatment

8-411.00 ASPHALTIC CONCRETE SURFACE (HOT MIX)

8-411.01 COMPUTATIONS FOR ASPHALTIC CONCRETE SURFACE (HOT MIX)

The computed quantity for asphalt surface mixtures is as follows:

$$\frac{\text{Compacted volume (C.Y.)} \times \text{Density (Lb./C.Y.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

OR

$$\frac{\text{Area (S.Y.)} \times \text{Density (Lb/SY-in)} \times \text{Compacted Thickness (in.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

Values for mixture density, Lb. per S.Y. per inch thickness, and item numbers are provided in *Table 8-2* below.

VALUES FOR COMPUTATION OF 411 ASPHALT SURFACE MIXTURE QUANTITIES			
ITEM NUMBER	DESCRIPTION	DENSITY (LB/CY)	DENSITY LB/SY-in)
411-01.07	ACS MIX(PG64-22) GRADING E SHOULDER	3816	106
411-01.10	GRADING D SURFACE (PG 64-22)	3816	106
411-01.11	ACS MIX(PG64-22) GRADING E RDWY	3816	106
411-02.10	GRADING D SURFACE (PG 70-22)	3816	106
411-03.10	GRADING D SURFACE (PG 76-22)	3816	106
411-04.10	GRADING D SURFACE (PG 82-22)	3816	106
411-03.07	GRADING TL SURFACE (PG 64-22)	3816	106
411-03.08	GRADING TL SURFACE (PG 70-22)	3816	106
411-03.09	GRADING TL SURFACE (PG 76-22)	3816	106
411-03.12	GRADING TLD SURFACE (PG 64-22)	3816	106
411-03.13	GRADING TLD SURFACE (PG 70-22)	3816	106
411-03.14	GRADING TLD SURFACE (PG 76-22)	3816	106
411-03.23	GRADING OGFC SURFACE (PG 76-22)	3168	88*
411-03.24	ACS MIX(PG64-22) THIN LIFT E ASPHALT	3816	106
411-03.25	ACS MIX(PG67-22) THIN LIFT E ASPHALT	3816	106
411-03.26	ACS MIX(PG70-22) THIN LIFT E ASPHALT	3816	106
411-03.27	ACS MIX(PG76-22) THIN LIFT E ASPHALT	3816	106
411-03.28	ACS MIX (PG76-22) OGFC GRADING E SHOULDER	3816	106
411-03.29	ACS MIX (PG64-22) OGFC GRADING E SHOULDER	3816	106
411-04.11	ACS MIX(PG82-22) GRADING E RDWY	3816	106

*For Region 1, McMinn, Bradley, Hamilton, and Marion Counties use 94 LB/SY-in.

TABLE 8-2

COMPUTATION OF 411 ASPHALT SURFACE MIXTURE QUANTITIES

8-414.00 EMULSIFIED ASPHALT SLURRY SEAL AND MICRO-SURFACING

8-414.01 COMPUTATIONS FOR MICRO-SURFACING

Item No. 414-03.01 Emulsified Asphalt for Micro-Surfacing

0.12 × Item No. 414-03.02 aggregate quantity = Tons

NOTE: Application rate based on 12 percent of the dry weight of the aggregate.

Item No. 414-03.02 Aggregate for Micro-Surfacing

$$\frac{\text{Surface area (Sq. Yd.)} \times \textbf{XX} \text{ (Lb./Sq. Yd.)}}{\text{2,000 Lb./ Ton}} = \text{Tons}$$

NOTE: Application rate: 1 pass = 22 pounds (approximate depth 0.275") per square yard
2 pass = 32 pounds (approximate depth 0.375") per square yard

Item No. 403-01.01 Bituminous Material for Tack Coat (Micro-Surfacing)

$$(0.25)\ \frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{\text{231 Gal./ Ton}} = \text{Tons}$$

* Rate 0.10 - 0.15 (Gal./Sq. Yd.) of the diluted emulsion

FOOTNOTE Quantity: No payment will be made directly for the water required to dilute the tack coat.

A Tack Coat (TC) shall be applied between the existing asphalt surface and the first micro-surface lift. If there are multiple lifts, no tack coat is required between the 1st and 2nd lift.

Note: In order to get the micro to adhere, the pavement marking needs to be removed. A pavement removal item numbers from the 716-08.** should be included in the plans.

8-415.00 COLD PLANING OF BITUMINOUS PLANT MIX PAVEMENTS

Cold Planning projects shall be paid for by the Ton, unless specified by TDOT Operations. For all dense graded asphalt mixes (all mixes except OGFC) cold planning shall be calculated using 105 Lb./S.Y./Inch of estimated depth to be cold planed, converted to Tons. When the existing surface is OGFC, estimate the top 1.25" of the cold planning using 88 Lb./S.Y./Inch. Any depth beyond 1.25" shall be calculated as dense graded mix as stated above.

This shall be measured and paid for under Item No. 415-01.01 Cold Planning of Bituminous Pavement per Ton.

SECTION 5 – RIGID PAVEMENT

8-501.00 PORTLAND CEMENT CONCRETE PAVEMENT

Item Number	Description	Unit of Measurement	Comment
501-01.01	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 8"	S.Y.	SP109A; RP-J-23
501-01.02	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 9"	S.Y.	SP109A; RP-J-23
501-01.03	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 10"	S.Y.	SP109A; RP-J-23
501-01.04	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 11"	S.Y.	SP109A; RP-J-23
501-01.05	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 12"	S.Y.	SP109A; RP-J-23
501-01.06	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 13"	S.Y.	SP109A; RP-J-23
501-01.07	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 14"	S.Y.	SP109A; RP-J-23
501-01.10	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 7" FAST TRACK	S.Y.	SP109A; RP-J-23
501-01.11	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 8" FAST TRACK	S.Y.	SP109A; RP-J-23
501-01.12	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 9" FAST TRACK	S.Y.	SP109A; RP-J-23
501-01.13	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 10" FAST TRACK	S.Y.	SP109A; RP-J-23
501-01.14	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 11" FAST TRACK	S.Y.	SP109A; RP-J-23
501-01.15	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 12" FAST TRACK	S.Y.	SP109A; RP-J-23

501-01.16	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 13" FAST TRACK	S.Y.	SP109A; RP-J-23
501-01.20	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 3" ULTRATHIN	S.Y.	SP109A
501-01.21	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) 4" ULTRATHIN	S.Y.	
501-01.30	PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN) ULTRATHIN	S.Y.	
501-02.01	COMPOSITE PORTLAND CEMENT CONCRETE PAVEMENT	S.Y.	
501-03.01	COLORED CONCRETE SHOULDERS	S.Y.	
501-03.02	CONCRETE SHOULDERS	S.Y.	
501-03.10	CONCRETE SHOULDER RUMBLE STRIPS	L.F.	RP-CS-1; RP-CS-2
501-03.15	CONCRETE SHOULDER MILLED RUMBLE STRIPS	L.M.	TO BE USED ON SHOULDERS OF INTERSTATES CONSTRUCTED WITH CONCRETE
501-03.20	CONCRETE PAVEMENT GROOVING	S.Y.	
501-04.01 to 501-04.02	ROLLER COMPACTED CONCRETE PAVEMENT(DEPTH)	C.Y.	SP501RC
501-04.03 to 501-04.04	ROLLER COMPACTED CONCRETE PAVEMENT(DEPTH)	S.Y.	SP501RC
501-05.90	REMOVE EXISTING BITUMINOUS MATERIAL	L.S.	

Silicone sealant shall be used on all new projects using Portland cement concrete pavement as a primary pavement for the main line or ramps, excluding rehabilitation of all old concrete pavement or joint repair. The silicone sealant is specified in Subsection 905.05 of the *Tennessee Department of Transportation Standard Specifications*.

8-502.00 COMPUTATIONS FOR UNDERSEALING CONCRETE PAVEMENT

Item Number	Description	Unit of Measurement	Comment
502-01	CLEANING AND SEALING JOINTS	L.F.	
502-01.02	CLEANING JOINTS	L.F.	
502-02	HOLES	EACH	
502-03.01	CEMENT GROUTING	C.F.	
502-03.05	HOT APPLIED FIBER-POLYMER PATCHING MATERIAL	LB.	SP502FRP
502-03.13	CONCRETE PAVEMENT REMOVAL	S.Y.	
502-03.21	PARTIAL DEPTH PCC PAVEMENT REPAIR	S.Y.	RP-J-24; NOT TO BE USED ON THE INTERSTATE/ FREEWAY OR INTERSTATE RAMPS
502-03.24	FULL DEPTH PCC PAVEMENT REPAIR HIGH EARLY (DESCRIPTION)	C.Y.	
502-03.25	FULL DEPTH PCC PAVEMENT REPAIR HIGH EARLY	C.Y.	SP502C
502-03.26	PARTIAL DEPTH PCC PAVEMENT REPAIR HIGH EARLY	S.Y.	SP502C
502-04.01	SAWING CONCRETE PAVEMENT (FULL DEPTH)	L.F.	SP502A; RP-J-23
502-04.02	LOAD TRANSFER DOWELS	EACH	SP502A; RP-J-23
502-04.03	TRANSVERSE TIE-BARS	EACH	SP502A; RP-J-23
502-05	CALCIUM CHLORIDE (TYPE 1)	BAG	
502-06.01	EXPANSION JOINT REPLACEMENT	L.F.	
502-08	PRE-ROLLING	S.Y.	

502-08.01	RESEALING JOINTS (HOT POURED ELASTIC)	L.F.	SP502J; RP-J-25
502-08.02	RESEALING JOINTS (SILICONE SEALANT)	L.F.	SP502J; RP-J-25
502-08.03	SEALING SHOULDER JOINTS	L.F.	SP502J; RP-J-25
502-08.07	SEALING RANDOM CRACKS (SILICONE SEALANT)	L.F.	SP502J; RP-J-24
502-08.10	SAWING & RESEALING JOINTS (SILICONE SEALANT)	L.F.	SP502J
502-08.23	CLEANING AND RESEALING JOINTS AND CRACKS	L.F.	SP502J
502-08.24	CRACK SEALANT	LB.	
502-10	CEMENT-FLY ASH GROUT	C.F.	
502-20	POLYURETHANE MATERIAL	LB.	
502-25	SAWING CONCRETE JOINTS	L.F.	

NOTE: The quantities are listed in the order of computation procedure.

Item No. 502-02 Holes

$$\frac{\text{Length of project (ft)} \times \text{number of lanes} \times 4 \text{ holes/slab}}{\text{Length of slabs}} = \text{Each}$$

Item No. 502-10 Cement-Fly Ash Grout

a) Cubic feet/hole x number of holes = Cubic Feet

b) Use one of the following values as directed on the Plan-in-Hand Field Review:

1. Concrete pavement in worse than average condition.

0.4 - 0.5 cubic feet/hole

2. Concrete pavement in average condition.

0.4 cubic feet/hole

3. Concrete pavement in better than average condition.

0.3 - 0.4 cubic feet/hole

NOTE: Pavement with cement-treated bases shall fall within the better than average range.

SECTION 6 – STRUCTURES

8-601.00 TIMBER STRUCTURES

Basis of Payment:

Item Number	Description	Unit of Measurement	Comment
601-01	UNTREATED TIMBER	MBFM	
601-02	TREATED TIMBER	MBFM	
601-03.01 to 601-03.05	TREATED TIMBER CROSS TIES (SIZE)	EACH	
601-10.01 to 601-10.02	TREATED TIMBER CROSS TIE REPAIRS (SIZE)	EACH	
601-10.03	TREATED TIMBER STRINGER REPAIRS (SIZE)	EACH	
601-10.04	TREATED TIMBER BENT CAP REPAIRS (SIZE)	EACH	
601-10.05	TREATED TIMBER PILE REPAIRS (SIZE)	EACH	
601-10.06	TREATED TIMBER REPAIRS	MBFM	
601-10.07	TIMBER BENT REPAIRS (RISER BLOCKS)	EACH	

601-10.08	TREATED TIMBER PILE REPAIRS (ENCASEMENT)	EACH	
601-10.09	TREATED TIMBER CAP BEAM REPAIRS (ENCASEMENT)	EACH	
601-10.10	TREATED TIMBER LAMINATED DECKING	MBFM	
601-10.11	TREATED TIMBER (SIDEWALK PLANKS AND CURBS)	MBFM	
601-10.12	TREATED TIMBER ABUTMENT REPAIRS	EACH	

8-602.00 STEEL STRUCTURES

Item Number	Description	Unit of Measurement	Comment
602-01	STRUCTURAL STEEL	LB.	SP602; S-GRS-3
602-02.01 to 602-02.10	STRUCTURAL STEEL (LOCATION & DESCRIPTION)	LB.	SP602
602-02.11 to 602-02.12	STRUCTURAL STEEL (W/SUPP. DESCRIPTION)	L.S.	
602-03 to 602-03.01	STEEL STRUCTURES	L.S.	SP602
602-03.02 to 602-03.04	PEDESTRIAN BRIDGE	L.S.	
602-04.01 to 602-04.09, 602-04.98, 602-04.99	STEEL STRUCTURES (LOCATION & DESCRIPTION)	L.S.	SP602
602-08.01	JACKING STRUCTURES (DESCRIPTION)	L.S.	SP602
602-08.02 to 602-08.05	JACKING STRUCTURES (DESCRIPTION)	EACH	
602-10.01	STRUCTURAL STEEL REPAIRS	L.S.	
602-10.05	BRACING REPAIRS	L.S.	
602-10.06	STRUCTURAL STEEL	LB.	
602-10.09	STEEL HANDRAIL REPAIRS	L.F.	
602-10.10	ANCHOR BOLTS	EACH	
602-10.12	BEARING DEVICE (REPAIR)	L.S.	
602-10.19	JACKING STEEL SPANS	L.S.	
602-10.20	BOLTS	EACH	
602-10.22	STRUCTURAL STEEL WELD REPAIR	EACH	

602-10.32	STRUCTURAL STEEL (REPAIRS)	LB.	
602-10.50	STRUCTURAL STEEL REPAIR	EACH	
602-10.51 to 602.10.59	STRUCTURAL STEEL REPAIR(DESCRIPTION)	EACH	
602-10.60 to 602-10.69	BEARING DEVICE (DESCRIPTION)	EACH	
602-10.70	STRUCTURAL STEEL CRACK REPAIR	EACH	
602-10.81	HEAT STRAIGHTENING	L.S.	

8-603.00 PAINTING

Item Number	Description	Unit of Measurement	Comment
603-01	PAINT STEEL STRUCTURE	L.S.	
603-01.01 to 603-01.09	PAINTING STEEL STRUCTURES (LOCATION & DESCRIPTION)	L.S.	
603-02.01 to 603-02.10	REPAINTING EXISTING STEEL STRUCTURES (LOC. & DES.)	L.S.	
603-02.15	REPAINT EXISTING BEARINGS	L.S.	
603-02.20	SPOT PAINTING EXISTING STEEL STRUCTURES	S.F.	

8-604.00 CONCRETE STRUCTURES

Item Number	Description	Unit of Measurement	Comment
604-01.01	CLASS A CONCRETE (ROADWAY)	C.Y.	EC-STR-29, MM-PS-1
604-01.02	STEEL BAR REINFORCEMENT (ROADWAY)	LB.	EC-STR-29, MM-PS-1
604-01.04	1-1/2" STEEL PIPE HANDRAIL	L.F.	MM-PS-1
604-01.05	2x2x1/4 IN BOX STEEL TUBE HANDRAIL	L.F.	
604-01.12	CLASS A CONCRETE (BRIDGE DECK)	C.Y.	
604-01.20	BOX TUBE SAFETY RAIL	L.F.	
604-01.32	CLASS A CONCRETE (LEVELING)	C.Y.	

604-01.52	CUSTOM ELASTOMERIC FORM LINER	L.S.	
604-01.53	CONCRETE STRUCTURE (DESCRIPTION)	EACH	
604-02.01	CLASS A CONCRETE (BOX BRIDGES)	C.Y.	
604-02.02	STEEL BAR REINFORCEMENT (BOX BRIDGES)	LB.	
604-02.03	EPOXY COATED REINFORCING STEEL	LB.	
604-02.10	REINFORCEMENT STEEL (ASTM A706)	LB.	
604-02.38	EPOXY COATED REINFORCING STEEL COUPLERS	EACH	
604-02.41 to 604-02.48	ENERGY DISSIPATER (DESCRIPTION)	EACH	
604-02.50 to 604-02.51	ENERGY DISSIPATER (DESCRIPTION)	L.S.	
604-02.60	BOX EXTENSION (_____)	L.S.	
604-03.01	CLASS A CONCRETE (BRIDGES)	C.Y.	
604-03.02	STEEL BAR REINFORCEMENT (BRIDGES)	LB.	
604-03.04	PAVEMENT @ BRIDGE ENDS	S.Y.	
604-03.05	CLASS A CONCRETE (FOUNDATION SEAL)	C.Y.	
604-03.06	BRIDGE DRAIN APRON	S.Y.	
604-03.07 to 604-03.08	CLASS A CONCRETE (DESCRIPTION)	C.Y.	
604-03.09	CLASS D CONCRETE (BRIDGE DECK)	C.Y.	
604-03.10 to 604-03.19	CONCRETE OVERLAY (DESCRIPTION)	S.Y.	
604-03.20	BRIDGE JOINT MODIFICATION	L.F.	
604-03.21	BRIDGE JOINT SEISMIC MODIFICATION	EACH	
604-03.22	CONCRETE OVERLAY (DESCRIPTION)	C.Y.	
604-03.24	CLASS A CONCRETE (FOOTING)	L.S.	
604-03.25	CLASS S CONCRETE (FOUNDATION SEAL)	C.Y.	
604-03.30	CLASS D CONCRETE	C.Y.	
604-03.31	CLASS D CONCRETE (DESCRIPTION)	C.Y.	
604-03.32	CLASS DS CONCRETE	C.Y.	
604-03.35	CLASS L CONCRETE	C.Y.	

604-03.36	LEAN CONCRETE	C.Y.	
604-03.37	EPOXY INJECTION	L.F.	
604-03.40 to 604-03.49	SEISMIC MODIFICATION (DESCRIPTION)	EACH	
604-03.50	CLEARANCE GAUGES	L.S.	
604-03.60 to 604-03.69	BRIDGE JOINT SEISMIC MODIFICATION (DESCRIPTION)	EACH	
604-03.70	CLASS A CONCRETE LOW SHRINKAGE	C.Y.	
604-03.71	SHRINKAGE COMPENSATING CONCRETE (PRECAST SLAB CLOSURE MIX)	C.F.	
604-03.74 to 604-03.76	CLASS X CONCRETE	C.Y.	
604-03.80	STEEL BAR REINFORCEMENT (STAINLESS STL)	LB.	
604-04.01	APPLIED TEXTURE FINISH (NEW STRUCTURES)	S.Y.	
604-04.02	APPLIED TEXTURE FINISH (EXISTING STRUCTURES)	S.Y.	
604-04.03	BRIDGE END DRAINS(2'X8')	EACH	
604-04.04	BRIDGE END DRAINS(4'X8')	EACH	
604-04.05	BRIDGE END DRAINS(SIZE)	EACH	
604-04.10	GRAFFITI PROTECTION SYSTEM(DESCRIPTION)	S.Y.	
604-04.12	CONCRETE INSTALLATION MOCK-UP	L.S.	
604-04.20	PAINTING CONCRETE SURFACES	S.F.	
604-04.21	STAINING CONCRETE SURFACES	S.F.	
604-04.25	LIMESTONE VENEER	S.F.	
604-04.41	THREE STAR STATE EMBLEM	EACH	
604-04.62	CLEAN & TEXTURE FINISH CONCRETE MEDIAN BARRIER	L.F.	
604-05.12	NON-REINFORCED CONCRETE LEVELING PAD	S.F.	
604-05.13	NON-REINFORCED CONCRETE LEVELING PAD	L.F.	
604-05.14	NON-REINFORCED CONCRETE LEVELING PAD	C.Y.	
604-05.31	BRIDGE DECK GROOVING (MECHANICAL)	S.Y.	
604-05.32	BRIDGE DECK GRINDING AND GROOVING	S.Y.	
604-06.01	LIGHTWEIGHT CONCRETE (BRIDGES)	C.Y.	

604-07.01 to 604-07.27	RETAINING WALL (DESCRIPTION)	S.F.	SP624
604-07.28	RETAINING WALL EXCAVATION	C.Y.	
604-07.29 to 604-07.39	RETAINING WALL (DESCRIPTION)	L.F.	SP624
604-07.40 to 604-07.59	RETAINING WALL (DESCRIPTION)	S.F.	SP624
604-07.75	RESTORATION OF REINFORCED EARTHWALLS	L.S.	
604-08.01	JACKING ROADWAY CONCRETE SLABS	C.F.	SP604H, SP604HD, SP624
604-08.02	LABOR, EQUIPMENT AND INCIDENTALS	HOUR	SP624
604-09.01	CLASS A CONCRETE (UNDER WATER)	C.Y.	
604-09.10	CLASS A CONCRETE (DESCRIPTION)	C.Y.	
604-09.60	HIGH SLUMP CONCRETE	C.Y.	
604-10.01	CONCRETE REPAIRS	L.S.	
604-10.02	CONCRETE REPAIRS	C.Y.	
604-10.03	CONCRETE DECK SEALANT	L.S.	
604-10.04	DEMOLITION WORK	L.S.	
604-10.05	CONCRETE	S.F.	
604-10.06	CONCRETE HANDRAIL REPAIR	L.F.	
604-10.07	CONCRETE REMOVAL	L.S.	
604-10.08	CONCRETE	L.S.	
604-10.09	CONCRETE	C.Y.	
604-10.10	CONCRETE SLAB REPAIRS	L.S.	
604-10.11	CONCRETE SLAB REPAIRS	S.Y.	
604-10.12	CONCRETE SLAB REPAIRS	C.Y.	
604-10.13	CONCRETE SLAB REMOVAL	L.S.	
604-10.14	REMOVE EXISTING WEARING SURFACE	L.S.	
604-10.15	STRUCTURE REPAIRS (FOUNDATIONS)	L.S.	
604-10.16	EXPANSION JOINT REPAIRS	L.S.	
604-10.17	NON-PENETRATING CONCRETE SEAL	S.Y.	
604-10.18	REINFORCING STEEL (REPAIRS)	LB.	
604-10.19	REINFORCING STEEL (REPAIRS)	L.S.	
604-10.20	HYDRODEMOLITION	S.Y.	SP604H, SP604HD

604-10.21	CONTAINMENT & DISPOSAL OF WASTE	L.S.	
604-10.22	CONCRETE PARAPET REPAIR	L.F.	
604-10.23	CONCRETE PARAPET REPAIR	L.S.	
604-10.24	JACKING CONCRETE SPANS	L.S.	
604-10.25	REPAIR OF EXISTING BENT ENDS	EACH	
604-10.26	BRACING	EACH	
604-10.29	CONCRETE SLOPE PAVING REPAIRS	S.Y.	
604-10.30	BRIDGE DECK REPAIRS (FULL DEPTH OF SLAB)	S.Y.	SP604HD
604-10.31	RESETTING EXISTING EXPANSION JOINTS	L.F.	
604-10.32	EXPANSION JOINT REPAIRS (TYPE A)	L.F.	
604-10.33	EXPANSION JOINT REPAIRS (TYPE B)	L.F.	
604-10.34	CONCRETE OVERLAYED BRIDGE DECK REPAIR (FULL DEPTH)	S.Y.	
604-10.35	EXPANSION JOINT REPAIRS (TYPE C)	L.F.	
604-10.36	CONCRETE CURTAIN WALL REPAIR	EACH	
604-10.39	PRECAST REINFORCED CONCRETE UNITS	S.F.	
604-10.40	EXPANSION JOINT REPAIRS (TYPE D)	L.F.	
604-10.41	EXPANSION JOINT REPAIRS (TYPE E)	L.F.	
604-10.42	CONCRETE REPAIRS	C.F.	
604-10.43	PENETRATING WATER REPELLENT CONCRETE SEAL	S.Y.	
604-10.44	EXPANSION JOINT REPAIRS	L.F.	
604-10.45	EXPANSION JOINT REPAIRS (TYPE F)	L.F.	
604-10.46	EXPANSION JOINT REPAIRS (TYPE G)	L.F.	
604-10.47	EXPANSION JOINT REPAIRS (TYPE H)	L.F.	
604-10.48	EXPANSION JOINT REPAIRS (TYPE J)	L.F.	
604-10.49	EXPANSION JOINT REPAIRS (TYPE K)	L.F.	
604-10.50	BRIDGE DECK REPAIRS (PARTIAL DEPTH OF SLAB)	S.Y.	
604-10.51	SCARIFYING	S.Y.	

604-10.52	PRESTRESSED BEAM REPAIR	L.S.	
604-10.53	CONCRETE REPAIRS	S.Y.	
604-10.54	CONCRETE REPAIRS	S.F.	
604-10.55	CONCRETE (FOUNDATION REPAIRS)	C.Y.	
604-10.56	CONCRETE OVERLAYED BRIDGE DECK REPAIR (PARTIAL DEPTH)	S.Y.	
604-10.57	BRIDGE DECK OVERLAY (RUBBERIZED ASPHALT ADDITIVE)	LB.	
604-10.58	EPOXY INJECTION (INJECTION)	GAL.	
604-10.59	CLOSURE POUR MATERIAL (ACCELERATED STRENGTH)	C.F.	
604-10.60 to 604-10.61	EXPANSION JOINT REPAIRS (MODULAR TYPE)	L.F.	
604-10.62	EPOXY INJECTION REPAIR (COMPLETE AND IN PLACE)	L.F.	
604-10.63	CONCRETE REPAIRS (CRACKS)	L.F.	
604-10.64	EXPANSION JOINT REPAIRS (MODULAR TYPE)	L.F.	
604-10.65	EXPANSION JOINT REPAIRS (TYPE L)	L.F.	
604-10.66	EXPANSION JOINT REPAIRS (TYPE M)	L.F.	
604-10.67 to 604-10.68	CONCRETE REPAIRS (DESCRIPTION)	L.F.	
604-10.69	PRESTRESSING STRAND SPLICE	EACH	
604-10.70	EXPANSION JOINT REPAIRS	L.F.	
604-10.71	MEASUREMENT OF EXISTING CLEARANCE GAGES	EACH	
604-10.72	REPAINTING EXISTING CLEARANCE GAGES	EACH	
604-10.73	LONGITUDINAL BRIDGE JOINT REPAIR	L.F.	
604-10.74	MODIFIED CLASS A CONCRETE (PARTIAL DEPTH REPAIR)	S.Y.	
604-10.75	MODIFIED CLASS A CONCRETE (FULL DEPTH REPAIR)	S.Y.	
604-10.76	BRIDGE DECK CRACK REPAIR	L.F.	
604-10.78	RISER BLOCK REPAIR	EACH	
604-10.79	COST OF MANUFACTURER REPRESENTATIVE	L.S.	
604-10.80	BRIDGE REPAIRS	L.S.	
604-10.81	CONCRETE REPAIRS	EACH	
604-10.83	COMPOSITE FIBER ENCASEMENT	S.F.	SP604FRP
604-10.84	FULL DEPTH REPAIR	S.Y.	

604-10.85	CLASS "D" CONCRETE (OVERLAY)	C.Y.	SP604HD
604-10.86	CLASS "D" CONCRETE (REPAIR)	C.Y.	SP604HD
604-10.87	CLASS "A" CONCRETE (OVERLAY)	C.Y.	
604-10.88	CLASS "A" CONCRETE (REPAIR)	C.Y.	
604-10.89, 604-10.91	MISCELLANEOUS BRIDGE ITEMS (Description)	L.S.	
604-10.90, 604-10.93 to 604-10.94	MISCELLANEOUS BRIDGE ITEMS	L.S.	
604-10.92	MEDIAN BARRIER REPAIR	L.F.	
604-10.97	CLASS "DS" CONCRETE (OVERLAY)	C.Y.	SP604HD
604-10.98	CLASS "DS" CONCRETE (REPAIR)	C.Y.	SP604HD
604-10.99	RETAINING WALL PILE ADJUSTMENT	L.F.	
604-11.01 to 604-11.10	EXPANSION DEVICE (DESCRIPTION)	L.F.	
604-11.64	EXPANSION JOINT FOR MEDIAN BARRIER	EACH	
604-11.99	CONCRETE WALL (BENT MODIFICATION)	S.F.	
604-12.01	CONCRETE IMPRINTING	S.F.	
604-12.02	FORM LINE FINISH	S.F.	
604-12.03	CONCRETE PIGMENT	LB.	
604-12.04	STONE VENEER FINISH	S.F.	
604-12.05	EXPOSED AGGREGATE FINISH	S.F.	
604-12.15	DRILL & GROUT STEEL BARS	EACH	
604-13.01 to 604-13.09	PRESTRESSED BEAM REPAIR (DESCRIPTION)	L.S.	
604-15.01	PORTLAND CEMENT GROUT	C.Y.	
604-15.02	PORTLAND CEMENT GROUT	BAG	
604-15.03	GROUTING BEAM JOINTS	L.F.	
604-15.20	COMPACTION GROUT	C.F.	SP204CG
604-15.21	COMPACTION GROUT (DESCRIPTION)	C.F.	
604-18.26	STEEL BAR COUPLERS AT APPROACH SLABS	EACH	
604-20.10	MODIFY BRIDGE RAIL	L.F.	
604-20.11	PAINTED METAL HANDRAIL	L.F.	
604-36	SCARIFYING	S.Y.	
604-36.05	HAND SCARIFYING	S.Y.	
604-36.10	BRIDGE DECK REPAIRS	S.Y.	
604-36.20	BRIDGE DECK REMOVAL (DESCRIPTION)	S.Y.	

604-36.30	BRIDGE DECK REMOVAL (DESCRIPTION)	L.S.	
604-40.01 to 604-40.09	BEAM END REPAIR (DESCRIPTION&STATION)	EACH	
604-42.01	UNDERWATER DIVERS	DAY	
604-44.10	TEMPORARY COVERED PEDESTRIAN GREENWAY	L.F.	
604-44.20	REMOVE & RESET (DESCRIPTION)	L.S.	
604-44.25	REMOVE & REPLACE DRAINAGE THROUGH WALL	L.F.	
604-50.01	DISTRIBUTION SLAB	S.Y.	
604-50.10	MECHANICAL COUPLER	EACH	

8-604.01 TYPE DESIGNATION FOR CONCRETE BOX AND SLAB TYPE CULVERTS AND BRIDGES

The plans must clearly indicate for each culvert or bridge, the type (box or slab) on which the quantities are based. This should be accomplished by showing a column in the tabulation block for culverts or bridges, indicating the type.

8-604.02 PAVED APRON FOR BOX CULVERT AND BRIDGE OUTLETS

The quantities for a paved apron shall be added to the concrete and steel quantities for the box culvert or bridge. Footnote these quantities to show the amount of concrete and steel bar reinforcement included for the paved aprons. The steel bar reinforcement may be computed using a weight of 58 pounds per 100 square feet of apron, plus the weight of the A-400 bars.

8-604.40 STOCK PASSES

Refer to Drainage Manual Chapter 6 Section 6.04.3.5. A 6’x6’ concrete box is the standard stock pass.

8-606.00 PILING

Item Number	Description	Unit of Measurement	Comment
606-02.01	TEST PILES (STEEL PILES, 10 INCH)	L.F.	
606-02.02	LOADING TEST (STEEL PILES, 10 INCH)	EACH	
606-02.03	STEEL PILES (10 INCH)	L.F.	
606-02.05	STEEL PILES (10 INCH) COLUMN	L.F.	

606-02.06	PILE TIPS (STEEL PILES, 10 INCH)	EACH	
606-03.01	TEST PILES (STEEL PILES, 12 INCH)	L.F.	
606-03.02	LOADING TEST (STEEL PILES, 12 INCH)	EACH	
606-03.03	STEEL PILES (12 INCH)	L.F.	
606-03.05	STEEL PILES (12 INCH) COLUMN	L.F.	
606-03.06	PILE TIPS (STEEL PILES, 12 INCH)	EACH	
606-04.01	TEST PILES (STEEL PILES, 14 INCH)	L.F.	
606-04.02	LOADING TEST (STEEL PILES, 14 INCH)	EACH	
606-04.03	STEEL PILES (14 INCH)	L.F.	
606-04.05	STEEL PILES (14 INCH) COLUMN	L.F.	
606-04.06	PILE TIPS (STEEL PILES, 14 INCH)	EACH	
606-05.01	TEST PILES (UNTREATED TIMBER, SIZE 1)	L.F.	
606-05.02	LOADING TEST (UNTREATED TIMBER, SIZE 1)	EACH	
606-05.03	UNTREATED TIMBER PILES (SIZE 1)	L.F.	
606-06.01	TEST PILES (UNTREATED TIMBER, SIZE 2)	L.F.	
606-06.02	LOADING TEST (UNTREATED TIMBER, SIZE 2)	EACH	
606-06.03	UNTREATED TIMBER PILES (SIZE 2)	L.F.	
606-07.01	TEST PILES (TREATED TIMBER, SIZE 1)	L.F.	
606-07.02	LOADING TESTS (TREATED TIMBER, SIZE 1)	EACH	
606-07.03	TREATED TIMBER PILES (SIZE 1)	L.F.	
606-07.05	PILE TIPS (TIMBER, SIZE 1)	EACH	
606-08.01	TEST PILES (TREATED TIMBER, SIZE 2)	L.F.	
606-08.02	LOADING TESTS (TREATED TIMBER, SIZE 2)	EACH	
606-08.03	TREATED TIMBER PILES (SIZE 2)	L.F.	
606-08.05	PILE TIPS (TIMBER, SIZE 2)	EACH	
606-09.01	TEST PILES (PRECAST CONCRETE, SIZE 1)	L.F.	
606-09.02	LOADING TEST (PRECAST CONCRETE, SIZE 1)	EACH	
606-09.03	PRECAST CONCRETE PILES (SIZE 1)	L.F.	
606-09.05	PILE TIPS (CONCRETE SIZE 1)(14 X 14)	EACH	
606-09.99	PRECAST CONCRETE PILES (SIZE _____)	L.F.	

606-10.01	TEST PILES (PRECAST CONCRETE, SIZE 2)	L.F.	
606-10.02	LOADING TEST (PRECAST CONCRETE, SIZE 2)	EACH	
606-10.03	PRECAST CONCRETE PILES (SIZE 2)	L.F.	
606-10.05	PILE TIPS (CONCRETE SIZE 2) (16 X 16)	EACH	
606-11.01	TEST PILES (CAST-IN-PLACE CONCRETE PILES)	L.F.	
606-11.02	LOADING TESTS (CAST-IN-PLACE CONCRETE PILES)	EACH	
606-11.03	CAST-IN-PLACE CONCRETE PILES	L.F.	
606-12.01	PILE ANCHORAGE SYSTEM (SEISMIC)	EACH	
606-12.02	ANCHORAGE SYSTEM (CABLE ENCASEMENT)	EACH	
606-15.01	TEST PILES (PRECAST CONCRETE) 18" SQUARE	L.F.	
606-15.02	LOADING TEST (PRECAST CONCRETE) 18" SQUARE	EACH	
606-15.03	18" PRESTRESSED CONCRETE PILES	L.F.	
606-15.04	PILE TIPS (CONCRETE)(18 X 18)	EACH	
606-15.06	PILE REMOVAL (DESCRIPTION)	EACH	
606-16.01	TEST PILES (STEEL PIPE PILES 10-INCH)	L.F.	
606-16.02	LOADING TEST (STEEL PIPE PILES 10-INCH)	EACH	
606-16.03	STEEL PIPE PILES (10-INCH)	L.F.	
606-16.05	STEEL PIPE PILES (10-INCH) COLUMN	L.F.	
606-16.06	PILE TIPS (STEEL PIPE PILES, 10-INCH)	EACH	
606-17.01	TEST PILES (STEEL PIPE PILES, 12-INCH)	L.F.	
606-17.02	LOADING TEST (STEEL PIPE PILES, 12-INCH)	EACH	
606-17.03	STEEL PIPE PILES (12-INCH)	L.F.	
606-17.05	STEEL PIPE PILES (12-INCH) COLUMN	L.F.	
606-17.06	PILE TIPS (STEEL PIPE PILES, 12-INCH)	EACH	
606-18.01	TEST PILES (STEEL PIPE PILES, 14-INCH)	L.F.	
606-18.02	LOADING TEST (STEEL PIPE PILES, 14-INCH)	EACH	

606-18.03	STEEL PIPE PILES (14-INCH)	L.F.	
606-18.05	STEEL PIPE PILES (14-INCH) COLUMN	L.F.	
606-18.06	PILE TIPS (STEEL PIPE PILES, 14-INCH)	EACH	
606-19.01	TEST PILES (STEEL PIPE PILES, 16-INCH)	L.F.	
606-19.02	LOADING TEST (STEEL PIPE PILES, 16-INCH)	EACH	
606-19.03	STEEL PIPE PILES (16-INCH)	L.F.	
606-19.05	STEEL PIPE PILES (16-INCH) COLUMN	L.F.	
606-19.06	PILE TIPS (STEEL PIPE PILES, 16-INCH)	EACH	
606-20.01	TEST PILES (STEEL PIPE PILES, 18-INCH)	L.F.	
606-20.02	LOADING TEST (STEEL PIPE PILES, 18-INCH)	EACH	
606-20.03	STEEL PIPE PILES (18-INCH)	L.F.	
606-20.05	STEEL PIPE PILES (18-INCH) COLUMN	L.F.	
606-20.06	PILE TIPS (STEEL PIPE PILES, 18-INCH)	EACH	
606-20.10	TEST PILES (STEEL PIPE PILES, SIZE)	L.F.	
606-20.20	LOADING TEST (STEEL PIPE PILES, SIZE)	EACH	
606-20.30	STEEL PIPE PILES (SIZE)	L.F.	
606-20.50	STEEL PIPE PILES - COLUMN (SIZE)	L.F.	
606-20.60	PILE TIPS - STEEL PIPE PILES (SIZE)	EACH	
606-21.10	TEST PILES - STEEL PIPE PILES (SIZE)	L.F.	
606-21.20	LOADING TEST - STEEL PIPE PILES (SIZE)	EACH	
606-21.30	STEEL PIPE PILES (SIZE)	L.F.	
606-21.50	STEEL PIPE PILES - COLUMN (SIZE)	L.F.	
606-21.60	PILE TIPS - STEEL PIPE PILES (SIZE)	EACH	
606-22.01	STEEL PIPE PILES (20 IN)	L.F.	
606-22.02	PILE TIPS (STEEL PIPE PILES 20 IN)	EACH	
606-22.03	TEST PILES (STEEL PIPE PILES 20 IN)	L.F.	
606-22.04	LOAD TESTING (STEEL PIPE PILES 20 IN)	EACH	
606-22.07	STEEL PIPE PILES (22 IN)	L.F.	
606-22.08	PILE TIPS (STEEL PIPE PILES 22 IN)	EACH	

606-22.09	TEST PILES (STEEL PIPE PILES 22 IN)	L.F.	
606-22.10	LOAD TESTING (STEEL PIPE PILES 22 IN)	EACH	
606-22.13	STEEL PIPE PILES (24 IN)	L.F.	
606-22.14	PILE TIPS (STEEL PIPE PILES 24 IN)	EACH	
606-22.15	TEST PILES (STEEL PIPE PILES 24 IN)	L.F.	
606-22.16	LOAD TESTING (STEEL PIPE PILES 24 IN)	EACH	
606-23.01	STEEL PIPE PILES AND TIPS (24-INCH)	L.F.	
606-24.10	SHEET PILES	S.F.	
606-24.11	SHEET PILES	L.S.	
606-24.12	TEMPORARY SHEET PILES	S.F.	
606-24.13	TEMPORARY SHEET PILES	L.S.	
606-25.01	TEST PILES (10" ROUND CONCRETE FILLED)	L.F.	
606-25.02	LOAD TEST (10" ROUND CONCRETE FILLED)	EACH	
606-25.03	10" ROUND STEEL PILES (CONCRETE FILLED)	L.F.	
606-28.03	MICROPILE (7 5/8" S .500" MICROPILE)	L.F.	
606-28.05	VERIFICATION LOADING TEST	EACH	TO BE USED FOR ALL VERIFICATION TESTS REGARDLESS OF MICROPILE SIZE.
606-28.06	PROOF LOADING TEST	EACH	TO BE USED FOR ALL PROOF LOADING TESTS REGARDLESS OF MICROPILE SIZE.
606-28.12	MICROPILE (9 5/8" X .500" MICROPILE)	L.F.	
606-28.14	MICROPILE (10 3/4" X .545" MICROPILE)	L.F.	

8-607.00 PIPE CULVERTS AND STORM SEWERS

Item Number	Description	Unit of Measurement	Comment
607-01.02	12" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-02.01	15" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-02.02	15" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-02.03	15" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-02.04	15" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-02.30	15IN PIPE CULVERT	L.F.	
607-03.02	18" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-03.03	18" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-03.04	18" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-03.05	18" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-03.30	18" PIPE CULVERT	L.F.	
607-05.01	24" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-05.02	24" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-05.03	24" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-05.04	24" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-05.05	24" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-05.06	24" PIPE CULVERT (JACKED-IN-PLACE)	L.F.	
607-05.07	24" CONCRETE PIPE CULVERT CLASS V (JACKED-IN-PLACE)	L.F.	
607-05.30	24" PIPE CULVERT	L.F.	
607-06.01	30" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-06.02	30" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-06.03	30" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	

607-06.04	30" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-06.05	30" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-06.06	30" PIPE CULVERT (JACKED-IN-PLACE)	L.F.	
607-06.07	36" PIPE CULVERT (JACKED-IN-PLACE)	L.F.	
607-06.08	36" CONCRETE PIPE CULVERT CLASS V (JACKED-IN-PLACE)	L.F.	
607-06.30	30" PIPE CULVERT	L.F.	
607-07.01	36" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-07.02	36" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-07.03	36" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-07.04	36" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-07.05	36" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-07.30	36" PIPE CULVERT	L.F.	
607-08.01	42" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-08.02	42" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-08.03	42" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-08.04	42" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-08.05	42" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-08.06	42" CONCRETE PIPE CULVERT (CLASS V) JACKED-IN-PLACE	L.F.	
607-08.30	42" PIPE CULVERT	L.F.	
607-09.01	48" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-09.02	48" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-09.03	48" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-09.04	48" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-09.05	48" CONCRETE PIPE CULVERT (CLASS IV)J ACKED-IN-PLACE	L.F.	
607-09.30	48" PIPE CULVERT	L.F.	

607-10.01	54" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-10.02	54" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-10.03	54" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-10.04	54" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-10.05	54" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-10.30	54" PIPE CULVERT	L.F.	
607-11.01	60" CONCRETE PIPE CULVERT (CLASS I)	L.F.	
607-11.02	60" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-11.03	60" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-11.04	60" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-11.05	60" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-11.06	60" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-11.07	66" CONCRETE PIPE CULVERT (CLASS IV) JACKED-IN-PLACE	L.F.	
607-11.30	60" PIPE CULVERT	L.F.	
607-12.01	66" CONCRETE PIPE CULVERT (CLASS I)	L.F.	
607-12.02	66" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-12.03	66" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-12.04	66" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-12.05	66" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-12.30	66" PIPE CULVERT	L.F.	
607-13.01	72" CONCRETE PIPE CULVERT (CLASS I)	L.F.	
607-13.02	72" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-13.03	72" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-13.04	72" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-13.05	72" CONCRETE PIPE CULVERT (CLASS V)	L.F.	

607-13.30	72" PIPE CULVERT	L.F.	
607-14.01	78" CONCRETE PIPE CULVERT (CLASS I)	L.F.	
607-14.02	78" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-14.03	78" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-14.04	78" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-14.05	78" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-14.30	78" PIPE CULVERT	L.F.	
607-15.01	84" CONCRETE PIPE CULVERT (CLASS I)	L.F.	
607-15.02	84" CONCRETE PIPE CULVERT (CLASS II)	L.F.	
607-15.03	84" CONCRETE PIPE CULVERT (CLASS III)	L.F.	
607-15.04	84" CONCRETE PIPE CULVERT (CLASS IV)	L.F.	
607-15.05	84" CONCRETE PIPE CULVERT (CLASS V)	L.F.	
607-15.30	84" PIPE CULVERT	L.F.	
607-16.01	23"X 14" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.02	30"X 19" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.03	34"X 22" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.04	38"X 24" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.05	45"X 29" HORIZONTAL OVAL CONCRETE PIPE CULVERT (CLASS__)	L.F.	
607-16.06	45"X 29" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.07	49"X 32" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.08	53"X 34" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.09	60"X 38" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.10	68"X 43" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.11	76"X 48" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	

607-16.12	83"X 53" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.13	91"X 58" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.14	98"X 63" HORIZONTAL OVAL CONCRETE. PIPE CULVERT	L.F.	
607-16.15	106"X 68" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.16	113"X 72" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.17	121"X 77" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.18	128"X 82" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.19	136"X 87" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.20	143"X 92" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.21	151"X 97" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.22	166"X 106" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.23	180"X 116" HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.34	34IN X 22IN HORIZONTAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-16.99	HORIZONTAL OVAL CONCRETE PIPE CULVERT (DESCRIPTION)	L.F.	
607-17.06	29"X 45" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.07	32"X 49" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.08	34"X 53" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.09	38"X 60" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.10	43"X 68" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.11	48"X 76" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.12	53"X 83" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.13	58"X 91" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.14	63"X 98" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	

607-17.15	68"X 106" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.16	72"X 113" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.17	77"X 121" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.18	82"X 128" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.19	87"X 136" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.20	92"X 143" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.21	97"X 151" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.22	106"X 166" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.23	116"X 180" VERTICAL OVAL CONCRETE PIPE CULVERT	L.F.	
607-17.24	48"X 72" FLAT BASE CONCRETE PIPE CULVERT (CP)	L.F.	
607-18.01	CULVERT INSPECTION WITH CAMERA	L.F.	
607-19.01	18 IN A-2000 PVC	L.F.	
607-19.02	24 IN A-2000 PVC	L.F.	
607-19.03	30 IN A-2000 PVC	L.F.	
607-19.04	36 IN A-2000 PVC	L.F.	
607-20.01	18" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.02	24" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.03	30" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.04	36" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.05	42" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.06	48" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.07	54" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS	L.F.	
607-20.08	60" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.09	66" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.10	72" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	

607-20.11	78" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-20.12	84" CROSSDRAIN PIPE CULVERT (COLLECTORS & LOCAL ROADS)	L.F.	
607-25.01	SAPL TYPE 1 GROUT (PIPE/CULVERT REPAIR)	C.F.	SP607SAPL
607-25.02	SPRAY APPLIED PIPE LINER (SAPL)	C.F.	SP607SAPL
607-36.01 to 607-36.05	FLAP GATE (SIZE PIPE)	EACH	
607-36.06 to 607-36.10	FLOOD GATE (BOX SIZE)	EACH	
607-37.01	15" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.02	18" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.03	24" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.04	30" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.05	36" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.06	42" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.07	48" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.08	54" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.09	60" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.10	66" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.11	72" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.12	78" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.13	84" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.14	90" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.15	96" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.16	102" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.17	108" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.18	114" CORRUGATED METAL PIPE CULVERT	L.F.	

607-37.19	120" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.20	126" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.21	132" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.22	138" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.23	144" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.24	150" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.25	156" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.26	162" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.27	168" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.28	174" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.29	180" CORRUGATED METAL PIPE CULVERT	L.F.	
607-37.30	12IN CORRUGATED METAL PIPE CULVERT	L.F.	
607-38.02	18" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.03	24" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.04	30" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.05	36" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.06	42" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.07	48" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.08	54" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.09	60" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.10	66" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.11	72" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.12	78" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	

607-38.13	84" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.14	90" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.15	96" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.16	102" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.17	108" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.18	114" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.19	120" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.20	126" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.21	132" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.22	138" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.23	144" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.24	150" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.25	156" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.26	162" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.27	168" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.28	174" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-38.29	180" CORRUGATED METAL PIPE CULVERT (PRECOATED)	L.F.	
607-39.01	15" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.02	18" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.03	24" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.04	30" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.05	36" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.06	42" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.07	48" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.08	54" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.09	60" PIPE CULVERT (SIDE DRAIN)	L.F.	
607-39.10	66" PIPE CULVERT (SIDE DRAIN)	L.F.	

607-40.02	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 18" ROUND)	L.F.	
607-40.03	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 21" ROUND)	L.F.	
607-40.04	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 24" ROUND)	L.F.	
607-40.05	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 30" ROUND)	L.F.	
607-40.06	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 36" ROUND)	L.F.	
607-40.07	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 42" ROUND)	L.F.	
607-40.08	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 48" ROUND)	L.F.	
607-40.09	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 54" ROUND)	L.F.	
607-40.10	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 60" ROUND)	L.F.	
607-40.11	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 66" ROUND)	L.F.	
607-40.12	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 72" ROUND)	L.F.	
607-40.13	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 78" ROUND)	L.F.	
607-40.14	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 84" ROUND)	L.F.	
607-40.15	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 90" ROUND)	L.F.	
607-40.16	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 96" ROUND)	L.F.	
607-40.17	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 102" ROUND)	L.F.	
607-40.18	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 108" ROUND)	L.F.	
607-40.19	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 114" ROUND)	L.F.	
607-40.20	CORRUGATED METAL PIPE ARCH (SIZE EQUVI. 120" ROUND)	L.F.	
607-40.21	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 126" ROUND)	L.F.	
607-40.22	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 132" ROUND)	L.F.	
607-40.23	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 138" ROUND)	L.F.	
607-40.24	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 144" ROUND)	L.F.	

607-40.25	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 150" ROUND)	L.F.	
607-40.26	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 156" ROUND)	L.F.	
607-40.27	CORRUGATED METAL PIPE ARCH (SIZE EQUIV. 162" ROUND)	L.F.	
607-40.70	CORRUGATED ALUMINUM BOX CULVERT (SIZE)	L.F.	
607-40.71	CORRUGATED ALUMINUM BOX CULVERT (SIZE)	L.F.	
607-40.72	CORRUGATED ALUMINUM BOX CULVERT (SIZE)	L.F.	
607-40.73	CORRUGATED ALUMINUM BOX CULVERT (SIZE)	L.F.	
607-40.74	CORRUGATED ALUMINUM BOX CULVERT (SIZE)	L.F.	
607-40.75	CORRUGATED ALUMINUM BOX CULVERT (SIZE)	L.F.	
607-41.02	15" SLOPE DRAIN PIPE	L.F.	EC-STR-29
607-41.03	18" SLOPE DRAIN PIPE	L.F.	EC-STR-29
607-41.04	24" SLOPE DRAIN PIPE	L.F.	EC-STR-29
607-41.05	30" SLOPE DRAIN PIPE	L.F.	EC-STR-29
607-41.06	36" SLOPE DRAIN PIPE	L.F.	EC-STR-29
607-45	12" SLOTTED DRAIN PIPE	L.F.	
607-45.01	15" SLOTTED DRAIN PIPE	L.F.	
607-45.02	18" SLOTTED DRAIN PIPE	L.F.	
607-45.03	24" SLOTTED DRAIN PIPE	L.F.	
607-45.04	30" SLOTTED DRAIN PIPE	L.F.	
607-45.05	36" SLOTTED DRAIN PIPE	L.F.	
607-50.01	PRECAST CONCRETE BOX CULVERT (10' X 5')	L.F.	
607-50.02	PRECAST CONCRETE BOX CULVERT (10' X 7')	L.F.	
607-50.03	PRECAST CONCRETE BOX CULVERT (12' X 4')	L.F.	
607-50.04	PRECAST CONCRETE BOX CULVERT (10' X 4')	L.F.	
607-50.05	PRECAST CONCRETE BOX CULVERT (8' X 4')	L.F.	
607-50.06	PRECAST CONCRETE BOX CULVERT (12' X 8')	L.F.	
607-50.07	PRECAST CONCRETE BOX CULVERT (12' X 6')	L.F.	
607-50.08	PRECAST CONCRETE BOX CULVERT (10' X 6')	L.F.	

607-50.09	PRECAST CONCRETE BOX CULVERT (6' X 4')	L.F.	
607-50.10	PRECAST CONCRETE BOX CULVERT (10' X 8')	L.F.	
607-50.11	PRECAST CONCRETE BOX CULVERT (8' X 6')	L.F.	
607-50.12	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.13	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.14	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.15	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.16	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.17	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.18	PRECAST CONCRETE BOX CULVERT (SIZE)	L.F.	
607-50.30 to 607-50.35	PRECAST CONCRETE BOX BRIDGE (SIZE)	L.F.	
607-50.50 to 607-50.55	PRECAST CONCRETE BOX CULVERT (SIZE)	L.S.	
607-50.60 to 607-50.64	THREE SIDED PRECAST CULVERT STRUCTURE - BARREL(SIZE)	L.F.	SP607CS
607-50.65	THREE SIDED PRECAST CULVERT STRUCTURE - BARREL(SIZE)	L.S.	SP607CS
607-57.01	REINFORCED CONCRETE PIPE ARCH (22" X 13")	L.F.	
607-57.02	REINFORCED CONCRETE PIPE ARCH (29" X 18")	L.F.	
607-57.03	REINFORCED CONCRETE PIPE ARCH (36" X 23")	L.F.	
607-57.04	REINFORCED CONCRETE PIPE ARCH (44" X 27")	L.F.	
607-57.05	REINFORCED CONCRETE PIPE ARCH (51" X 31")	L.F.	
607-57.06	REINFORCED CONCRETE PIPE ARCH (58" X 36")	L.F.	
607-57.07	REINFORCED CONCRETE PIPE ARCH (65" X 40")	L.F.	
607-57.08	REINFORCED CONCRETE PIPE ARCH (73" x 45")	L.F.	
607-57.09 to 607-57.10	REINFORCED CONCRETE PIPE ARCH (SIZE)	L.F.	

607-60.01 to 607-60.09	ENCASEMENT PIPE (DESCRIPTION)	L.F.	
607-60.11	18" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.12	24" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.13	30" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.14	42" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.15	48" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.16	54 STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.17	60" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-60.18	36" STEEL PIPE CULVERT (JACK-IN-PLACE)	L.F.	
607-65.19	SITE PREPARATION	L.S.	
607-65.20	SITE PREPARATION	EACH	
607-65.57	6IN MINIMUM ID PIPE TO SLIP LINE 8IN PIPE	L.F.	
607-65.61	10" MINIMUM ID PIPE TO SLIP LINE 12" PIPE	L.F.	SP607G
607-65.62	12" MINIMUM ID PIPE TO SLIP LINE 15" PIPE	L.F.	SP607G
607-65.63	15" MINIMUM ID PIPE TO SLIP LINE 18" PIPE	L.F.	SP607G
607-65.64	18" MINIMUM ID PIPE TO SLIP LINE 24" PIPE	L.F.	SP607G
607-65.65	24" MINIMUM ID PIPE TO SLIP LINE 30" PIPE	L.F.	SP607G
607-65.66	30" MINIMUM ID PIPE TO SLIP LINE 36" PIPE	L.F.	SP607G
607-65.67	33" MINIMUM ID PIPE TO SLIP LINE 42" PIPE	L.F.	SP607G
607-65.68	36" MINIMUM ID PIPE TO SLIP LINE 48" PIPE	L.F.	SP607G
607-65.69	42" MINIMUM ID PIPE TO SLIP LINE 54" PIPE	L.F.	SP607G
607-65.70	48" MINIMUM ID PIPE TO SLIP LINE 60" PIPE	L.F.	SP607G
607-65.71	60" MINIMUM ID PIPE TO SLIP LINE 72" PIPE	L.F.	SP607G
607-65.72	21" MINIMUM ID PIPE TO SLIP LINE 30" PIPE	L.F.	SP607G

607-65.73	27" MINIMUM ID PIPE TO SLIP LINE 36" PIPE	L.F.	SP607G
607-65.74	30" MINIMUM ID PIPE TO SLIP LINE 42" PIPE	L.F.	SP607G
607-65.75	40" MINIMUM ID PIPE TO SLIP LINE 54" PIPE	L.F.	SP607G
607-65.76	42" MINIMUM ID PIPE TO SLIP LINE 60" PIPE	L.F.	SP607G
607-65.77	40IN X 56IN HDPE TO SLIP LINE 47IN X 71IN	L.F.	SP607G
607-65.78	54IN MIN I.D. to SLIP LINE 60IN CMP	L.F.	SP607G
607-65.79	54"MINIMUM ID PIPE TO SLIP LINE 72"PIPE	L.F.	SP607G
607-65.80	60IN MIN ID PIPE TO SLIP LINE 66IN PIPE	L.F.	SP607G
607-65.81	60X47IN MIN ID PIPE TO SLIP LINE 70X50IN PIPE	L.F.	SP607G
607-65.89	10.75" OD PIPE TO SLIP LINE 12" PIPE	L.F.	
607-65.90	12.75" OD PIPE TO SLIP LINE 16" PIPE	L.F.	
607-65.91	16" OD PIPE TO SLIP LINE 18" PIPE	L.F.	
607-65.92	20" OD PIPE TO SLIP LINE 24" PIPE	L.F.	
607-65.93	28" OD PIPE TO SLIP LINE 32" PIPE	L.F.	
607-65.94	32" OD PIPE TO SLIP LINE 36" PIPE	L.F.	
607-65.95	36" OD PIPE TO SLIP LINE 42" PIPE	L.F.	
607-65.96	48" OD PIPE TO SLIP LINE 54" PIPE	L.F.	
607-66.01	PORTLAND CEMENT 94 LB BAG	EACH	

8-610.00 PIPE DRAINS

Item Number	Description	Unit of Measurement	Comment
610-07.01	12" PIPE DRAIN (BRIDGE DRAIN)	L.F.	
610-07.02	15" PIPE DRAIN (BRIDGE DRAIN)	L.F.	
610-07.03	18" PIPE DRAIN (BRIDGE DRAIN)	L.F.	
610-09.01	DRAINAGE SYSTEM RAILROAD ABUTS & RETAINING WALL(DESCR)	L.S.	
610-09.02 to 610-09.03	DRAINAGE SYSTEM RAILROAD ABUTS & RETAINING WALL(DESCR)	L.S.	
610-10.01 to 610-10.03	DRAINAGE SYSTEM RAILROAD - BRIDGE DECK(DESCR)	L.S.	
610-10.04, 610-10.14	DRAINAGE SYSTEM - BRIDGE DECK (DESCRIPTION)	L.S.	

610-10.35 to 610-10.36	MODIFY BRIDGE DECK DRAIN SYSTEM	L.S.	
610-10.40 to 610-10.41	BRIDGE DECK DRAINS	L.S.	
610-10.45 to 610-10.46	DECK DRAINS (DESCRIPTION)	EACH	
610-12.01	HORIZONTAL DRAINS AND CASING	L.F.	Utilized for emergency and CMGC
610-12.02	HORIZONTAL DRAINS	L.F.	Utilized for emergency and CMGC
610-12.03	HORIZONTAL DRAIN OUTLET	EACH	

8-611.00 MANHOLES, CATCHBASINS, INLETS, AND PIPE END WALLS

Item Number	Description	Unit of Measurement	Comment
611-01.01	MANHOLES, 0' - 4' DEPTH	EACH	
611-01.02	MANHOLES, > 4' - 8' DEPTH	EACH	D-MH-2, D-MH-5, D-MH-6, D-MH-7
611-01.03	MANHOLES, > 8' - 12' DEPTH	EACH	D-MH-2, D-MH-5, D-MH-6, D-MH-7
611-01.04	MANHOLES, > 12' - 16' DEPTH	EACH	D-MH-2, D-MH-5, D-MH-6, D-MH-7
611-01.05	MANHOLES, > 16' - 20' DEPTH	EACH	D-MH-2, D-MH-5, D-MH-6, D-MH-7
611-01.06	MANHOLES, > 20' - 24' DEPTH	EACH	D-MH-2, D-MH-5, D-MH-6, D-MH-7
611-01.07	MANHOLES, > 24' - 28' DEPTH	EACH	D-MH-2, D-MH-5, D-MH-6, D-MH-7
611-01.08	MANHOLES, > 28' - 32' DEPTH	EACH	
611-01.10 to 611-01.19	MANHOLES,(__' - __' DEPTH)	EACH	D-MH-2

611-01.20	ADJUSTMENT OF EXISTING MANHOLE	EACH	
611-01.21	REWORK MANHOLE	EACH	
611-01.22	CAPPING EXISTING MANHOLE	EACH	
611-01.23	ADJUSTMENT OF WATER VALVE	EACH	
611-02.01	SPRING DRAIN BOX, TYPE 1	EACH	D-SDS-1
611-02.02	SPRING DRAIN BOX, TYPE 2A	EACH	D-SDS-2A
611-02.03	SPRING DRAIN BOX, TYPE 2B	EACH	D-SDS-2B
611-02.04	SPRING DRAIN BOX, TYPE 3A	EACH	D-SDS-3A
611-02.10	JUNCTION BOX, TYPE 1	EACH	D-JBS-1
611-02.11	JUNCTION BOX, TYPE 2	EACH	D-JBS-2
611-02.12	JUNCTION BOX, TYPE 3	EACH	D-JBS-3
611-02.13	JUNCTION BOX, TYPE 4	EACH	D-JBS-4
611-02.14	JUNCTION BOX, TYPE 5	EACH	D-JBS-5
611-02.15	JUNCTION BOX, TYPE 6	EACH	
611-02.16	JUNCTION BOX (DESCRIPTION)	EACH	
611-02.20 to 611-02.25	SPRING DRAIN BOX(DESCRIPTION)	EACH	
611-03.04	GRAY IRON CASTINGS (CATCHBASIN)	LB	D-CBB-12A,12B, 12D,13,31,42
611-05.01	TRENCH DRAINS	L.F.	MM-SW-2,D-TD-1
611-05.02	12IN PVC PIPE FOR TRENCH DRAINS	L.F.	
611-06.10	BRIDGE END DRAIN (2' X 3')	EACH	
611-06.11	BRIDGE END DRAIN (4' X 3')	EACH	
611-06.12	BRIDGE END DRAIN (6' X 3')	EACH	
611-06.13 to 611-06.15	BRIDGE END DRAIN (SIZE)	EACH	
611-07.01	CLASS A CONCRETE (PIPE ENDWALLS)	C.Y.	D-PE-4;SD-MSE-1
611-07.02	STEEL BAR REINFORCEMENT (PIPE ENDWALLS)	LB.	D-PE-4
611-07.03	STRUCTURAL STEEL (PIPE ENDWALLS)	LB.	
611-07.10	CLEAN DRAIN (TRENCH DRAIN)	L.F.	
611-07.11	CLEAN DRAIN(WITH GRATE)	EACH	
611-07.12	CLEAN DRAIN(WALL DRAIN)	EACH	
611-07.13	PIPE CLEANING (<18IN DIA.)	L.F.	
611-07.14	PIPE CLEANING (>OR=18IN DIA.)	L.F.	
611-07.16	PIPE CLEANING (18IN TO 24IN)	L.F.	
611-07.17	PIPE CLEANING (>24IN TO 36IN)	L.F.	

611-07.18	PIPE CLEANING (>36IN TO 42IN)	L.F.	
611-07.19	PIPE CLEANING (>42IN TO 60IN)	L.F.	
611-07.30	15IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.31	18IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.32	24IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.33	30IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.34	36IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.35	42IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.36	48IN ENDWALL (SIDE DRAIN)	EACH	D-SEW-1A
611-07.51	15IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-15A
611-07.52	15IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-15A
611-07.53	15IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-15A
611-07.54	18IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-18A
611-07.55	18IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-18A
611-07.56	18IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-18A
611-07.57	24IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-24A
611-07.58	24IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-24A
611-07.59	24IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-24A
611-07.60	30IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-30A
611-07.61	30IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-30A
611-07.62	30IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-30A
611-07.63	36IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-36A
611-07.64	36IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-36A
611-07.65	36IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-36A
611-07.66	42IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-42A
611-07.67	42IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-42A
611-07.68	42IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-42A
611-07.69	48IN ENDWALL (CROSS DRAIN) 3:1	EACH	D-PE-48A
611-07.70	48IN ENDWALL (CROSS DRAIN) 4:1	EACH	D-PE-48A
611-07.71	48IN ENDWALL (CROSS DRAIN) 6:1	EACH	D-PE-48A
611-07.72	15IN ENDWALL (MEDIAN DRAIN)	EACH	D-SEW-12D
611-07.73	18IN ENDWALL (MEDIAN DRAIN)	EACH	D-SEW-12D
611-09.01	ADJUSTMENT OF EXISTING CATCHBASIN	EACH	
611-09.02	REWORK CATCHBASIN	EACH	
611-09.03	CAPPING EXISTING CATCHBASIN	EACH	
611-09.04	CATCHBASIN RETROFIT	EACH	
611-10.01	CATCH BASINS, TYPE 10, 0' - 4' DEPTH	EACH	D-CB-10LPC, 10RA, 10S, 10SB

611-10.02	CATCH BASINS, TYPE 10, > 4' - 8' DEPTH	EACH	D-CB-10LPC, 10RA,10S,10 SB
611-10.03	CATCH BASINS, TYPE 10, > 8' - 12' DEPTH	EACH	D-CB-10RA, 10S,10SB
611-10.04	CATCH BASINS, TYPE 10, > 12' - 16' DEPTH	EACH	D-CB-10RA,10S,10 SB
611-10.05	CATCH BASINS, TYPE 10, > 16' - 20' DEPTH	EACH	D-CB-10RA, 10S,10SB
611-10.06	CATCH BASINS, TYPE 10, > 20' - 24' DEPTH	EACH	D-CB-10SB
611-10.07	CATCH BASINS, TYPE 10, > 24' - 28' DEPTH	EACH	D-CB-10SB
611-10.08	CATCH BASINS, TYPE 10, >(' - ' DEPTH)	EACH	
611-12.01	CATCH BASINS, TYPE 12, 0' - 4' DEPTH	EACH	D-CB-12LP, 12P, 12RA, 12RB, 12S, 12SB; D-CB-DI
611-12.02	CATCH BASINS, TYPE 12, > 4' - 8' DEPTH	EACH	D-CB-12LP, 12RA,12RC,12RC, 12S,12SB,12SC, 12SD, 12SE
611-12.03	CATCH BASINS, TYPE 12, > 8' - 12' DEPTH	EACH	D-CB-12P, 12RA,12RB,12RC,12S,12SB,12SC,12SD,12SE
611-12.04	CATCH BASINS, TYPE 12, > 12' - 16' DEPTH	EACH	D-CB-12RA,12RB,12RC,12S,12SB,12SC,12SD,12SE
611-12.05	CATCH BASINS, TYPE 12, > 16' - 20' DEPTH	EACH	D-CB-12RA, 12RB,12RC,12S,12SB,12SC,12SD,12SE
611-12.06	CATCH BASINS, TYPE 12, > 20' - 24' DEPTH	EACH	D-CB-12RB,12RC,12SB,12SC,12SD,12SE
611-12.07	CATCH BASINS, TYPE 12, > 24' - 28' DEPTH	EACH	D-CB-12RB, 12RC, 12SB,

			12SC, 12SD, 12SE
611-12.08	CATCH BASINS, TYPE 12, >(' - ' DEPTH)	EACH	D-CB-12RB, 12RC
611-13.01	CATCH BASINS, TYPE 13, 0' - 4' DEPTH	EACH	D-CB-13P, 13RA,13RB,13S
611-13.02	CATCH BASINS, TYPE 13, > 4' - 8' DEPTH	EACH	D-CB-13P, 13RA,13RB,13RC,13S
611-13.03	CATCH BASINS, TYPE 13, > 8' - 12' DEPTH	EACH	D-CB-13P, 13RA,13RB,13RC,13S
611-13.04	CATCH BASINS, TYPE 13, > 12' - 16' DEPTH	EACH	D-CB-13RA, 13RB,13RC,13S
611-13.05	CATCH BASINS, TYPE 13, > 16' - 20' DEPTH	EACH	D-CB-13RA, 13RB,13RC,13S
611-13.06	CATCH BASINS, TYPE 13, > 20' - 24' DEPTH	EACH	D-CB-13RB, 13RC
611-13.07	CATCH BASINS, TYPE 13, > 24' - 28' DEPTH	EACH	D-CB-13RB, 13RC
611-13.08	CATCH BASINS, TYPE 13, >(' - ' DEPTH)	EACH	D-CB-13RB, 13RC
611-14.01	CATCH BASINS, TYPE 14, 0' - 4' DEPTH	EACH	D-CB-DI
611-14.02	CATCH BASINS, TYPE 14, > 4' - 8' DEPTH	EACH	D-CB-14P, 14RB,14S,14SE
611-14.03	CATCH BASINS, TYPE 14, > 8' - 12' DEPTH	EACH	D-CB-14P, 14RB,14S,14SE
611-14.04	CATCH BASINS, TYPE 14, > 12' - 16' DEPTH	EACH	D-CB-14RB, 14S,14SE
611-14.05	CATCH BASINS, TYPE 14, > 16' - 20' DEPTH	EACH	D-CB-14RB, 14S,14SE
611-14.06	CATCH BASINS, TYPE 14, > 20' - 24' DEPTH	EACH	D-CB-14RB, 14S,14SE
611-14.07	CATCH BASINS, TYPE 14, > 24' - 28' DEPTH	EACH	D-CB-14RB, 14SE
611-14.08	CATCH BASINS, TYPE 14, >(' - ' DEPTH)	EACH	D-CB-14RB
611-16.01	CATCH BASINS, TYPE 16, 0' - 4' DEPTH	EACH	
611-16.02	CATCH BASINS, TYPE 16, > 4' - 8' DEPTH	EACH	D-CB-16S

611-16.03	CATCH BASINS, TYPE 16, > 8' - 12' DEPTH	EACH	D-CB-16S
611-16.04	CATCH BASINS, TYPE 16, > 12' - 16' DEPTH	EACH	D-CB-16S
611-16.05	CATCH BASINS, TYPE 16, > 16' - 20' DEPTH	EACH	D-CB-16S
611-16.08	CATCH BASINS, TYPE 16, >(' - ' DEPTH)	EACH	
611-17.01	CATCH BASINS, TYPE 17, 0' - 4' DEPTH	EACH	
611-17.02	CATCH BASINS, TYPE 17, > 4' - 8' DEPTH	EACH	D-CB-17S
611-17.03	CATCH BASINS, TYPE 17, > 8' - 12' DEPTH	EACH	D-CB-17S
611-17.04	CATCH BASINS, TYPE 17, > 12' - 16' DEPTH	EACH	D-CB-17S
611-17.05	CATCH BASINS, TYPE 17, > 16' - 20' DEPTH	EACH	D-CB-17S
611-17.08	CATCH BASINS, TYPE 17, >(' - ' DEPTH)	EACH	
611-25.01	CATCH BASINS, TYPE 25, 0' - 4' DEPTH	EACH	D-CB-25LP, 25P,25RA,25 RB,25S,25SB
611-25.02	CATCH BASINS, TYPE 25, > 4' - 8' DEPTH	EACH	D-CB-25LP, 25P,25RA,25 RB,25S,25SB ,25SC,25SD, 25SE
611-25.03	CATCH BASINS, TYPE 25, > 8' - 12' DEPTH	EACH	D-CB-25P, 25RA,25RB,2 5S,25SB,25S C,25SD,25SE
611-25.04	CATCH BASINS, TYPE 25, > 12' - 16' DEPTH	EACH	D-CB-25RA, 25RB,25S,25 SB,25SC,25S D,25SE
611-25.05	CATCH BASINS, TYPE 25, > 16' - 20' DEPTH	EACH	D-CB-25RA, 25RB,25S,25 SB,25SC,25S D,25SE
611-25.06	CATCH BASINS, TYPE 25, > 20' - 24' DEPTH	EACH	D-CB-25RB, 25SB,25SD,2 5SE
611-25.07	CATCH BASINS, TYPE 25, > 24' - 28' DEPTH	EACH	D-CB-25RB, 25SB,25SD,2 5SE
611-25.08	CATCH BASINS, TYPE 25, >(' - ' DEPTH)	EACH	D-CB-25RB

611-26.01	CATCH BASINS, TYPE 26, 0' - 4' DEPTH	EACH	
611-26.02	CATCH BASINS, TYPE 26, > 4' - 8' DEPTH	EACH	D-CB-26P, 26S
611-26.03	CATCH BASINS, TYPE 26, > 8' - 12' DEPTH	EACH	D-CB-26S
611-26.04	CATCH BASINS, TYPE 26, > 12' - 16' DEPTH	EACH	D-CB-26S
611-26.05	CATCH BASINS, TYPE 26, > 16' - 20' DEPTH	EACH	D-CB-26S
611-26.08	CATCH BASINS, TYPE 26, >(' - ' DEPTH)	EACH	
611-27.01	CATCH BASINS, TYPE 27, 0' - 4' DEPTH	EACH	
611-27.02	CATCH BASINS, TYPE 27, > 4' - 8' DEPTH	EACH	D-CB-27S
611-27.03	CATCH BASINS, TYPE 27, > 8' - 12' DEPTH	EACH	D-CB-27S
611-27.04	CATCH BASINS, TYPE 27, > 12' - 16' DEPTH	EACH	D-CB-27S
611-27.05	CATCH BASINS, TYPE 27, > 16' - 20' DEPTH	EACH	D-CB-27S
611-27.08	CATCH BASINS, TYPE 27, >(' - ' DEPTH)	EACH	
611-28.01	CATCH BASINS, TYPE 28, 0' - 4' DEPTH	EACH	
611-28.02	CATCH BASINS, TYPE 28, > 4' - 8' DEPTH	EACH	
611-28.03	CATCH BASINS, TYPE 28, > 8' - 12' DEPTH	EACH	
611-28.04	CATCH BASINS, TYPE 28, > 12' - 16' DEPTH	EACH	
611-28.05	CATCH BASINS, TYPE 28, > 16' - 20' DEPTH	EACH	
611-28.06	CATCH BASINS, TYPE 28, > 20' - 24' DEPTH	EACH	
611-28.07	CATCH BASINS, TYPE 28, > 24' - 28' DEPTH	EACH	
611-28.08	CATCH BASINS, TYPE 28, >(' - ' DEPTH)	EACH	
611-29.01	CATCH BASINS, TYPE 29, 0' - 4' DEPTH	EACH	
611-29.02	CATCH BASINS, TYPE 29, > 4' - 8' DEPTH	EACH	
611-29.03	CATCH BASINS, TYPE 29, > 8' - 12' DEPTH	EACH	

611-29.04	CATCH BASINS, TYPE 29, > 12' - 16' DEPTH	EACH	
611-29.05	CATCH BASINS, TYPE 29, > 16' - 20' DEPTH	EACH	
611-29.08	CATCH BASINS, TYPE 29, >(' - ' DEPTH)	EACH	
611-31.01	CATCH BASINS, TYPE 31, 0' - 4' DEPTH	EACH	
611-31.02	CATCH BASINS, TYPE 31, > 4' - 8' DEPTH	EACH	D-CB-31R, 31SD,31SE
611-31.03	CATCH BASINS, TYPE 31, > 8' - 12' DEPTH	EACH	D-CB-31R, 31SD,31SE
611-31.04	CATCH BASINS, TYPE 31, > 12' - 16' DEPTH	EACH	D-CB-31R, 31SD,31SE
611-31.05	CATCH BASINS, TYPE 31, > 16' - 20' DEPTH	EACH	D-CB-31R, 31SD,31SE
611-31.06	CATCH BASINS, TYPE 31, > 20' - 24' DEPTH	EACH	D-CB-31R, 31SD,31SE
611-31.07	CATCH BASINS, TYPE 31, > 24' - 28' DEPTH	EACH	D-CB-31R, 31SD,31SE
611-31.08	CATCH BASINS, TYPE 31, >(' - ' DEPTH)	EACH	D-CB-31R
611-32.01	CATCH BASINS, TYPE 32, > 0' - 4' DEPTH	EACH	D-CB-32LP
611-32.02	CATCH BASINS, TYPE 32, > 4' - 6' DEPTH	EACH	D-CB-32LP
611-38.01	CATCH BASINS, TYPE 38, 0' - 4' DEPTH	EACH	D-CB-38RB, 38S,38SB
611-38.02	CATCH BASINS, TYPE 38, > 4' - 8' DEPTH	EACH	D-CB-38RB, 38S,38SB,38 SC
611-38.03	CATCH BASINS, TYPE 38, > 8' - 12' DEPTH	EACH	D-CB-38RB, 38SB,38SC
611-38.04	CATCH BASINS, TYPE 38, > 12' - 16' DEPTH	EACH	D-CB-38RB, 38SB,38SC
611-38.05	CATCH BASINS, TYPE 38, > 16' - 20' DEPTH	EACH	D-CB-38RB, 38SB,38SC
611-38.06	CATCH BASINS, TYPE 38, > 20' - 24' DEPTH	EACH	D-CB-38RB, 38SB,38SC
611-38.07	CATCH BASINS, TYPE 38, > 24' - 28' DEPTH	EACH	D-CB-38RB, 38SB,38SC
611-38.08	CATCH BASINS, TYPE 38, >(' - ' DEPTH)	EACH	D-CB-38RB
611-39.01	CATCH BASINS, TYPE 39, 0' - 4' DEPTH	EACH	D-CB-39S

611-39.02	CATCH BASINS, TYPE 39, > 4' - 8' DEPTH	EACH	D-CB-39RB, 39S,39SC,39 SD,39SE
611-39.03	CATCH BASINS, TYPE 39, > 8' - 12' DEPTH	EACH	D-CB-39RB, 39S,39SC,39 SD,39SE
611-39.04	CATCH BASINS, TYPE 39, > 12' - 16' DEPTH	EACH	D-CB-39RB, 39S,39SC,39 SD,39SE
611-39.05	CATCH BASINS, TYPE 39, > 16' - 20' DEPTH	EACH	D-CB-39RB, 39S,39SC,39 SD,39SE
611-39.06	CATCH BASINS, TYPE 39, > 20' - 24' DEPTH	EACH	D-CB-39RB, 39S,39SC,39 SD,39SE
611-39.07	CATCH BASINS, TYPE 39, > 24' - 28' DEPTH	EACH	D-CB-39RB, 39S,39SC,39 SD,39SE
611-39.08	CATCH BASINS, TYPE 39, >(' - ' DEPTH)	EACH	D-CB-39RB
611-40.01	CATCH BASINS, TYPE 40, 0' - 4' DEPTH	EACH	D-CB-40S
611-40.02	CATCH BASINS, TYPE 40, > 4' - 8' DEPTH	EACH	D-CB-40S, 40SE
611-40.03	CATCH BASINS, TYPE 40, > 8' - 12' DEPTH	EACH	D-CB-40S, 40SE
611-40.04	CATCH BASINS, TYPE 40, > 12' - 16' DEPTH	EACH	D-CB-40S, 40SE
611-40.05	CATCH BASINS, TYPE 40, > 16' - 20' DEPTH	EACH	D-CB-40S, 40SE
611-40.08	CATCH BASINS, TYPE 40, >(' - ' DEPTH)	EACH	
611-41.01	CATCH BASINS, TYPE 41, 0' - 4' DEPTH	EACH	D-CB-41LP, 41P,41RB,41 S,41SB
611-41.02	CATCH BASINS, TYPE 41, > 4' - 8' DEPTH	EACH	D-CB-41LP, 41P,41RB,41 S,41SB,41SC ,41SD,41SE
611-41.03	CATCH BASINS, TYPE 41, > 8' - 12' DEPTH	EACH	D-CB-41P, 41RB,41S,41 SB,41SC,41S D,41SE
611-41.04	CATCH BASINS, TYPE 41, > 12' - 16' DEPTH	EACH	D-CB-41P, 41RB,41S,41 SB,41SC,41S D,41SE

611-41.05	CATCH BASINS, TYPE 41, > 16' - 20' DEPTH	EACH	D-CB-41P, 41RB,41S,41SB,41SC,41SD,41SE
611-41.06	CATCH BASINS, TYPE 41, > 20' - 24' DEPTH	EACH	D-CB-41RB, 41SB,41SC,41SD,41SE
611-41.07	CATCH BASINS, TYPE 41, > 24' - 28' DEPTH	EACH	D-CB-41RB,41SB,41SC,41SD,41SE
611-41.08	CATCH BASINS, TYPE 41, >(' - ' DEPTH)	EACH	D-CB-41RB
611-42.01	CATCH BASINS, TYPE 42, 0' - 4' DEPTH	EACH	D-CB-42S, 42SB
611-42.02	CATCH BASINS, TYPE 42, > 4' - 8' DEPTH	EACH	D-CB-42S, 42SB,42SC,42SD
611-42.03	CATCH BASINS, TYPE 42, > 8' - 12' DEPTH	EACH	D-CB-42SB, 42SC,42SD
611-42.04	CATCH BASINS, TYPE 42, > 12' - 16' DEPTH	EACH	D-CB-42SB, 42SC,42SD
611-42.05	CATCH BASINS, TYPE 42, > 16' - 20' DEPTH	EACH	D-CB-42SB, 42SC,42SD
611-42.06	CATCH BASINS, TYPE 42, > 20' - 24' DEPTH	EACH	D-CB-42SB, 42SC,42SD
611-42.07	CATCH BASINS, TYPE 42, > 24' - 28' DEPTH	EACH	D-CB-42SB, 42SC,42SD
611-42.08	CATCH BASINS, TYPE 42, >(' - ' DEPTH)	EACH	
611-43.01	CATCH BASINS, TYPE 43, 0' - 4' DEPTH	EACH	D-CB-43SB
611-43.02	CATCH BASINS, TYPE 43, > 4' - 8' DEPTH	EACH	D-CB-43R, 43SB,43SC
611-43.03	CATCH BASINS, TYPE 43, > 8' - 12' DEPTH	EACH	D-CB-43R, 43SB,43SC
611-43.04	CATCH BASINS, TYPE 43, > 12' - 16' DEPTH	EACH	D-CB-43R, 43SB,43SC
611-43.05	CATCH BASINS, TYPE 43, > 16' - 20' DEPTH	EACH	D-CB-43R, 43SB,43SC
611-43.06	CATCH BASINS, TYPE 43, > 20' - 24' DEPTH	EACH	D-CB-43R
611-43.07	CATCH BASINS, TYPE 43, > 24' - 28' DEPTH	EACH	D-CB-43R
611-43.08	CATCH BASINS, TYPE 43, >(' - ' DEPTH)	EACH	D-CB-43R

611-44.01	CATCH BASINS, TYPE 44, 0' - 4' DEPTH	EACH	
611-44.02	CATCH BASINS, TYPE 44, > 4' - 8' DEPTH	EACH	D-CB-44SE
611-44.03	CATCH BASINS, TYPE 44, > 8' - 12' DEPTH	EACH	D-CB-44SE
611-44.04	CATCH BASINS, TYPE 44, > 12' - 16' DEPTH	EACH	D-CB-44SE
611-44.05	CATCH BASINS, TYPE 44, > 16' - 20' DEPTH	EACH	D-CB-44SE
611-44.06	CATCH BASINS, TYPE 44, > 20' - 24' DEPTH	EACH	D-CB-44SE
611-44.07	CATCH BASINS, TYPE 44, > 24' - 28' DEPTH	EACH	D-CB-44SE
611-44.08	CATCH BASINS, TYPE 44, >(' - ' DEPTH)	EACH	
611-45.01	CATCH BASINS, TYPE 45, 0' - 4' DEPTH	EACH	D-CB-45S
611-45.02	CATCH BASINS, TYPE 45, > 4' - 8' DEPTH	EACH	D-CB-45S
611-45.03	CATCH BASINS, TYPE 45, > 8' - 12' DEPTH	EACH	D-CB-45S
611-45.04	CATCH BASINS, TYPE 45, > 12' - 16' DEPTH	EACH	D-CB-45S
611-45.05	CATCH BASINS, TYPE 45, > 16' - 20' DEPTH	EACH	D-CB-45S
611-45.08	CATCH BASINS, TYPE 45, >(' - ' DEPTH)	EACH	
611-46.01	CATCH BASINS, TYPE 46, 0' - 4' DEPTH	EACH	
611-46.02	CATCH BASINS, TYPE 46, > 4' - 8' DEPTH	EACH	D-CB-46SE
611-46.03	CATCH BASINS, TYPE 46, > 8' - 12' DEPTH	EACH	D-CB-46SE
611-46.04	CATCH BASINS, TYPE 46, > 12' - 16' DEPTH	EACH	D-CB-46SE
611-46.05	CATCH BASINS, TYPE 46, > 16' - 20' DEPTH	EACH	D-CB-46SE
611-46.06	CATCH BASINS, TYPE 46, > 20' - 24' DEPTH	EACH	D-CB-46SE
611-46.07	CATCH BASINS, TYPE 46, > 24' - 28' DEPTH	EACH	D-CB-46SE
611-46.08	CATCH BASINS, TYPE 46, >(' - ' DEPTH)	EACH	
611-51.01	CATCH BASINS, TYPE 51, 0' - 4' DEPTH	EACH	

611-51.02	CATCH BASINS, TYPE 51, > 4' - 8' DEPTH	EACH	D-CB-51SC, 51SD,51SE
611-51.03	CATCH BASINS, TYPE 51, > 8' - 12' DEPTH	EACH	D-CB-51SC, 51SD,51SE
611-51.04	CATCH BASINS, TYPE 51, > 12' - 16' DEPTH	EACH	D-CB-51SC, 51SD,51SE
611-51.05	CATCH BASINS, TYPE 51, > 16' - 20' DEPTH	EACH	D-CB-51SC, 51SD,51SE
611-51.06	CATCH BASINS, TYPE 51, > 20' - 24' DEPTH	EACH	D-CB-51SC, 51SD,51SE
611-51.07	CATCH BASINS, TYPE 51, > 24' - 28' DEPTH	EACH	D-CB-51SC, 51SD,51SE
611-51.08	CATCH BASINS, TYPE 51, >(' - ' DEPTH)	EACH	
611-52.02	CATCH BASINS, TYPE 52, > 4FT - 8FT DEPTH	EACH	D-CB-52SE
611-52.03	CATCH BASINS, TYPE 52, > 8FT - 12FT DEPTH	EACH	D-CB-52SE
611-52.04	CATCH BASINS, TYPE 52, > 12FT - 16FT DEPTH	EACH	D-CB-52SE
611-52.05	CATCH BASINS, TYPE 52, > 16FT - 20FT DEPTH	EACH	D-CB-52SE
611-52.06	CATCH BASINS, TYPE 52, > 20FT - 24FT DEPTH	EACH	D-CB-52SE
611-52.07	CATCH BASINS, TYPE 52, > 24FT - 28FT DEPTH	EACH	D-CB-52SE
611-90.01 to 611-90.09	CATCH BASINS, (TYPE __, __' DEPTH)	EACH	

8-611.01 BRIDGE END DRAINS

When bridge end drains are included on a project, the Designer will only have to calculate quantities for drain pipe and end treatment. The Structures Division Standard Drawings STD-1-6 through STD-1-9 show bridge end drain for structures, which have concrete approach slabs and Standard Drawings STD-1-10 through STD-1-13 show bridge end drain for structures without concrete approach slabs. The Designer shall check the preliminary structures layout sheet to see which drawings are included. On some structures, such as those having open bridge railing, bridge end drains will not be used. If there are questions about these drawings or the type of bridge end drain to use, check with the appropriate Structures Division personnel.

The length of the outlet pipe is to be measured from the outside limits of the bridge end drain pipe, which is included in the cost of the bridge drain box (as shown on Standard Drawings STD-1-7 or STD-1-11), down the slope to the end of the outlet pipe. Actual length for payment will come from measurement taken from the appropriate sheet in the Roadway Plans. It shall be paid for as Item No. 610-07.03, 18-inch Pipe Drain (Bridge Drain) per linear foot. The cost of the bridge drain outlet pipe endwall shall be paid for as Item No. 709-01.01, Rubble-Stone Rip-Rap per cubic yard. These pay items in the estimated roadway quantities block shall be footnoted as follows:

"Standard Drawing STD-1-7 (or STD-1-11) is to be used for burial of the outlet pipe and for end treatment details."

The Designer shall reference only the appropriate Standard Drawing in the above note. Standard Drawing STD-1-7 will be used in the note when the structure has a concrete approach slab. Standard Drawing STD-1-11 will be used in the note when the structure does not have a concrete approach slab.

When bridge end drains are not required, the shoulder shall be paved full width for a distance of 25 feet past the end of the parapet, and rip-rap shall be hand placed around the guardrail for an equal distance.

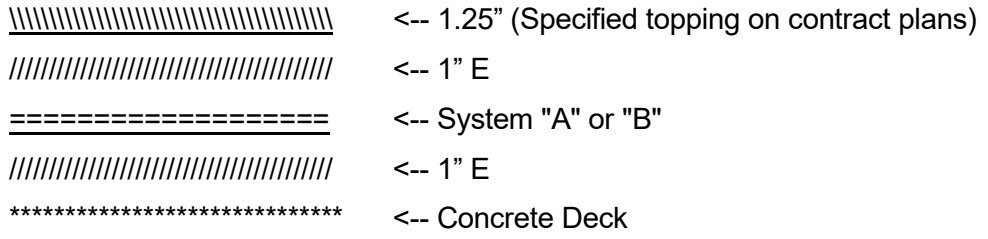
8-617.00 BRIDGE DECK SEALANT

Item Number	Description	Unit of Measurement	Comment
617-01	BRIDGE DECK SEALANT	S.Y.	
617-02	BRIDGE DECK CRACK SEALING	L.F.	SP604CR
617-03	BRIDGE DECK CRACK SEALING	GAL.	
617-04.01	TYPE 1 THIN EPOXY OVERLAY (EPOXY-URETHANE)	S.Y.	
617-04.02	TYPE 2 THIN EPOXY OVERLAY (LOW-MOD EPOXY)	S.Y.	
617-05	SEALANT (DESCRIPTION)	GAL.	SP604CR

When calculating the quantity of bridge deck sealant, include a two foot transition length beyond each end of the bridge. Do not use sealant on approach pavement.

The following is the procedure for using bridge deck sealant:

1. Bare concrete decks considered sealable shall be sealed using a "sandwich seal", system "A" or "B", as follows:



2. Concrete decks with existing asphalt overlays shall be sealed using a "sandwich seal", System "A" or "B".

    a) For State projects the existing asphalt will be sealed as follows:

\\ <-- 1.25” (Specified topping on contract plans)
// <-- 1” E
========== <-- System "A" or "B"
|||||||||||||||||||| <-- 403-01 Bituminous Material (Tack Coat)
########################## <-- Existing Asphalt

Existing asphalt overlays are not to be removed unless the bridge deck has deteriorated to the point that the overlay is unstable.

    b) On State projects, if the deck survey indicates the existing asphalt is too rough to seal, a 1-inch layer of "E" mix will be substituted for the tack coat. Since the membrane must be installed on a uniform surface, leveling ("C" mix), or additional "E" mix may be necessary to bring the deck surface to a true plane.

NOTE: When overlaying existing bridges, the Structures Division will furnish expansion joint adjustment details upon request by the Designer if expansion joints exist.

NOTE: On construction projects where "E" mix is not specified, but "D" mix is specified, "D" mix may be substituted for "E" mix.

NOTE: On construction projects where "C-W" mix is specified in lieu of "D" or "E" mix for surface course, "C-W" mix shall be used as follows:

1. Bottom layer below System "A" or "B" = 1.25 inches thick
2. Top layer above System "A" or "B" = 1.75 inches thick

The bridge deck sealant and the wearing surface over the sealant will continue to be roadway items with the Structures Division furnishing the quantity of deck sealant as part of the bridge design.

Unless otherwise directed, the appropriate pay item for bridge deck sealant is:

Item Number 617-01 Bridge Deck Sealant per square yard

8-621.00 TEMPORARY STRUCTURES

Item Number	Description	Unit of Measurement	Comment
621-01.01 to 621-01.10	TEMPORARY STRUCTURE (DESCRIPTION - STATION)	L.S.	
621-03.01	15" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.02	18" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.03	24" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.04	30" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.05	36" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.06	42" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.07	48" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.08	54" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.09	60" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.10	66" TEMPORARY DRAINAGE PIPE	L.F.	
621-03.11	72" TEMPORARY DRAINAGE PIPE	L.F.	
621-05.01	TEMPORARY SHORING	S.F.	
621-05.02 to 621-05.03	TEMPORARY SHORING	L.S.	

On all construction projects having detours requiring temporary drainage structures, the Designer shall use Item Nos. 621-01.01 through 621-01.10 Temporary Structures (Description-Station) per lump sum, as opposed to using the specific item numbers for each type of structure (pipe, box culvert, etc.). Item Nos. 621-01.01 through 621-01.10 shall be footnoted as follows:

"Quantity is based on minimum calculated length. Actual length required will be determined based on field conditions encountered. The bidder is responsible for verifying estimated lengths prior to submitting their bid. Additional length, if any, required by actual field measurements will be installed at no additional cost. All costs shall be included in the bid price for these items."

This footnote is for Item Nos. 621-01.01 through 621-01.10, which have been identified by the Structures Division or as needed by the design. The above footnote does not apply to any temporary structure used for a channel change or erosion prevention and sediment control.

SECTION 7 – INCIDENTAL CONSTRUCTION AND SERVICES

8-701.00 CEMENT CONCRETE SIDEWALKS, DRIVEWAYS AND MEDIAN PAVEMENT

Item Number	Description	Unit of Measurement	Comment
701-01.01	CONCRETE SIDEWALK (4 ")	S.F.	MM-SW-1; RP-J-26; RP-D-15,16
701-01.02	CONCRETE SIDEWALK (6 ")	S.F.	MM-SW-1; RP-J-26; RP-D-16
701-01.05	CONCRETE SIDEWALK -6IN (DESCRIPTION)	S.F.	
701-01.07	EXPOSED AGGREGATE CONCRETE DRIVEWAY	S.F.	
701-01.08	CONCRETE PAVERS (CROSS-WALK)	S.F.	
701-01.09	ORNAMENTAL CONCRETE (DESCRIPTION)	S.F.	
701-01.10	CONCRETE SIDEWALK (DESCRIPTION)	S.F.	
701-01.20	BRICK SIDEWALK	S.Y.	
701-02	CONCRETE DRIVEWAY	S.F.	RP-D-15
701-02.01	CONCRETE CURB RAMP (RETROFIT)	S.F.	MM-CR-2,3,4,5,6,7,8,9
701-02.02	CONCRETE DRIVEWAY (8")	S.F.	
701-02.03	CONCRETE CURB RAMP	S.F.	MM-CR-1,2,3,4,5,6,7,8,9
701-02.06	DETECTABLE WARNING SURFACE (REHABILITATION)	S.F.	MM-CR-1
701-99.91	RAISED CONCRETE MEDIAN	L.S.	
701-99.92	RAISED GRASS MEDIAN WITH CONCRETE CURB	L.S.	

8-702.00 CEMENT CONCRETE SIDEWALKS, DRIVEWAYS AND MEDIAN PAVEMENT

Item Number	Description	Unit of Measurement	Comment
702-01	CONCRETE CURB	C.Y.	MM-CR-2,3,4,5,6,7,8,9; RP-J-26; RP-SC-1; RP-VC-10,11
702-01.01	EXTRUDED SLOPING CURB	L.F.	RP-SC-1
702-01.02	CONCRETE CURB	L.F.	
702-01.03	MODULAR CURB W/DELINEATOR	L.F.	
702-03	CONCRETE COMBINED CURB & GUTTER	C.Y.	MM-CR-2,3,4,5,6,7,8,9; D-SLD-1; RP-J-26; RP-D-16; RP-SC-1; RP-VC-10,11
702-10.02	WHEEL STOP	EACH	

8-703.00 CEMENT CONCRETE DITCH PAVING

Item Number	Description	Unit of Measurement	Comment
703-01	PORTLAND CEMENT CONCRETE DITCH PAVING	C.Y.	
703-02	CEMENT CONCRETE DITCH PAVING (REINFORCED)	C.Y.	
703-02.05	CEMENT CONCRETE DITCH PAVING (SLOTTED DRAINS)	C.Y.	

8-705.00 GUARDRAIL

Item Number	Description	Unit of Measurement	Comment
705-01.01	ROCK DRILLING GUARDRAIL POST	L.F.	S-GR31-1D

705-02.01	SINGLE GUARDRAIL WITH RUB-RAIL (TYPE 2)	L.F.	S-GRT-1A and 1B
705-02.10	GUARDRAIL TRANSITION 27IN TO 31IN	EACH	S-GRS-4
705-04.02	GUARDRAIL TERMINAL (TYPE 12)	EACH	SP705A; S-GRT-1; S-GRA-1A
705-04.10	EARTH PAD FOR GUARD RAIL END TREATMENT	EACH	S-GRT-2P,2R
705-04.11	STONE FOR GUARDRAIL END TERMINAL PAD	TON	SP705A
705-04.21	GUARDRAIL DELINEATION ENHANCEMENT	L.F.	USED WITH SAFETY UPGRADE AND RESURFACING
705-04.22	GUARDRAIL DELINEATION ENHANCEMENT (BI-DIRECTIONAL)	EACH	USED WITH SAFETY UPGRADE AND RESURFACING
705-04.23	GUARDRAIL DELINEATION ENHANCEMENT (BI-DIRECTIONAL)	L.F.	USED WITH SAFETY UPGRADE AND RESURFACING
705-04.24	GUARDRAIL END TERMINAL DELINEATION SHEETING	S.F.	USED WITH SAFETY UPGRADE AND RESURFACING
705-04.25	GUARDRAIL & BARRIER DELINEATOR	EACH	USED WITH SAFETY UPGRADE AND RESURFACING
705-04.26	REMOVE AND REPLACE BARRIER DELINEATOR	EACH	USED WITH SAFETY UPGRADE AND RESURFACING
705-06.01	W BEAM GR (TYPE 2) MASH TL3	L.F.	S-PL-6; S-GR31-1; S-GR31-1A; S-GRC-6; S-GRS-1,2,3; S-GRT-2,3; S-GRA-5; S-SSMB-6,6C,6F; S-PL-2M
705-06.02	W BEAM GR (TYPE 2) MASH TL3 (LONG POST)	L.F.	S-PL-6; S-SSMB-6E

705-06.09	WEAK-POST GUARDRAIL ATTACHMENT TO CULVERT(MASH TL-3)(TYPE _)	L.F.	S-GRC-5, 5A, AND 5B
705-06.10	GR TERMINALTRAILING END (TYPE 13) MASH TL3	EACH	S-GRA-3; S-PL-2M
705-06.11	GR TERMINAL (IN-INLINE) MASH TL3	EACH	S-GRA-4; S-PL-2M
705-06.15	SHORT-RADIUS GUARDRAIL SYSTEM MASH TL-3 (DESCRIPTION)	EACH	S-GRS-7
705-06.20	TANGENT ENERGY ABSORBING TERM MASH TL-3	EACH	S-PL-3,5; S-GRT-2,2P,2R; S-SSMB-6C,6F; S-PL-2M
705-06.21	TANGENT ENERGY ABSORBING TERM MASH TL-3 (POWDER COATING)	EACH	
705-06.25	THRIE BEAM BRIDGE TRANSITION MASH TL-3	EACH	S-PL-3,5; S-GRT-2,2P,2R, S-SSMB-6B,6C,6E; S-PL-2M
705-06.26	THRIE BEAM BRIDGE TRANSITION MASH TL-2	EACH	S-PL-3,4;S-SSMB-6
705-06.27	THRIE BEAM 38IN VEHICLE & PEDESTRIAN SAFETY RAIL MASH TL-3	L.F.	MM-VPR-1
705-06.30	GR TERMINAL (ENERGY ABSORBING) MASH TL2	EACH	S-PL-3; S-GR31-1; S-GRC-6; S-GRT-2P,2R,3; S-SSMB-6; S-PL-2M
705-06.40	CABLE BARRIER (MASH TL-3)	L.F.	S-CB-1
705-06.41	CABLE BARRIER ANCHOR (MASH TL-3)	EACH	S-CB-1
705-06.50	CABLE BARRIER (MASH TL-4)	L.F.	
705-06.51	CABLE BARRIER ANCHOR (MASH TL-4)	EACH	
705-08.13	PERMANENT IMPACT ATTENUATOR NCHRP350 TL-3	EACH	
705-10.33	GUARDRAIL ATTACHMENT TO STEEL BRIDGERAIL	L.F.	
705-10.39	GUARDRAIL BRIDGERAIL ATTACHED TO BRIDGERAIL POST	L.F.	
705-11.21	W BEAM GR (TYPE 2) MASH TL-3 (POWDER COATED)	L.F.	SP909A

705-11.22	W BEAM GR (TYPE 2) MASH TL-3 (LONG POST)(POWDER COATED)		
705-11.29	WEAK-POST GR ATTACHMENT TO CULVERT(MASH TL-3) (TYPE _)(POWDER COATED)	L.F.	S-GRC-5, 5A, AND 5B
705-11.30	GR TERMINAL TRAILING END (TYPE 13) MASH TL-3 (POWDER COATED)	EACH	SP909A
705-11.31	GR TERMINAL (TYPE IN LINE) MASH TL-3 (POWDER COATED)	EACH	SP909A
705-11.41	TANGENT ENERGY ABSORBING TERM MASH TL-3 (POWDER COATING)	EACH	SP909A
705-20.20	LOW MAINT CRASH CUSHN NARROW (MASH TL-3)	EACH	
705-20.21	LOW MAINT CRASH CUSHION WIDE (MASH TL-3)	EACH	S-CC-1, USE INSTEAD OF 705-08.10 OR 8
705-20.22	REUSABLE CRSH CUSHION NARW (MASH TL-3)	EACH	S-CC-1, USE INSTEAD OF 705-08.10 OR 9
705-20.23	REUSABLE CRASH CUSHION WIDE (MASH TL-3)	EACH	S-CC-1, USE INSTEAD OF 705-08.10
705-20.24	GATING CRASH CUSHION (MASH TL-3)	EACH	USE INSTEAD OF 705-08.10 OR 11
705-80.24	CONCRETE MONOLITHIC BLOCK FOR CABLE END TERMINAL FOUNDATION	EACH	

8-706.00 GUARDRAIL REMOVED

Item Number	Description	Unit of Measurement	Comment
706-01	GUARDRAIL REMOVED	L.F.	ALWAYS ADD WHEN GUARDRAIL WILL BE REMOVED

8-707.00 FENCES

Item Number	Description	Unit of Measurement	Comment

707-01.01	CHAIN-LINK FENCE (4-FOOT)	L.F.	S-F-10B; MM-BPR-1
707-01.02	END & CORNER POST ASSEMBLY (CHAIN-LINK FENCE 4')	EACH	S-F-10B; MM-BPR-1
707-01.03	GATE - CHAIN-LINK FENCE-4 FOOT (DESCRIPTION)	EACH	S-F-10B
707-01.04	GATE - CHAIN-LINK FENCE-4 FOOT (DESCRIPTION)	EACH	S-F-10B; MM-BPR-1
707-01.11	CHAIN LINK FENCE (6 FOOT)	L.F.	S-F-10B
707-01.12	END & CORNER POST ASSEMBLY (CHAIN-LINK FENCE 6')	EACH	S-F-10B
707-01.13 to 707-01.14	GATE - CHAIN-LINK FENCE-6 FOOT (DESCRIPTION)	EACH	S-F-10B
707-01.28	END & CORNER POST ASSEMBLY (DESCRIPTION)	EACH	
707-01.50	CHAIN-LINK FENCE (__ FOOT)	L.F.	
707-01.51	END & CORNER POST ASSEMBLY (CHAIN-LINK FENCE __')	EACH	
707-01.52 to 707-01.53	GATE - CHAIN-LINK FENCE (__ FOOT - DESCRIPTION)	EACH	S-F-10B
707-02.01	CHAIN-LINK FENCE (4') (VINYL COATED)	L.F.	
707-02.02	END & CORNER POST ASSEMBLIES (4' VINYL COATED)	EACH	
707-02.03 to 707-02.04	GATE - CHAIN-LINK FENCE-4',VINYL COATED (DESCRIPTION)	EACH	
707-02.11	CHAIN-LINK FENCE (6 FOOT) (VINYL COATED)	L.F.	
707-02.12	END & CORNER POST ASSEMBLIES (6' VINYL COATED)	EACH	
707-02.13 to 707-02.14	GATE - CHAIN-LINK FENCE-6',VINYL COATED (DESCRIPTION)	EACH	
707-02.41	ROCK ANCHOR, TYPE I	EACH	SP707D, SP707E
707-02.42	ROCK ANCHOR, TYPE II	EACH	SP707D, SP707E
707-02.43	ROCK ANCHOR, TYPE I	L.F.	SP707D, SP707E
707-02.44	ROCK ANCHOR, TYPE II	L.F.	SP707D, SP707E
707-03.01	STOCK FENCE	L.F.	S-F-10; S-F-10A
707-03.02	END, BRACED LINE, CORNER POST ASSEMBLY (STOCK FENCE)	EACH	S-F-10; S-F-10A
707-03.03 to 707-03.04	STOCK FENCE GATE (DESCRIPTION)	EACH	
707-03.08	TEMPORARY STOCK FENCE	L.F.	

707-03.20	DRIVE GATE (STOCK FENCE) (DESCRIPTION)	EACH	S-FG-11
707-04	WATER CROSSING	L.F.	S-FG-20
707-04.01 to 707-04.02	WATER CROSSING(DESCRIPTION)	L.F.	
707-05	WATER GATE	S.F.	S-FG-20
707-06.01	REMOVAL OF FENCE (DESCRIPTION)	L.F.	
707-06.02	REMOVAL OF GATE (DESCRIPTION)	EACH	
707-06.03	REMOVAL AND RESET FENCE (DESCRIPTION)	L.F.	
707-06.04	REMOVAL AND RESET GATE (DESCRIPTION)	EACH	
707-06.05	REMOVAL OF FENCE (DESCRIPTION)	L.S.	
707-07.01	CHAIN-LINK FENCE (BRIDGES)	S.F.	
707-08.01	FENCE (DESCRIPTION)	L.F.	S-F-1
707-08.02	GATE (DESCRIPTION)	EACH	
707-08.11	HIGH-VISIBILITY CONSTRUCTION FENCE	L.F.	
707-10.01	ROCKFALL FENCE (TYPE I)	L.F.	SP707H
707-10.02	ROCKFALL FENCE (TYPE II)	L.F.	SP707H
707-10.03	ROCKFALL FENCE (TYPE III)	L.F.	SP707H
707-10.04	ROCKFALL FENCE (TYPE IV)	L.F.	SP707H
707-10.05	ROCKFALL DRAPE (TYPE I)	S.Y.	SP707D, SP707E
707-10.06	ROCKFALL DRAPE (TYPE II)	S.Y.	SP707D, SP707E
707-10.07	ROCKFALL DRAPE (TYPE III)	S.Y.	SP707D, SP707E
707-10.08	WIRE MESH (DESCRIPTION)	S.Y.	SP707H; SD-MSE-1
707-10.21	ROCKFALL DRAPE TYPE IV (A)	S.Y.	SP707D, SP707E
707-10.22	ROCKFALL DRAPE TYPE IV (B)	S.Y.	SP707D
707-10.30	ROCKFALL FENCE (PORTABLE-TEMPORARY)		
707-11.01	PEDESTRIAN CONSTRUCTION BARRIER FENCE	L.F.	T-WZ-55
707-15.55	REMOVAL & SITE PREPARATION (STOCK FENCE)	L.F.	

On projects where right-of-way stock fence is required use standard drawing S-F-10. Standard drawing S-F-10C is approved for use on right-of-way fence for bridge and culverts and S-F-10D is approved for use on right-of-way fence locations at interchanges.

8-708.00 MONUMENTS AND MARKERS

Item Number	Description	Unit of Measurement	Comment
708-01.01	MONUMENTS (DESCRIPTION)	EACH	
708-02.01	MARKERS (CONCRETE R.O.W. POSTS)	EACH	
708-02.02	MARKERS (DESCRIPTIONS)	EACH	
708-02.03	HISTORICAL MARKER – MOVE AND RESET	EACH	
708-02.04	(DESCRIPTION) MOVE AND RESET	EACH	

8-709.00 RIP-RAP AND SLOPE PAVEMENT

Item Number	Description	Unit of Measurement	Comment
709-01.01	RUBBLE STONE RIP-RAP	C.Y.	
709-01.02	RUBBLE STONE RIP-RAP	TON	
709-02.01	RUBBLE STONE RIP-RAP (GROUTED)	C.Y.	
709-03	CONCRETE BLOCK RIP-RAP	C.Y.	
709-03.01 to 709-03.02	RUBBLE STONE(DESCRIPTION)	C.Y.	
709-04	REINFORCED CONCRETE SLOPE PAVEMENT	C.Y.	
709-05.04	MACHINED RIP-RAP (3" TO 6")	C.Y.	EC-STR-25
709-05.05	MACHINED RIP-RAP (CLASS A-3)	TON	EC-STR-13,21,25,27,29,31,32,33; SD-MSE-1
709-05.06	MACHINED RIP-RAP (CLASS A-1)	TON	
709-05.07	MACHINED RIP-RAP (CLASS A-2)	TON	EC-STR-12,21,32,33
709-05.08	MACHINED RIP-RAP (CLASS B)	TON	EC-STR-21,32,33
709-05.09	MACHINED RIP-RAP (CLASS C)	TON	NOTE 1, RDG 9-150.00
709-05.10	MACHINED RIP-RAP (DESCRIPTION)	C.Y.	NOTE 1, RDG 9-150.00

709-05.11	MACHINED RIP-RAP (DESCRIPTION)	C.Y.	
709-05.12 to 709-05.13	MACHINED RIP-RAP (DESCRIPTION)	TON	
709-05.81	ROCK RIFFLES	L.S.	
709-10.01 to 709-10.05	GABIONS (DESCRIPTION)	C.Y.	
709-99.99	ROUND RIVER STONE RIP-RAP (SIZE)	C.Y.	

8-709.01 RIP-RAP

For estimating purposes, multiply cubic yards by 1.75 to convert to tons.

Machined Rip-Rap (Class A-1, A-2, A-3, B, and C) will be measured by the ton (1.75 Tons/C.Y.) as designed and completed in place (unless revised by the sequence of construction, which may require reconstruction and re-measurement.)

Computed Quantity (C.Y.) x 1.75 Tons/C.Y. = Total (Tons)

Classifications of machined rip-rap and their pay item nos. are as follows:

709-05.05 Machined Rip-Rap (Class A-3)
709-05.06 Machined Rip-Rap (Class A-1)
709-05.07 Machined Rip-Rap (Class A-2)
709-05.08 Machined Rip-Rap (Class B)
709-05.09 Machined Rip-Rap (Class C)

These classifications are detailed in Subsection 709.03 of the Standard Specifications.

If a gradation of machined rip-rap other than these is required, use Item No. 709-05.10 through 709-05.13, Machined Rip-Rap (Description), and use the notes in *Section 9-150.00, Rip-Rap.*

All machined rip-rap quantities are to be shown in the estimated roadway quantities block. Those quantities supplied by the Structures Division shall be added to any roadway quantities for the same item number, and they shall be footnoted. Footnote each structure separately identifying all quantities and the structures with which they are used.

8-710.00 UNDERDRAINS

Item Number	Description	Unit of Measurement	Comment
710-02	AGGREGATE UNDERDRAINS (WITH PIPE)	L.F.	RD-UD-3; MM-SW-2
710-04	FILTER CLOTH UNDERDRAIN (WITH PIPE)	L.F.	RD-UD-3; MM-SW-2
710-05	LATERAL UNDERDRAIN	L.F.	RD-UD-4; MM-SW-2
710-06.10	LATERAL UNDERDRAIN ENDWALL (1:1)	EACH	RD-UD-6
710-06.11	LATERAL UNDERDRAIN ENDWALL (2:1)	EACH	RD-UD-6
710-06.12	LATERAL UNDERDRAIN ENDWALL (3:1)	EACH	RD-UD-7
710-06.13	LATERAL UNDERDRAIN ENDWALL (4:1)	EACH	RD-UD-7
710-06.14	LATERAL UNDERDRAIN ENDWALL (5:1)	EACH	RD-UD-8
710-06.15	LATERAL UNDERDRAIN ENDWALL (6:1)	EACH	RD-UD-9
710-09.01	6" PERFORATED PIPE WITH VERTICAL DRAIN SYSTEM	L.F.	
710-09.02	6" PIPE UNDERDRAIN	L.F.	
710-09.06	6" PERFORATED PIPE WITH STONE	L.F.	
710-09.07	6" PERFORATED PLASTIC PIPE (FRENCH DRAIN)	L.F.	
710-10.01	4" PERFORATED PLASTIC PIPE	L.F.	
710-10.02	6" PERFORATED PLASTIC PIPE	L.F.	
710-10.03	8" PERFORATED PLASTIC PIPE	L.F.	
710-10.04	10" PERFORATED PLASTIC PIPE	L.F.	
710-10.05	12" PERFORATED PLASTIC PIPE	L.F.	
710-10.06	14" PERFORATED PLASTIC PIPE	L.F.	
710-10.07	16" PERFORATED PLASTIC PIPE	L.F.	
710-10.08	18" PERFORATED PLASTIC PIPE	L.F.	
710-10.09	24" PERFORATED PLASTIC PIPE	L.F.	
710-13.03	FILTER CLOTH	S.Y.	

The Designer will use underdrains, with or without filter cloth, as detailed on Standard Drawings RD-UD-3 and RD-UD-4, on all new paving projects and rehabilitation projects as directed by the Pavement Design Section.

The Designer will need only to show the underdrain on the roadway typical section and refer to it as "Detail____" using the proper detail identification letter shown on Standard Drawing RD-UD-3.

8-711.00 CONCRETE MEDIAN BARRIER

Item Number	Description	Unit of Measurement	Comment
711-01.08	MEDIAN BARRIER EMERGENCY ACCESS GATE	EACH	
711-02.01	REINFORCED CONCRETE BARRIER (BRIDGE PIER PROTECTION)	L.F.	
711-02.03	REINFORCED CONCRETE MEDIAN BARRIER (BRIDGES)	L.F.	
711-02.04 to 711-02.06	REINFORCED CONCRETE MEDIAN BARRIER (DESCRIPTION)	L.F.	
711-04.21	CONCRETE BARRIER DELINEATION ENHANCEMENT	L.F.	QPL
711-04.23	CONCRETE BARRIER DELINEATION ENHANCEMENT (BI-DIRECTIONAL)	L.F.	QPL
711-05.01	REMOVAL & DISPOSAL OF CONCRETE MEDIAN BARRIER	L.F.	
711-05.69	36IN SINGLE SLOPE CONCRETE BARRIER WALL	L.F.	S-SSMB-1A
711-05.70	32IN SINGLE SLOPE CONCRETE BARRIER WALL	L.F.	MM-BPR-2; S-SSMB-1
711-05.71	51IN SINGLE SLOPE CONCRETE BARRIER WALL	L.F.	S-PL-4; S-SSMB-2
711-05.72	SINGLE SLOPE HALF CONCRETE BARRIER WALL	L.F.	S-SSMB-3
711-05.77	FLARED S/S CONCRETE MEDIAN BARRIER WALL	L.F.	S-SSMB-4
711-05.78	GRADE SEPARATED SINGE SLOPE MEDIAN WALL	L.F.	
711-05.81	32IN HALF SIZE SINGLE SLOPE CONCRETE BARRIER WALL	L.F.	MM-BPR-3
711-05.82	32IN HALF SIZE SINGLE SLOPE CONC BARRIER SLOPED END TREATMNT	L.F.	MM-BPR-3

8-712.00 TEMPORARY TRAFFIC CONTROL

Item Number	Description	Unit of Measurement	Comment
712-01	TRAFFIC CONTROL	L.S.	T-WZ-33, T-WZ-34; RDG NOTES 17,18, RDG 9-135.03

712-01.02	LANE CLOSURE	EACH	MAINTENANCE USE
712-01.03	LANE CLOSURE(NIGHT WORK)	EACH	MAINTENANCE USE
712-01.04	TRAFFIC CONTROL SUPERVISOR	L.S.	SP712B
712-01.05	FLAGMAN	HOUR	CONSTRUCTION USE – BY CHANGE ORDER
712-01.50	MAINTENANCE OF TRAFFIC	EACH	MAINTENANCE USE
712-01.51	PORTABLE BARRIER RAIL DELINEATOR (DOUBLE)	EACH	
712-01.52 to 712-01.56	MAINTENANCE OF TRAFFIC ( )	EACH	MAINTENANCE USE
712-02.02	INTERCONNECTED PORTABLE BARRIER RAIL	L.F.	T-WZ-PBR1
712-02.10	PORTABLE BARRIER RAIL (MASH TL-3)	L.F.	T-WZ-PCB1, T-WZ-PCB2, T-WZ-PCB3, T-WZ-PCB4
712-02.12	PORTABLE BARRIER RAIL, REDUCED DEFLECTION (MASH TL-3)	L.F.	T-WZ-PCB1, T-WZ-PCB2, T-WZ-PCB2A, T-WZ-PCB3, T-WZ-PCB4
712-02.36	REMOVE AND RELOCATE PORTABLE BARRIER RAIL	L.F.	
712-02.45	INTERCONNECTED PORTABLE BARRIER RAIL(TO REMAIN)	L.F.	
712-02.47	BRIDGE MOUNTED INTERCONNECTED PORTABLE BARRIER RAIL	L.F.	
712-02.60	TEMPORARY WORK ZONE CRASH CUSHION (MASH TL-3)	EACH	T-WZ-11, T-WZ-12, T-WZ-14, T-WZ-16, T-WZ-18, T-WZ-19
712-04.01	FLEXIBLE DRUMS (CHANNELIZING)	EACH	T-WZ-11, T-WZ-12, T-WZ-13,

			T-WZ-14, T-WZ-15, T-WZ-16, T-WZ-18, T-WZ-19, T-WZ-21
712-04.10	TEMPORARY FLEXIBLE TUBULAR DELINEATOR	EACH	
712-04.50	BARRIER RAIL DELINEATOR	EACH	T-WZ-11, T-WZ-12, T-WZ-14, T-WZ-16, T-WZ-18, T-WZ-19, T-WZ-32, T-WZ-PBR2
712-05.01	WARNING LIGHTS (TYPE A)	EACH	
712-05.03	WARNING LIGHTS (TYPE C)	EACH	
712-06	SIGNS (CONSTRUCTION)	SF	T-WZ-30, T-WZ-31, T-WZ-34, T-WZ-50, T-WZ-51, T-WZ-52, T-WZ-53, T-WZ-54
712-06.16	SIGNS (CONSTRUCTION) (REDUCED SPEED WARNING)	EACH	T-WZ-60
712-07.01	TEMPORARY BARRICADES (TYPE I)	L.F.	
712-07.02	TEMPORARY BARRICADES (TYPE II)	L.F.	
712-07.03	TEMPORARY BARRICADES (TYPE III)	L.F.	
712-08.01	UNIFORMED POLICE OFFICER	DOLL	MAY BE REQUESTED AT CFR
712-08.03	ARROW BOARD (TYPE C)	EACH	T-WZ-11, T-WZ-12, T-WZ-13, T-WZ-14, T-WZ-15, T-WZ-18, T-WZ-19, T-WZ-21, T-WZ-FAB-1

712-08.07	PORTABLE SPEED MONITOR UNIT	EACH	BY TRAFFIC REQUEST
712-08.08	SPEED FEEDBACK SIGN ASSEMBLY	EACH	SP712SFS, MAY BE ADDED BY TRAFFIC OPERATIONS REQUEST
712-08.09	DIGITAL SPEED LIMIT SIGN ASSEMBLY	EACH	SP712DSL, MAY BE ADDED BY TRAFFIC OPERATIONS REQUEST
712-08.10	MOBILE MESSAGE SIGN UNIT W/ATTENUATOR	HOUR	
712-08.12	QUEUE PROTECTION TRUCK	DAY	SP712PTQ
712-08.13	QUEUE PROTECTION TRUCK (EMERGENCY CALL OUT)	DAY	
712-08.14	PORTABLE QUEUE WARNING SYSTEM	DAY	SP712PQWS
712-08.20	TRUCK MOUNTED ATTENUATOR W/MSSAGE BOARD	DAY	
712-09.02	REMOVABLE PAVEMENT MARKING (8" BARRIER LINE)	L.F.	T-WZ-11, T-WZ-12, T-WZ-13, T-WZ-14, T-WZ-15, T-WZ-18, T-WZ-19, T-WZ-21 T-WZ-32; NOTE 17, RDG 9-135.03
712-09.03	REMOVABLE PAVEMENT MARKING (CHANNELIZING STRIPING)	S.Y.	
712-09.04	REMOVABLE PAVEMENT MARKING (STOP LINE)	L.F.	T-WZ-32
712-09.05	REMOVABLE PAVEMENT MARKING (ARROW)	EACH	
712-09.07	REMOVABLE PAVEMENT MARKING (STOP AHEAD)	EACH	

712-09.08	REMOVABLE PAVEMENT MARKING (6" LINE)	L.F.	T-WZ-16, T-WZ-32; NOTE 17, RDG 9-135.03
712-09.09	REMOVABLE PAVEMENT MARKING (4" LINE)	L.F.	NOTE 17, RDG 9-135.03
712-09.20	TEMPORARY PLASTIC PAVEMENT MARKING (NOISE STRIP)	L.F.	
712-09.21	REMOVABLE WET REFLECTIVE PAVEMENT MARKING TAPE	L.F.	
712-09.30	REMOVABLE BLACK-OUT TAPE (6")	L.F.	
712-09.31	REMOVABLE BLACK-OUT TAPE (8IN)	L.F.	
712-09.33	MODIFY EXISTING OVERHEAD SIGNS	EACH	
712-10.01	TEMPORARY PORTABLE RUMBLE STRIPS	EACH	
712-10.02	TEMPORARY TRANSVERSE RUMBLE STRIPS	L.F.	T-WZ-56
712-12.10	TEMPORARY CURB W/FLEXIBLE DELINEATOR	L.F.	
712-12.47	BRIDGE MOUNTED INTERCONNECTED PORTABLE BARRIER RAIL	L.F.	

- The TDOT Standard Specifications for Road and Bridge Construction specifies that “The lump sum payment for Traffic Control is full compensation for providing Temporary Work Zone Lighting and all equipment, labor and materials, and for furnishing flaggers and traffic cones, and for removing conflicting and incorrect pavement markings, as required, until Project Completion”.

- Removable Pavement Marking (Line) will be measured by the linear foot of installed line.

8-713.00 SIGNS

Item Number	Description	Unit of Measurement	Comment
713-01.01	CLASS A CONCRETE (FOUNDATION FOR SIGN SUPPORTS)	C.Y.	

713-01.02	STEEL BAR REINFORCEMENT (FOUNDATION FOR SIGN SUPPORTS)	LB	
713-02.04	DELINEATOR (MILE MARKER) & STEEL POST	EACH	
713-02.11	REMOVAL OF EXISTING DELINEATORS	EACH	
713-02.14	FLEXIBLE DELINEATOR (WHITE)	EACH	T-WZ-16, T-WZ-PBR2
713-02.15	FLEXIBLE DELINEATOR (YELLOW)	EACH	T-WZ-PBR2
713-02.16	FLEXIBLE TYPE II OBJECT MARKER	EACH	T-WZ-PBR2
713-02.26 TO 713-02.27	CONCRETE BARRIER PARAPET DELINEATOR	EACH	
713-02.30	FLEXIBLE TUBULAR DELINEATOR	EACH	T-WZ-PBR2
713-02.33	FLEXIBLE TUBULAR DELINEATOR (RED)	EACH	T-WZ-PBR2
713-04.02	STEEL I-BEAMS & W-F BEAMS FOR SIGN SUPPORTS	LB	
713-05	STEEL HOLLOW SQUARE POST (BREAKAWAY) SIGN SUPPORTS	LB	
713-06	STEEL I-BEAMS & WF-BEAMS (BREAKAWY) SIGN SUPPORT	EACH	
713-09.01 TO 713-09.42	STEEL OVERHEAD SIGN STRUCTURE (SPAN __)	EACH	
713-10.01 TO 713-10.19	STEEL CANTILEVER SIGN STRUCTURE (SIGN NO)	EACH	
713-11.01	“U” SECTION STEEL POSTS	LB	
713-11.02	PERFORATED/KNOCKOUT SQUARE TUBE POST	LB	
713-11.03	2 ½” DIA ROUND STEEL TUBE SIGN POST	LB	
713-11.04	SURFACE MNT BREAKAWAY BASE FOR SIGN POST	EACH	
713-11.05	SQUARE TUBE SIGN SUPPORT	LB	
713-11.21	P POST SLIP BASE	EACH	

713-11.22	U POST SLIP BASE	EACH	
713-11.23	ROUND POST SLIP BASE	EACH	
713-13.01 TO 713-13.04	FLAT SHEET ALUMINUM SIGN (__" THICK)	S.F.	
713-14	EXTRUDED ALUMINUM PANEL SIGNS	S.F.	
713-15	REMOVAL OF SIGNS, POSTS AND FOOTINGS	L.S.	
713-15.02	REMOVAL & RELOCATION OF SIGN & SUPPORT	L.S.	
713-15.35	METAL BARRICADE (TYPE III)	EACH	T-WZ-19
713-16.01 and 713-16.04	CHANGEABLE MESSAGE SIGN UNIT	EACH	T-WZ-15, T-WZ-21
713-16.05	RAILROAD CROSS-BUCK SIGN & SUPPORT	EACH	
713-16.06	DEAD END SIGN AND SUPPORT	EACH	
713-16.09	RAILROAD ADVANCE WARNING SIGN AND SUPPORT	EACH	
713-16.20 TO 713-16.39	SIGNS (DESCRIPTION)	EACH	
713-16.50	REMOVE AND REPLACE SIGN (DESCRIPTION)	EACH	
713-17.60 TO 713-17.64	SIGN MOUNTED ON CONCRETE MEDIAN BARRIER (_____)	EACH	
713-30.05	BARRIER MOUNTED SQUARE TUBE SIGN SUPPORT	EACH	T-S-21
713-30.08	BARRIER MOUNTED PERFORATED/KNOCKOUT SIGN SUPPORT	EACH	T-S-21
713-30.09	BARRIER MOUNTED SIGN SUPPORT	EACH	T-S-21
713-30.10	BARRIER MOUNTED SIGN SUPPORT (PERF/KNOCKOUT)	EACH	T-S-21

8-714.00 ROADWAY AND STRUCTURE LIGHTING

The quantities for these items should come from the Traffic Operations Division – Signals and Lighting Section.

If the inclusion of construction items are required and the project includes any traffic signal work, notify the Manager of Traffic Operations Division, Signals and Lighting section in order to avoid possible duplication of construction items.

8-715.00 ASPHALTIC CONCRETE CURB (HOT MIX)

The quantities for these items should come from the Traffic Operations Division – Signals and Lighting Section.

8-716.00 PAVEMENT MARKINGS

Item Number	Description	Unit of Measurement	Comment
716-01.05	TEMPORARY RAISED PAVEMENT MARKER	EACH	
716-01.06	TEMPORARY RAISED PAVEMENT MARKER, WHITE	EACH	
716-01.07	TEMPORARY RAISED PAVEMENT MARKER, YELLOW	EACH	
716-01.11	RAISED PVMT MARKER (BI-DIRECTIONAL) (1 COLOR LENS)	EACH	T-WZ-16
716-01.12	RAISED PVMT MARKER (MONO-DIRECTIONAL) (1 COLOR LENS)	EACH	
716-01.13	RAISED PVMT MARKER (BI-DIRECTIONAL) (2 COLOR LENS)	EACH	
716-01.14	RAISED PAVEMENT MARKER REMOVAL	EACH	
716-01.21	SNOWPLOWABLE RAISED PAVEMENT MARKERS (BI-DIR) (1 COLOR)	EACH	T-M-1, T-M-2
716-01.22	SNOWPLOWABLE RAISED PAVEMENT MARKERS (MONO-DIR) (1 COLOR)	EACH	T-M-1, T-M-2
716-01.23	SNOWPLOWABLE RAISED PAVEMENT MARKERS (BI-DIR) (2 COLOR)	EACH	T-M-2, T-M-5, T-M-6, T-M-7, T-M-8
716-01.30	REMOVAL OF SNOWPLOWABLE REFLECTIVE MARKER	EACH	
716-01.40	REMOVE AND REPLACE LENS ON SNOWPLOWABLE REFLECTIVE MARKER	EACH	

716-02.03	PLASTIC PAVEMENT MARKING (CROSS-WALK)	L.F.	T-M-4
716-02.04	PLASTIC PAVEMENT MARKING (CHANNELIZATION STRIPING)	S.Y.	T-M-3
716-02.05	PLASTIC PAVEMENT MARKING (STOP LINE)	L.F.	T-M-4
716-02.06	PLASTIC PAVEMENT MARKING (TURN LANE ARROW)	EACH	T-M-4
716-02.07	PLASTIC PAVEMENT MARKING (24” BARRIER LINE)	L.F.	T-M-3, T-M-7, T-M-8
716-02.08	PLASTIC PAVEMENT MARKING (8” DOTTED LINE)	L.F.	T-M-4, RDG 2-508.00
716-02.09	PLASTIC PAVEMENT MARKING (LONGITUDINAL CROSS-WALK)	L.F.	T-M-4, RDG 2-508.00
716-02.11	PLASTIC PAVEMENT MARKING (6” DOTTED LINE)	L.F.	
716-02.12	PLASTIC PAVMENT MARKING (8 IN LINE)	L.M.	
716-02.15	PLASTIC PAVEMENT MARKING (U TURN ARROW)	EACH	
716-02.22	PLASTIC AERIAL SPEED BARS	L.F.	
716-02.23	PLASTIC PAVEMENT MARKING (12 IN BARRIER LINE)	L.F.	
716-02.24	PLASTIC PAVEMENT MARKING (12 IN DWL)	L.F.	
716-02.30	RETRACING PAVEMENT MARKINGS-PLASTIC (4” LINE)	L.M.	
716-02.31	RETRACING PAVEMENT MARKINGS-PLASTIC (8” BARRIER LINE)	L.F.	
716-02.32	RETRACING PAVEMENT MARKINGS-PLASTIC (6” LINE)	L.M.	
716-02.33	RETRACING PAVEMENT MARKINGS-PLASTIC (DOTTED LINE)	L.F.	
716-03.01	PLASTIC WORD PAVEMENT MARKING (ONLY)	EACH	T-M-4

716-03.02	PLASTIC WORD PAVEMENT MARKING (RXR)	EACH	
716-03.03	PLASTIC WORD PAVEMENT MARKING (STOP AHEAD)	EACH	
716-03.04	PLASTIC WORD PAVEMENT MARKING (SCHOOL)	EACH	
716-03.05	PLASTIC WORD PAVEMENT MARKING (BIKE LANE)	EACH	
716-03.06	PLASTIC WORD PAVEMENT MARKING (SIGNAL AHEAD)	EACH	
716-03.07	PLASTIC WORD PAVEMENT MARKING (STOP)	EACH	
716-03.08	PLASTIC WORD PAVEMENT MARKING (PED XING)	EACH	
716-03.09 TO 716-03.11	PLASTIC WORD PAVEMENT MARKING (DESCRIPTION)	EACH	
716-03.12	PLASTIC PVMT MARKING (DESCRIPTION)	EACH	
716-03.13	PLASTIC PVMT MARKING (NO TRUCKS THIS LANE)	EACH	
716-04.01	PLASTIC PAVEMENT MARKING (STRAIGHT-TURN ARROW)	EACH	T-M-6
716-04.02	PLASTIC PAVEMENT MARKING (DOUBLE TURNING ARROW)	EACH	
716-04.03	PLASTIC PAVEMENT MARKING (4” DOTTED LINE)	L.F.	
716-04.04	PLASTIC PAVEMENT MARKING (TRANSVERSE SHOULDER)	L.F.	T-M-3, T-M-7, T-M-8
716-04.05	PLASTIC PAVEMENT MARKING (STRAIGHT ARROW)	EACH	T-M-6
716-04.06	PLASTIC PAVEMENT MARKING (WRONG WAY ARROW)	EACH	T-M-9
716-04.07	PLASTIC PAVEMENT MARKING (EXIT ONLY ARROW)	EACH	T-M-6
716-04.08	PLASTIC PAVEMENT MARKING (OPTION LANE ARROW)	EACH	
716-04.09	PLASTIC PAVEMENT MARKING (H.O.V. DIAMOND)	EACH	T-M-5

716-04.10	PLASTIC PAVEMENT MARKING (HANDICAP SYMBOL)	EACH	
716-04.11	PLASTIC PAVEMENT MARKING (BICYCLE SYMBOL W/ RIDER)	EACH	
716-04.12	PLASTIC PAVEMENT MARKING (YIELD LINE)	S.Y.	
716-04.13	PLASTIC PAVEMENT MARKING (BIKELANE SYMBOL & ARROW)	EACH	
716-04.14	PLASTIC PAVEMENT MARKING (LANE REDUCTION ARROW)	EACH	T-M-2, T-M-5
716-04.15	PLASTIC PAVEMENT MARKING (BIKE SYMBOL/ARROW SHARED)	EACH	
716-04.16	PLASTIC PAVEMENT MARKING (NOISE STRIP)	L.F.	
716-04.17	PLASTIC PAVEMENT MARKING (YIELD SYMBOL)	EACH	
716-04.18	PLASTIC PAVEMENT MARKING (BIKE/XING)	EACH	
716-04.21	GREEN TEXTURED BIKE LANE	S.Y.	
716-04.23	PLASTIC PAVEMENT MARKING (FISH-HOOKS WITH 1 ARROW)	EACH	
716-04.24	PLASTIC PAVEMENT MARKING (FISH-HOOKS WITH 2 ARROWS)	EACH	
716-04.25	PLASTIC PAVEMENT MARKING (FISH-HOOKS WITH 3 ARROWS)	EACH	
716-05.01	PAINTED PAVEMENT MARKING (4” LINE)	L.M.	T-RR-1
716-05.02	PAINTED PAVEMENT MARKING (8” BARRIER LINE)	L.F.	T-WZ-11, T-WZ-12, T-WZ-13, T-WZ-14, T-WZ-15, T-WZ-18, T-WZ-19
716-05.03	PAINTED PAVEMENT MARKING (CROSS-WALK)	L.F.	T-M-4
716-05.04	PAINTED PAVEMENT MARKING (CHANNELIZATION STRIPING)	S.Y.	
716-05.05	PAINTED PAVEMENT MARKING (STOP LINE)	L.F.	MM-PM-1

716-05.06	PAINTED PAVEMENT MARKING (TURN LANE ARROW)	EACH	
716-05.07	PAINTED PAVEMENT MARKING (24” BARRIER LINE)	L.F.	
716-05.08	PAINTED PAVEMENT MARKING (PARKING LINE)	L.F.	
716-05.09	PAINTED PAVEMENT MARKING (STRAIGHT-TURN ARROW)	EACH	
716-05.10	PAINTED PAVEMENT MARKING (RXR)	EACH	MM-PM-1
716-05.11	PAINTED PAVEMENT MARKING (STRAIGHT ARROW)	EACH	
716-05.12	PAINTED PAVEMENT MARKING (CONTRAST 6” LINE)	L.M.	
716-05.13	PAINTED PAVEMENT MARKING (CONTRAST 8” LINE)	L.M.	
716-05.20	PAINTED PAVEMENT MARKING (6” LINE)	L.M.	
716-05.21	PAINTED PAVEMENT MARKING (4” DOTTED LINE)	L.F.	
716-05.22	PAINTED PAVEMENT MARKING (LONGITUDINAL CROSS-WALK)	L.F.	T-M-4
716-05.49	PAINTED PAVEMENT MARKINGS (8” LINE)	L.M.	
716-05.50	PAINTED PAVEMENT MARKINGS (8” LINE)	L.F.	
716-05.51	PAINTED PAVEMENT MARKINGS (12” LINE)	L.F.	
716-05.52	PAINTED PAVEMENT MARKING (AREA)	S.F.	
716-06.01	PAINTED WORD PAVEMENT MARK ( )	EACH	
716-08.01	REMOVAL OF PAVEMENT MARKING (LINE)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)

716-08.02	REMOVAL OF PAVEMENT MARKING (8” BARRIER LINE)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.03	REMOVAL OF PAVEMENT MARKING (CROSS-WALK)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.04	REMOVAL OF PAVEMENT MARKING (CHANNELIZATION STRIPING)	S.Y	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.05	REMOVAL OF PAVEMENT MARKING (STOP LINE)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.06	REMOVAL OF PAVEMENT MARKING (TURN LANE ARROW)	EACH	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.07	REMOVAL OF PAVEMENT MARKING (STRAIGHT-TURN ARROW)	EACH	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.08	REMOVAL OF PAVEMENT MARKING (DOUBLE TURNING ARROW)	EACH	PAID WHEN REMOVAL IS REQUIRED PRIOR TO

			BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.09	REMOVAL OF PAVEMENT MARKING (DOTTED LINE)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.10	REMOVAL OF PAVEMENT MARKING (TRANSVERSE SHOULDER)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.11 THRU 716-08.17	REMOVAL OF PAVEMENT MARKING (DESCRIPTION)	EACH	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.18	REMOVAL OF PAVEMENT MARKING (WRONG WAY ARROW)	EACH	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.19	REMOVAL OF PAVEMENT MARKING (YIELD LINE)	S.Y.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.20	REMOVAL OF PAVEMENT MARKING (LINE)	L.M.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG.

			INTERSECTION IMPROVEMENTS)
716-08.21	REMOVAL OF PAVEMENT MARKING (24 IN BARRIER LINE)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.22	REMOVAL OF PAVEMENT MARKING (NOISE STRIP)	L.F.	PAID WHEN REMOVAL IS REQUIRED PRIOR TO BEGINNING OF WORK (EG. INTERSECTION IMPROVEMENTS)
716-08.30	HYDROBLAST REMOVAL OF PAVEMENT MARKING (LINE)	L.M.	USED BY CONSTRUCTION REQUEST
716-08.31	HYDROBLAST REMOVAL OF PAVEMENT MARKING (DESCRIPTION)	L.M.	USED BY CONSTRUCTION REQUEST
716-08.32	HYDROBLAST REMOVAL OF PAVEMENT MARKING (DESCRIPTION)	L.F.	USED BY CONSTRUCTION REQUEST
716-08.33	HYDROBLAST REMOVAL OF PAVEMENT MARKING (DESCRIPTION)	EACH	USED BY CONSTRUCTION REQUEST
716-08.34	HYDROBLAST REMOVAL OF PAVEMENT MARKING (DESCRIPTION)	S.Y.	USED BY CONSTRUCTION REQUEST
716-09.02	WET REFLECT. PVMT MARKING (8” BARRIER LINE)	L.F.	USED BY CONSTRUCTION REQUEST
716-09.03	WET REFLECTIVE PAVEMENTT MARKING (6” LINE)	L.M.	USED BY CONSTRUCTION REQUEST
716-09.30	WET REFLECTIVE CHANNELIZATION STRIPING	S.Y.	USED BY CONSTRUCTION REQUEST
716-09.32	EXIT ONLY ARROW	EACH	

716-09.33	6 INCH DOTTED LINE	L.F.	
716-09.72	WET REFLECTIVE PAVEMENT MARKING (4” LINE)	L.M.	
716-09.85	CONTRAST PAVEMENT MARKING 4”	L.M.	
716-09.86	CONTRAST PAVEMENT MARKING 6”	L.M.	SP716CPM
716-09.87	CONTRAST PAVEMENT WORDS AND SYMBOLS	EACH	SP716CPM
716-09.88	CONTRAST PAVEMENT MARKING 8”	L.M.	SP716CPM
716-09.89	CONTRAST PAVEMENT MARKING 12”	L.F.	SP716CPM
716-09.90	CONTRAST PAVEMENT MARKING 6” DOTTED	L.F.	SP716CPM
716-09.94	CONTRAST PAVEMENT SHADOW MARKING 6”	L.M.	SP716CPM
716-09.95	CONTRAST PAVEMENT SHADOW MARKING 8”	L.M.	SP716CPM
716-10.07	PREFORMED PLASTIC PAVEMENT MARKING (STOP LINE)	L.F.	
716-10.50	PREFORMED PLASTIC PAVEMENT MARKING (INTERSTATE SHIELD)	EACH	
716-10.51	PREFRMED PLSTC PVMNT MRKNG (STATE SHLD)	EACH	
716-10.52	PREFRMED PLSTC PVMNT MRKNG (US SHLD)	EACH	
716-12.01	ENHANCED FLATLINE THERMO PVMT MRKNG (4 IN LINE)	L.M.	FOR LOCAL USE
716-12.02	ENHANCED FLATLINE THERMO PVMT MRKNG (6 IN LINE)	L.M.	T-M-5, T-M-16A
716-12.03	ENHANCED FLATLINE THERMO PVMT MRKNG (8 IN BARRIER LINE)	L.F.	
716-12.04	ENHANCED FLATLINE THERMO PVMT MRKNG (4 IN DOTTED LINE)	L.F.	

716-12.05	ENHANCED FLATLINE THERMO PVMT MRKNG (6 IN DOTTED LINE)	L.F.	T-M-5
716-12.06	ENHANCED FLAT LINE THERMO (8 IN LINE)	L.F.	
716-12.07	ENHANCED FLAT LINE THERMO (8 IN BROKEN LINE)	L.F.	
716-12.08	ENHANCED FLAT LINE THERMO (12 IN BARRIER LINE)	L.F.	
716-12.09	ENHANCED FLAT LINE THERMO (12 IN LINE)	L.F.	T-M-5
716-12.10	ENHANCED FLAT LINE THERMO (12 IN DOTTED)	L.F.	T-M-5
716-14.01	PROFILED THERMO PVMT MRKNG AUDIBLE (4 IN)	L.M.	SP716PTA
716-14.02	PROFILED THERMO PVMT MRKNG AUDIBLE (6 IN)	L.M.	T-M-16, T-M-16A, SP716PTA
716-40.01	POLYUREA PAVEMENT MARKING (6 IN LINE)	L.M.	
716-40.02	POLYUREA PAVEMENT MARKINGS-WORDS-SYMBOLS	EACH	
716-40.03	POLYUREA PAVEMENT MARKING (STOP BAR)	L.F.	
716-40.41	GROOVING FOR RECESSED PAVEMENT MARKING (DOTTED LINE)	L.F.	
716-40.42	GROOVING FOR RECESSED PAVEMENT MARKING (SOLID)	L.M.	

A. 716-02.04, Plastic Pavement Marking (Channelization Striping) - Sq. Yd.

The unit of payment is per square yard of striping material applied including the boundary lines of the channelized area. This is applicable for 8 inch wide border lines only. All other border lines (edge lines and double yellow centerline) are paid for under their respective pay items and measured by the linear foot. This is used on medians, pavement transitions, obstruction approaches and traffic islands with areas greater than 400 Sq. ft.

Note that the unit of payment for Item No. 716-08.04, Removal of Pavement Marking (Channelization Striping), has been changed from per linear foot to per square yard of striping material removed.

B. 716-02.07, Plastic Pavement Marking (24" Barrier Line) - Linear Feet

The unit of payment is per linear foot of boundary line (with no diagonal marking used).

For all channelization markings detailed on Standard Drawing T-M-3, the following pay items and methods of measurement shall be used:

A. 716-04.04, Plastic Pavement Marking (Transverse Shoulder) - Linear Feet

The unit of payment is per linear foot of diagonal marking.

8-717.00 MOBILIZATION OF FORCES, SUPPLIES AND EQUIPMENT

Item Number	Description	Unit of Measurement	Comment
717-01	MOBILIZATION	L.S.	
717-01.04 TO 717-01.10	MOBILIZATION (DESCRIPTION)	EACH	
717-01.11 TO 717-01.12	MOBILIZATION (DESCRIPTION)	L.S.	
717-10.01	INVOLUNTARY WORK SUSPENSION (DESCRIPTION)	DAY	SP107AQ

8-718.00 NOISE BARRIER

Item Number	Description	Unit of Measurement	Comment
718-01.01 to 718-01.18	NOISE BARRIER (DESCRIPTION)	S.F.	
718-01.45	BOAT RAMP / PARKING AREA	L.S.	
718-01.50	RELOCATED KEY STONE WALL	L.F.	
718-02	NOISE BARRIER SAFETY WALL	L.F.	

718-02.75	NOISE BARRIER SAFETY WALL (EPOXY STEEL)	L.F.	

8-721.00 LANDSCAPING

Item Number	Description	Unit of Measurement	Comment
721-01.01	BENCH	EACH	
721-01.02	TRASH RECEPTACLE	EACH	

8-722.00 FIELD OFFICE

Item Number	Description	Unit of Measurement	Comment
722-01.01	FIELD OFFICE (TYPE 1)	L.S.	
722-01.02	FIELD OFFICE (TYPE 2)	L.S.	

During the Plan-in-Hand Field Review, the Operations representative will let the Designer know if a field office is to be added to the project.

8-730.00 TRAFFIC SIGNALS

Information concerning traffic signals can be found within the Traffic Operations Division, Signal and Lighting Design Section of TDOT.

8-730.01 REPLACEMENT OF TRAFFIC SIGNAL DETECTION LOOPS

Item Number	Description	Unit of Measurement	Comment
730-14.02	SAW SLOT	L.F.	
730-14.03	LOOP WIRE	L.F.	

When there are existing traffic signals on a cold planning project, contact shall be made with the City or County to determine the presence and location of detection loops. If loops are

present, and there is no way to avoid them in the cold planning process, then add Item Nos. 730-14.02, Saw Slot, and 730-14.03, Loop Wire, to the plans.

The Designer will obtain as-built plans from the maintaining agency to utilize for quantity calculations. These plans shall then be forwarded to the Regional Construction Office for submission to the contractor at the Pre-Construction Conference.

Roadway Standard Drawings T-SG-2 and T-SG-3 shall be included.

The Designer shall be aware that other pavement rehabilitation and resurfacing projects may affect the detection loops, in which case procedures described above will be required. Another type of project is the resealing of concrete pavement joints when a signal is controlling interstate ramp terminals with a local street.

The quantities for these items should come from the Traffic Operations Division – Signals and Lighting Section with the exception of Temporary Traffic Signal Systems.

8-730.02 TEMPORARY TRAFFIC SIGNAL SYSTEMS USED AT TWO-LANE BRIDGE RECONSTRUCTION SITES

When using Item No. 730-40 Temporary Traffic Signal System per each to provide traffic control for one-lane alternating flow at two-lane bridge reconstruction sites, see Standard Drawing Nos. T-WZ-32, T-WZ-33, T-WZ-34, and T-WZ-35 for details and general notes.

8-740.00 GEOSYNTHETICS

Item Number	Description	Unit of Measurement	Comment
740-06.01	GEOMEMBRANE	S.Y.	SP740D
740-07.01	GEO GRID REINFORCEMENT	S.Y.	
740-07.02	GEOGRID REINFORCEMENT (SOIL SLOPES)	S.Y.	SP205RSS
740-07.03	GEOGRID REINFORCEMENT TYPE 1	S.Y.	
740-07.04	GEOGRID REINFORCEMENT TYPE 2	S.Y.	
740-07.05	GEOGRID REINFORCEMENT TYPE 3	S.Y.	
740-07.06	GEOGRID REINFORCEMENT TYPE 4	S.Y.	
740-08.01	CELLULAR CONFINEMENT SYSTEM (DESCRIPTION)	S.Y.	
740-08.02 to 740.08.03	CELLULAR CONFINEMENT SYSTEM (DESCRIPTION)	S.Y.	

740-10.01	GEOTEXTILE(TYPE I) (SUBSURFACE DRAINAGE)	S.Y.	
740-10.02	GEOTEXTILE (TYPE II)(SEDIMENT CONTROL)	S.Y.	
740-10.03	GEOTEXTILE (TYPE III)(EROSION CONTROL)	S.Y.	EC-STR-2,11,11A,12,13,17,21,25,31,32,59; D-PB-1,2; D-NSD-13; D-NSD-32A
740-10.04	GEOTEXTILE (TYPE IV)(STABILIZATION)	S.Y.	EC-STR-12
740-10.05	GEOTEXTILE - TYPE V (DESCRIPTION)	S.Y.	
740-10.06	GEOTEXTILE TUBE	L.F.	Not Commonly Used
740-11.01	TEMPORARY SEDIMENT TUBE 8IN	L.F.	EC-STR-37
740-11.02	TEMPORARY SEDIMENT TUBE 12IN	L.F.	EC-STR-37
740-11.03	TEMPORARY SEDIMENT TUBE 18IN	L.F.	EC-STR-37
740-11.04	TEMPORARY SEDIMENT TUBE 20IN	L.F.	EC-STR-37
740-11.05	TEMPORARY SEDIMENT TUBE 24IN	L.F.	EC-STR-37
740-11.06	TEMPORARY SEDIMENT TUBE CHECK DAM	EACH	

SECTION 8 – ROADSIDE DEVELOPMENT

8-801.00 SEEDING

Item Number	Description	Unit of Measurement	Comment
801-01	SEEDING (WITH MULCH)	UNIT	NOTES 1, 4 RDG 9-105.00
801-01.02	CROWN VETCH MIXTURE (WITH MULCH)	UNIT	
801-01.04	SEEDING (WILDFLOWER MIXTURE)	UNIT	
801-01.06	SEEDING (SPECIAL MIXTURE)	UNIT	
801-01.07	TEMPORARY SEEDING (WITH MULCH)	UNIT	EC-STR-13,17
801-01.08	SEEDING (SPECIAL MIXTURE) WITH MULCH	UNIT	
801-01.10	SEEDING (WITH BONDED FIBER MATRIX)	UNIT	
801-01.16	BONDED FIBER MATRIX HYDROMULCH (W/PERMANENT SEED)	UNIT	
801-01.30	COVER CROP SEED MIX (RIPZN/FLPL) W/MULCH	UNIT	
801-01.34	GRASS SEED MIX (RIPZN/FLPL)	UNIT	
801-01.35	GRASS SEED MIX (RIPZN/FLPL) W/MULCH	UNIT	
801-01.36	SPECIAL WETLAND SEED MIXTURE	UNIT	
801-01.40	HYDRAULIC EROSION CONTROL PRODUCT (HECP) TYPE 1	UNIT	DRAINAGE MANUAL CHAPTER 10
801-01.41	HYDRAULIC EROSION CONTROL PRODUCT (HECP) TYPE 2	UNIT	DRAINAGE MANUAL CHAPTER 10
801-01.42	HYDRAULIC EROSION CONTROL PRODUCT (HECP) TYPE 3	UNIT	DRAINAGE MANUAL CHAPTER 10

801-01.43	HYDRAULIC EROSION CONTROL PRODUCT (HECP) TYPE 4	UNIT	DRAINAGE MANUAL CHAPTER 10
801-01.44	HYDRAULIC EROSION CONTROL PRODUCT (HECP) TYPE 5	UNIT	DRAINAGE MANUAL CHAPTER 10
801-01.65	TEMPORARY MULCH	UNIT	
801-02	SEEDING (WITHOUT MULCH)	UNIT	EC-STR-34,36; NOTE 5, RDG 9-105.00
801-02.01	CROWN VETCH MIXTURE (WITHOUT MULCH)	UNIT	EC-STR-34,36
801-02.08	TEMPORARY SEEDING (WITHOUT MULCH)	UNIT	EC-STR-34,36
801-02.15	FERTILIZER	TON	
801-03	WATER (SEEDING & SODDING)	M.G.	
801-06.11	STRAW WATTLES (SIZE)	L.F.	
801-07	SEED (SUPPLEMENTAL APPLICATION)	LB	
801-07.01	CROWN VETCH SEED (SUPPLEMENTAL APPLICATION)	LB	
801-08	FERTILIZER (SUPPLEMENTAL APPLICATION)	TON	
801-09	AGRICULTURAL LIME	TON	

8-801.01 SEEDING (WITH MULCH)

Method for computation of seeding on right-of-way.

$$\frac{\text{Area to be seeded (Sq. ft.)}}{\text{1,000 Sq. ft./ unit}} \times 1.25 = \_\_\_\_\_ \text{units}$$

Item No. 801-01
and/or
Item No. 801-01.02

Method for computation of seeding on waste areas and borrow pits outside right-of-way.

$$\frac{\text{Excess material to be wasted (C.Y.)}}{\text{500 C.Y./ unit}} = \_\_\_\_\_ \text{units}$$

Item No.801-01
and/or
Item No. 801-01.02

$$\frac{\text{Borrow material (C.Y.)}}{\text{500 C.Y./ unit}} = \_\_\_\_\_ \text{units}$$

Item No. 801-01
and/or
Item No. 801-01.02

Note: The cost of fertilizer and lime used in initial seed bed preparation is to be included in the cost of seeding. See Section 801 of TDOT Standard Specifications for Road and Bridge Construction.

8-801.02 CROWN VETCH MIXTURE (WITH MULCH)

Item Number	Description	Unit of Measurement	Comment
801-01.02	CROWN VETCH MIXTURE (WITH MULCH)	UNIT	

Item No. 801-01.02 Crown Vetch Mixture (with Mulch) per unit shall be used on slopes 3:1 or steeper and other areas that are inaccessible for mowing.

Crown vetch mixture shall be used, unless otherwise directed on the Plan-in-Hand Field Review, in all areas of Tennessee except Region IV.

On any project requiring crown vetch, the following note shall be put in the general notes with the parentheses being replaced by the proper item.

Item No. 801-01.02, Crown Vetch Mixture (with mulch) shall be used on slopes 3H:1V or steeper and other areas, as indicated in the plans, that are inaccessible for mowing.

Note: The cost of fertilizer and lime used in initial seed bed preparation is to be included in the cost of seeding. See Section 801 of TDOT Standard Specifications for Road and Bridge Construction.

8-801.03 TEMPORARY SEEDING (WITH MULCH)

Item Number	Description	Unit of Measurement	Comment
801-01.07	TEMPORARY SEEDING (WITH MULCH)	UNIT	EC-STR-13,17
801-02	SEEDING (WITHOUT MULCH)	UNIT	EC-STR-34,36; NOTE 5, RDG 9-105.00

The use of Temporary Seeding (with Mulch) is strongly recommended on projects.

Temporary seeding (with mulch) and seeding (without mulch) will be measured by the Unit (1,000 Sq. Ft.) as designed and completed in place, unless revised by the sequence of construction, in which case complete replacement and re-measurement may be required.

Note: The cost of fertilizer and lime used in initial seed bed preparation is to be included in the cost of seeding. See Section 801 of TDOT Standard Specifications for Road and Bridge Construction.

$$\frac{\text{Total area of seeding (Sq. ft.)} \times \text{number of effective phases of the sequence of construction}}{\text{1,000 (Sq. ft.)/unit}} = \text{Total seeding (UNITS)}$$

Exceptional locations where the slopes are flatter than 3H:1V, but where crown vetch is requested on the Plan-in-Hand Field Review, shall be outlined on the proposed layout sheet in a manner similar to *Figure 8-8*.

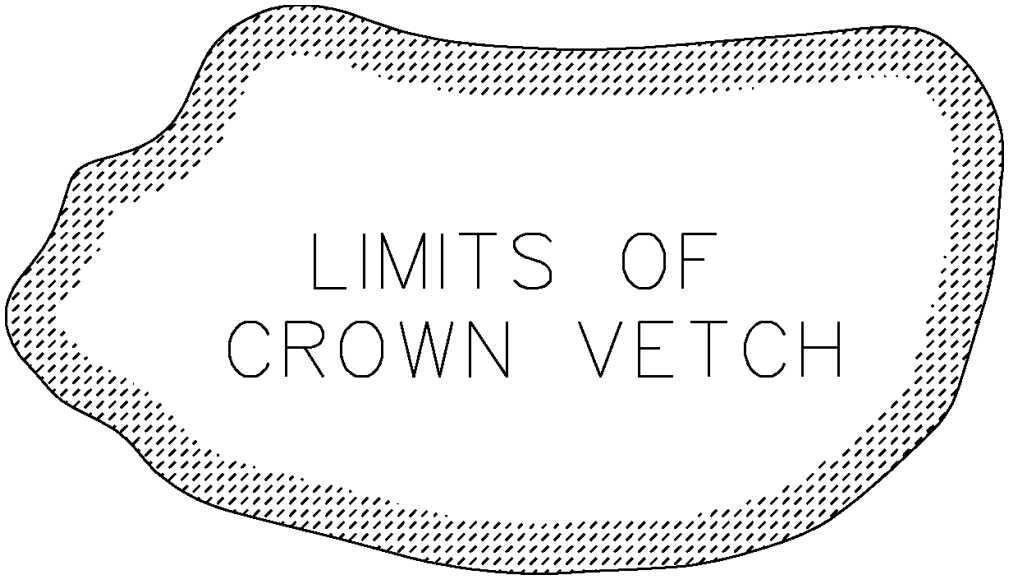


Figure 8-8
Typical Limits of Crown Vetch

8-801.04 WATER (SEEDING AND SODDING)

Item Number	Description	Unit of Measurement	Comment
801-03	WATER (SEEDING & SODDING)	M.G.	

Water for seeding, sodding, crown vetch mixture or sprigging (crown vetch):

Water will be measured by the thousand gallons (M.G.) as designed and completed in place, unless revised by the sequence of construction, in which case complete replacement and re-measurement may be required.

Seeding (all areas):

$$\frac{\text{Surface area (Sq.ft.)} \times 0.1 \text{ M.G./unit}}{1{,}000 \text{ Sq.ft./unit}} = \_\_\_\_\_ \text{M.G.}$$ **Item 801-03**

Total seeding (units) × 0.1 M.G./ unit = Total Water (M.G.)

The Designer shall **footnote** pay item as follows:

"Includes _____ thousand gallons for erosion prevention and sediment control."

Sodding:

$$\frac{\text{Surface area (Sq.Yd.)} \times 10 \text{ Gal./Sq.Yd.}}{1{,}000 \text{ Gal./M.G.}} = \_\_\_\_\_ \text{M.G.}$$ **Item 801-03**

8-801.05 SEEDING (SUPPLEMENTAL APPLICATION)

Item Number	Description	Unit of Measurement	Comment
801-07	SEED (SUPPLEMENTAL APPLICATION)	LB.	10 LB MINIMUM
801-07.01	CROWN VETCH SEED (SUPPLEMENTAL APPLICATION)	LB.	

Units of **801-01** (Seeding (with Mulch)) × 1.5 Lb/Unit × 1.15 =_____Lbs. **Item 801-07**

Units of **801-01.02** (Crown Vetch Mixture (with Mulch)) × 1.5 Lb/Unit × 1.15 = _____Lbs. **Item 801-07.01**

Note: For larger projects with significant amount of disturbed area, include Item No. 801-07 and/or Item No. 801-07.01 when using item no. 801-01 and/or 801-01.02.

8-801.06 FERTILIZER (SUPPLEMENTAL APPLICATION)

Item Number	Description	Unit of Measurement	Comment
801-08	Fertilizer (Supplemental Application)	TON	1 TON MINIMUM

1 Ton Minimum Quantity

Units of 801-01 and/or 801-01.02 $\times \frac{23 \text{ Lbs./Unit}}{2{,}000 \text{ Lb./ Ton}} \times 1.15 =$ _____Ton **Item 801-08**

For larger projects with significant amount of disturbed area, include Item No. 801-08 and/or when using Item No. 801-01 and/or 801-01.02.

Note: The cost of any necessary lime to be used in conjunction with supplemental fertilizer is to be included in the cost of the supplemental fertilizer. See Section 801 of TDOT Standard Specifications for Road and Bridge Construction.

8-802.00 LANDSCAPE PLANTING

Item Number	Description	Unit of Measurement	Comment
802-01.07	TREES (LIQUIDAMBER STYRACIFLUA) (1.5 - 2" CAL. B&B)	EACH	
802-01.08	TREES (PLATANUS OCCIDENTALIS) (1.5 - 2"CAL. B&B)	EACH	
802-01.10 TO 802-01.50	TREES (DESCRIPTION)	EACH	
802-02.01 TO 802-02.11	SEEDLINGS (DESCRIPTION)	EACH	
802-02.30	CUTTINGS: SALIX NIGRA (18IN-24IN LENGTH)	EACH	
802-02.31	CUTTINGS: SALIX SERICEA (18IN-24IN)	EACH	

802-02.32	CUTTINGS: CORNUS AMOMUM (18IN-24IN)	EACH	
802-02.33	CUTTINGS: SAMBUCUS CANADENSIS (18IN-24IN)	EACH	
802-02.34	CUTTINGS: SALIX INTERIOR (18IN-24IN)	EACH	
802-02.35	CUTTINGS: CEPHALANTHUS OCCIDENTALIS (18IN-24IN)	EACH	
802-02.36	CUTTINGS: CORNUS SERICEA (18IN-24IN)	EACH	
802-02.37	CUTTINGS: ALNUS SERRULATA (18IN-24IN)	EACH	
802-02.38	CUTTINGS: PLATANUS OCCIDENTALIS (18IN-24IN)	EACH	
802-02.39	CUTTINGS: POPULUS DELTOIDES (18IN-24IN)	EACH	
802-02.40	CUTTINGS: SALIX NIGRA (24-48IN LENGTH)	EACH	D-NSD-34
802-02.41	CUTTINGS: SALIX SERICEA (24-48IN)	EACH	D-NSD-34
802-02.42	CUTTINGS: CORNUS AMOMUM (24-48IN)	EACH	D-NSD-34
802-02.43	CUTTINGS: SAMBUCUS CANADENSIS (24-48IN)	EACH	D-NSD-34
802-02.44	CUTTINGS: SALIX INTERIOR (24-48IN)	EACH	D-NSD-34
802-02.45	CUTTINGS: CEPHALANTHUS OCCIDENTALIS (24-48IN)	EACH	D-NSD-34
802-02.46	CUTTINGS: CORNUS SERICEA (24-48IN)	EACH	D-NSD-34
802-02.47	CUTTINGS: ALNUS SERRULATA (24-48IN)	EACH	D-NSD-34
802-03.01 TO 802-03.21	SHRUBS (DESCRIPTION)	EACH	
802-04.01 TO 802-04.21	GROUND COVER (DESCRIPTION)	S.Y.	
802-04.70-04.95	GROUND COVER (DESCRIPTION)	EACH	
802-07.01 – 802-07.09	FLOWER (DESCRIPTION OF GROUPS)	EACH	
802-11.01	ACER NEGUNDO (BOX ELDER 2-5FT CNTNR GRWN)	EACH	
802-11.02	ACER RUBRUM (RED MAPLE 2-5FT CNTNR GRWN)	EACH	

802-11.03	ACER SACCHARINUM (SILVER MAPLE 2-5FT CNTNR GRWN)	EACH	
802-11.04	ACER SACCHARUM (SUGAR MAPLE 2-5FT CNTNR GRWN)	EACH	
802-11.05	AESCULUS GLABRA (OHIO BUCKEYE 2-5FT CNTNR GRWN)	EACH	
802-11.06	ASIMINA TRILOBA (PAWPAW 2-5FT CNTNR GRWN)	EACH	
802-11.07	BETULA NIGRA (RIVER BIRCH 2-5FT CNTNR GRWN)	EACH	
802-11.08	CARYA GLABRA (PIGNUT HICKORY 2-5FT CNTNR GRWN)	EACH	
802-11.09	CARYA OVATA (SHAGBARK HICKORY 2-5FT CNTNR GRWN)	EACH	
802-11.10	CARYA TOMENTOSA (MOCKERNUT HICKORY 2-5FT CNTNR GRWN)	EACH	
802-11.11	CERCIS CANADENSIS (REDBUD 2-5FT CNTNR GRWN)	EACH	
802-11.12	CORNUS FLORIDA (FLOWERING DOGWOOD 2-5FT CNTNR GRWN)	EACH	
802-11.13	CRATAEGUS PHAENOPYRUM (WSHNGTN HAWTHORN 2-5FT CNTNR GRWN)	EACH	
802-11.14	DIOSPYROS VIRGINIANA (PERSIMMON 2-5FT CNTNR GRWN)	EACH	
802-11.15	FAGUS GRANDIFOLIA (BEECH 2-5FT CNTNR GRWN)	EACH	
802-11.16	FRAXINUS PENNSYLVANICA (GREEN ASH 2-5FT CNTNR GRWN)	EACH	
802-11.17	JUGLANS NIGRA (BLACK WALNUT 2-5FT CNTNR GRWN)	EACH	
802-11.18	LIQUIDAMBER STYRACIFLUA (SWEETGUM 2-5FT CNTNR GRWN)	EACH	
802-11.19	LIRIODENDRON TULIPIFERA (TULIP POPLAR 2-5FT CNTNR GRWN)	EACH	
802-11.20	NYSSA AQUATICA (SWAMP TUPELO 2-5FT CNTNR GRWN)	EACH	
802-11.21	NYSSA SYLVATICA (BLCKGUM 2-5FT CNTNR GRWN)	EACH	

802-11.22	OSTRYA VIRGINIANA (IRONWOOD 2-5FT CNTNR GRWN)	EACH	
802-11.23	PINUS ENCHINATA (SHORTLEAF PINE 2-5FT CNTNR GRWN)	EACH	
802-11.24	PINUS STROBUS (WHITE PINE 2-5FT CNTNR GRWN)	EACH	
802-11.25	PINUS TAEDA (LOBLOLLY PINE 2-5FT CNTNR GRWN)	EACH	
802-11.26	PLATANUS OCCIDENTALIS (SYCAMORE 2-5FT CNTNR GRWN)	EACH	
802-11.27	POPULUS DELTOIDES (COTTONWOOD 2-5FT CNTNR GRWN)	EACH	
802-11.28	PRUNUS SEROTINA (BLACK CHERRY 2-5FT CNTNR GRWN)	EACH	
802-11.29	QUERCUS ALBA (WHITE OAK 2-5FT CNTNR GRWN)	EACH	
802-11.30	QUERCUS BICOLOR (SWAMP WHITE OAK 2-5FT CNTNR GRWN)	EACH	
802-11.31	QUERCUS FALCATA (SOUTHERN RED OAK 2-5FT CNTNR GRWN)	EACH	
802-11.32	QUERCUS LYRATA (OVERCUP OAK 2-5FT CNTNR GRWN)	EACH	
802-11.33	QUERCUS MICHAUXII (SWMP CHSTNT OAK 2-5FT CNTNR GRWN)	EACH	
802-11.34	QUERCUS MUEHLENBERGII (CHINKAPIN OAK 2-5FT CNTNR GRWN)	EACH	
802-11.35	QUERCUS NIGRA (WATER OAK 2-5FT CNTNR GRWN)	EACH	
802-11.36	QUERCUS NUTTALLII (NUTTALL OAK 2-5FT CNTNR GRWN)	EACH	
802-11.37	QUERCUS PALUSTRIS (PIN OAK 2-5FT CNTNR GRWN)	EACH	
802-11.38	QUERCUS PHELLOS (WILLOW OAK 2-5FT CNTNR GRWN)	EACH	
802-11.39	QUERCUS RUBRA (NORTHERN RED OAK 2-5FT CNTNR GRWN)	EACH	
802-11.40	SALIX NIGRA (BLACK WILLOW 2-5FT CNTNR GRWN)	EACH	

802-11.41	SASSAFRAS ALBIDUM (SASSAFRAS 2-5FT CNTNR GRWN)	EACH	
802-11.42	TAXODIUM DISTICHUM (BALD CYPRESS 2-5FT CNTNR GRWN)	EACH	
802-11.43	TSUGA CANADENSIS (HEMLOCK 2-5FT CNTNR GRWN)	EACH	
802-11.44	ULMUS AMERICANA (AMERICAN ELM 2-5FT CNTNR GRWN)	EACH	
802-11.45	CARPINUS CAROLINIANA (AMERICAN HORNBEAM 2-5FT CONTAINER GR)	EACH	
802-11.46	QUERCUS SHUMARDII (SHUMARD OAK 2-5 FT CNTNR GRWN)	EACH	
802-11.48	ROSA PALUSTRIS (SWAMP ROSE 2-5FT CNTNR GRWN)	EACH	
802-11.57	VIBURNUM RUFIDULUM (RUSTY BLACKHAW 2-5FT C.G.)	EACH	
802-11.58	OXYDENDRUM ARBOREUM (SOURWOOD 2-5FT C.G.)	EACH	
802-11.59	PRUNUS AMERICANA (AMERICAN PLUM 2-5FT CNTNR GRWN)	EACH	
802-11.60	KALMIA LATIFOLIA (MOUNTAIN LAUREL 2-5 FT CNTNR GRWN)	EACH	
802-11.61	ALNUS SERRULATA (HAZEL ALDER 2-5FT CNTNR GRWN)	EACH	
802-11.62	CORNUS ALTERNIFOLIA (ALTERNATE LEAF DGWOOD 2-5FT CNTNR GRWN)	EACH	
802-11.63	HAMAMELIS VIRGINIANA (AMERICAN WITCHHAZEL 2-5FT CNTNR GRWN)	EACH	
802-11.64	ILEX DECIDUA (DECIDUOUS HOLLY 2-5FT CNTNR GRWN)	EACH	
802-11.65	MALUS ANGUSTIFOLIA (SOUTHERN CRABAPPLE 2-5FT CNTNR GRWN)	EACH	
802-11.66	PRUNUS ANGUSTIFOLIA (CHICKASAW PLUM 2-5FT CNTNR GRWN)	EACH	
802-11.67	EUONYMUS AMERICANUS (STRAWBERRY BUSH 2-5FT CONTAINER GR0WN)	EACH	

802-12.01	ACER NEGUNDO (BOX ELDER SEEDLNG B.R.)	EACH	
802-12.02	ACER RUBRUM (RED MAPLE SEEDLNG B.R.)	EACH	
802-12.03	ACER SACCHARINUM (SILVER MAPLE SEEDLNG B.R.)	EACH	
802-12.04	ACER SACCHARUM (SUGAR MAPLE SEEDLNG B.R.)	EACH	
802-12.05	AESCULUS GLABRA (OHIO BUCKEYE SEEDLNG B.R.)	EACH	
802-12.06	ASIMINA TRILOBA (PAWPAW SEEDLNG B.R.)	EACH	
802-12.07	BETULA NIGRA (RIVER BIRCH SEEDLNG B.R.)	EACH	
802-12.08	CARYA GLABRA (PIGNUT HICKORY SEEDLNG B.R.)	EACH	
802-12.09	CARYA OVATA (SHAGBARK HICKORY SEEDLNG B.R.)	EACH	
802-12.10	CARYA TOMENTOSA (MOCKERNUT HICKORY SEEDLNG B.R.)	EACH	
802-12.11	CERCIS CANADENSIS (REDBUD SEEDLNG B.R.)	EACH	
802-12.12	CORNUS FLORIDA (FLOWERING DOGWOOD SEEDLNG B.R.)	EACH	
802-12.13	CRATAEGUS PHAENOPYRUM (WSHNGTN HAWTHORN SEEDLNG B.R.)	EACH	
802-12.14	DIOSPYROS VIRGINIANA (PERSIMMON SEEDLNG B.R.)	EACH	
802-12.15	FAGUS GRANDIFOLIA (BEECH SEEDLNG B.R.)	EACH	
802-12.16	FRAXINUS PENNSYLVANICA (GREEN ASH SEEDLNG B.R.)	EACH	
802-12.17	JUGLANS NIGRA (BLACK WALNUT SEEDLNG B.R.)	EACH	
802-12.18	LIQUIDAMBER STYRACIFLUA (SWEETGUM SEEDLNG B.R.)	EACH	
802-12.19	LIRIODENDRON TULIPIFERA (TULIP POPLAR SEEDLNG B.R.)	EACH	
802-12.20	NYSSA AQUATICA (SWAMP TUPELO SEEDLNG B.R.)	EACH	
802-12.21	NYSSA SYLVATICA (BLCKGUM SEEDLNG B.R.)	EACH	
802-12.22	OSTRYA VIRGINIANA (IRONWOOD SEEDLNG B.R.)	EACH	

802-12.23	PINUS ENCHINATA (SHORTLEAF PINE SEEDLNG B.R.)	EACH	
802-12.24	PINUS STROBUS (WHITE PINE SEEDLNG B.R.)	EACH	
802-12.25	PINUS TAEDA (LOBLOLLY PINE SEEDLNG B.R.)	EACH	
802-12.26	PLATANUS OCCIDENTALIS (SYCAMORE SEEDLNG B.R.)	EACH	
802-12.27	POPULUS DELTOIDES (COTTONWOOD SEEDLNG B.R.)	EACH	
802-12.28	PRUNUS SEROTINA (BLACK CHERRY SEEDLNG B.R.)	EACH	
802-12.29	QUERCUS ALBA (WHITE OAK SEEDLNG B.R.)	EACH	
802-12.30	QUERCUS BICOLOR (SWAMP WHITE OAK SEEDLNG B.R.)	EACH	
802-12.31	QUERCUS FALCATA (SOUTHERN RED OAK SEEDLNG B.R.)	EACH	
802-12.32	QUERCUS LYRATA (OVERCUP OAK SEEDLNG B.R.)	EACH	
802-12.33	QUERCUS MICHAUXII (SWMP CHSTNT OAK SEEDLNG B.R.)	EACH	
802-12.34	QUERCUS MUEHLENBERGII (CHINKAPIN OAK SEEDLNG B.R.	EACH	
802-12.35	QUERCUS NIGRA (WATER OAK SEEDLNG B.R.)	EACH	
802-12.36	QUERCUS NUTTALLII (NUTTALL OAK SEEDLNG B.R.)	EACH	
802-12.37	QUERCUS PALUSTRIS (PIN OAK SEEDLNG B.R.)	EACH	
802-12.38	QUERCUS PHELLOS (WILLOW OAK SEEDLNG B.R.)	EACH	
802-12.39	QUERCUS RUBRA (NORTHERN RED OAK SEEDLNG B.R.)	EACH	
802-12.40	SALIX NIGRA (BLACK WILLOW SEEDLNG B.R.)	EACH	
802-12.41	SASSAFRAS ALBIDUM (SASSAFRAS SEEDLNG B.R.)	EACH	
802-12.42	TAXODIUM DISTICHUM (BALD CYPRESS SEEDLNG B.R.)	EACH	
802-12.43	TSUGA CANADENSIS (HEMLOCK SEEDLNG B.R.)	EACH	
802-12.44	ULMUS AMERICANA (AMERICAN ELM SEEDLNG B.R.)	EACH	

802-12.45	CARPINUS CAROLINIANA (AMERICAN HORNBEAM SEEDLING B.R.)	EACH	
802-12.46	QUERCUS SHUMARDII (SHUMARD OAK SEEDLING B.R.)	EACH	
802-12.50	CARYA AQUATICA (WATER HICKORY SEEDLING B.R.)	EACH	
802-12.51	CORNUS AMOMUM (SILKY DOGWOOD SEEDLING B.R.)	EACH	
802-12.52	CORNUS FOEMINA (STIFF DOGWOOD SEEDLING B.R.)	EACH	
802-12.53	QUERCUS PAGODA (CHERRYBARK OAK SEEDLING B.R.)	EACH	
802-12.54	CARYA CORDIFORMIS (BITTERNUT HICKORY SEEDLING B.R.)	EACH	
802-12.55	CARYA LACINIOSA (SHELLBARK HICKORY SEEDLING B.R.)	EACH	
802-12.56	CARYA ILLINOINESIS (PECAN SEEDLING B.R.)	EACH	
802-12.57	VIBURNUM RUFIDULUM (RUSTY BLACKHAW SDLNG B.R.)	EACH	
802-12.58	OXYDENDRUM ARBOREUM (SOURWOOD SDLNG B.R.)	EACH	
802-12.59	PRUNUS AMERICANA (AMERICAN PLUM SEEDLING B.R.)	EACH	
802-12.60	KALMIA LATIFOLIA (MOUNTAIN LAUREL SEEDLING B.R.)	EACH	
802-12.61	ALNUS SERRULATA (HAZEL ALDER SEEDLING B.R.)	EACH	
802-12.62	CORNUS ALTERNIFOLIA (ALTERNATE LEAF DOGWOOD SEEDLING B.R.)	EACH	
802-12.63	HAMAMELIS VIRGINIANA (AMERICAN WITCHHAZEL SEEDLING B.R.)	EACH	
802-12.64	ILEX DECIDUA (DECIDUOUS HOLLY SEEDLING B.R.)	EACH	
802-12.65	MALUS ANGUSTIFOLIA (SOUTHERN CRABAPPLE SEEDLING B.R.)	EACH	
802-12.66	PRUNUS ANGUSTIFOLIA (CHICKASAW PLUM SEEDLING B.R.)	EACH	

802-13.01	ALNUS SERRULATA (HAZEL ALDER 2-5FT CNTNR GRWN)	EACH	
802-13.02	CALYCANTHUS FLORIDUS (SWEETSHRUB 2-5FT CNTNR GRWN)	EACH	
802-13.03	CEPHALANTHUS OCCIDENTALIS (BUTTONBUSH 2-5FT CNTNR GRWN)	EACH	
802-13.04	CORNUS AMOMUM (SILKY DOGWOOD 2-5FT CNTNR GRWN)	EACH	
802-13.05	HAMAMELIS VIRGINIANA (WITCH HAZEL 2-5FT CNTNR GRWN)	EACH	
802-13.06	HYDRANGEA QUERCIFOLIA (OAKLF HYDRANGEA 2-5FT CNTNR GRWN)	EACH	
802-13.07	ILEX OPACA (AMERICAN HOLLY 2-5FT CNTNR GRWN)	EACH	
802-13.08	ITEA VIRGINICA (VIRGINIA SWEETSPIRE 2-5FT CNTNR GRWN)	EACH	
802-13.09	LINDERA BENZOIN (SPICEBUSH 2-5FT CNTNR GRWN)	EACH	
802-13.10	SAMBUCUS CANADENSIS (ELDERBERRY 2-5FT CNTNR GRWN)	EACH	
802-13.11	ARONIA MELANOCARPA (BLCK CHOKEBERRY 2-5FT C.G.)	EACH	
802-13.12	ILEX VERTICILLATA (CMMN WINTERBERRY 2-5FT C.G.)	EACH	
802-13.13	VACCINIUM STAMINEUM (DEERBERRY 2-5FT C.G.)	EACH	
802-13.14	CALLICARPA AMERICANA (AMRCN BEAUTYBERRY) 2-5FT C.G.	EACH	
802-13.15	PHYSOCARPUS OPULIFOLIUS (NINEBARK) 2-5FT C.G.	EACH	
802-13.16	CORYLUS AMERICANA (HAZELNUT) 2-5FT C.G.	EACH	
802-13.17	HIBISCUS MOSCHEUTOS (SWAMP MALLOW SDLNG B.R.)	EACH	
802-13.18	HIBISCUS MOSCHEUTOS (SWAMP MALLOW 2-5 FT C.G.)	EACH	
802-13.19	ROSA PALUSTRIS (SWAMP ROSE SDLNG B.R.	EACH	
802-13.20	ROSA PALUSTRIS (SWAMP ROSE 2-5FT CNTNR GRWN)	EACH	

802-13.21	VACCINIUM ARBOREUM (FARKLEBERRY 2-5FT C.G.)	EACH	
802-13.22	VACCINIUM ARBOREUM (FARKLEBERRY SDLNG B.R.)	EACH	
802-13.23	RHODODENDRON CANESCENS (WILD AZALEA SDLNG BR)	EACH	
802-13.24	RHODODENDRON CANESCENS (WILD AZALEA 2-5 FT CG)	EACH	
802-13.25	RHODODENDRON MAXIMUM (ROSEBAY RHODODENDRON SDLNG BR)	EACH	
802-13.26	RHODODENDRON MAXIMUM (ROSEBAY RHODODENDRON 2-5 FT CG)	EACH	
802-13.27	AESCULUS PAVIA (RED BUCKEYE 2-5 FT CNTNR GRWN)	EACH	
802-13.28	AMORPHA FRUTICOSA (INDIGOBUSH 2-5 FT CNTNR GRWN)	EACH	
802-13.29	CORNUS DRUMMONDII (ROUGH LEAF DOGWOOD 2-5 FT CNTNR GRWN)	EACH	
802-13.30	RHODODENDRON CALENDULACEUM (FLAMING AZALEA 2-5 FT	EACH	
802-13.31	RHODODENDRON MAXIMUM (RHODODENDRON 2-5 FT CNTNR GRWN)	EACH	
802-13.32	RHUS AROMATICA (FRAGRANT SUMAC 2-5 FT CNTNR GRWN)	EACH	
802-13.33	RHUS COPALLINUM (WINGED SUMAC 2-5 FT CNTNR GRWN)	EACH	
802-13.34	RHUS GLABRA (SMOOTH SUMAC 2-5 FT CNTNR GRWN)	EACH	
802-13.35	RHUS TYPHINA (STAGHORN SUMAC 2-5 FT CNTNR GRWN)	EACH	
802-13.36	VIBURNUM DENTATUM (ARROWWOOD VIBURNUM 2-5 FT CNTNR GRWN)	EACH	
802-13.37	VIBURNUM NUDUM (POSSUMHAW VIBURNUM 2-5 FT CNTNR GRWN)	EACH	
802-13.51	ALNUS SERRULATA (HAZEL ALDER SDLNG BARE ROOT)	EACH	
802-13.52	CALYCANTHUS FLORIDUS (SWEETSHRUB SDLNG BARE ROOT)	EACH	

802-13.53	CEPHALANTHUS OCCIDENTALIS (BUTTONBUSH SDLNG BARE ROOT)	EACH	
802-13.54	CORNUS AMOMUM (SILKY DOGWOOD SDLNG BARE ROOT)	EACH	
802-13.55	HAMAMELIS VIRGINIANA (WITCH HAZEL SDLNG BARE ROOT)	EACH	
802-13.56	HYDRANGEA QUERCIFOLIA (OAKLF HYDRANGEA SDLNG BARE ROOT)	EACH	
802-13.57	ILEX OPACA (AMERICAN HOLLY SDLNG BARE ROOT)	EACH	
802-13.58	ITEA VIRGINICA (VIRGINIA SWEETSPIRE SDLNG BARE ROOT)	EACH	
802-13.59	LINDERA BENZOIN (SPICEBUSH SDLNG BARE ROOT)	EACH	
802-13.60	SAMBUCUS CANADENSIS (ELDERBERRY SDLNG BARE ROOT)	EACH	
802-13.61	ARONIA MELANOCARPA (BLCK CHOKEBERRY SDLNG B.R.)	EACH	
802-13.62	ILEX VERTICILLATA (CMMN WINTERBERRY SDLNG B.R.)	EACH	
802-13.63	VACCINIUM STAMINEUM (DEERBERRY SDLNG B.R.)	EACH	
802-13.64	AESCULUS PAVIA (RED BUCKEYE SDLING B.R.)	EACH	
802-13.65	AMORPHA FRUTICOSA (INDIGOBUSH SDLING B.R.)	EACH	
802-13.66	CORNUS DRUMMONDII (ROUGH LEAF DOGWOOD SDLING B.R.)	EACH	
802-13.67	RHODODENDRON CALENDULACEUM (FLAMING AZALEA SDLING B.R.)	EACH	
802-13.68	RHODODENDRON MAXIMUM (RHODODENDRON SDLING B.R.)	EACH	
802-13.69	RHUS AROMATICA (FRAGRANT SUMAC SDLING B.R.)	EACH	
802-13.70	RHUS COPALLINUM (WINGED SUMAC SDLING B.R.)	EACH	
802-13.71	RHUS GLABRA (SMOOTH SUMAC SDLING B.R.)	EACH	
802-13.72	RHUS TYPHINA (STAGHORN SUMAC SDLING B.R.)	EACH	

802-13.73	VIBURNUM DENTATUM (ARROWWOOD VIBURNUM SDLING B.R.)	EACH	
802-13.74	VIBURNUM NUDUM (POSSUMHAW VIBURNUM SDLING B.R.)	EACH	
802-13.75	ARONIA ARBUTIFOLIA (RED CHOKEBERRY SEEDLING B.R.)	EACH	
802-13.76	CELTIS LAEVIGATA (SUGARBERRY SEEDLING B.R.)	EACH	
802-14.01	PARTHENOCISSUS QUINQUEFOLIA (VIRGINIA CREEPER C.G.)	EACH	
802-15.01	ELEOCHARIS ACICULARIS (SLENDER SPIKERUSH)	EACH	
802-15.02	JUSTICIA AMERICANA (WATERWILLOW AKA BASSGRASS)	EACH	
802-15.03	ELEOCHARIS PALUSTRIS (CREEPING SPIKERUSH)	EACH	
802-15.04	JUNCUS EFFUSUS (SOFT RUSH)	EACH	
802-15.05	ACORUS CALAMUS (SWEET FLAG)	EACH	
802-15.06	CASTANEA DENTATA (AMERICAN CHESTNUT)	EACH	
802-31.10	CARYA TOMENTOSA (MCKRNT HCKRY 12-15FT CG)	EACH	
802-31.41	QUERCUS STELLATA (POST OAK 12-15FT CG)	EACH	
802-50.99	PLANTING SOIL	C.Y.	

Additional Item No. 802-11.01 to 802-31.10 area available for specific varies and sizes. Designers need to include a quantity for water for plant establishment.

8-803.00 SODDING

Item Number	Description	Unit of Measurement	Comment
803-01	SODDING (NEW SOD)	S.Y.	

Topsoil at a depth of 3” is required under sod. Designers should remember to add the appropriate item number for topsoil to the estimated quantities. Designers should also remember to

include the appropriate amount of Item Number 801-03 Water (Seeding & Sodding). See RDG 2-1007.00 for additional information on topsoil.

8-805.00 EROSION CONTROL BLANKETS

Item Number	Description	Unit of Measurement	Comment
805-01.01	TURF REINFORCEMENT MAT (CLASS I)	S.Y.	EC-STR-36
805-01.02	TURF REINFORCEMENT MAT (CLASS II)	S.Y.	EC-STR-36
805-01.03	TURF REINFORCEMENT MAT (CLASS III)	S.Y.	EC-STR-36
805-01.04	TURF REINFORCEMENT MAT (CLASS IV)	S.Y.	
805-05.02	SOIL NAIL STABILIZATION	L.F.	
805-05.03	REINFORCED SHOTCRETE FACING	S.F.	
805-05.04	SECONDARY WALL (DESCRIPTION)	S.F.	
805-12.01	EROSION CONTROL BLANKET (TYPE I)	S.Y.	EC-STR-34
805-12.02	EROSION CONTROL BLANKET (TYPE II)	S.Y.	EC-STR-34
805-12.03	EROSION CONTROL BLANKET (TYPE III)	S.Y.	EC-STR-34
805-12.04	EROSION CONTROL BLANKET (TYPE IV)	S.Y.	EC-STR-34
805-12.08	700 GRAM COIR FIBER EROSION BLANKET	S.Y.	D-NSD-33

See Chapter 10 of the Drainage Manual for additional information.

8-806.00 ROADSIDE MAINTENANCE

Item Number	Description	Unit of Measurement	Comment
806-01	MOWING	ACRE	
806-02.03	MOWING AND VEGETATION REMOVAL	MOWING CYCLE	
806-02.05 TO 806-02.09	HERBICIDE APPLICATION (DESCRIPTION)	ACRE	
806-02.13	SWATH MOWING	ACRE	

Projects on State Routes with high traffic volumes and high visibility shall include Item No. 806-02.03 Project Mowing per cycle on their construction plans. This item is not intended for use on resurfacing projects.

For the purpose of determining applicable projects, Designers will include Project Mowing on new construction projects, reconstruction projects (including widening) or on-system bridge replacement projects where one or more of the following apply:

- Expected project duration is one year or greater
- Project is in an urban area (an urban area is defined as any city with a population of 5,000 or greater)
- The current Average Daily Traffic (ADT) is 20,000 or greater

The quantity to be set up for a project should be based on a minimum of 2 mowing cycles per year of construction. Since most projects fall into the 2 to 3 year range, a minimum of 4-6 cycles would be needed. The number of mowing cycles per year of construction may be increased based upon input received at the Plan-in-Hand Field Review. Design Managers should check with the Construction Division to determine the length of the contract.

Item No. 806-02.03 Project Mowing per cycle shall include the following footnote under the estimated roadway quantities block:

“Item includes litter and trash removal. This work will not be measured and paid for directly but will be included in the cost of Item No. 806-02.03 Project Mowing per Cycle.”

PDN – CHAPTER 9

GENERAL AND SPECIAL NOTES

CHAPTER 9 GENERAL AND SPECIAL NOTES

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INTRODUCTION

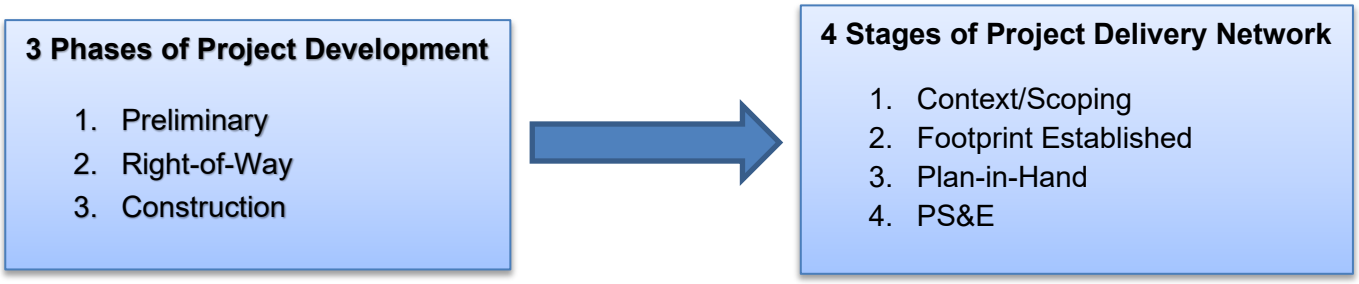
ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Designer** – Preconstruction Roadway Designer, or Consultant Designer
- **Design Manager** – Preconstruction Design Lead, or Consultant Design Manager
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Technical Report** – Concept Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.



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CHAPTER 9 – GENERAL NOTES AND SPECIAL NOTES

(THE BLUE TEXT IS FOR YOUR INFORMATION ONLY AND SHOULD NOT BE INCLUDED IN THE PLANS).

SECTION 1 – GENERAL NOTES

9-100.00 GRADING

(1) ANY AREA THAT IS DISTURBED OUTSIDE LIMITS OF CONSTRUCTION DURING THE LIFE OF THIS PROJECT SHALL BE REPAIRED BY THE CONTRACTOR AT HIS EXPENSE.

(2) CERTIFICATION FOR ALL BORROW PITS MUST BE OBTAINED IN ACCORDANCE WITH SUBSECTION 107.06 OF THE STANDARD SPECIFICATIONS.

(3) THE CONTRACTOR SHALL NOT DISPOSE OF ANY MATERIAL EITHER ON OR OFF STATE-OWNED R.O.W. IN A REGULATORY FLOOD WAY AS DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) WITHOUT APPROVAL BY FEMA. ALL MATERIAL SHALL BE DISPOSED OF IN UPLAND (NON-WETLAND) AREAS AND ABOVE ORDINARY HIGH WATER OF ANY ADJACENT WATERCOURSE. THIS DOES NOT ELIMINATE THE NEED TO OBTAIN ANY OTHER LICENSES OR PERMITS THAT MAY BE REQUIRED BY ANY OTHER FEDERAL, STATE OR LOCAL AGENCY.

(4) ARCHAEOLOGICAL SITE NO. _____ MUST BE AVOIDED AS A SOURCE OF FILL OR HEAVY MACHINERY STAGING AREA. EARTH FILL WILL BE REQUIRED FROM AREAS OUTSIDE THE PROPOSED RIGHT-OF-WAY. CERTIFICATION MUST BE OBTAINED IN ACCORDANCE WITH SUBSECTION 107.06 OF THE STANDARD SPECIFICATIONS.

9-105.00 SEEDING AND SODDING

(1) ALL EXISTING ROADS WITHIN THE RIGHT-OF-WAY AND NOT IN THE GRADED AREA THAT ARE TO BE ABANDONED SHALL BE SCARIFIED, OBLITERATED, TOPSOILED AND SEEDED. SCARIFYING AND OBLITERATING THE PAVEMENT WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COST WILL BE INCLUDED IN THE COST OF OTHER ITEMS. TOPSOIL, IN ACCORDANCE WITH SECTION 203 OF THE STANDARD SPECIFICATIONS, WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 203-04 AND/OR 203-07. SEEDING, IN ACCORDANCE WITH SECTION 801 OF THE STANDARD SPECIFICATIONS, WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 801-01.

(2) SOD SHALL BE PLACED AT LOCATIONS SHOWN ON THE PLANS TO PREVENT DAMAGE TO ADJACENT FACILITIES AND PROPERTY DUE TO EROSION ON ALL NEWLY GRADED CUT AND FILL SLOPES AS WORK PROGRESSES.

NOTE: SEE SECTION 4-801.05. NOTE (3) SHALL BE PLACED IN THE GENERAL NOTES WITH THE BLANK BEING FILLED IN WITH THE PROPER ITEM NUMBER.

(3) ITEM NO. ____ SHALL BE USED ON SLOPES 3:1 OR STEEPER AND OTHER AREAS AS INDICATED IN THE PLANS THAT ARE INACCESSIBLE FOR MOWING.

(4) ITEM NO. 801-01, SEEDING (WITH MULCH), SHALL BE USED WHERE EROSION CONTROL BLANKET OR SOD ARE NOT APPLIED.

(5) ITEM NO. 801-02, SEEDING (WITHOUT MULCH) AND EROSION CONTROL BLANKET, SHALL BE PLACED AT LOCATIONS SHOWN ON THE PLANS AS WELL AS LOCATIONS DIRECTED BY THE ENGINEER.

9-110.00 GUARDRAIL

(1) THE CONTRACTOR SHALL NOT REMOVE ANY SECTIONS OF EXISTING GUARDRAIL TO REWORK SHOULDERS OR FLATTEN SLOPES UNTIL THE ENGINEER CONCURS IN THE NECESSITY OF REMOVAL DUE TO CONSTRUCTION REQUIREMENTS AND THE APPROPRIATE WARNING DEVICES ARE INSTALLED. THE PROPOSED GUARDRAIL, INCLUDING ANY ANCHOR SYSTEM, SHALL BE INSTALLED QUICKLY TO MINIMIZE TRAFFIC EXPOSURE TO ANY HAZARD. NO PAYMENT WILL BE MADE FOR A SECTION OF PROPOSED GUARDRAIL, INCLUDING ANCHORS, UNTIL IT IS COMPLETE IN PLACE.

NOTE: NOTE (2) NOT NECESSARY IF NOTE (1) IS USED.

(2) THE PROPOSED GUARDRAIL, INCLUDING ANY ANCHOR SYSTEM, SHALL BE INSTALLED QUICKLY TO MINIMIZE TRAFFIC EXPOSURE TO ANY HAZARD. NO PAYMENT WILL BE MADE FOR A SECTION OF PROPOSED GUARDRAIL, INCLUDING ANCHORS, UNTIL IT IS COMPLETE IN PLACE.

NOTE: NOTE (3) NOT NECESSARY IF NOTE (2) IS USED.

(3) IF ANY APPROACH END OF A SECTION OF GUARDRAIL OR BRIDGE RAIL MUST TEMPORARILY BE LEFT INCOMPLETE AND EXPOSED TO TRAFFIC, THE CONTRACTOR SHALL USE TWO (2) TEMPORARY BARRICADES OR DRUMS WITH TYPE “A” LIGHTS AND ROUNDED END ELEMENTS AS MINIMUM MEASURES TO PROTECT TRAFFIC FROM THE HAZARD OF AN EXPOSED END. ALL COST OF FURNISHING AND INSTALLING TEMPORARY BARRICADES OR DRUMS WITH TYPE “A” LIGHTS TO DELINEATE GUARDRAIL END AND A TEMPORARY ROUNDED END ELEMENT SHALL BE INCLUDED IN THE COST OF THE PROPOSED GUARDRAIL END TERMINAL.

NOTE: NOTE (4) TO BE USED ON NEW ALIGNMENT ONLY OR IF THE ROADWAY HAS BEEN CLOSED TO TRAFFIC DURING CONSTRUCTION.

(4) GUARDRAIL IS TO BE COMPLETE IN PLACE BEFORE THE MAINLINE ROADWAY IS OPENED TO TRAFFIC.

9-115.00 DRAINAGE

(1) THE CONTRACTOR SHALL SHAPE DITCHES TO THE SPECIFIED DESIGN. THIS WORK WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COST WILL BE INCLUDED IN THE COST OF OTHER ITEMS.

NOTE: SEE SECTION 4-204.00.

(2) EXCAVATION FOR _____ WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT WILL BE INCLUDED IN THE PRICE BID PER LINEAR FOOT OF PIPE (CHOOSE THE APPLICABLE ITEM(S) FROM THE FOLLOWING: PIPE CULVERTS, STORM SEWERS, CONDUITS, ALL OTHER CULVERTS AND MINOR STRUCTURES).

(3) CULVERT EXCAVATION FOR CONCRETE BOX OR SLAB TYPE CULVERTS OR BRIDGES WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COST WILL BE INCLUDED IN THE COST OF OTHER ITEMS.

(4) THE CUTTING OF INLET AND OUTLET DITCHES WHERE SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER WILL BE MEASURED AND PAID FOR AS ITEM NO. 203-01 ROAD AND DRAINAGE EXCAVATION (UNCLASSIFIED).

(5) WHERE A CULVERT (PIPE, SLAB OR BOX) IS MOVED TO A NEW LOCATION OTHER THAN THAT SHOWN ON THE PLANS, INCREASING OR DECREASING THE AMOUNT OF CULVERT EXCAVATION WILL NOT RESULT IN AN INCREASE OR DECREASE IN THE AMOUNT OF PAYMENT THAT WILL BE MADE DUE TO SUCH CHANGE.

(6) DURING CONSTRUCTION OF DRAINAGE STRUCTURES ALL COST ASSOCIATED WITH MAINTAINING THE FLOW OF WATER AND TRAFFIC, AT THESE STRUCTURES, DURING THE PHASED CONSTRUCTION OF THIS PROJECT ARE TO BE INCLUDED IN THE UNIT PRICE OF THE DRAINAGE STRUCTURES AND TRAFFIC CONTROL ITEMS.

(7) ALL EXISTING PIPES AS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER THAT ARE TO BE LEFT IN PLACE AND ABANDONED MUST BE BACKFILLED AND PLUGGED. ALL COST FOR THIS WORK SHALL BE INCLUDED IN ITEM NO. 204-08.01, BACKFILL MATERIAL (FLOWABLE FILL), C.Y.

9-120.00 FENCING

(1) LOCATION OF THE FENCE SHALL BE ONE FOOT INSIDE THE RIGHT-OF-WAY EXCEPT WHERE SHOWN OTHERWISE ON THE PLANS.

(2) FENCES SHALL BE TURNED IN AT DRAINAGE STRUCTURES, STOCK PASSES AND BRIDGES WHERE DIRECTED BY THE ENGINEER SO AS TO ABUT WINGWALLS AND/OR ABUTMENTS.

(3) THE CONTRACTOR SHALL GIVE THE AFFECTED PROPERTY OWNERS A TWO-WEEK NOTICE PRIOR TO CUTTING FENCES.

(4) THE CONTRACTOR SHALL BE REQUIRED TO INSTALL ACCESS CONTROL FENCES PRIOR TO CUTTING EXISTING STOCK FENCES IN AREAS UTILIZED BY DOMESTIC LIVESTOCK OR OTHER AREAS AS DIRECTED BY THE ENGINEER.

9-125.00 MISCELLANEOUS

(1) ALL DETOUR, ACCESS, SERVICE AND FRONTAGE ROADS SHALL BE CONSTRUCTED WITH A MINIMUM OF ONE (1) COURSE OF BASE MATERIAL BEFORE TRAFFIC IS INTERRUPTED ON EXISTING ROADS.

(2) THE CONTRACTOR SHALL BE REQUIRED TO REMOVE AND RESET MAILBOXES AND POSTS WHERE AND AS DIRECTED BY THE ENGINEER. COST TO BE INCLUDED IN PRICE BID FOR OTHER CONSTRUCTION ITEMS.

(3) NOTHING IN THE GENERAL NOTES OR SPECIAL PROVISIONS SHALL RELIEVE THE CONTRACTOR FROM HIS RESPONSIBILITIES TOWARD THE SAFETY AND CONVENIENCE OF THE GENERAL PUBLIC AND THE RESIDENTS ALONG THE PROPOSED CONSTRUCTION AREA.

9-130.00 ROAD CLOSURE

(1) NO LESS THAN SEVEN (7) DAYS PRIOR TO THE CLOSURE OF THE ROAD, THE CONTRACTOR SHALL NOTIFY THE FOLLOWING INDIVIDUALS OR AGENCIES COMPLETELY DESCRIBING THE AFFECTED ROADS AND THE APPROXIMATE DURATION OF THE CONSTRUCTION: THESE PARTIES INCLUDE, BUT ARE NOT LIMITED TO: (1) LOCAL LAW ENFORCEMENT OFFICE, (2) LOCAL FIRE DEPARTMENT, (3) AMBULANCE SERVICE, (4) LOCAL SCHOOL SUPERINTENDENT, (5) UNITED STATES POSTAL SERVICE, AND (6) LOCAL ROAD SUPERINTENDENT.

9-135.00 PAVEMENT MARKINGS

NOTE: SEE SECTION 4-716.05 THROUGH 4-716.36.

9-135.01 TEMPORARY PAVEMENT MARKINGS ON INTERMEDIATE LAYERS

(1) TEMPORARY PAVEMENT LINE MARKINGS ON INTERMEDIATE LAYERS OF PAVEMENT SHALL BE REFLECTIVE TAPE OR REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.01, PAINTED PAVEMENT MARKING (4" LINE), L.M.

(2) TEMPORARY PAVEMENT LINE MARKINGS ON INTERMEDIATE LAYERS OF PAVEMENT SHALL BE REFLECTIVE TAPE OR REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.20, PAINTED PAVEMENT MARKING (6" LINE), L.M.

(3) TEMPORARY PAVEMENT LINE MARKINGS ON INTERMEDIATE LAYERS OF PAVEMENT SHALL BE REFLECTIVE TAPE OR REFLECTORIZED PAINT INSTALLED

TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.02, PAINTED PAVEMENT MARKING (8" BARRIER LINE), L.F.

(4) WIDE (8 INCH) TEMPORARY PAVEMENT MARKING LINE WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.02 PAINTED PAVEMENT MARKING (8" BARRIER LINE), LIN. FT.

9-135.02 FINAL PAVEMENT MARKING

NOTE (5) SHOULD BE ADDED FOR ALL RESURFACING PROJECTS AND PROJECTS WITH RESURFACING OR RETRACING IN WHICH IT IS DETERMINED AT THE PLAN-IN-HAND FIELD REVIEW THAT BROOMING/DEGRASSING WILL BE INCLUDED IN THE PROJECT INSTEAD OF MAINTENANCE FORCES PERFORMING THIS TASK.

NOTE (6) SHOULD BE ADDED FOR ALL RESURFACING PROJECTS AND PROJECTS WITH RESURFACING OR RETRACING THAT USE OGFC IN WHICH IT IS DETERMINED AT THE PLAN-IN-HAND FIELD REVIEW THAT BROOMING/DEGRASSING WILL BE INCLUDED IN THE PROJECT INSTEAD OF MAINTENANCE FORCES PERFORMING THIS TASK .

(5) THE CONTRACTOR WILL BE REQUIRED TO PERFORM THE FOLLOWING WORK:

a. SHOULDERS SHALL BE BROOMED AND DE-GRASSED AND MATERIAL SHALL BE PICKED UP AND REMOVED. THIS WILL BE PAID FOR UNDER ITEM NO. 208-01.05.

b. REMOVE ALL GARBAGE AND CONSTRUCTION DEBRIS FROM PROJECT. THE COST FOR THIS WILL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF CONSTRUCTION.

(6) IN AREAS WITH OPEN-GRADED FRICTION COURSE PAVEMENT, THE CONTRACTOR WILL BE REQUIRED TO PERFORM THE FOLLOWING WORK:

a. SHOULDERS SHALL BE BROOMED AND DE-GRASSED IN A MANNER WHICH PERMITS PROPER DRAINAGE OF PAVEMENT STRUCTURE. MATERIAL SHALL BE PICKED UP AND REMOVED. THIS WILL BE PAID FOR UNDER ITEM NO. 208-01.05.

b. REMOVE ALL GARBAGE AND CONSTRUCTION DEBRIS FROM PROJECT. THE COST FOR THIS WILL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF CONSTRUCTION.

IF 4" ENHANCED FLATLINE THERMOPLASTIC IS USED.

(7) PERMANENT PAVEMENT LINE MARKINGS SHALL BE 4" ENHANCED FLATLINE THERMOPLASTIC INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-12.01, ENHANCED FLATLINE THERMO PVMT MRKNG (4IN LINE), L.M. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATION IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

IF 6" ENHANCED FLATLINE THERMOPLASTIC IS USED.

(8) PERMANENT PAVEMENT LINE MARKINGS SHALL BE 6" ENHANCED FLATLINE THERMOPLASTIC INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-12.02, ENHANCED FLATLINE THERMO PVMT MRKNG (6IN LINE), L.M. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATION IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

IF 8" ENHANCED FLATLINE THERMOPLASTIC IS USED.

(9) PERMANENT PAVEMENT LINE MARKINGS SHALL BE 8" ENHANCED FLATLINE THERMOPLASTIC INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-12.03, ENHANCED FLATLINE THERMO PVMT MRKNG (8IN BARRIER LINE), L.F. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATION IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

IF 4" SPRAY THERMOPLASTIC (60 mil) IS USED.

(10) PERMANENT PAVEMENT LINE MARKINGS SHALL BE 4" SPRAY THERMOPLASTIC (60 mil) INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-13.01, SPRAY THERMO PVMT MRKNG (60 mil) (4IN LINE), L.M. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATION IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT

BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

IF 6" SPRAY THERMOPLASTIC (60 mil) IS USED.

(11) PERMANENT PAVEMENT LINE MARKINGS SHALL BE 6" SPRAY THERMOPLASTIC (60 mil) INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-13.02, SPRAY THERMO PVMT MRKNG (60 mil) (6IN LINE), L.M. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATION IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

IF 8" SPRAY THERMOPLASTIC (60 mil) IS USED.

(12) PERMANENT PAVEMENT LINE MARKINGS SHALL BE 8" SPRAY THERMOPLASTIC (60 mil) INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT UNMARKED SECTIONS SHALL NOT BE ALLOWED. PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-13.03, SPRAY THERMO PVMT MRKNG (60 mil) (8IN BARRIER LINE), L.F. THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKINGS AFTER THE PAVING OPERATION IS COMPLETED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS.

IF REFLECTORIZED PAINT IS USED.

(13) PERMANENT PAVEMENT LINE MARKINGS SHALL BE REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.01, PAINTED PAVEMENT MARKING (4IN LINE), L.M.

(14) PERMANENT PAVEMENT LINE MARKINGS SHALL BE REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.20, PAINTED PAVEMENT MARKING (6IN LINE), L.M.

(15) PERMANENT PAVEMENT LINE MARKINGS SHALL BE REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK. SHORT, UNMARKED SECTIONS SHALL NOT BE ALLOWED. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-05.02, PAINTED PAVEMENT MARKING (8IN BARRIER LINE), L.F.

9-135.03 DETOURS, LANE SHIFTS AND MEDIAN CROSS-OVERS

(16) THE PAVEMENT MARKING ON THE _(C)_ FOR _(D)_ WILL BE INSTALLED AND MAINTAINED TO THE SAME STANDARDS AS FOR PERMANENT MARKINGS ON THE MAIN ROADWAY. THESE MARKINGS SHALL BE IN PLACE PRIOR TO ALLOWING TRAFFIC ONTO THE PAVEMENT. THESE PAVEMENT MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. _(E)_, LIN. MI.

(C) NOTE: FILL IN THE BLANK WITH APPROPRIATE WORDS(S) FOR THE SPECIAL ROADWAY(S): DETOUR, LANE SHIFT, MEDIAN CROSSOVER, ETC.

(D) NOTE: FILL IN THE BLANK WITH APPROPRIATE WORD(S) FOR THE KIND OF PAVEMENT MARKING(S) NEEDED: CENTERLINE, EDGELINES, LANE LINES.

(E) NOTE: SEE SECTIONS 4-712.10 AND 4-716.11. FILL IN THE BLANK WITH ITEM NO. 716-05.01 PAINTED PAVEMENT MARKING (4IN LINE), L.M., 716-05.20 PAINTED PAVEMENT MARKING (6IN LINE), L.M., OR 716-05.02 PAINTED PAVEMENT MARKING (8IN BARRIER LINE), L.F.

NOTE: NOTE (17) IS TO BE USED WHEN ANY ITEM NUMBER FOR REMOVABLE PAVEMENT MARKING LINE, LIN. FT. IS REQUIRED.

(17) BEFORE OPENING THE _(C)_ TO TRAFFIC, THE TRANSITIONAL MARKINGS ON THE EXISTING ROADWAY MUST BE IN PLACE. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. _(D)_ PER L.F. ALL EXISTING MARKINGS IN THE AREA OF THESE TRANSITIONAL MARKINGS SHALL BE OBLITERATED AND ALL EXISTING RAISED PAVEMENT MARKERS SHALL BE REMOVED TO ELIMINATE CONFLICTING MARKINGS. REMOVAL OF THE EXISTING CONFLICTING MARKINGS AND RAISED PAVEMENT MARKERS WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT THE COST WILL BE INCLUDED IN ITEM NO. 712-01, TRAFFIC CONTROL, LUMP SUM.

(C) NOTE: FILL IN THE BLANK WITH APPROPRIATE WORDS(S) FOR THE SPECIAL ROADWAY(S): DETOUR, LANE SHIFT, MEDIAN CROSSOVER, ETC.

(D) NOTE: SEE SECTIONS 4-716.10 AND 4-716.30 AND STANDARD DRAWINGS T-WZ SERIES FOR GUIDANCE ON MARKING WIDTHS AND MATERIALS. FILL IN THE BLANK WITH THE APPROPRIATE ITEM NUMBER: 712-09.01, REMOVABLE PAVEMENT MARKING LINE, L.F.; 712-09.02 REMOVABLE PAVEMENT MARKING (8" BARRIER LINE), L.F.; 712-09.08 REMOVABLE PAVEMENT MARKING (6" LINE), L.F.; OR 712-09.09 REMOVABLE PAVEMENT MARKING (4" LINE), L.F.

NOTE: NOTE (18) IS TO BE USED WHEN A PROJECT DOES NOT HAVE ANY REMOVABLE PAVEMENT MARKING LINE.

(18) BEFORE OPENING THE _(C)_ TO TRAFFIC, THE TRANSITIONAL MARKINGS ON THE EXISTING ROADWAY MUST BE IN PLACE. ALL EXISTING MARKINGS IN THE AREA OF THESE TRANSITIONAL MARKINGS SHALL BE OBLITERATED AND ALL EXISTING RAISED PAVEMENT MARKERS SHALL BE REMOVED TO ELIMINATE CONFLICTING MARKINGS. REMOVAL OF THE EXISTING CONFLICTING MARKINGS AND RAISED PAVEMENT MARKERS WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT

THE COST WILL BE INCLUDED IN ITEM NO. 712-01, TRAFFIC CONTROL, LUMP SUM.

(C) NOTE: FILL IN THE BLANK WITH APPROPRIATE WORDS(S) FOR THE SPECIAL ROADWAY(S): DETOUR, LANE SHIFT, MEDIAN CROSSOVER, ETC.

9-135.04 SNOWPLOWABLE REFLECTIVE PAVEMENT MARKERS

(19) REMOVE EXISTING SNOWPLOWABLE MARKERS PRIOR TO PAVING AND/OR COLD PLANING. REMOVE ALL ADHESIVES PRIOR TO PAVING. PATCH ANY HOLES OR DIVOTS RESULTING FROM THE REMOVAL OF A MARKER IN A MANNER WHICH ENSURES A UNIFORM PAVED SURFACE. PATCH WORK SHALL BE INCLUDED WITH COST OF OTHER ITEMS OF CONSTRUCTION.

9-140.00 PAVEMENT

NOTE: NOTES (1) AND/OR (2) ARE TO BE PLACED ON ALL PROJECTS, INCLUDING ALL RESURFACING PROJECTS.

NOTE: NOTES (4), (5), (6), AND (9) ARE TO BE PLACED ON ALL RESURFACING PROJECTS ON ROADWAYS WITH SHOULDERS AND DITCHES (NO CURB AND GUTTER).

NOTE: NOTES (4), (7), (8), AND (9) ARE TO BE PLACED ON ALL RESURFACING PROJECTS ON ROADWAYS WITH URBAN CURB AND GUTTERS.

NOTE: NOTE (3) SHALL BE PLACED ON ALL CONSTRUCTION PROJECTS WITH SHOULDERS AND DITCHES (NO CURB AND GUTTER) OR ON RESURFACING PROJECTS WHERE SAFETY EDGE IS SPECIFIED.

9-140.01 PAVING

(1) THE CONTRACTOR SHALL BE REQUIRED TO PAVE IN THE DIRECTION OF TRAFFIC.

(2) THE CONTRACTOR SHALL BE REQUIRED TO COLD PLANE AND PAVE IN THE DIRECTION OF TRAFFIC.

(3) THE CONTRACTOR SHALL ATTACH A DEVICE TO THE SCREED OF THE PAVER SUCH THAT MATERIAL IS CONFINED AT THE END GATE AND EXTRUDES THE ASPHALT MATERIAL IN SUCH A WAY THAT RESULTS IN A CONSOLIDATED WEDGE-SHAPE PAVEMENT EDGE OF APPROXIMATELY 25 TO 30 DEGREES AS IT LEAVES THE PAVER (MEASURED FROM A LINE PARALLEL TO THE PAVEMENT SURFACE.) THE DEVICE SHALL MEET THE REQUIREMENTS THAT ARE CURRENTLY SET FORTH IN SPECIAL PROVISION 407SE.

9-140.02 RESURFACING

NOTE: NOTES (4) THROUGH (9) FOR RESURFACING ONLY.

(4) WHERE DIRECTED BY THE TDOT ENGINEER, THE CONTRACTOR SHALL BE REQUIRED TO SHAPE PUBLIC SIDE ROADS, BUSINESS ENTRANCES, AND PRIVATE DRIVES, AS WELL AS CLEANING OF EXISTING DRAINS BEFORE PLACING

MATERIALS. ALL COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF CONSTRUCTION.

(5) ALL PUBLIC SIDE ROADS SHALL BE PAVED ONE PAVER WIDTH THROUGH THE INTERSECTION AS A MINIMUM. A SATISFACTORY TRANSITION FROM THE NEW PAVEMENT TO THE EXISTING GRADE OF THE INTERSECTING PUBLIC ROAD OR BUSINESS ENTRANCE SHALL BE PROVIDED. SHOULD THE PAVEMENT OF THE INTERSECTING PUBLIC ROAD BE DISTRESSED, THE RESURFACING WIDTH MAY BE INCREASED TO THE NORMAL RIGHT OF WAY LINE.

(6) PRIVATE DRIVEWAYS, FIELD ENTRANCES, AND BUSINESS ENTRANCES WILL BE RESURFACED A PAVER WIDTH (LANE WIDTH) AS A MINIMUM. A PAVEMENT TAPER TO TRANSITION THE NEW PAVEMENT SHALL BE REQUIRED, IT SHALL BE BASED ON AN ADDITIONAL ONE FOOT OF WIDTH PER ONE INCH DEPTH OF PAVEMENT. IF THE SHOULDER IS NARROW ENOUGH THAT THE SUM OF THE SHOULDER AND THE TRANSITION ARE LESS THAN A PAVER WIDTH, THE TRANSITION SHALL OCCUR WITHIN THE PAVER WIDTH. IF THE SUM OF THE SHOULDER AND THE TRANSITION IS GREATER THAN A PAVER WIDTH (LANE WIDTH), THE TRANSITION SHALL OCCUR OUTSIDE OF THE PAVER WIDTH.

(7) ON CURB AND GUTTER SECTIONS, PUBLIC ROAD INTERSECTIONS SHALL BE RESURFACED TO THE END OF RADIUS. A SATISFACTORY TRANSITION FROM THE NEW PAVEMENT TO THE EXISTING GRADE OF THE INTERSECTING PUBLIC ROAD SHALL BE PROVIDED.

(8) ON URBAN TYPICAL SECTIONS, (CURB AND GUTTER), RESIDENTIAL DRIVEWAYS AND BUSINESS ENTRANCES SHALL HAVE A MINIMUM WIDTH OF MATERIAL NOT LESS THAN ONE FOOT USED IN THE TRANSITION TO FEATHER THE PAVEMENT EDGE.

(9) IN ALL CASES, THE LENGTH OF THE PAVEMENT TRANSITION, THE THICKNESS AND WIDTH OF THE RESURFACING AND ANY ADDITIONAL PAVEMENT MATERIALS SHALL BE AS DIRECTED BY THE TDOT ENGINEER.

9-145.00 GRADED SOLID ROCK

NOTE: IF A NOTE WORDED DIFFERENTLY FROM (1) IS SUPPLIED, THAT NOTE SHOULD BE USED. IF A MAXIMUM DIMENSION TWO FEET OR LESS IS SPECIFIED, NOTE (2) IS NOT NECESSARY; HOWEVER, IF A MAXIMUM DIMENSION GREATER THAN TWO FEET BUT NOT THREE FEET IS SPECIFIED, IT SHALL BE NECESSARY TO CONTACT THE CONSTRUCTION OFFICE FOR THE APPROPRIATE MAXIMUM DEPTH TO BE USED IN NOTE (2).

(1) THE ROCK FILL (GRADED SOLID ROCK) MATERIAL SHALL CONSIST OF SOUND, NON-DEGRADABLE LIMESTONE OR SANDSTONE WITH A MAXIMUM SIZE OF 3’-0”. AT LEAST 50% (BY WEIGHT) OF THE ROCK SHALL BE UNIFORMLY DISTRIBUTED BETWEEN 1’-0” AND 3’-0” IN DIAMETER, AND NO GREATER THAN 10% (BY WEIGHT) SHALL BE LESS THAN 2” IN DIAMETER. THE MATERIAL SHALL BE ROUGHLY EQUIDIMENSIONAL; THIN, SLABBY MATERIALS WILL NOT BE ACCEPTED. THE CONTRACTOR SHALL BE REQUIRED TO PROCESS THE MATERIAL WITH AN ACCEPTABLE MECHANICAL MEANS (A SCREENING PROCESS CAPABLE OF

PRODUCING THE REQUIRED GRADATION). THE ROCK SHALL BE APPROVED BY A REPRESENTATIVE OF THE DIVISION OF MATERIALS AND TESTS BEFORE USE.

(2) THIS GRADED SOLID ROCK MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING FIVE FEET IN DEPTH.

9-150.00 RIPRAP

NOTE: NOTES (1) AND (2) ARE NOT REQUIRED IF CLASS A-1, A-2, A-3, B, OR C MACHINED RIPRAP IS USED.

(1) MACHINED RIPRAP SHALL BE IN ACCORDANCE WITH SECTION 709 OF THE STANDARD SPECIFICATIONS EXCEPT AS MODIFIED BY THIS NOTE. MACHINED RIPRAP SHALL BE CLEAN SHOT ROCK CONTAINING NO SAND, DUST, OR ORGANIC MATERIALS AND SHALL VARY IN SIZE FROM __" TO __ '- __". THE STONE SIZES SHALL BE DISTRIBUTED UNIFORMLY THROUGHOUT THE SIZE RANGE WITH NO MORE THAN 20% OF THE MATERIAL (BY WEIGHT) LESS THAN __". THE THICKNESS OF THE STONE LAYER SHALL BE __'-__" (+/-3") AND THE SIZE GRADATION SHALL BE UNIFORMLY DISTRIBUTED THROUGHOUT THE LAYER THICKNESS AND FROM TOP TO BOTTOM OF THE SLOPE.

UPON COMPLETION OF THE PROJECT, A VISUAL INSPECTION SHALL REVEAL THAT APPROXIMATELY 50% OF THE SURFACE AREA CONSISTS OF STONES __" OR LARGER. PAYMENT WILL BE MADE UNDER ITEM NO. 709-05.10 MACHINED RIPRAP (DESCRIPTION), C.Y., AND QUANTITIES WILL BE BASED ON THE AVERAGE THICKNESS OF __'- __".

(2) RIPRAP SHALL CONSIST OF FURNISHING AND PLACING EITHER RUBBLE STONES BY HAND OR MACHINED. RUBBLE STONE SHALL MEET THE REQUIREMENTS OF SECTION 709 OF THE STANDARD SPECIFICATIONS AND SHALL BE CLEAN (FREE FROM ORGANIC MATTER), DURABLE, ANGULAR WITH FRACTURED FACES, NEARLY RECTANGULAR IN SHAPE WITH A BREADTH OR THICKNESS AT LEAST ONE-THIRD ITS LENGTH.

IF THE CONTRACTOR ELECTS TO USE MACHINED RIPRAP, IT SHALL BE IN ACCORDANCE WITH SECTION 709 OF THE STANDARD SPECIFICATIONS EXCEPT AS MODIFIED BY THIS NOTE. MACHINED RIPRAP SHALL BE CLEAN SHOT ROCK CONTAINING NO SAND, DUST, OR ORGANIC MATERIALS, AND SHALL VARY IN SIZE FROM __" TO __'- __". THE STONE SIZES SHALL BE DISTRIBUTED UNIFORMLY THROUGHOUT THE SIZE RANGE WITH NO MORE THAN 20% OF THE MATERIAL (BY WEIGHT) LESS THAN __". THE THICKNESS OF THE STONE LAYER SHALL BE __'- __" (+/-3") AND THE SIZE GRADATION SHALL BE UNIFORMLY DISTRIBUTED THROUGHOUT THE LAYER THICKNESS AND FROM TOP TO BOTTOM OF THE SLOPE. UPON COMPLETION OF THE PROJECT, A VISUAL INSPECTION SHALL REVEAL THAT APPROXIMATELY 50% OF THE SURFACE AREA CONSISTS OF STONES __" OR LARGER. PAYMENT WILL BE MADE UNDER ITEM NO. _(A)_ AND QUANTITIES WILL BE BASED ON A THICKNESS OF __'- __".

(A) NOTE: FILL IN THE BLANK WITH APPROPRIATE RIPRAP ITEM NUMBER.

9-155.00 SIGNING

NOTE: NOTE (1) SHALL BE PLACED ON ALL PROJECTS WHERE AN EXTRUDED PANEL SIGN IS BEING PROPOSED.

NOTE (5) – EMAIL ADDRESSES FOR REGIONAL SIGN DESIGNERS CAN BE FOUND IN SECTION 4-713.15.

(1) THE LETTERS, DIGITS, ARROWS, BORDERS, AND ALPHABET ACCESSORIES ON ALL FLAT SHEET SIGNS SHALL BE APPLIED BY SILK SCREENING PROCESS, EXCEPT THAT CUT-OUT DIRECT APPLIED COPY SHALL BE USED ON ALL FLAT SHEET SIGNS WITH A GREEN BACKGROUND. THE LETTERS, DIGITS, ARROWS, BORDERS, AND ALPHABET ACCESSORIES ON ALL EXTRUDED PANEL SIGNS SHALL BE DIRECT APPLIED OR DEMOUNTABLE. ALL EXTRUDED PANEL SIGNS SHALL BE ATTACHED TO THE SIGN FACE, AS OUTLINED IN THE STANDARD SPECIFICATIONS. ALL SHIELDS ON GUIDE SIGNS SHALL BE DIRECT APPLIED OR DEMOUNTABLE AND ATTACHED TO THE SIGN FACE AS OUTLINED IN THE STANDARD SPECIFICATIONS.

(2) FOR ALL PERMANENT PANEL SIGNS WITH A SILVER-WHITE, YELLOW, RED, GREEN, BROWN, OR BLUE BACKGROUND, PROVIDE REFLECTIVE SHEETING THAT MEETS OR EXCEEDS AASHTO M268, TYPE D.

(3) THE LENGTHS OF ALL SIGN SUPPORTS SHOWN ON THE SIGN SCHEDULE ARE APPROXIMATE AND ARE FOR ESTIMATING PURPOSES ONLY. THE LENGTHS WERE COMPUTED FROM THE CROSS-SECTIONS CONTAINED IN THE CONSTRUCTION PLANS. IN THE EVENT THE SUPPORT LENGTHS ARE 2 FEET SHORTER OR LONGER THAN SHOWN ON THE PLANS, THE ENGINEER SHALL VERIFY THE SUPPORT TYPE WITH THE _____. THE CONTRACTOR SHALL VERIFY ALL SUPPORT LENGTHS AT THE SITE PRIOR TO ORDERING MATERIAL. THE TOP OF THE SIGN FOOTINGS SHALL BE PLACED LEVEL WITH THE GROUND LINE.

(4) THE TOP OF THE SIGN FOOTINGS SHALL BE PLACED LEVEL WITH THE GROUND LINE.

(5) AFTER THE SIGN LOCATIONS HAVE BEEN STAKED, BUT PRIOR TO ORDERING ANY MATERIAL FOR THE SUPPORTS, THERE SHALL BE A FIELD INSPECTION AND APPROVAL BY THE _____.

(6) THE CONTRACTOR SHALL BE REQUIRED TO FURNISH LAYOUT DRAWINGS OF ALL EXTRUDED PANEL SIGNS WITH SPACING OF ALL LETTERS, NUMERALS, SHIELDS, AND ARROWS. ONE PDF SET OF THE LAYOUT DRAWINGS SHALL BE SENT TO THE _____, FOR REVIEW.

(7) ALL SIGNS MARKED “TO BE REMOVED” ARE TO BE REMOVED BY THE CONTRACTOR AND PAID FOR UNDER ITEM NO. 713-15 AND BECOME THE PROPERTY OF THE CONTRACTOR.

(8) THE EXISTING FOOTINGS ARE TO BE REMOVED 6 INCHES BELOW GROUND LINE.

(9) THE LETTERS, DIGITS, ARROWS, BORDERS, AND ALPHABET ACCESSORIES ON ALL FLAT SHEET SIGNS SHALL BE APPLIED BY SILK SCREENING PROCESS,

EXCEPT THAT CUT-OUT DIRECT APPLIED COPY SHALL BE USED ON ALL FLAT SHEET SIGNS WITH A GREEN BACKGROUND, OR BROWN BACKGROUND.

(10) THE LENGTHS OF ALL SIGN SUPPORTS SHOWN ON THE SIGN SCHEDULE ARE APPROXIMATE AND ARE FOR ESTIMATING PURPOSES ONLY. THE CONTRACTOR SHALL VERIFY ALL SUPPORT LENGTHS AT THE SITE PRIOR TO ERECTION.

(11) THE LETTERS, DIGITS, ARROWS, BORDERS, AND ALPHABET ACCESSORIES ON ALL FLAT SHEET SIGNS SHALL BE APPLIED BY SILK SCREENING PROCESS.

NOTE: NOTE (11) IS TO BE USED ON ALL PROJECTS, INCLUDING RESURFACING. IT IS TO ADDRESS SITES WHERE AN EXISTING PERMANENT SIGN IS TO BE REMOVED OR RELOCATED.

(12) ALL SIGNS WHICH INTERFERE WITH CONSTRUCTION WILL BE RELOCATED OUTSIDE LIMITS OF CONSTRUCTION BY THE CONTRACTOR. UPON COMPLETION OF CONSTRUCTION, THE CONTRACTOR WILL RESTORE THE SIGNS TO ORIGINAL LOCATION. THE CONTRACTOR SHALL CHECK WITH THE _____ PRIOR TO MOVING ANY PERMANENT SIGNS.

NOTE: ADD NOTE (12) TO ALL RESURFACING PROJECTS WHICH WILL INCLUDE THE INSTALLATION OF NEW PERMANENT SIGN(S).

(12) AFTER THE PERMANENT SIGN LOCATIONS HAVE BEEN STAKED, THERE SHALL BE A FIELD INSPECTION AND APPROVAL BY THE _____. PAYMENT FOR LOCATION AND STAKING SHOULD BE INCLUDED IN THE BID PRICE FOR OTHER ITEMS OF CONSTRUCTION. ANY RELOCATION REQUIRED, DUE TO THE SIGN NOT BEING INSTALLED IN THE CORRECT LOCATION, WILL BE DONE AT THE CONTRACTOR'S EXPENSE.

9-160.00 TRAFFIC CONTROL DIRECTIONAL SIGNING

NOTE: NOTES (1) THROUGH (5) ARE TO BE PLACED ON ALL ACCESS CONTROLLED AND INTERSTATE RECONSTRUCTION PROJECTS AND ACCESS CONTROLLED AND INTERSTATE RESURFACING PROJECTS WHEN THE TRAFFIC CONTROL PHASING REQUIRES PLACEMENT OF TEMPORARY PAVEMENT MARKINGS WHICH CONFLICT DIRECTIONAL SIGNS OR REQUIRES DIRECTIONAL SIGNS TO BE RELOCATED OR ADJUSTED.

(1) ON ALL ACCESS CONTROLLED AND INTERSTATE RECONSTRUCTION AND NEW CONSTRUCTION PROJECTS, THE CONTRACTOR SHALL UTILIZE ALL EXISTING DIRECTIONAL SIGNING FOR AS LONG AS POSSIBLE. THESE EXISTING SIGNS CAN BE MOVED USING TEMPORARY SUPPORTS AS NEEDED. AS SOON AS THESE EXISTING DIRECTIONAL SIGNS COME DOWN PERMANENTLY, THE CONTRACTOR SHALL HAVE UP AT LEAST ONE NEW TEMPORARY "ADVANCE GUIDE SIGN" AND ONE NEW TEMPORARY "EXIT DIRECTIONAL SIGN" AT ALL EXIT RAMPS. THESE SIGNS ARE TO BE MAINTAINED WITHIN CLEAR VIEW OF THE PUBLIC ON THE RIGHT SIDE OF THE HIGHWAY AND SHALL BE REPLACED IF DAMAGED, DURING ALL PHASES OF CONSTRUCTION, AS DIRECTED BY THE ENGINEER.

(2) THE SIZE OF THESE NEW TEMPORARY SIGNS WILL BE DETERMINED BY THE MESSAGE. THE MESSAGE SHALL BE THE SAME AS THE EXISTING SIGN THAT THESE NEW TEMPORARY SIGNS WILL BE REPLACING. THE LETTER SIZE SHALL BE A MINIMUM OF 8 INCH, "D" UPPER CASE LETTER. THE DIRECTIONAL ARROW WILL BE A "B" ARROW AT A 45 DEGREE ANGLE (SAME ANGLE AS THE EXISTING ARROW). THE MATERIAL SHALL BE 0.100 INCH SHEET ALUMINUM; THE COLOR SHALL BE A REFLECTIVE GREEN BACKGROUND WITH REFLECTIVE WHITE COPY.

(3) ALL WORK AND MATERIAL TO MAKE THESE NEW TEMPORARY DIRECTIONAL SIGNS ALONG WITH ADEQUATE SUPPORTS AND TO MOVE THEM AS NEEDED DURING EACH PHASE OF CONSTRUCTION WILL BE PAID FOR UNDER ITEM NO. (A) , AS DIRECTED BY THE ENGINEER.

(A) NOTE: FILL IN THE BLANK WITH APPROPRIATE 712-SERIES ITEM NUMBER.

(4) SOME OF THESE DIRECTIONAL SIGNS WILL NEED AN INTERSTATE, U.S., OR A STATE HIGHWAY SHIELD, A CARDINAL DIRECTION, AND A DIRECTION ARROW TO ACCOMPANY THE DIRECTIONAL SIGN. THESE SIGNS SHALL BE MOUNTED BELOW THE DIRECTIONAL SIGN.

(5) ALL EXISTING "EMERGENCY REFERENCE MARKERS" AND "HOSPITAL SIGNS" SHALL BE MAINTAINED WITHIN FULL VIEW OF THE MOTORING PUBLIC THROUGHOUT ALL PHASES OF CONSTRUCTION. ALL WORK IN MOVING AND TEMPORARY SUPPORTS SHALL BE PAID FOR UNDER ITEM NO. (B) .

(B) NOTE: FILL IN THE BLANK WITH APPROPRIATE 712-SERIES ITEM NUMBER.

NOTE: NOTE (6) SHOULD BE PLACED ON ACCESS CONTROL AND INTERSTATE PROJECTS WITH EXISTING "LOGO" SIGNS.

(6) WHEN "LOGO" SIGNS ARE ON ACCESS CONTROLLED AND INTERSTATE RECONSTRUCTION AND NEW CONSTRUCTION PROJECTS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING THESE SIGNS IN FULL VIEW TO THE MOTORING PUBLIC DURING ALL PHASES OF CONSTRUCTION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE TO THE DEPARTMENT FOR THE REIMBURSEMENT OF THE SIGN FACE IF IT IS DAMAGED. ALL WORK IN MOVING THESE "LOGO" SIGNS AND THE TEMPORARY SUPPORTS ARE TO BE PAID FOR UNDER ITEM NO. (C) , AS DIRECTED BY THE ENGINEER. THE SUPPORTS FOR THE FINAL LOCATION OF THESE SIGNS WILL BE PAID FOR UNDER OTHER ITEMS OF CONSTRUCTION.

(C) NOTE: FILL IN THE BLANK WITH APPROPRIATE 712-SERIES ITEM NUMBER.

NOTE: NOTE (7) SHOULD BE PLACED ON NON-ACCESS CONTROLLED PROJECTS.

(7) WHEN EXISTING "TOURIST ORIENTED DIRECTIONAL SIGNS" (TODS) ARE ON NON-ACCESS CONTROLLED CONSTRUCTION PROJECTS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING THESE SIGNS IN FULL VIEW TO THE MOTORING PUBLIC DURING ALL PHASES OF CONSTRUCTION. ALL WORK IN MOVING THESE "TODS" AND TEMPORARY SUPPORTS ARE TO BE PAID FOR UNDER ITEM NO. (D) , AS DIRECTED BY THE ENGINEER. NEW SUPPORTS AND SIGN FACE FOR FINAL LOCATION WILL BE PAID FOR UNDER OTHER ITEMS OF CONSTRUCTION.

(D) NOTE: FILL IN THE BLANK WITH APPROPRIATE 712-SERIES ITEM NUMBER.

9-165.00 SIGNALIZATION

(1) EQUIPMENT AND INSTALLATION OF TRAFFIC SIGNALS SHALL COMPLY WITH TDOT STANDARD SPECIFICATIONS, SECTION 730.

NOTE: NOTE (2) IS FOR USE IN HAMILTON COUNTY, AS DIRECTED.

(2) EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TDOT "SPECIAL PROVISIONS REGARDING SECTION 730C-TRAFFIC SIGNALS."

NOTE: NOTE (3) IS FOR USE IN KNOX COUNTY, AS DIRECTED.

(3) EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TDOT "SPECIAL PROVISIONS REGARDING SECTION 730K-TRAFFIC SIGNALS."

NOTE: NOTE (4) IS FOR USE IN SHELBY COUNTY, AS DIRECTED.

(4) EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TDOT "SPECIAL PROVISIONS REGARDING SECTION 730M-TRAFFIC SIGNALS."

NOTE: NOTE (5) IS FOR USE IN DAVIDSON COUNTY, AS DIRECTED.

(5) EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TDOT "SPECIAL PROVISIONS REGARDING SECTION 730N-TRAFFIC SIGNALS."

(6) SALVAGEABLE EQUIPMENT SHALL BECOME THE PROPERTY OF THE (CITY OR COUNTY) AND SHALL BE STOCKPILED AT A LOCATION DESIGNATED BY THE ENGINEER FOR PICKUP BY THE (CITY OR COUNTY).

(7) IF RESURFACING IS INCLUDED IN THE PROJECT, SIGNAL DETECTION LOOPS SHALL BE INSTALLED BEFORE THE FINAL SURFACE IS APPLIED.

(8) ANY SIGNAL HEADS, WHEN VISIBLE TO DRIVERS BUT NOT OPERATIONAL, SHALL BE COMPLETELY COVERED.

(9) AN ADVANCE FLASH OPERATION PERIOD IS REQUIRED TO MAKE MOTORISTS AWARE OF THE PRESENCE OF NEW SIGNAL HEADS. NEW SIGNAL HEADS SHALL BE PUT IN FLASH OPERATION FOR MINIMUM OF SEVEN (7) CALENDAR DAYS UP TO FOURTEEN (14) CALENDAR DAYS PRIOR TO ACTIVATION OF NORMAL TRAFFIC SIGNAL OPERATION. OTHER FLASH OPERTATION TIME PERIODS MAY BE CONSIDERED UPON WRITTEN APPROVAL FROM THE REGIONAL TRAFFIC ENGINEER.

(10) THE CONTRACTOR SHALL CONTACT _____ A MINIMUM OF THIRTY (30) DAYS PRIOR TO ACTIVATION OF THE SIGNAL TO OBTAIN THE INITIAL SIGNAL TIMINGS.

NOTE: FOR NOTES (11) THROUGH (14) SEE SECTION 4-730.08.

(11) THE PROJECT ENGINEER SHALL NOTIFY THE LOCAL GOVERNMENTAL AGENCY RESPONSIBLE FOR TRAFFIC CONTROL MAINTENANCE AT LEAST ONE DAY IN ADVANCE OF THE COLD PLANING ACTIVITY AT SIGNALIZED INTERSECTIONS WHERE DETECTOR LOOPS ARE ON THE PAVEMENT. THE MAINTAINING AGENCY WILL THEN BE RESPONSIBLE FOR DISCONNECTING THE LOOP DETECTORS AND MAKING ANY NECESSARY TIMING ADJUSTMENTS IN THE SIGNAL CONTROLLER PRIOR TO THE CONSTRUCTION.

(12) THE PROJECT ENGINEER SHALL BE RESPONSIBLE FOR SUPPLYING THE CONTRACTOR WITH AS BUILT SIGNAL PLANS AT THE PRE-CONSTRUCTION CONFERENCE. THESE PLANS WILL PROVIDE THE CONTRACTOR WITH THE DESIRED LOCATION FOR DETECTOR LOOP REPLACEMENT.

(13) LOOPS SHALL BE INSTALLED IN THE LEVELING COURSE IF A LEVELING COURSE IS PROVIDED.

(14) LOOP REPLACEMENT SHALL BE IN ACCORDANCE WITH SECTION 730 OF THE STANDARD SPECIFICATIONS.

9-170.00 CONSTRUCTION WORK ZONE & TRAFFIC CONTROL

(1) ADVANCED WARNING SIGNS SHALL NOT BE DISPLAYED MORE THAN FORTY-EIGHT (48) HOURS BEFORE PHYSICAL CONSTRUCTION BEGINS. SIGNS MAY BE ERECTED UP TO ONE WEEK BEFORE NEEDED, IF THE SIGN FACE IS FULLY COVERED.

(2) IF THE CONTRACTOR MOVES OFF THE PROJECT, HE SHALL COVER OR REMOVE ALL UNNEEDED SIGNS AS DIRECTED BY THE ENGINEER. COSTS OF REMOVAL, COVERING, AND REINSTALLING SIGNS SHALL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT ALL COSTS SHALL BE INCLUDED IN THE ORIGINAL UNIT PRICE BID FOR ITEM NO. 712-06, SIGNS (CONSTRUCTION) PER SQUARE FOOT.

(3) A LONG TERM BUT SPORADIC USE WARNING SIGN, SUCH AS A FLAGGER SIGN, MAY REMAIN IN PLACE WHEN NOT REQUIRED PROVIDED THE SIGN FACE IS FULLY COVERED.

(4) TRAFFIC CONTROL DEVICES SHALL NOT BE DISPLAYED OR ERECTED UNLESS RELATED CONDITIONS ARE PRESENT NECESSITATING WARNING.

(5) USE OF BARRICADES, PORTABLE BARRIER RAILS, AND DRUMS SHALL BE LIMITED TO THE IMMEDIATE AREAS OF CONSTRUCTION WHERE A HAZARD IS PRESENT. THESE DEVICES SHALL NOT BE STORED ALONG THE ROADWAY WITHIN THIRTY (30) FEET OF THE EDGE OF THE TRAVELED WAY BEFORE OR AFTER USE UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL INCREASE TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE. THESE DEVICES SHALL BE REMOVED FROM THE CONSTRUCTION WORK ZONE WHEN THE ENGINEER DETERMINES THEY ARE NO LONGER NEEDED. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS REQUIRED SETBACK, THE CONTRACTOR SHALL DETERMINE THE ALTERNATE LOCATIONS AND REQUEST THE ENGINEER'S APPROVAL TO USE THEM.

(6) THE CONTRACTOR SHALL NOT BE PERMITTED TO PARK ANY VEHICLES OR CONSTRUCTION EQUIPMENT DURING PERIODS OF INACTIVITY, WITHIN THIRTY (30) FEET OF THE EDGE OF PAVEMENT WHEN THE LANE IS OPEN TO TRAFFIC UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES FOR ROADWAYS WITH CURRENT ADT'S

LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL BE INCREASED TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE. PRIVATELY OWNED VEHICLES SHALL NOT BE ALLOWED TO PARK WITHIN THIRTY (30) FEET OF AN OPEN TRAFFIC LANE AT ANY TIME UNLESS PROTECTED AS DESCRIBED ABOVE FOR ROADWAYS WITH CURRENT ADT'S LESS THAN 1500 AND DESIGN SPEED OF LESS THAN 60 MPH. THIS DISTANCE SHALL BE INCREASED TO FORTY-FIVE (45) FEET FOR ROADWAYS WITH CURRENT ADT'S OF 1500 OR GREATER AND DESIGN SPEED OF 60 MPH OR GREATER OR ON THE OUTSIDE OF A HORIZONTAL CURVE. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS REQUIRED SETBACK, THE CONTRACTOR SHALL DETERMINE THE ALTERNATE LOCATIONS AND REQUEST THE ENGINEER'S APPROVAL TO USE THEM.

(7) ALL DETOUR AND CONSTRUCTION SIGNING SHALL BE IN STRICT ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

(8) ALL DETOURS SHALL BE PAVED, STRIPED, SIGNED, AND FLEXIBLE DRUMS ARE TO BE IN PLACE BEFORE IT IS OPENED TO TRAFFIC.

NOTE (9) THIS NOTE IS TO BE USED ON ALL PROJECTS WHERE THE CONTRACTOR IS RESPONSIBLE FOR STAKING THE CONSTRUCTION SIGNS. AT THE PLAN-IN-HAND FIELD REVIEW, VERIFY IF THE CONTRACTOR OR THE CONSTRUCTION OFFICE IS RESPONSIBLE FOR STAKING SIGNS. IF THE CONTRACTOR IS RESPONSIBLE, USE NOTE (9).

(9) THE CONTRACTOR SHALL BE RESPONSIBLE FOR STAKING CONSTRUCTION SIGNS. THE COST OF THIS WORK SHALL BE INCLUDED IN ITEM NO. 712-06, SIGNS (CONSTRUCTION), S.F.

9-175.00 LIGHTING

(1) INSTALLATION AND MATERIALS SHALL COMPLY WITH SECTIONS 714 AND 917 OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION DATED JANUARY 1, 2015 AND WITH THE LATEST REVISIONS TO THE NATIONAL ELECTRIC CODE, NFPA 70.

(2) ALL WIRING SHALL BE CONCEALED UNDERGROUND IN 2-INCH SCHEDULE 40 PVC RIGID CONDUIT.

(3) THE GROUND WIRE SHALL BE RUN INSIDE CONDUIT WITHIN STRUCTURES, SHALL BE COLORED GREEN AND HAVE THW INSULATION.

(4) EXISTING FOUNDATIONS TO BE REMOVED A MINIMUM OF SIX INCHES BELOW GRADE.

(5) ALL INCIDENTAL EQUIPMENT AND MATERIAL REQUIRED FOR THE SUCCESSFUL EXECUTION OF THIS WORK SHALL BE FURNISHED IN 714 ITEMS WHETHER SPECIFICALLY NOTED OR NOT.

(6) LIGHT STANDARDS SHALL BE ROUND TAPERED POLES. LENGTH SHALL BE DETERMINED BY REQUIRED MOUNTING HEIGHT.

(7) STANDARDS SHALL BE DESIGNED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORT FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS PUBLISHED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS.

(8) STANDARDS SHALL BE DESIGNED FOR 80-MPH WIND PRESSURE AND SHALL SUPPORT A 62-POUND LUMINAIRE ON A 15-FOOT ARM.

(9) ALL NEW ROADWAY LIGHT STANDARDS SHALL BE MOUNTED ON BASES WITH ACCESS DOOR. TRANSFORMER BASES SHALL MEET AASHTO SPECIFICATIONS AND HAVE FHWA APPROVAL. STANDARDS SHALL BE ALUMINUM WITH TRANSFORMER BASES.

(10) BRACKET ARMS SHALL BE ROUND TAPERED TRUSS TYPE WITH STRAP MOUNTING AND LENGTHS AS SCHEDULED.

(11) BRACKET ARM UPSWEEP SHALL BE THE SAME FOR ALL LIGHT STANDARDS OF THE SAME TYPE.

SECTION 2 – SPECIAL NOTES

9-200.00 GRADING

NOTE: THESE NOTES SHALL BE ADDED TO THE PLANS AS SPECIAL NOTES ON ALL PROJECTS FOR WHICH A GEOTECHNICAL REPORT IS PREPARED UNLESS OTHERWISE DIRECTED BY THE DESIGN MANAGER AFTER CONSULTATION WITH THE SOILS AND GEOLOGY SECTION OF THE MATERIALS AND TESTS DIVISION AND THE HEADQUARTERS CONSTRUCTION DIVISION. ALL GRADING QUANTITIES ON THE ESTIMATED ROADWAY QUANTITIES SHEET SHALL BE FOOTNOTED "SEE GRADING SPECIAL NOTES ON SHEET 2___."

(1) THE GRADING TABULATIONS AND RESULTING EARTHWORK ASSOCIATED BID QUANTITIES WERE PREPARED UTILIZING AVAILABLE GEOTECHNICAL INFORMATION AND/OR REPORTS PREPARED FOR THIS PROJECT. THIS INFORMATION IS PROVIDED FOR GENERAL INFORMATION AND ESTIMATION GUIDANCE ONLY.

(2) BORING DEPICTIONS SHOWN ON THE FOUNDATION DATA SHEETS, SOILS SHEETS, PLANS, AND CROSS-SECTIONS INDICATE SOIL AND ROCK CONDITIONS AT THE SPECIFIC BORING LOCATIONS. ANY SOIL PROFILE AND/OR ROCK LINE IS INTERPRETIVE BASED ON THE JUDGMENT OF THE GEOTECHNICAL ENGINEER/GEOLOGIST. THE TRANSITION BETWEEN BORINGS AND LAYERS MAY VARY SIGNIFICANTLY DEPENDING ON THE GEOLOGIC FORMATIONS ENCOUNTERED.

(3) TO ASSIST IN BID PREPARATION FOR EARTHWORK AND FOUNDATION CONSTRUCTION, DETAIL ROCK AND SOIL DESCRIPTION AND ON SOME PROJECTS, ROCK CORE SAMPLES ARE AVAILABLE FOR INSPECTION AT THE MATERIALS AND TESTS HEADQUARTERS AT 6601 CENTENNIAL BOULEVARD, NASHVILLE, TN OR AT THE TDOT REGION 1 BUILDING IN KNOXVILLE, TN.

(4) THE CONTRACTOR SHALL UTILIZE ALL INFORMATION PROVIDED IN THE PLANS, CROSS-SECTIONS AND CONTRACT DOCUMENTS INCLUDING ANY SPECIAL PROVISIONS AS WELL AS UTILIZING HIS PAST EXPERIENCE WITH PROJECTS OF SIMILAR NATURE, SCOPE AND LOCATION IN PREPARATION OF HIS BID FOR EARTHWORK ITEMS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE AND PROVIDE EQUIPMENT AND MEANS NECESSARY TO CONDUCT THE EXCAVATION ACTIVITIES IN ACCORDANCE WITH PLANS AND SPECIFICATIONS.

(5) EARTHWORK IS PAID FOR UNDER ITEM NO. 203-01, ROAD AND DRAINAGE EXCAVATION (UNCLASSIFIED). NO ADDITIONAL PAYMENT WILL BE MADE FOR EARTHWORK QUANTITIES BASED SOLELY ON A CLAIM THAT THE QUANTITIES SHOWN IN THE GRADING TABULATION OR ELSEWHERE IN THE PLANS ARE INACCURATE WITH RESPECT TO THE TYPE OF MATERIALS ENCOUNTERED DURING CONSTRUCTION EXCEPT AS PROVIDED FOR BY SECTION 104.02 IN THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION OR AS AMENDED IN SUPPLEMENTAL SPECIFICATIONS.

9-205.00 DEMOLITION

9-205.01 DEMOLITION OF BUILDINGS

ON ANY PROJECT IN WHICH THE REMOVAL OF A BUILDING IS NOT ACCOMPLISHED DURING THE RIGHT-OF-ACQUISITION PHASE OF THE PROJECT AND IS INSTEAD INCLUDED IN SCOPE OF THE PROJECT THE DESIGNER SHALL ADD THE FOLLOWING SPECIAL NOTES TO THE PLANS:

(1) IF THE ASBESTOS SURVEY AND ABATEMENT IS NOT PART OF THE CONTRACT, THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH THE TDOT HAZARDOUS MATERIALS OFFICE TO VERIFY THAT AN ASBESTOS SURVEY HAS BEEN COMPLETED FOR ANY BUILDING TO BE REMOVED. IN THE CASE THAT NO SURVEY HAS BEEN COMPLETED THE CONTRACTOR SHALL COORDINATE WITH THE HAZARDOUSE MATERIAL OFFICE IN SCHEDULING A SURVEY.

(2) ASBESTOS-CONTAINING MATERIALS (ACM) ABATEMENT SHALL BE COMPLETED PRIOR TO ANY DEMOLITION ACTIVITIES FOR BUILDINGS INCLUDED IN THE PROJECT. ABATEMENT SHOULD BE ACCOMPLISHED PER SP202ACM SPECIAL PROVISION REGARDING REMOVAL OF ASBESTOS-CONTAINING MATERIALS. STATE OF TENNESSEE ASBESTOS ACCREDITATION REQUIREMENTS (TCA 1200-01-20) MANDATE THAT ACM ABATEMENT WORK BE PERFORMED BY AN ACCREDITED FIRM (CONTRACTOR) USING ACCREDITED ABATEMENT WORKERS AND SUPERVISORS.

(3) THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING A NOTICE TO THE TDEC, DIVISION OF AIR POLLUTION CONTROL TEN (10) DAYS IN ADVANCE OF ANY ACM ABATEMENT, DEMOLITION, OR MAJOR REPAIR INVOLVING THE REMOVAL/REPLACEMENT OF A STRUCTURAL COMPONENT.

9-205.02 DEMOLITION, REPAIR, OR REHABILITATION OF BRIDGES

NOTE: ON ANY PROJECT IN WHICH THE REMOVAL OF A BUILDING IS NOT ACCOMPLISHED DURING THE RIGHT-OF-ACQUISITION PHASE OF THE PROJECT AND IS INSTEAD INCLUDED IN SCOPE OF THE PROJECT THE DESIGNER SHALL ADD THE FOLLOWING SPECIAL NOTES TO THE PLANS

(1) THE CONTRACTOR SHALL VERIFY THAT AN ASBESTOS SURVEY HAS BEEN COMPLETED PRIOR TO ANY DEMOLITION, REPAIR OR REHABILITATIONS ACTIVITIES (NOT INCLUDING ASPHALT MILLING OR OVERLAY).

(2) ASBESTOS-CONTAINING MATERIALS (ACM) ABATEMENT IS THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE COMPLETED PRIOR TO ANY DEMOLITION, REPAIR OR REHABILITATION OF BRIDGE(S). ABATEMENT SHOULD BE ACCOMPLISHED PER SP202ACM SPECIAL PROVISION REGARDING REMOVAL OF ASBESTOS-CONTAINING MATERIALS. STATE OF TENNESSEE ASBESTOS ACCREDITATION REQUIREMENTS (TCA 1200-01-20) MANDATE THAT ACM ABATEMENT WORK BE PERFORMED BY AN ACCREDITED FIRM (CONTRACTOR) USING ACCREDITED ABATEMENT WORKERS AND SUPERVISORS.

(3) THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING A NOTICE TO THE TDEC, DIVISION OF AIR POLLUTION CONTROL TEN (10) DAYS IN ADVANCE OF

ANY ACM ABATEMENT, DEMOLITION, OR MAJOR REPAIR INVOLVING THE REMOVAL/REPLACEMENT OF A STRUCTURAL COMPONENT.

9-210.00 RETAINING WALLS

THE FOLLOWING SPECIAL NOTES (MODIFY AS NEEDED) ARE TO BE ADDED TO THE SPECIAL NOTES SHEET ON PROJECTS WITH RETAINING WALLS.

(1) THE (RIGHT-OF-WAY/EASEMENT) BETWEEN STATION __ TO STATION __ SHALL REMAIN CLEAR FOR THE CONSTRUCTION OF THE RETAINING WALL. NO UTILITY LINES MAY BE PLACED THERE WITHOUT APPROVAL FROM STRUCTURES DIVISION.

(2) THE OPTIONS FOR RETAINING WALL TYPES SHALL BE LIMITED TO THE APPROVED ALTERNATIVES AS SPECIFIED ON THE RETAINING WALL SHEET(S).

NOTE (3): FOR PROJECTS WITH MULTIPLE RETAINING WALLS, EACH RETAINING WALL SHOULD HAVE ITS OWN ITEM NUMBER AND DESCRIPTION. INCLUDE ALL RETAINING WALL ITEM NUMBERS THAT VALUE ENGINEERING CHANGE PROPOSALS WILL NOT BE ACCEPTED. RETAINING WALLS DESIGNED IN-HOUSE SHALL NOT BE VALUE ENGINEERED.

(3) VALUE ENGINEERING CHANGE PROPOSALS WILL NOT BE ACCEPTED FOR RETAINING WALLS ITEM NO.(S): 604-07 (Description), 604-08 (Description), etc.

NOTE (4): FOR PROJECTS DESIGNED BY CONTRACTORS, SPECIAL PROVISION 624 APPLIES. FOR RETAINING WALLS DESIGNED INHOUSE, SPECIAL PROVISION 624 DOES NOT APPLY AND NOTE 4 SHOULD BE USED. IF THERE ARE MULTIPLE RETAINING WALLS AND SPECIAL PROVISION 624 DOES NOT APPLY TO ALL RETAINING WALLS, NOTE 4 SHOULD INCLUDE WHICH RETAINING WALLS THIS NOTE APPLIES. CHECK WITH HQ CONSTRUCTION FOR CLARIFICATION IF SPECIAL PROVISION 624 WILL BE IN THE CONTRACT.

(4) ALL COST OF BUILDING, INSTALLING AND BACKFILLING THE RETAINING WALL, INCLUDING GRANULAR BACKFILL, GEOTEXTILE FABRIC (TYPE IV), LEVELING PAD, AMD MOMENT SLAB, SHALL BE INCLUDED IN THE COST OF THE RETAINING WALL. COSTS FOR EXCAVATION OF THE WALL SHALL BE INCLUDED IN ITEM NO. 203-01, ROAD AND DRAINAGE EXCAVATION PER CUBIC YARD. END AREAS FOR EXCAVATION FOR THE WALL SHALL BE INCLUDED IN END AREA TOTALS ON CROSS-SECTIONS.

9-215.00 PAVEMENT

9-215.01 RESURFACING

NOTE: NOTE (1) SHOULD BE ADDED TO THE SPECIAL NOTES ON INTERSTATE RESURFACING PLANS WHICH INCLUDE COLD PLANING ITEMS.

(1) TRAFFIC WILL BE ALLOWED TO TEMPORARILY DRIVE ON THE MILLED SURFACE OF THE ROADWAY UNDER THE FOLLOWING CONDITIONS ONLY:

A. THE MILLED SURFACE IS FINE TEXTURED. THE FINE TEXTURE SHALL BE OBTAINED BY A MILLING MACHINE UTILIZING A MILLING HEAD WITH TEETH SPACING 3/8" OR LESS OPERATING AT LESS THAN 80 FEET PER MINUTE.

B. THE SURFACE SHALL BE SWEPT AND CLEANED OF ALL LOOSE MATERIALS.

C. THE MILLED SURFACE SHALL BE PAVED WITHIN 72 HOURS IF THE CURRENT ADT IS ≥ 70,000 OR WITHIN 96 HOURS IF THE CURRENT ADT IS < 70,000.

D. RAIN OR INCLEMENT WEATHER IS NOT EXPECTED OR FORECASTED WITHIN 48 HOURS AFTER MILLING.

E. ALL APPLICABLE SIGNING IS INSTALLED IN ACCORDANCE WITH THE MUTCD. SIGNING SHALL INCLUDE MOTORCYCLE WARNING SIGNS (W8-15 AND W8-15P) PLACED IN ADVANCE OF ANY MILLED AREAS.

F. IF MILLED SURFACE BEGINS TO DETERIORATE, PAVING TO COVER UP DETERIORATING MILLED SURFACES SHOULD OCCUR AS DIRECTED BY THE ENGINEER DURING THE NEXT WORKING DAY. IF SEVERE DISTRESS OCCURS, IMMEDIATE RESPONSE WILL BE REQUIRED.

G. ONLY ONE LANE IN EACH DIRECTION SHALL HAVE A MILLED SURFACE AT ONE TIME.

9-220.00 HISTORICAL

(1) THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVING AND COORDINATING WITH THE TDOT REGIONAL SIGN SHOP FOR STORING HISTORIC MARKER(S). AT THE TIME THE MARKER(S) IS TAKEN DOWN, LINDA WYNN WITH THE TENNESSEE HISTORICAL COMMISSION SHOULD BE NOTIFIED AT (615)-770-1093. AT THE END OF CONSTRUCTION, MARKER(S) WILL BE RESET BY THE SIGN SHOP AT THE DIRECTION OF THE REGIONAL TRAFFIC ENGINEER. IF THE MARKER CANNOT BE RESET OUTSIDE OF THE CLEAR ZONE, THE REGIONAL TRAFFIC ENGINEER WILL CONTACT THE TENNESSEE HISTORIC COMMISSION AND RETURN THE MARKER(S).

9-225.00 SIGNALIZATION

NOTE: NOTE (1) SHALL BE ADDED TO ALL PLANS WITH PROPOSED SIGNAL POLES, MAST ARMS, STRAIN POLES, ETC. NOTE (2) & (3) SHALL BE ADDED TO THE PLANS FOR ANY PROJECT IN METRO NASHVILLE-DAVIDSON COUNTY THAT INCLUDE CANTILEVERED TRAFFIC SIGNAL SUPPORT POLES OR ANY OTHER POLE TYPE AS SPECIFIED BY THE TRAFFIC OPERATIONS DIVISON.

(1) THE DESIGN OF TRAFFIC SIGNAL SUPPORT POLES, MAST ARMS, STRAIN POLES, ETC. SHALL BE IN CONFORMANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, CURRENT EDITION. OVERHEAD CANTILEVERED TRAFFIC SIGNAL STRUCTURES SHALL BE DESIGNED FOR FATIGUE CATEGORY 1.

(2) THE TRAFFIC SIGNAL SUPPORT POLES SHALL BE DESIGNED IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRIES, AND TRAFFIC SIGNALS (CURRENT EDITION WITH ADDENDA). WIND LOADS SHALL BE BASED ON A BASIC WIND SPEED OF 90 MPH WITH A RECURRENCE INTERVAL OF 50 YEARS. OVERHEAD CANTILEVERED TRAFFIC SIGNAL STRUCTURES SHALL BE DESIGNED FOR FATIGUE CATEGORY I. FATIGUE LOADS ARE BASED ON THE REQUIREMENTS OF SECTION 11.7 OF THE SUBJECT AASHTO DOCUMENT AND THE FOLLOWING LOADS:

A. GALLOPING – NO DESIGN NECESSARY. VIBRATION DAMPENERS SHALL BE USED ON ALL CANTILEVERED ARMS THAT ARE 50’ OR LONGER.

B. VORTEX SHEDDING – NOT APPLICABLE ON TRAFFIC SIGNAL SUPPORTS WITH A TAPER OF AT LEAST 0.14 IN/FT.

C. NATURAL WIND GUSTS – THE YEARLY MEAN WIND SPEED FOR NATURAL WIND GUSTS SHALL BE 11.2 MPH.

THE TRAFFIC SIGNAL SUPPORT POLES SHALL BE POLES WITH CURVED CANTILEVERED ARM(S) IN ACCORDANCE WITH METRO PUBLIC WORKS. FOR POLE AND ARM DETAILS, CONTACT MIKE HIRTZER AT 615-880-3261.

9-226.00 MULTIMODAL

NOTE: ALL PROJECTS DEVELOPED BY THE DEPARTMENT SHALL ADDRESS MULTIMODAL ACCESSIBILITY AND PEDESTRIAN CONNECTIVITY ISSUES. AT A MINIMUM, ALL PROJECTS SHALL IDENTIFY THE PROPOSED MULTIMODAL ACCESSIBILITY RELATED QUANTITIES AND THEIR ITEM NUMBERS. NOTE (1) SHOULD BE ADDED IF A CURB RAMP TABULATION BLOCK IS PROVIDED IN THE PLANS. 3R, RSA, SPECIAL PROJECTS WITH LIMITED SCOPE WITH NO PLANS, OR ROADWAY PLANS DEVELOPED WITHOUT PERFORMING A FIELD SURVEY, SUCH AS RESURFACING PLANS, SHALL ADDRESS THE ACCESSIBILITY IMPLEMENTATION DETAILS AT LOCATIONS WHERE THE STANDARD CURB RAMP STANDARDS MAY NOT BE APPLICABLE DUE TO THE EXISTING SITE CONDITIONS AS FOLLOWS:

(1) DURING CONSTRUCTION, IF THE CONSTRUCTION SUPERVISOR IDENTIFIES CURB RAMP LOCATIONS WITHIN THE PROJECT LIMITS WHERE THE TDOT ROADWAY STANDARDS CANNOT BE USED DUE TO SITE LIMITATIONS, A SKETCH OR PICTURE, SHOWING EXISTING CONDITIONS AS WELL AS PROPOSED MODIFICATIONS SHOULD BE SUBMITTED TO THE REGIONAL PROJECT DEVELOPMENT OFFICE THREE WEEKS PRIOR TO THE BEGINNING OF CURB RAMP CONSTRUCTION. THE OFFICE WILL REVIEW AND EVALUATE THE LOCATIONS TO DEVELOP PROPER CURB RAMP DESIGN THAT WILL MEET REGULATIONS.

SECTION 3 – RIGHT-OF-WAY/UTILITY NOTES

NOTE: THESE NOTES SHALL BE PLACED ON PLAN SHEET 3 – RIGHT-OF-WAY NOTES, UTILITY NOTES AND UTILITY OWNERS SHEET.

9-300.00 RIGHT-OF-WAY

NOTE: NOTES 1, 2, 11 & 12, IF APPLICABLE, SHALL BE ADDED TO THE PLANS. NOTES 3-7, IF APPLICABLE, SHALL BE USED ON NEW AND RECONSTRUCTION PROJECTS WITH PARTIAL ACCESS CONTROL. NOTES 3, 4, 5, 6, 8, 9, & 10, IF APPLICABLE, SHALL BE USED ON NEW OR RECONSTRUCTION PROJECTS WITH NO ACCESS CONTROL.

(1) IT IS INTENDED THAT ALL BUILDINGS AND/OR PORTIONS OF BUILDINGS THAT ARE WITHIN THE PROPOSED RIGHT-OF-WAY AND/OR EASEMENT LINES FOR THE PROJECT BE REMOVED THERE FROM IN THE PROCESS OF RIGHT-OF-WAY ACQUISITION. IF ANY SUCH BUILDINGS OR IMPROVEMENTS ARE NOT REMOVED IN THE COURSE OF RIGHT-OF-WAY ACQUISITION, __(A)__ TO BE NOTIFIED IN SUFFICIENT TIME TO PERMIT HAVING SUCH REMOVALS DESIGNATED AS A PART OF THE CONSTRUCTION CONTRACT.

(A) NOTE: FILL IN THE BLANK WITH APPROPRIATE PERSONNEL TITLE(S). "THE PROJECT MANAGER, AND REGIONAL PROJECT DEVELOPMENT OFFICE ARE".

(2) ALL RAMPS MUST CONFORM TO THE DEPARTMENT'S "POLICY ON FINANCING CONSTRUCTION OF PUBLIC ROAD INTERSECTIONS AND DRIVEWAYS ON HIGHWAY RESURFACING, RECONSTRUCTION AND CONSTRUCTION PROJECTS ON NEW LOCATIONS", THE MANUAL ON RULES AND REGULATIONS FOR CONSTRUCTING DRIVEWAYS ON STATE HIGHWAY RIGHT-OF-WAY, STANDARD DRAWING RP-R-1, AND OTHER ACCEPTED DESIGN AND SAFETY STANDARDS.

(3) EXISTING PAVED DRIVEWAY PER TRACT REMAINDER WILL BE REPLACED IN KIND TO A TOUCHDOWN POINT.

(4) WHERE THE EXISTING DRIVEWAY IS UNPAVED AND THE PROPOSED DRIVEWAY EXCEEDS 7 PERCENT IN GRADE, EACH DRIVEWAY WILL BE PAVED TO A TOUCHDOWN POINT OR UNTIL THE GRADE IS LESS THAN 7 PERCENT.

(5) WHERE THE EXISTING DRIVEWAY IS UNPAVED AND THE PROPOSED DRIVEWAY IS LESS THAN 7 PERCENT IN GRADE, EACH DRIVEWAY WILL BE PAVED A SHOULDER WIDTH FROM THE EDGE OF PAVEMENT AND THE REMAINDER OF THAT DRIVEWAY REPLACED IN KIND TO A TOUCHDOWN POINT.

(6) ANY NECESSARY PAVING OF DRIVEWAYS WILL BE DONE DURING PAVING OPERATIONS ON THE MAIN ROADWAY.

(7) TRACT REMAINDERS NOT HAVING AN EXISTING DRIVEWAY WILL BE PROVIDED ONE 50-FOOT OPENING IN THE ACCESS CONTROL FENCE AND A DRIVEWAY WILL BE CONSTRUCTED UNLESS ACCESS IS PROVIDED FROM AN INTERSECTING ROAD OR BASED ON PHYSICAL CONDITIONS AND/OR CONFLICTS WITH OTHER DESIGN CONSIDERATIONS WHICH PREVENT AN ACCESS OPENING. PAVING OF

THESE NEW DRIVEWAYS WILL BE IN ACCORDANCE TO THE 7 PERCENT CRITERIA PREVIOUSLY MENTIONED FOR EXISTING DRIVEWAYS.

(8) NEW DRIVEWAYS PROVIDED IN THE PLANS WILL BE PAVED BASED ON THE 7 PERCENT CRITERIA. THOSE 7 PERCENT OR STEEPER IN GRADE WILL BE PAVED AND THOSE FLATTER THAN 7 PERCENT WILL BE COVERED WITH BASE STONE.

(9) ON PROJECTS WITHOUT CURB AND GUTTER THAT ARE ON STATE ROUTES, IT WILL BE THE RESPONSIBILITY OF THE OWNER TO SECURE A PERMIT AND TO CONSTRUCT ADDITIONAL DRIVEWAYS AND FIELD ENTRANCES OTHER THAN THOSE PROVIDED IN THE PLANS.

(10) ON PROJECTS WITH CURB AND GUTTER THAT ARE ON STATE ROUTES, IT WILL BE THE RESPONSIBILITY OF THE OWNER TO SECURE A PERMIT. AFTER THE PERMIT HAS BEEN GRANTED, THE DEPARTMENT WILL CONSTRUCT THE DRIVEWAY OR FIELD ENTRANCE THROUGH THE CURB AND SIDEWALK, PROVIDED THE CURB AND SIDEWALK HAVE NOT BEEN CONSTRUCTED. IT WILL BE THE RESPONSIBILITY OF THE PROPERTY OWNER TO CONSTRUCT THE DRIVEWAY OR FIELD ENTRANCE FROM BACK OF SIDEWALK TO TOUCHDOWN POINT FOR ANY ADDITIONAL DRIVEWAYS OR FIELD ENTRANCES OTHER THAN THOSE PROVIDED IN THE PLANS.

(11) ON NON-STATE ROUTES, ADDITIONAL DRIVEWAYS AND FIELD ENTRANCES OTHER THAN THOSE PROVIDED IN THE PLANS SHALL REQUIRE A PERMIT ONLY IF THE LOCAL AGENCY SPECIFIES THE NEED FOR THAT PERMIT.

(12) EASEMENT REQUIRED FOR THE RAILROAD CROSSING IS TO BE OBTAINED BY THE UTILITIES ENGINEER BY PROVISIONS CONTAINED IN THE CROSSING AGREEMENT NEGOTIATED WITH THE RAILROAD.

9-305.00 UTILITY

(1) THE LOCATIONS OF UTILITIES SHOWN WITHIN THESE PLANS ARE APPROXIMATE ONLY. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES. ABOVE GRADE AND UNDERGROUND UTILITIES SHOWN WERE TAKEN FROM VISIBLE APPURTENANCES AT THE SITE, PUBLIC RECORDS, AND/OR MAPS PREPARED BY OTHERS. THEREFORE, RELIANCE UPON THE TYPE, SIZE, AND LOCATION OF UTILITIES SHOWN SHOULD BE DONE SO WITH THIS CIRCUMSTANCE CONSIDERED. DETAILED VERIFICATION OF EXISTENCE, LOCATION, AND DEPTH SHOULD ALSO BE MADE PRIOR TO ANY DECISION RELATIVE THERETO IS MADE. AVAILABILITY AND COST OF SERVICE SHOULD BE CONFIRMED WITH THE APPROPRIATE UTILITY COMPANY. IN TENNESSEE, IT IS A REQUIREMENT, PER “THE UNDERGROUND UTILITY DAMAGE PREVENTION ACT”, THAT ANYONE WHO ENGAGES IN EXCAVATION MUST NOTIFY ALL KNOWN UNDERGROUND UTILITY OWNERS, NO LESS THAN THREE (3) OR NOT MORE THAN TEN (10) WORKING DAYS PRIOR TO THE DATE OF THEIR INTENT TO EXCAVATE AND ALSO TO AVOID ANY POSSIBLE HAZARD OR CONFLICT. NOTIFICATION BY CALLING THE TENNESSEE ONE CALL SYSTEM, INC., AT 1-800-351-1111 AS REQUIRED BY TCA 65-31-106 WILL BE REQUIRED.

(2) UNLESS OTHERWISE NOTED, ALL UTILITY ADJUSTMENTS WILL BE PERFORMED BY THE UTILITY OR ITS REPRESENTATIVE. THE CONTRACTOR AND UTILITY OWNERS WILL BE REQUIRED TO COOPERATE WITH EACH OTHER IN ORDER TO

EXPEDITE THE WORK REQUIRED BY THIS CONTRACT. ON CONTRACTS WHERE CONSTRUCTION STAKES, LINES, AND GRADES ARE CONTRACT ITEMS, THE CONTRACTOR WILL BE REQUIRED TO PROVIDE RIGHT-OF-WAY OR SLOPE STAKES, DITCH OR STREAM BED GRADES, OR OTHER ESSENTIAL SURVEY STAKING TO PREVENT CONFLICTS WITH THE HIGHWAY CONSTRUCTION. FREQUENTLY, THIS WILL BE REQUIRED AS THE FIRST ITEM OF WORK AND AT ANY LOCATION ON THE PROJECT DIRECTED BY THE ENGINEER.

(3) THE CONTRACTOR WILL PROVIDE ALL NECESSARY PROTECTIVE MEASURES TO SAFEGUARD EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION OF THIS PROJECT. IN THE EVENT THAT SPECIAL EQUIPMENT IS REQUIRED TO WORK OVER AND AROUND THE UTILITIES, THE CONTRACTOR WILL BE REQUIRED TO FURNISH SUCH EQUIPMENT. THE COST OF PROTECTING UTILITIES FROM DAMAGE AND FURNISHING SPECIAL EQUIPMENT WILL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF CONSTRUCTION.

(4) PRIOR TO SUBMITTING HIS BID, THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR CONTACTING OWNERS OF ALL AFFECTED UTILITIES IN ORDER TO DETERMINE THE EXTENT TO WHICH UTILITY RELOCATIONS AND/OR ADJUSTMENTS WILL HAVE UPON THE SCHEDULE OF WORK FOR THE PROJECT. WHILE SOME WORK MAY BE REQUIRED 'AROUND' UTILITY FACILITIES THAT WILL REMAIN IN PLACE, OTHER UTILITY FACILITIES MAY NEED TO BE ADJUSTED CONCURRENTLY WITH THE CONTRACTOR'S OPERATIONS. ADVANCE CLEAR CUTTING MAY BE REQUIRED BY THE ENGINEER AT ANY LOCATION WHERE CLEARING IS CALLED FOR IN THE SPECIFICATIONS AND CLEAR CUTTING IS NECESSARY FOR A UTILITY RELOCATION. ANY ADDITIONAL COST WILL BE INCLUDED IN THE UNIT PRICE BID FOR THE CLEARING ITEM SPECIFIED IN THE PLANS.

NOTE: ALL PROJECTS, INCLUDING RESURFACING, SHALL ADD NOTE (5) TO THE PLANS.

(5) THE CONTRACTOR SHALL NOTIFY EACH INDIVIDUAL UTILITY OWNER OF HIS PLAN OF OPERATION IN THE AREA OF THE UTILITIES. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL CONTACT THE UTILITY OWNERS AND REQUEST THEM TO PROPERLY LOCATE THEIR RESPECTIVE UTILITY ON THE GROUND. THIS NOTIFICATION SHALL BE GIVEN AT LEAST THREE (3) BUSINESS DAYS PRIOR TO COMMENCEMENT OF OPERATIONS AROUND THE UTILITY IN ACCORDANCE WITH TCA 65-31-106. NOTIFICATION BY CALLING THE TENNESSEE ONE CALL SYSTEM, INC AT 1-800-351-1111 WILL BE REQUIRED.

(6) NO WORK SHALL OCCUR IN THE AREA MARKED ON THE PLANS AS STREAM/WETLAND MITIGATION RIGHT-OF-WAY OR MITIGATION AREA. NO UTILITY RELOCATION OR OTHER LAND DISTURBANCE IS AUTHORIZED. ONLY ACTIVITIES PERTAINING TO THE CONSTRUCTION OR MANAGEMENT OF THE STREAM/ WETLAND MITIGATION SITE MAY OCCUR, WHICH WILL BE INDICATED ON THE STREAM MITIGATION PLANS (ADD PLAN SHEET NUMBERS HERE). ANY VIOLATIONS OF THE ABOVE MENTIONED WILL RESULT IN NON-COMPLIANCE WITH ENVIRONMENTAL PERMIT REQUIREMENTS.

SECTION 4 – ENVIRONMENTAL NOTES

SUBSECTION 1 – ENVIRONMENTAL GENERAL NOTES

The following notes are part of the Functional plan set and should be added to the Environmental Notes sheet. This sheet comes after the General and Special Notes.

9-400.00 ENVIRONMENTAL GENERAL NOTES

9-400.01 NATURAL RESOURCES

NOTE: NOTES (1-9) ARE REQUIRED FOR ALL PROJECTS OTHER THAN RESURFACING PROJECTS. ONLY NOTES (4) & (9) SHOULD BE ADDED TO ALL RESURFACING PLANS.

(1) SOIL MATERIALS MUST BE PREVENTED FROM ENTERING WATERS OF THE STATE/U.S. EPSC MEASURES TO PROTECT NATURAL RESOURCES AND WATER QUALITY SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD. APPROPRIATE EPSC MEASURES MUST BE INSTALLED ALONG THE BASE OF ALL FILLS AND CUTS, ON THE DOWNHILL SIDE OF STOCKPILED SOIL, AND ALONG NATURAL RESOURCES IN CLEARED AREAS TO PREVENT SEDIMENT MIGRATION INTO STREAMS, WETLANDS OR OTHER NATURAL FEATURES IN ACCORDANCE WITH TDOT STANDARDS. EPSC MEASURES SHALL BE INSTALLED ON THE CONTOUR, ENTRENCHED AND STAKED, AND EXTEND THE WIDTH OF THE AREA TO BE CLEARED.

(2) NEW CHANNEL CONSTRUCTION SHALL BE COMPLETED IN THE DRY AND STABILIZED FOR AT LEAST 72 HOURS PRIOR TO DIVERTING WATER FROM THE EXISTING AND/OR TEMPORARY CHANNEL.

(3) INSTREAM EPSC DEVICES REQUIRE THE TDOT ENVIRONMENTAL DIVISION, PERMITS SECTION REVIEW AND MUST BE PROCESSED BY THE PERMITS SECTION TO OBTAIN WATER QUALITY PERMITS.

(4) THE OPERATION OF EQUIPMENT IN WATERS OF THE STATE/U.S., INCLUDING WETLANDS AND EPHEMERAL, INTERMITTENT, AND PERENNIAL STREAMS, IS NOT ALLOWED.

(5) THE WIDTH OF THE FILL ASSOCIATED WITH TEMPORARY CROSSINGS SHALL BE LIMITED TO THE MINIMUM NECESSARY FOR THE ACTUAL CROSSING, NOT TO EXCEED THE WIDTH SPECIFIED IN THE STANDARD DRAWING.

(6) STREAM BEDS SHALL NOT BE USED AS TRANSPORTATION ROUTES FOR CONSTRUCTION EQUIPMENT. TEMPORARY CULVERT CROSSINGS SHALL BE LIMITED TO ONE POINT PER STREAM AND EPSC MEASURES SHALL BE USED WHERE THE STREAM BANKS ARE DISTURBED. WHERE THE STREAMBED IS NOT COMPOSED OF BEDROCK, A PAD OF CLEAN ROCK SHALL BE USED AT THE CROSSING POINT AND CULVERTED TO PREVENT THE IMPOUNDMENT OF WATER FLOW. CLEAN ROCK IS ROCK OF VARIOUS TYPE AND SIZE, DEPENDING UPON APPLICATION, WHICH CONTAINS NO FINES, SOILS, OR OTHER WASTES OR CONTAMINANTS. OTHER MATERIALS USED FOR ALL TEMPORARY FILLS SHALL BE COMPLETELY REMOVED IN THEIR ENTIRETY AFTER THE WORK IS

COMPLETED AND THE AFFECTED AREAS RETURNED TO PREEXISTING ELEVATIONS. ALL TEMPORARY CROSSINGS SHALL BE CONSTRUCTED IN ACCORDANCE WITH STD. DWG. EC-STR-25 UNLESS SPECIFICALLY ADDRESSED IN THE EPSC PLANS. ALTERNATIVELY, PLACING A TEMPORARY BRIDGE (E.G. BAILEY BRIDGE OR EQUIVALENT, TIMBERS, ETC.) FROM TOP OF BANK TO TOP OF BANK OR THE APPROPRIATE USE OF BARGES AT THE CROSSING TO AVOID DISTURBANCE OF THE STREAMBED IS AN ACCEPTABLE OPTION.

(7) HEAVY EQUIPMENT WORKING IN WETLANDS WITH PERMITTED TEMPORARY IMPACTS SHALL BE PLACED ON MATS, OR OTHER MEASURES MUST BE TAKEN TO MINIMIZE SOIL DISTURBANCE AND COMPACTION UNLESS SPECIFICALLY ADDRESSED IN THE PLANS, SPECIFICATION, AND ESTIMATE (PS&E) PLANS. ANY MATS AND OTHER MEASURES USED FOR HEAVY EQUIPMENT SHALL BE REMOVED IN THEIR ENTIRETY AFTER THE WORK IS COMPLETED. ALL AFFECTED AREAS SHOULD BE RETURNED TO PRE-EXISTING CONDITIONS.

(8) WETLANDS SHALL NOT BE USED AS EQUIPMENT STORAGE, STAGING, OR TRANSPORTATION AREAS, UNLESS SPECIFICALLY PROVIDED FOR IN THE PLANS, SPECIFICATION, AND ESTIMATE (PS&E) PLANS AND PERMITS.

(9) THE CONTRACTOR SHALL TAKE APPROPRIATE STEPS PRIOR TO ANY CONSTRUCTION AND MAINTENANCE ACTIVITIES TO ENSURE THAT ENVIRONMENTAL FEATURES (E.G., STREAMS, WETLANDS, SPRINGS, ETC.) ARE NOT IMPACTED BEYOND PERMITTED LOCATIONS. IF THE CONTRACTOR OR TDOT INSPECTOR IS UNSURE OF THE IDENTITY OF AN ENVIRONMENTAL FEATURE, THE INSPECTOR SHALL CONTACT THE TDOT REGION ENVIRONMENTAL TECH GROUP IMMEDIATELY.

9-400.02 SPECIES

NOTE: NOTES (10-12) ARE REQUIRED FOR ALL PROJECTS OTHER THAN RESURFACING PLANS. ONLY NOTES (11) & (12) SHOULD BE ADDED TO ALL RESURFACING PLANS.

(10) NO ACTIVITY MAY SUBSTANTIALLY DISRUPT THE MOVEMENT OF THOSE SPECIES OF AQUATIC LIFE INDIGENOUS TO THE WATER BODY, INCLUDING THOSE SPECIES THAT NORMALLY MIGRATE THROUGH THE AREA.

(11) SHOULD CLIFF SWALLOW OR BARN SWALLOW NESTS, EGGS, OR BIRDS (YOUNG AND ADULTS) BE PRESENT, THE CONTRACTOR SHALL CONTACT THE REGIONAL ECOLOGY OFFICE TO DETERMINE IF SEASONAL RESTRICTIONS WILL BE NECESSARY. GENERALLY, BIRDS, NESTS, AND EGGS MAY NOT BE DISTURBED BETWEEN APRIL 15 AND JULY 31. FROM AUGUST 1 TO APRIL 14, NESTS CAN BE REMOVED OR DESTROYED SO LONG AS BIRDS OR EGGS ARE NOT PRESENT, AND MEASURES IMPLEMENTED TO PREVENT FUTURE NEST BUILDING AT THE SITE (I.E., CLOSING OFF AREA USING NETTING).

(12) IF THE REMOVAL OF ANY TREES WITH A DIAMETER AT BREAST HEIGHT (DBH) GREATER THAN 3 INCHES IS DEEMED NECESSARY THE TDOT SUPERVISOR SHALL CONTACT THE TDOT ENVIRONMENTAL DIVISION, ECOLOGY SECTION IMMEDIATELY.

9-400.03 PERMITS, PLANS & RECORDS

NOTE: NOTES (13-17) ARE REQUIRED FOR ALL PROJECTS OTHER THAN RESURFACING PLANS. ONLY NOTE (15) SHOULD BE ADDED TO ALL RESURFACING PLANS.

(13) THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR AND OBTAIN ANY NECESSARY ENVIRONMENTAL PERMITS OR APPROVALS, INCLUDING BUT NOT LIMITED TO ARCHAEOLOGY, ECOLOGY, HISTORICAL, HAZARDOUS MATERIALS, AIR AND NOISE, TDEC ARAP/401, USACE SECTION 404, TVA SECTION 26A, AND TDEC NPDES PERMITS, FROM FEDERAL, STATE AND/OR LOCAL AGENCIES REGARDING ANY MATERIAL AND STAGING AREAS AND THE OPERATION OF ANY PROJECT-DEDICATED ASPHALT AND/OR CONCRETE PLANTS TO BE USED. ANY SUCH PERMITS SHALL BE SUPPLIED TO THE TDOT PROJECT RESPONSIBLE PARTY PRIOR TO THE USE OF THE PERMITTED AREA(S).

(14) ANY DISAGREEMENT BETWEEN THE PLANS, SPECIFICATION, AND ESTIMATE (PS&E) PLANS, THE PROJECT AS CONSTRUCTED, AND THE PERMIT(S) ISSUED FOR THE PROJECT, SHALL BE BROUGHT TO THE ATTENTION OF THE TDOT PROJECT RESPONSIBLE PARTY. THE ENVIRONMENTAL DIVISION, ENGINEERING DIVISION, AND HEADQUARTERS CONSTRUCTION OFFICE SHALL BE CONTACTED IN THESE INSTANCES AND DECIDE WHICH HAS PRECEDENCE AND WHETHER PERMIT OR PLANS REVISIONS ARE NEEDED. IN GENERAL, PERMIT CONDITIONS WILL PREVAIL.

(15) IF A CHANGE IN PROJECT SCOPE OCCURS DURING CONSTRUCTION, INCLUDING VALUE ENGINEERING, THE TDOT PERMIT SECTION SHALL BE CONTACTED TO DETERMINE WHETHER PERMIT REVISIONS ARE NEEDED. THE ENGINEERING PRODUCTION SUPPORT DIVISION SHALL BE CONTACTED TO DETERMINE IF ANY PLAN REVISIONS ARE NEEDED.

(16) THE CONTRACTOR SHALL REVIEW ALL EXISTING PERMITS TO ENSURE THAT WORK AT PERMITTED SITES DOES NOT EXCEED EXPIRATION DATE. IF WORK IS GOING TO BE CONTINUED AFTER EXPIRATION DATES, THE CONTRACTOR SHALL CONTACT THE TDOT PROJECT RESPONSIBLE PARTY TO COMMENCE PERMIT RENEWAL PROCESS.

(17) ALL WATER QUALITY PERMITS SHALL BE POSTED NEAR THE MAIN ENTRANCE OF THE CONSTRUCTION SITE ACCESSIBLE TO THE PUBLIC. THE NAME, COMPANY NAME, EMAIL ADDRESS, TELEPHONE NUMBER AND ADDRESS OF THE PROJECT SITE OWNER, OPERATOR, OR A LOCAL CONTACT PERSON WITH A BRIEF DESCRIPTION OF THE PROJECT SHALL ALSO BE POSTED. IF POSTING THIS INFORMATION NEAR A MAIN ENTRANCE IS INFEASIBLE, THE INFORMATION SHALL BE PLACED IN A PUBLICLY ACCESSIBLE LOCATION NEAR WHERE THE CONSTRUCTION IS ACTIVELY UNDERWAY AND MOVED AS NECESSARY. THIS LOCATION SHALL BE POSTED AT THE CONSTRUCTION SITE. ALL POSTINGS SHALL BE MAINTAINED IN LEGIBLE CONDITION.

9-400.04 SUPPORT ACTIVITIES

NOTE: THIS NOTE IS REQUIRED FOR ALL PROJECTS OTHER THAN RESURFACING PROJECTS.

(18) MATERIALS AND STAGING AREAS SHALL NOT AFFECT ANY WATERS OF THE STATE/U.S. UNLESS THESE AREAS ARE SPECIFICALLY COVERED BY ENVIRONMENTAL PERMITS, OBTAINED SOLELY BY THE CONTRACTOR. THE CONTRACTOR SHALL REVIEW ALL EXISTING PERMITS TO ENSURE THAT WORK AT PERMITTED SITES DOES NOT EXCEED EXPIRATION DATES. IF WORK IS GOING TO BE CONTINUED AFTER EXPIRATION DATES, THE CONTRACTOR SHALL CONTACT THE TDOT PROJECT RESPONSIBLE PARTY TO COMMENCE PERMIT RENEWAL PROCESS.

9-400.05 STREAMS, WETLANDS & BUFFER ZONES

NOTE: NOTE SHALL BE INCLUDED FOR ALL PROJECTS THAT HAS A STREAM RELOCATION.

(19) ONCE WATER IS DIVERTED INTO A NEWLY CONSTRUCTED AND STABILIZED RELOCATED STREAM / CHANNEL, THE ECOLOGY SECTION SHALL BE NOTIFIED. THE STREAM NAME, STREAM NUMBER, AND DATE THE WATER WAS DIVERTED INTO THE NEWLY CONSTRUCTED STREAM / CHANNEL SHALL BE SUPPLIED WITH THE NOTIFICATION.

9-400.06 ENVIRONMENTAL

NOTE: FOR ALL PROJECTS EXCEPT RESURFACING PROJECTS, THE EPSC PLAN SHALL ADDRESS PERIODS OF THE YEAR DURING WHICH CLEARING, GRUBBING, EXCAVATION, GRADING, CUTTING OR FILLING WILL NOT OCCUR AND LIMITATIONS ON THE TOTAL AREA OF EXPOSED SOIL (AREAS THAT DO NOT HAVE TEMPORARY OR PERMANENT STABILIZATION) AT ANY TIME DURING CONSTRUCTION. AS SUCH, THE FOLLOWING GUIDANCE SHALL BE FOLLOWED.

IF THE COMBINED EARTHWORK QUANTITIES FOR COMMON EXCAVATION (NOT ROCK) AND UNCLASSIFIED BORROW EXCAVATION IS GREATER THAN 1,000,000 CY, OR THE PROJECT IS 1 MILE OR CLOSER TO THE NEAREST DESIGNATED "EXCEPTIONAL TENNESSEE WATER" STREAM, THE DESIGN LEAD SHALL NOTIFY THE APPROPRIATE ENGINEERING DIVISION ASSISTANT DIRECTOR. THE ENGINEERING DIVISION ASSISTANT DIRECTOR SHALL IN TURN REQUEST ADDITIONAL GUIDANCE FROM THE ENVIRONMENTAL DIVISION PERMITS SECTION AND THE CONSTRUCTION DIVISION REGARDING APPROPRIATENESS OF SEASONAL LIMITATIONS AND LIMITATIONS ON THE TOTAL AREA OF EXPOSED SOIL.

IF THE COMBINED EARTHWORK QUANTITIES FOR COMMON EXCAVATION (NOT ROCK) AND UNCLASSIFIED BORROW EXCAVATION IS LESS THAN 1,000,000 CY OR THE PROJECT IS FURTHER THAN 1 MILE FROM THE NEAREST DESIGNATED "EXCEPTIONAL TENNESSEE WATER" STREAM, THE DESIGNER SHALL INCLUDE THE FOLLOWING NOTE ON THE FIRST SHEET OF THE EPSC PLAN SET.

(20) EXCEPT AS OTHERWISE SPECIFIED, THERE ARE NO KNOWN SPECIAL ENVIRONMENTAL FACTORS PRESENT ON THIS PROJECT THAT INDICATE A NEED FOR SEASONAL LIMITATIONS ON THE CLEARING, GRUBBING, EXCAVATION, GRADING, CUTTING OR FILLING OPERATIONS OR ON THE TOTAL AREA OF EXPOSED SOIL.

SUBSECTION 2 – ENVIRONMENTAL SPECIAL NOTES

The following notes are part of the Functional plan set and should be added to the Environmental Notes sheet after the Environmental General Notes section. This sheet comes after the General and Special Notes.

9-405.00 ENVIRONMENTAL SPECIAL NOTES

9-405.01 ENVIRONMENTAL

(1) STAFF FROM THE TDOT ENVIRONMENTAL DIVISION COMPLIANCE AND FIELD SERVICES OFFICE SHALL BE INVITED TO ALL FIELD REVIEW MEETINGS.

9-405.02 ECOLOGY

(2) STAFF FROM THE TDOT ENVIRONMENTAL DIVISION OR A DESIGNEE SHALL ADVISE THE CONTRACTOR DURING THE PS&E FIELD REVIEW MEETING WHEN ENVIRONMENTAL DIVISION PERSONNEL OR A DESIGNATED CONSULTANT WILL NEED TO BE ONSITE FOR WORK BEING DONE WHICH COULD AFFECT WATERS OF THE STATE/U.S. OR SPECIES.

(3) STAFF FROM THE TDOT ENVIRONMENTAL DIVISION OR A DESIGNEE SHALL ATTEND THE PS&E FIELD REVIEW MEETING FOR ALL PROJECTS WHICH HAVE THREATENED OR ENDANGERED SPECIES OR CRITICAL HABITAT PROXIMAL TO SCHEDULED WORK. THIS WILL PROVIDE THE OPPORTUNITY TO ENSURE THAT PERSONNEL INCLUDING THE CONTRACTOR'S PERSONNEL AND SUBCONTRACTORS ARE MADE AWARE OF THE NECESSARY PRECAUTIONS THAT MUST BE FOLLOWED.

(4) ALL PROJECTS WITH LEGALLY PROTECTED SPECIES OR CRITICAL HABITAT IDENTIFIED SHALL HAVE MEASURES IN PLACE TO CONTAIN CONCRETE DUST, CEMENT DUST AND ALL OTHER MATERIALS. THESE MATERIALS ARE NOT ALLOWED TO ENTER WATERS OF THE STATE/U.S.

9-405.03 PROJECT COMMITMENTS

(5) SEE PROJECT COMMITMENTS, SHEET_____, FOR DETAILS RELATING TO SPECIAL ENVIRONMENTAL COMMITMENTS REQUIRED BY THIS PROJECT.

9-405.04 SCOPE OF WORK

NOTE: INCLUDE A DESCRIPTION OF THE SCOPE OF WORK FOR THE PROJECT.

(6)

SUBSECTION 3 – EROSION PREVENTION AND SEDIMENT CONTROL GENERAL NOTES

The following notes shall be included on the first sheet of the EPSC Plan sheet series. For Resurfacing Plans, add these notes after the General, Special and Environmental Notes sheets.

9-410.00 EROSION PREVENTION AND SEDIMENT CONTROL GENERAL NOTES

9-410.01 DISTURBED AREA

NOTE: NOTES (1-5) SHALL BE ADDED TO THE PLANS FOR ALL PROJECTS, EXCLUDING RESURFACING PROJECTS, REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. ONLY NOTE (1) SHOULD BE ADDED TO ALL RESURFACING PLANS.

(1) IF DISTURBED ACREAGE IS EQUAL TO ONE ACRE OR MORE, PLEASE CONTACT TDOT ENVIRONMENTAL DIVISION, PERMITS SECTION AS SOON AS POSSIBLE BECAUSE AN NPDES PERMIT WILL BE REQUIRED.

(2) AREAS TO BE UNDISTURBED SHALL BE CLEARLY MARKED IN THE FIELD BEFORE CONSTRUCTION ACTIVITIES BEGIN.

(3) UNLESS OTHERWISE NOTED IN THE PLANS, THE CONTRACTOR SHALL NOT CLEAR/DISTURB ANY AREA BEYOND 15 FEET FROM SLOPE LINES.

(4) PRE-CONSTRUCTION VEGETATIVE GROUND COVER SHALL NOT BE DESTROYED, REMOVED OR DISTURBED (I.E. CLEARING AND GRUBBING INITIATED) MORE THAN 14 CALENDAR DAYS PRIOR TO GRADING OR EARTH MOVING ACTIVITIES UNLESS THE AREA IS MULCHED, SEEDED WITH MULCH, OR OTHER TEMPORARY COVER IS APPLIED.

(5) CLEARING, GRUBBING, AND OTHER DISTURBANCE TO RIPARIAN VEGETATION SHALL BE LIMITED TO THE MINIMUM NECESSARY FOR SLOPE CONSTRUCTION AND EQUIPMENT OPERATIONS. EXISTING VEGETATION, INCLUDING STREAM AND WETLAND BUFFERS (UNLESS PERMITTED), SHOULD BE PRESERVED TO THE MAXIMUM EXTENT POSSIBLE. UNNECESSARY VEGETATION REMOVAL IS PROHIBITED.

9-410.02 SEDIMENT CONTROL

NOTE: NOTES (6-10) SHALL BE ADDED TO THE PLANS FOR ALL PROJECTS, EXCLUDING RESURFACING PLANS, REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. ONLY NOTE (6) & (8) SHOULD BE ADDED TO ALL RESURFACING PLANS.

(6) EPSC MEASURES SHALL BE INSTALLED AND FUNCTIONAL PRIOR TO ANY EARTH MOVING OPERATIONS AND SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD EXCEPT AS SUCH WORK MAY BE NECESSARY TO INSTALL EPSC MEASURES.

(7) TEMPORARY EPSC MEASURES MAY BE REMOVED AT THE BEGINNING OF THE WORKDAY BUT MUST BE REINSTALLED AT THE END OF THE WORKDAY OR BEFORE/DURING A PRECIPITATION EVENT.

(8) THE CONTRACTOR SHALL ESTABLISH AND MAINTAIN A PROACTIVE METHOD TO PREVENT THE OFFSITE MIGRATION OR DEPOSIT OF SEDIMENT OFF THE PROJECT LIMITS (E.G. R.O.W., EASEMENTS, ETC.), INTO WATERS OF THE STATE/U.S., OR ONTO ROADWAYS USED BY THE GENERAL PUBLIC. IF SEDIMENT ESCAPES THE CONSTRUCTION SITE, OFFSITE ACCUMULATIONS OF SEDIMENT THAT HAVE NOT REACHED A STREAM MUST BE REMOVED AT A FREQUENCY SUFFICIENT TO MINIMIZE OFFSITE IMPACTS (E.G., FUGITIVE SEDIMENT THAT HAS ESCAPED THE CONSTRUCTION SITE AND HAS COLLECTED IN A STREET MUST BE REMOVED SO THAT IT IS NOT SUBSEQUENTLY WASHED INTO STORM SEWERS AND STREAMS BY THE NEXT RAIN AND/OR SO THAT IT DOES NOT POSE A SAFETY HAZARD TO USERS OF PUBLIC STREETS). ARRANGEMENTS CONCERNING REMOVAL OF SEDIMENT ON ADJOINING PROPERTY MUST BE NEGOTIATED WITH THE ADJOINING PROPERTY OWNER BEFORE REMOVAL OF SEDIMENT.

(9) OFFSITE VEHICLE TRACKING OF SEDIMENTS AND THE GENERATION OF DUST SHALL BE MINIMIZED. A STABILIZED CONSTRUCTION EXIT (A POINT OF ENTRANCE/EXIT TO THE CONSTRUCTION PROJECT) SHALL BE PROVIDED TO REDUCE THE TRACKING OF MUD AND DIRT ONTO PUBLIC ROADS BY CONSTRUCTION VEHICLES.

(10) THE DEWATERING OF WORK AREAS, TRENCHES, FOUNDATIONS, EXCAVATIONS, ETC. THAT HAVE COLLECTED STORMWATER, WATER FROM VEHICLE WASH AREAS, OR GROUNDWATER SHALL BE EITHER HELD IN SETTLING BASINS OR TREATED BY FILTRATION AND/OR CHEMICAL TREATMENT PRIOR TO ITS DISCHARGE. ALL PHYSICAL AND/OR CHEMICAL TREATMENT WILL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES AND FULLY DESCRIBED IN THE EPSC PLANS. WATER DISCHARGED SHALL NOT CAUSE AN OBJECTIONABLE COLOR CONTRAST WITHIN THE RECEIVING NATURAL RESOURCE. WATER MUST BE HELD IN SETTLING BASINS UNTIL AT LEAST AS CLEAR AS THE RECEIVING WATERS. SETTLING BASINS SHALL NOT BE LOCATED CLOSER THAN 20 FEET FROM THE TOP BANK OF A STREAM. SETTLING BASINS AND SEDIMENT TRAPS SHALL BE PROPERLY DESIGNED ACCORDING TO THE SIZE OF THE DRAINAGE AREAS OR VOLUME OF WATER TO BE TREATED. TREATED WATER MUST BE DISCHARGED THROUGH A PIPE OR WELL-VEGETATED OR LINED CHANNEL, SO THAT THE DISCHARGE DOES NOT CAUSE EROSION OR SEDIMENT TRANSPORT. DISCHARGES FROM BASINS AND IMPOUNDMENTS SHALL UTILIZE OUTLET STRUCTURES THAT ONLY WITHDRAW WATER FROM NEAR THE SURFACE OF THE BASIN OR IMPOUNDMENT. DISCHARGES MUST NOT CAUSE AN OBJECTIONABLE COLOR CONTRAST WITH THE RECEIVING STREAM.

9-410.03 INSPECTION, MAINTENANCE & REPAIR

NOTE: NOTE (11) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING 1 ACRE OR MORE OF TOTAL DISTURBED AREA, FOR WHICH, AN NPDES PERMIT IS REQUIRED.

(11) REFER TO THE STORM WATER POLLUTION AND PREVENTION PLAN SHEET SERIES (S-1) FOR SWPPP, PERMITS, AND RECORDS NOTES.

NOTE: NOTES (12-19) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH, AN NPDES PERMIT IS NOT REQUIRED. THESE NOTES SHOULD NOT BE ADDED TO RESURFACING PLANS.

(12) THE TDOT CONSTRUCTION SUPERVISOR (OR THEIR DESIGNEE) AND THE CONTRACTOR'S RESPONSIBLE PARTY ARE RESPONSIBLE FOR INSPECTIONS. MAINTENANCE AND REPAIR ACTIVITIES ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE TDOT CONSTRUCTION SUPERVISOR OR THEIR DESIGNEE SHALL COMPLETE THE EPSC INSPECTION REPORTS AND DISTRIBUTE COPIES PER THE CONTRACT.

(13) TDOT CONSULTANTS AND CONTRACTOR STAFF RESPONSIBLE FOR THE INSPECTION, IMPLEMENTATION, MAINTENANCE, AND/OR REPAIR OF EPSC MEASURES SHALL SUCCESSFULLY COMPLETE THE TDEC "LEVEL 1 - FUNDAMENTALS OF EROSION PREVENTION AND SEDIMENT CONTROL FOR CONSTRUCTION SITES" COURSE AND ANY REFRESHER COURSES AS REQUIRED TO MAINTAIN CERTIFICATION. TDOT STAFF AND SUPERVISORS RESPONSIBLE FOR THE INSPECTION, IMPLEMENTATION, MAINTENANCE, AND/OR REPAIR OF EPSC MEASURES SHALL SUCCESSFULLY COMPLETE THE TDOT "FUNDAMENTALS OF EROSION AND SEDIMENT CONTROL" CLASS AND ANY REFRESHER COURSES AS REQUIRED TO MAINTAIN CERTIFICATION.

(14) EPSC CONTROLS SHALL BE INSPECTED ACCORDING TO PERMIT REQUIREMENTS TO VERIFY MEASURES HAVE BEEN INSTALLED AND MAINTAINED IN ACCORDANCE WITH TDOT STANDARD DRAWINGS, SPECIFICATIONS, AND GOOD ENGINEERING PRACTICES. EPSC INSPECTIONS SHALL BE DOCUMENTED ON THE TDOT EPSC INSPECTION REPORT.

(15) DISCHARGE POINTS SHALL BE INSPECTED TO ASCERTAIN WHETHER EPSC MEASURES ARE EFFECTIVE IN PREVENTING EROSION AND CONTROLLING SEDIMENT INCLUDING SIGNIFICANT IMPACTS TO SURROUNDING NATURAL RESOURCES AND ADJACENT PROPERTY OWNERS. WHERE DISCHARGE LOCATIONS ARE INACCESSIBLE, NEARBY DOWN GRADIENT LOCATIONS SHALL BE INSPECTED. LOCATIONS WHERE VEHICLES ENTER AND EXIT THE SITE SHALL BE INSPECTED FOR EVIDENCE OF OFFSITE ROADWAY SEDIMENT TRACKING.

(16) UPON CONCLUSION OF THE INSPECTIONS, EPSC MEASURES FOUND TO BE INEFFECTIVE SHALL BE REPAIRED, REPLACED, OR MODIFIED BEFORE THE NEXT RAIN EVENT, IF POSSIBLE, BUT IN NO CASE MORE THAN 24 HOURS AFTER THE INSPECTION OR WHEN THE CONDITION IS IDENTIFIED. IF THE REPAIR, REPLACEMENT OR MODIFICATION IS NOT PRACTICAL WITHIN THE 24 HOUR TIMEFRAME, WRITTEN DOCUMENTATION SHALL BE PROVIDED IN THE FIELD DIARY AND EPSC INSPECTION REPORT. AN ESTIMATED REPAIR, REPLACEMENT OR MODIFICATION SCHEDULE SHALL BE DOCUMENTED WITHIN 24 HOURS AFTER IDENTIFICATION.

(17) INSPECTION, REPAIR, AND MAINTENANCE OF EPSC MEASURES SHALL BE PERFORMED ON A REGULAR BASIS. SEDIMENT SHALL BE REMOVED FROM SEDIMENT CONTROL STRUCTURES WHEN THE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT (50%). DURING SEDIMENT REMOVAL, THE

CONTRACTOR SHALL TAKE STEPS TO ENSURE THAT STRUCTURAL COMPONENTS OF EPSC MEASURES ARE NOT DAMAGED AND THUS MADE INEFFECTIVE. IF DAMAGE DOES OCCUR, THE CONTRACTOR SHALL REPAIR THE EPSC MEASURES AT THE CONTRACTOR'S OWN EXPENSE.

(18) THE EPSC PLAN SHALL BE UPDATED WHENEVER EPSC INSPECTIONS INDICATE, OR WHERE STATE OR FEDERAL OFFICIALS DETERMINE EPSC MEASURES ARE PROVING INEFFECTIVE IN ELIMINATING OR SIGNIFICANTLY MINIMIZING POLLUTANT SOURCES OR ARE OTHERWISE NOT ACHIEVING THE GENERAL OBJECTIVES OF CONTROLLING POLLUTANTS IN STORM WATER DISCHARGES ASSOCIATED WITH THE CONSTRUCTION ACTIVITY.

(19) SEDIMENT REMOVED FROM SEDIMENT CONTROL STRUCTURES SHALL BE PLACED AND TREATED IN A MANNER SO THAT THE SEDIMENT IS CONTAINED WITHIN THE PROJECT LIMITS AND DOES NOT MIGRATE ONTO ADJACENT PROPERTIES AND INTO WATERS OF THE STATE/U.S. COST FOR THIS TREATMENT SHALL BE INCLUDED IN PRICE BID FOR ITEM NO. 209-05 SEDIMENT REMOVAL, C.Y.

9-410.04 EROSION PREVENTION

NOTE: NOTES (20-27) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. THESE NOTES SHOULD NOT BE ADDED TO RESURFACING PLANS.

(20) CONSTRUCTION SHALL BE SEQUENCED AND STAGED TO MINIMIZE THE EXPOSURE TIME OF GRADED OR DENUDED SOIL AREAS, PRESERVE TOPSOIL, AND MINIMIZE SOIL COMPACTION.

(21) THE ACCEPTED EPSC PLAN SHALL REQUIRE THAT EPSC MEASURES BE IN PLACE BEFORE CLEARING, GRUBBING, EXCAVATION, GRADING, CULVERT OR BRIDGE CONSTRUCTION, CUTTING, FILLING, OR ANY OTHER EARTHWORK OCCURS, EXCEPT AS SUCH WORK MAY BE NECESSARY TO INSTALL EPSC MEASURES.

(22) NO WORK SHALL BE STARTED UNTIL THE CONTRACTOR'S PLAN FOR THE STAGING OF OPERATIONS, INCLUDING THE PLAN FOR STAGING OF TEMPORARY AND PERMANENT EPSC MEASURES, HAS BEEN ACCEPTED BY THE TDOT RESPONSIBLE PARTY. THE CONTRACTOR'S EPSC PLAN SHALL INCORPORATE AND SUPPLEMENT, AS ACCEPTABLE, THE BASIC EPSC DEVICES ON THE EPSC PLAN.

(23) TEMPORARY STABILIZATION SHALL BE INITIATED WITHIN 14 DAYS (2 WEEKS) WHEN CONSTRUCTION ACTIVITIES ON A PORTION OF THE SITE ARE TEMPORARILY CEASED AND EARTH DISTURBING ACTIVITIES WILL NOT RESUME UNTIL AFTER 14 DAYS (2 WEEKS). PERMANENT STABILIZATION MEASURES IN DISTURBED AREAS SHALL BE INITIATED WITHIN 14 DAYS (2 WEEKS) AFTER FINAL GRADING OF ANY PHASE OF CONSTRUCTION.

(24) STEEP SLOPES SHALL BE TEMPORARILY STABILIZED NOT LATER THAN 7 DAYS (A WEEK) AFTER CONSTRUCTION ACTIVITY ON THE SLOPE HAS TEMPORARILY OR PERMANENTLY CEASED. STEEP SLOPES ARE DEFINED AS A NATURAL OR CREATED SLOPE OF 35% GRADE OR GREATER REGARDLESS OF HEIGHT.

(25) PERMANENT STABILIZATION WILL REPLACE TEMPORARY MEASURES AS SOON AS PRACTICABLE. PRIORITY SHALL BE GIVEN TO FINISHING OPERATIONS AND PERMANENT EPSC MEASURES OVER TEMPORARY EPSC MEASURES ON ALL PROJECTS.

(26) TEMPORARY OR PERMANENT STABILIZATION MUST BE FREE OF FINES (SILT AND CLAY SIZED PARTICLES). UNPACKED GRAVEL CONTAINING FINES OR CRUSHER-RUN WILL NOT BE CONSIDERED SUFFICIENT STABILIZATION.

(27) DELAYING THE PLANTING OF COVER VEGETATION UNTIL WINTER MONTHS OR DRY MONTHS SHOULD BE AVOIDED.

9-410.05 PERMITS, PLANS & RECORDS

NOTE: NOTE (28) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. THIS NOTE SHOULD NOT BE ADDED TO RESURFACING PLANS.

(28) THE EPSC PLAN IS TO SERVE AS AN INITIAL GUIDE FOR SITE PERSONNEL AS THE CONSTRUCTION PROCESS DEVELOPS. IT MUST BE AMENDED, MODIFIED, AND UPDATED WHENEVER A CHANGE IN THE DESIGN OR CONSTRUCTION OF THE PROJECT OCCURS. THE STAGES DEPICTED IN THE EPSC PLANS MAY NOT COINCIDE WITH THE ACTUAL PHASES OF CONSTRUCTION ESTABLISHED BY THE CONTRACTOR DURING CONSTRUCTION, THUS MODIFICATIONS WILL BE REQUIRED TO ENSURE THE EPSC PLAN IS MAINTAINED TO DEPICT CURRENT SITE CONDITIONS. IT SHOULD BE MAINTAINED SUCH THAT IT WILL ALWAYS REFLECT THE MEASURES THAT ARE INSTALLED DURING THE VARIOUS PHASES OF CONSTRUCTION. IT IS IMPRACTICAL TO DETERMINE ALL THE INTERMEDIATE PHASES OF CONSTRUCTION THAT WILL OCCUR; THUS THESE DOCUMENTS WILL HAVE TO BE UPDATED THROUGHOUT THE LIFE OF THE CONSTRUCTION PROJECT.

9-410.06 GOOD HOUSEKEEPING MEASURES & WASTE DISPOSAL

NOTE: NOTES (29-40) ARE REQUIRED FOR ALL PROJECTS, INCLUDING RESURFACING.

(29) THE CONTRACTOR SHALL ESTABLISH AND MAINTAIN A PROACTIVE METHOD TO PREVENT LITTER AND CONSTRUCTION WASTES FROM ENTERING WATERS OF THE STATE/U.S. THESE MATERIALS SHALL BE REMOVED FROM STORMWATER EXPOSURE PRIOR TO ANTICIPATED STORM EVENTS OR BEFORE BEING CARRIED OFFSITE BY WIND, OR OTHERWISE PREVENTED FROM BECOMING A POLLUTANT SOURCE FOR STORMWATER DISCHARGES. AFTER USE, MATERIALS USED FOR EPSC SHALL BE REMOVED FROM THE SITE.

(30) THE CONTRACTOR SHALL TAKE APPROPRIATE STEPS TO ENSURE THAT PETROLEUM PRODUCTS OR OTHER CHEMICAL POLLUTANTS ARE PREVENTED FROM ENTERING WATERS OF THE STATE/U.S. ALL EQUIPMENT REFUELING, SERVICING, AND STAGING AREAS SHALL COMPLY WITH ALL LOCAL, STATE, AND FEDERAL LAWS, RULES, REGULATIONS, AND ORDINANCES, INCLUDING THOSE OF THE NATIONAL FIRE PROTECTION ASSOCIATION. APPROPRIATE CONTAINMENT MEASURES FOR THESE AREAS SHALL BE USED.

(31) CONTRACTORS SHALL PROVIDE DESIGNATED TRUCK WASHOUT AREAS ON THE SITE. THESE AREAS MUST BE SELF CONTAINED, NOT CONNECTED TO ANY

STORMWATER OUTLET OF THE SITE, AND PROPERLY SIGNED. WASH DOWN OR WASTE DISCHARGE OF CONCRETE TRUCKS SHALL NOT BE PERMITTED ONSITE UNLESS PROPER SETTLEMENT AREAS HAVE BEEN PROVIDED IN ACCORDANCE WITH BOTH STATE AND FEDERAL REGULATIONS.

(32) WHEEL WASH WATER SHALL BE COLLECTED AND ALLOWED TO SETTLE OUT SUSPENDED SOLIDS PRIOR TO DISCHARGE. WHEEL WASH WATER SHALL NOT BE DISCHARGED DIRECTLY INTO ANY STORMWATER SYSTEM OR STORMWATER TREATMENT SYSTEM.

(33) IF PORTABLE SANITARY FACILITIES ARE PROVIDED ON CONSTRUCTION SITES, SANITARY WASTE SHALL BE COLLECTED FROM THE PORTABLE UNITS IN A TIMELY MANNER BY A LICENSED WASTE MANAGEMENT CONTRACTOR OR AS REQUIRED BY ANY REGULATIONS. THE CONTRACTOR SHALL OBTAIN ANY AND ALL NECESSARY PERMITS TO DISPOSE OF SANITARY WASTE.

(34) ONLY CONSTRUCTION PRODUCTS NEEDED SHALL BE STORED ONSITE BY THE CONTRACTOR. THE CONTRACTOR SHALL STORE ALL MATERIALS UNDER COVER AND IN APPROPRIATE CONTAINERS. PRODUCTS MUST BE STORED IN ORIGINAL CONTAINERS AND LABELED. MATERIAL MIXING SHALL BE CONDUCTED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR'S RESPONSIBLE PARTY SHALL INSPECT MATERIALS STORAGE AREAS REGULARLY TO ENSURE PROPER USE AND DISPOSAL.

(35) WHEN POSSIBLE, ALL PRODUCTS SHALL BE USED COMPLETELY BEFORE PROPERLY DISPOSING OF THE CONTAINER OFFSITE. THE MANUFACTURER'S DIRECTIONS FOR DISPOSAL OF MATERIALS AND CONTAINERS SHALL BE FOLLOWED.

(36) ALL PAINT CONTAINERS SHALL BE TIGHTLY SEALED AND STORED WHEN NOT REQUIRED FOR USE. EXCESS PAINT SHALL BE DISPOSED OF ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS AND APPLICABLE STATE AND LOCAL REGULATIONS.

(37) ALL HAZARDOUS WASTE MATERIALS SHALL BE DISPOSED OF IN A MANNER WHICH IS COMPLIANT WITH LOCAL OR STATE REGULATIONS. SITE PERSONNEL SHALL BE INSTRUCTED IN THESE PRACTICES, AND THE INDIVIDUAL DESIGNATED AS THE CONTRACTOR'S RESPONSIBLE PARTY SHALL BE RESPONSIBLE FOR SEEING THAT THESE PRACTICES ARE FOLLOWED. THE CONTRACTOR SHALL OBTAIN ANY AND ALL NECESSARY PERMITS TO DISPOSE OF HAZARDOUS MATERIAL.

(38) OPEN BURNING IS PROHIBITED UNLESS IT IS SPECIFICALLY ALLOWED BY LAW. IF ALLOWED, NATURAL VEGETATION, TREES, AND UNTREATED LUMBER SHALL BE THE ONLY MATERIALS THAT CAN BE OPEN BURNED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL APPLICABLE STATE AND LOCAL PERMITS PRIOR TO ANY BURNING.

(39) DISPOSAL OF ONSITE VEGETATION AND TREES BY CHIPPING THEM INTO MULCH IS PREFERABLE TO OPEN BURNING. THIS MULCH MAY BE USED AS AN ONSITE SOIL STABILIZATION MEASURE WHERE APPROPRIATE.

(40) WASTE MATERIAL (EARTH, ROCK, ASPHALT, CONCRETE, ETC.) NOT REQUIRED FOR THE CONSTRUCTION OF THE PROJECT WILL BE DISPOSED OF BY THE CONTRACTOR. IMPACTS TO WATERS OF THE STATE/U.S. SHALL BE AVOIDED IF POSSIBLE. IF UNAVOIDABLE, THE CONTRACTOR WILL OBTAIN ANY AND ALL NECESSARY PERMITS INCLUDING, BUT NOT LIMITED TO NPDES, AQUATIC RESOURCES ALTERATION PERMIT(S), CORPS OF ENGINEERS SECTION 404 PERMITS, AND TVA SECTION 26A PERMITS TO DISPOSE OF WASTE MATERIALS.

9-410.07 SUPPORT ACTIVITIES

NOTE: NOTES (41-43) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. THESE NOTES DO NOT APPLY TO RESURFACING PLANS.

(41) IF OFFSITE BORROW AND WASTE AREAS BECOME NECESSARY DURING THE LIFE OF THE PROJECT, THIS SUPPORT ACTIVITY SHALL BE ADDRESSED PER THE TDOT WASTE AND BORROW MANUAL.

(42) MATERIALS AND STAGING AREAS SHALL BE LOCATED IN NON-WETLAND AREAS AND ABOVE THE 100-YEAR, FEDERAL EMERGENCY MANAGEMENT AGENCY FLOODPLAIN.

(43) IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO SUPPLY EPSC PLANS FOR THE MATERIAL AND STAGING AREAS TO THE ENVIRONMENTAL DIVISION COMPLIANCE AND FIELD SERVICES OFFICE FOR REVIEW.

9-410.08 SPILL PREVENTION, MANAGEMENT & NOTIFICATION

NOTE: NOTES (44-53) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED, AND TO ALL RESURFACING PLANS.

(44) ALL ONSITE VEHICLES SHALL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTIVE MAINTENANCE TO REDUCE THE CHANCE OF LEAKAGE AND SPILLS.

(45) FOR ALL HAZARDOUS MATERIALS STORED ONSITE, THE MANUFACTURER'S RECOMMENDED METHODS FOR SPILL CLEAN UP SHALL BE CLEARLY POSTED. SITE PERSONNEL SHALL BE MADE AWARE OF THE PROCEDURES AND THE LOCATIONS OF THE INFORMATION AND CLEANUP SUPPLIES.

(46) APPROPRIATE CLEANUP MATERIALS AND EQUIPMENT SHALL BE MAINTAINED BY THE CONTRACTOR IN THE MATERIALS STORAGE AREA ONSITE AND UNDER COVER. SPILL RESPONSE EQUIPMENT SHALL BE INSPECTED AND MAINTAINED BY THE CONTRACTOR AS NECESSARY TO REPLACE ANY MATERIALS USED IN SPILL RESPONSE ACTIVITIES.

(47) ALL SPILLS SHALL BE CLEANED IMMEDIATELY AFTER DISCOVERY AND THE MATERIALS DISPOSED OF PROPERLY. THE SPILL AREA SHALL BE KEPT WELL VENTILATED AND PERSONNEL WILL WEAR APPROPRIATE PROTECTIVE CLOTHING TO PREVENT INJURY FROM CONTACT WITH A HAZARDOUS SUBSTANCE.

(48) THE CONTRACTOR'S RESPONSIBLE PARTY SHALL BE THE SPILL PREVENTION AND CLEANUP COORDINATOR. THE CONTRACTOR IS RESPONSIBLE FOR

ENSURING THAT THE SITE SUPERINTENDENT HAS HAD APPROPRIATE TRAINING FOR HAZARDOUS MATERIALS HANDLING, SPILL MANAGEMENT, AND CLEANUP.

(49) IF AN OIL SHEEN IS OBSERVED ON SURFACE WATER (E.G. SETTLING PONDS, DETENTION PONDS, SWALES), ACTION SHALL BE TAKEN IMMEDIATELY TO REMOVE THE MATERIAL CAUSING THE SHEEN. THE CONTRACTOR SHALL USE APPROPRIATE MATERIALS TO CONTAIN AND ABSORB THE SPILL. THE SOURCE OF THE OIL SHEEN WILL ALSO BE IDENTIFIED AND REMOVED OR REPAIRED AS NECESSARY TO PREVENT FURTHER RELEASES.

(50) FERTILIZERS SHALL BE APPLIED ONLY IN THE AMOUNTS SPECIFIED. ONCE APPLIED, FERTILIZERS SHALL BE WORKED INTO THE SOIL TO LIMIT THE EXPOSURE TO STORMWATER.

(51) IF A SPILL OCCURS THE CONTRACTOR'S RESPONSIBLE PARTY SHALL BE RESPONSIBLE FOR COMPLETING THE SPILL REPORTING FORM AND FOR REPORTING THE SPILL TO THE TDOT PROJECT RESPONSIBLE PARTY. ALL SPILLS MUST BE REPORTED TO THE APPROPRIATE AGENCY, AND MEASURES SHALL BE TAKEN IMMEDIATELY TO PREVENT THE POLLUTION OF WATERS OF THE STATE/U.S., INCLUDING GROUNDWATER, SHOULD A SPILL OCCUR.

(52) WHERE A RELEASE CONTAINING A HAZARDOUS SUBSTANCE IN AN AMOUNT EQUAL TO OR IN EXCESS OF A REPORTABLE QUANTITY ESTABLISHED UNDER EITHER 40 CFR 117 OR 40 CFR 302 OCCURS DURING A 24 HOUR PERIOD, SEE THE LATEST TENNESSEE GENERAL PERMIT NO. TNR100000 STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITIES SECTION 5.1 FOR REPORTING REQUIREMENTS.

(53) CONTRACTOR'S BULK FUEL AND PETROLEUM PRODUCTS STORED ONSITE OR ADJACENT TO THE R.O.W. IN ABOVE GROUND STORAGE CONTAINERS WITH A COMBINED CAPACITY OF 1320 GALLONS OR MORE SHALL HAVE SECONDARY CONTAINMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARING A SPILL PREVENTION CONTROL AND COUNTERMEASURE (SPCC) PLAN FOR THE BULK STORAGE AND BE SOLELY RESPONSIBLE FOR OBTAINING ANY NECESSARY LOCAL, STATE, AND FEDERAL PERMITS. THE SPCC PLAN AND/OR PERMITS SHALL BE KEPT ONSITE AND A COPY PROVIDED TO THE TDOT PROJECT RESPONSIBLE PARTY PRIOR TO STORING 1320 GALLONS ON SITE.

9-410.09 STREAMS, WETLANDS & BUFFER ZONES

NOTE: NOTE (54) SHALL BE INCLUDED ON THE FIRST SHEET OF THE EPSC PLAN SET FOR ALL PROJECTS WITH CULVERTS AND BRIDGES THAT INCLUDE PROPOSED WORK WITHIN A STREAM CHANNEL AREA. THIS NOTE PERTAINING TO WORK WITHIN THE STREAM CHANNEL AREA FOR CONSTRUCTION HAS BEEN DEVELOPED TO ELIMINATE SUPPLEMENTS AND PAYMENT CONCERNS FOR EROSION PREVENTION AND SEDIMENT CONTROL ITEMS USED FOR THIS PURPOSE. THE STRUCTURES DIVISION SHALL INCLUDE A SIMILAR NOTE IN THE STRUCTURES PLANS FOR BRIDGES.

(54) ANY WORK WITHIN THE STREAM CHANNEL AREA (E.G., PIER FOOTING, RIP-RAP PLACEMENT, CULVERT/BRIDGE CONSTRUCTION, ETC.) SHALL BE SEPARATED FROM FLOWING WATER OR EXPECTED FLOW PATH AND PERFORMED DURING LOW FLOW CONDITIONS. ALL ITEMS USED WITHIN THE STREAM CHANNEL AREA FOR DIVERSION OF FLOW (OR EXPECTED FLOW), UNLESS SPECIFIED IN THE

PLANS, SHALL NOT BE PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE COST OF OTHER ITEMS. THIS NOTE EXCLUDES ANY ITEMS SPECIFIED IN THE PLANS FOR THE TEMPORARY DIVERSION CHANNELS (EC-STR-31) AND TEMPORARY DIVERSION CULVERTS (EC STR-32) FOR SINGLE BARREL CULVERT CONSTRUCTION.

SUBSECTION 4 – EROSION PREVENTION AND SEDIMENT CONTROL SPECIAL NOTES

The following notes shall be included on the first sheet of the EPSC Plan sheet series and placed after the EPSC General Notes. For Resurfacing Plans, add these notes after the General, Special and Environmental Notes sheets.

9-415.00 EROSION PREVENTION AND SEDIMENT CONTROL SPECIAL NOTES

NOTE: REFER TO CHAPTER 5-402.00 SPECIAL EPSC NOTES.

9-415.01 STREAMS, WETLANDS & BUFFER ZONES

NOTE: NOTES (1-3) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. THESE NOTES DO NOT APPLY TO RESURFACING PLANS.

(1) FOR PROJECTS THAT DISCHARGE INTO KNOWN EXCEPTIONAL TENNESSEE WATERS OR WATERS IMPAIRED BY SILTATION, A 60 FOOT NATURAL RIPARIAN BUFFER ZONE ADJACENT TO AND ON BOTH SIDES OF THE RECEIVING STREAM WITH THIS DESIGNATION SHALL BE PRESERVED TO THE MAXIMUM EXTENT PRACTICABLE DURING CONSTRUCTION ACTIVITIES AT THE SITE. THE 60 FOOT CRITERION FOR THE WIDTH OF THE BUFFER ZONE CAN BE ESTABLISHED ON AN AVERAGE WIDTH BASIS AT A PROJECT, AS LONG AS THE MINIMUM WIDTH OF THE BUFFER ZONE IS MORE THAN 30 FEET AT ANY MEASURED LOCATION.

(2) A 30 FOOT NATURAL RIPARIAN BUFFER ZONE ADJACENT TO AND ON BOTH SIDES OF THE RECEIVING STREAM SHALL BE PRESERVED TO THE MAXIMUM EXTENT PRACTICABLE DURING CONSTRUCTION ACTIVITIES AT THE SITE. THE 30 FOOT CRITERION FOR THE WIDTH OF THE BUFFER ZONE CAN BE ESTABLISHED ON AN AVERAGE WIDTH BASIS AT A PROJECT, AS LONG AS THE MINIMUM WIDTH OF THE BUFFER ZONE IS MORE THAN 15 FEET AT ANY MEASURED LOCATION. EVERY ATTEMPT SHALL BE MADE FOR CONSTRUCTION ACTIVITIES NOT TO TAKE PLACE WITHIN THE BUFFER ZONES.

(3) BUFFER ZONES ARE NOT SEDIMENT CONTROL MEASURES AND MUST NOT BE RELIED UPON AS PRIMARY SEDIMENT CONTROL MEASURES. THE RIPARIAN BUFFER ZONE SHALL BE ESTABLISHED BETWEEN THE TOP OF THE STREAM BANK AND THE DISTURBED CONSTRUCTION AREA. EVERY ATTEMPT SHALL BE MADE FOR CONSTRUCTION ACTIVITIES NOT TO TAKE PLACE WITHIN THE BUFFER ZONES. BEST MANAGEMENT PRACTICES (BMPS) PROVIDING EQUIVALENT PROTECTION AS THE NATURAL RIPARIAN ZONE MAY BE USED. WHERE ISSUED, ARAP/401 REQUIREMENTS WILL PREVAIL IF IN CONFLICT WITH THESE BUFFER ZONE REQUIREMENTS.

9-415.02 NPDES

9-415.03 UTILITY RELOCATION

NOTE: NOTES (5) THROUGH (14) SHALL BE INCLUDED ON THE FIRST SHEET OF THE EPSC PLAN SET FOR ALL PROJECTS IN WHICH UTILITIES ARE IN THE CONTRACT IN

WHICH THE PROJECTS REQUIRE LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED. REFER TO SECTION 3-305.07.

(5) STORMWATER WHICH COLLECTS IN THE UTILITY TRENCH SHALL BE PUMPED INTO A DEWATERING STRUCTURE OR SEDIMENT FILTER BAG AND TREATED PRIOR TO DISCHARGE.

(6) SILT FENCE SHALL BE INSTALLED ON THE DOWNGRADIENT SIDE OF STOCKPILED SOIL. TRENCHING ACROSS WET WEATHER CONVEYANCES SHALL BE DONE DURING DRY CONDITIONS AND STABILIZED BY THE END OF THE WORK DAY.

(7) UTILITY CROSSINGS IN ENVIRONMENTAL FEATURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH TDOT STANDARDS AND NO WORK SHALL BE CONDUCTED IN FLOWING WATERS. ENVIRONMENTAL PERMITS APPLY TO UTILITIES IN THIS PROJECT. THE STATE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF THE PERMITS.

(8) IT IS THE RESPONSIBILITY OF THE STATE UTILITY CONTRACTOR TO PROTECT EXPOSED EARTH FROM EROSION AND TO PROVIDE FOR CONTAINMENT OF SEDIMENT THAT MAY RESULT FROM THEIR WORK. PRIOR TO BEGINNING WORK, ADEQUATE MEASURES MUST BE IN PLACE TO TRAP ANY SEDIMENT THAT MAY TRAVEL OFFSITE IN THE EVENT OF RAIN. DURING THE PROGRESSION OF THEIR WORK, EXPOSED EARTH AREAS SHALL BE STABILIZED AS SOON AS POSSIBLE TO PREVENT EROSION. AT NO TIME SHALL EXPOSED EARTH RESULTING FROM THEIR OPERATIONS HAVE UNPROTECTED ACCESS TO FLOWING OFFSITE AND ENTERING WATERS OF THE STATE/U.S.

(9) FOR THE INSTALLATION OF BURIED UTILITIES (PIPES AND CABLES), TRENCHES SHALL BE BACKFILLED DAILY AS CONSTRUCTION PROCEEDS. BACKFILLED TRENCHES SHALL BE SEEDED AND MULCHED OR SODDED DAILY IF POSSIBLE, BUT NO LATER THAN SEVEN DAYS AFTER BEING BACKFILLED. ANY TEMPORARY SPOILS OF EXCAVATED EARTH SHALL BE LOCATED WITHIN TDOT EPSC MEASURES OR RECEIVE SEPARATE EPSC MEASURES. IF TRENCHES ARE NOT BACKFILLED OVERNIGHT, APPROPRIATE EPSC MEASURES WILL BE INSTALLED BY THE STATE UTILITY CONTRACTOR UNTIL SUCH TIME AS THE TRENCH IS BACKFILLED.

(10) IN REGARD TO EPSC, TDEC REGULATIONS APPLY TO THE STATE UTILITY CONTRACTORS ON THIS PROJECT. THE STATE CONTRACTOR IS RESPONSIBLE FOR EPSC MEASURES RELATED TO UTILITY CONSTRUCTION INCLUDED IN THE STATE CONTRACT.

(11) TRENCHES FORMED FOR THE INSTALLATION OF BURIED UTILITIES MAY CAUSE STORMWATER RUNOFF TO CONCENTRATE AT THE TRENCH LINE. ADDITIONAL EPSC MEASURES MAY BE REQUIRED TO BE INSTALLED AS APPROVED BY THE TDOT PROJECT RESPONSIBLE PARTY.

(12) FOR THE INSTALLATION OF UNDERGROUND UTILITIES OUTSIDE OF THE TDOT RIGHT-OF-WAY, EPSC MEASURES SHALL BE INSTALLED PRIOR TO CLEARING (TRENCHING AND ASSOCIATED BLASTING) IN THOSE AREAS NECESSARY TO PREVENT SEDIMENT FROM LEAVING THE CONSTRUCTION AREA. THESE EPSC

MEASURES SHALL REMAIN UNTIL THE BACKFILLED TRENCH IS STABILIZED WITH FINAL VEGETATIVE COVER.

(13) THE UTILITY CONTRACTOR SHALL RESTORE ALL AFFECTED WET WEATHER CONVEYANCES TO THE EXISTING TOPOGRAPHIC CONDITIONS AS APPROVED BY THE TDOT RESPONSIBLE PARTY.

(14) THE UTILITY CONTRACTOR WILL PROVIDE APPROPRIATE EPSC MEASURES TO REPLACE ONSITE EPSC MEASURES REMOVED TO FACILITATE THE INSTALLATION OF UTILITIES. REPLACEMENT OF EPSC MEASURES WILL BE COORDINATED WITH THE TDOT RESPONSIBLE PARTY BEFORE COMMENCING WORK.

9-415.04 RAILROAD ENVIRONMENTAL

NOTE: THIS NOTE SHALL BE INCLUDED ON THE FIRST SHEET OF THE EPSC PLAN SET FOR ALL PROJECTS WHERE A BRIDGE IS BEING WIDENED, REPLACED, OR REHABILITATED OVER RAILROAD RIGHT-OF-WAY. FILL IN THE BLANK WITH THE NAME(S) OF THE APPROPRIATE RAILROAD(S) INVOLVED IN THE PROJECT.

(15) THE CONTRACTOR SHALL MAINTAIN A COMPLETE AND COMPREHENSIVE EPSC PLAN AND SWPPP TO PREVENT ROADWAY AND/OR CONSTRUCTION SEDIMENT OR DEBRIS AND ANY PETROLEUM BASED PRODUCTS OR CHLORINATED SOLVENTS, PAINTS OR COATINGS ETC. FROM FALLING ONTO THE RAILROAD'S RIGHT-OF-WAY AND/OR FROM ENTERING THE DRAINAGE DITCHES OR DRAINAGE STRUCTURES OF THE RAILROAD, AND ANY SEDIMENT OR DEBRIS OR PETROLEUM BASED PRODUCTS OR CHLORINATED SOLVENTS, ETC. THAT DO ENTER SUCH DRAINAGE AREAS OF THE RAILROAD'S RIGHT-OF-WAY ARE TO BE REMOVED IN ACCORDANCE WITH RULES SET FORTH BY _____ AND AT THE CONTRACTOR'S EXPENSE.

9-415.05 FLOCCULANTS

NOTE: NOTES (16) THROUGH (23) SHALL BE INCLUDED ON THE FIRST SHEET OF THE EPSC PLAN SET FOR ALL PROJECTS WHERE FLOCCULANTS ARE USED IN WHICH THE PROJECTS REQUIRES LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED.

(16) ENSURE THE FLOCCULANT EMULSIONS AND POWDERS ARE OF THE ANIONIC TYPE AND MEET THE FOLLOWING REQUIREMENTS:

A. MEETS THE EPA AND FDA ACRYLAMIDE MONOMER LIMITS OF EQUAL TO OR GREATER THAN 0.005% ACRYLAMIDE MONOMER.

B. HAS A DENSITY OF 10% TO 55% BY WEIGHT AND A MOLECULAR WEIGHT OF 16 TO 24 MG/MOLE.

C. MIXTURE IS NON-COMBUSTIBLE.

D. CONTAINS ONLY MANUFACTURER’S RECOMMENDED ADDITIVES.

(17) FLOCCULANT SHALL BE MIXED AND APPLIED IN ACCORDANCE WITH ALL OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) MATERIAL SAFETY DATA SHEET REQUIREMENTS AND THE MANUFACTURER’S

RECOMMENDATIONS FOR THE SPECIFIED USES CONFORMING TO ALL FEDERAL, STATE, AND LOCAL LAWS, RULES, AND REGULATIONS.

(18) ALL VENDORS AND SUPPLIERS OF FLOCCULANT BLENDS SHALL PRESENT OR SUPPLY A WRITTEN TOXICITY REPORT WHICH VERIFIES ACCEPTABLE TOXICITY PARAMETERS WHICH MEET OR EXCEED THE EPA REQUIREMENTS FOR THE STATE AND FEDERAL WATER QUALITY STANDARDS. WHOLE EFFLUENT TESTING DOES NOT MEET THIS REQUIREMENT AS PRIMARY REACTIONS HAVE OCCURRED AND TOXIC POTENTIALS HAVE BEEN REDUCED. CATIONIC FORMS OF FLOCCULANTS ARE NOT ALLOWED UNDER THIS SECTION DUE TO HIGH LEVELS OF TOXICITY TO AQUATIC ORGANISMS. FLOCCULANT EMULSIONS SHALL NEVER BE APPLIED DIRECTLY TO STORMWATER RUNOFF OR RIPARIAN WATERS DUE TO SURFACTANT TOXICITY. THE CONTRACTOR MUST SEEK THE APPROVAL OF THE EPSC DESIGN ENGINEER AND TDOT IF CHITOSAN IS PROPOSED FOR USE ON THIS PROJECT.

(19) ALL VENDORS AND SUPPLIERS OF FLOCCULANT BLENDS SHALL SUPPLY WRITTEN “SITE SPECIFIC” TESTING RESULTS DEMONSTRATING A PERFORMANCE OF 95% OR GREATER REDUCTION OF NTU OR TSS FROM STORMWATER DISCHARGES.

(20) EMULSION BATCHES SHALL BE MIXED FOLLOWING RECOMMENDATIONS OF THE TESTING LABORATORY THAT DETERMINES THE PROPER PRODUCT AND RATE TO MEET SITE REQUIREMENTS. APPLICATION METHOD SHALL ENSURE UNIFORM COVERAGE TO THE TARGET AREA. EMULSIONS SHALL NEVER BE APPLIED DIRECTLY TO STORMWATER RUNOFF OR RIPARIAN WATERS.

(21) FLOCCULANT POWDER MAY BE APPLIED BY A HAND OR MECHANICAL SPREADER. MIXING OF THE FLOCCULANT POWDER WITH DRY SILICA SAND WILL AID IN SPREADING.

(22) PREMIXING OF FLOCCULANT POWDER INTO FERTILIZER, SEED, OR OTHER SOIL AMENDMENTS IS ALLOWED WHEN SPECIFIED IN THE DESIGN PLAN. APPLICATION METHOD SHALL ENSURE UNIFORM COVERAGE TO THE TARGET AREA.

(23) FLOCCULANT LOGS OR BLOCKS SHALL BE APPLIED FOLLOWING SITE TESTING RESULTS TO ENSURE PROPER PLACEMENT AND PERFORMANCE AND SHALL MEET OR EXCEED STATE AND FEDERAL WATER QUALITY REQUIREMENTS.

SECTION 5 – PAVEMENT EDGE DROP-OFF TRAFFIC CONTROL NOTES

NOTE: APPLICABLE NOTES IN THIS SECTION SHALL BE INCLUDED IN THE TRAFFIC CONTROL NOTES ON THE FIRST SHEET OF THE TRAFFIC CONTROL PLAN SET FOR ALL PROJECTS.

NOTE: FOR RESURFACING PROJECTS, THESE NOTES CAN BE INCLUDED IN THE PLANS AS A SEPARATE SHEET OR ON THE SPECIAL NOTES SHEET.

A. DIFFERENCES IN ELEVATION BETWEEN ADJACENT TRAFFIC LANES OR TRAFFIC LANE AND SHOULDER WHERE THE TRAFFIC LANE IS BEING USED BY TRAFFIC, CAUSED BY BASE, PAVING OR RESURFACING:

1. DIFFERENCES IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS GREATER THAN 0.75 INCH AND NOT EXCEEDING 1.75 INCHES:

   a. WARNING SIGNS, UNEVEN LANES (W8-11) AND/OR SHOULDER DROP-OFF WITH PLAQUE (W8-17 AND W8-17P), SHALL BE PLACED IN ADVANCE OF AND THROUGHOUT THE EXPOSED AREA. MAXIMUM SPACING BETWEEN SIGNS SHALL BE 2,000 FEET WITH A MINIMUM OF 2 SIGNS PER EXPOSED AREA. WHERE UNEVEN PAVEMENT IS ENCOUNTERED, SIGNS SHALL BE PLACED ON EACH SIDE OF THE ROADWAY.

   b. DIFFERENCES IN ELEVATION BETWEEN ADJACENT TRAFFIC LANES BEING UTILIZED BY TRAFFIC CAUSED BY ADDED PAVEMENT SHALL BE ELIMINATED WITHIN THREE WORKDAYS.

   c. DIFFERENCES IN ELEVATION BETWEEN ADJACENT TRAFFIC LANES BEING UTILIZED BY TRAFFIC CAUSED BY COLD PLANING SHALL BE ELIMINATED WITHIN THREE WORKDAYS.

   d. WHEN THE DIFFERENCE IN ELEVATION IS BETWEEN THE TRAFFIC LANE BEING UTILIZED BY TRAFFIC AND SHOULDER THE DIFFERENCE IN ELEVATION SHALL BE ELIMINATED WITHIN SEVEN WORKDAYS AFTER THE CONDITION IS CREATED.

2. DIFFERENCES IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS GREATER THAN 1.75 INCHES AND NOT EXCEEDING 6 INCHES, TRAFFIC IS NOT TO BE ALLOWED TO TRAVERSE THIS DIFFERENCE IN ELEVATION.

   a. SEPARATION SHALL BE ACCOMPLISHED BY DRUMS, BARRICADES OR OTHER APPROVED DEVICES IN ACCORDANCE WITH THE FOLLOWING:

      (1) WHERE POSTED SPEEDS ARE 50 MPH OR GREATER, SPACING OF THE PROTECTIVE DEVICES SHALL NOT EXCEED 100 FEET.

      (2) WHERE POSTED SPEEDS ARE LESS THAN 50 MPH, THE MAXIMUM SPACING OF THE PROTECTIVE DEVICES IN FEET SHALL NOT EXCEED TWICE THE POSTED SPEED IN MILES PER HOUR OR 50 FEET, WHICHEVER SPACING IS GREATER.

   b. IF THE DIFFERENCE IN ELEVATION IS ELIMINATED OR DECREASED TO 2 INCHES OR LESS BY THE END OF EACH WORKDAY, CONES MAY BE USED DURING DAYLIGHT HOURS IN LIEU OF DRUMS, BARRICADES OR OTHER

APPROVED PROTECTIVE DEVICES MENTIONED IN PARAGRAPH a, PROVIDED WARNING SIGNS ARE ERECTED. WARNING SIGNS (UNEVEN LANES AND/OR SHOULDER DROP-OFF) SHALL BE PLACED IN ADVANCE OF AND THROUGHOUT THE EXPOSED AREA. MAXIMUM SPACING BETWEEN SIGNS SHALL BE 2,000 FEET WITH A MINIMUM OF 2 SIGNS PER EXPOSED AREA. WHERE UNEVEN PAVEMENT IS ENCOUNTERED, SIGNS SHALL BE PLACED ON EACH SIDE OF THE ROADWAY.

c. WHEN THE DIFFERENCE IN ELEVATION IS BETWEEN THE THROUGH TRAFFIC LANE AND THE SHOULDER AND THE ELEVATION DIFFERENCE IS LESS THAN 3 INCHES, THE CONTRACTOR MAY USE WARNING SIGNS AND/OR PROTECTIVE DEVICES AS APPLICABLE AND APPROVED BY THE REGIONAL TRAFFIC ENGINEER. SEE PARAGRAPH a REGARDING USE OF DRUMS, BARRICADES OR OTHER APPROVED PROTECTIVE DEVICES. WARNING SIGNS (UNEVEN LANES AND/OR SHOULDER DROP-OFF) WILL BE PLACED IN ADVANCE OF AND THROUGHOUT THE EXPOSED AREA. MAXIMUM SPACING BETWEEN SIGNS SHALL BE 2,000 FEET WITH A MINIMUM OF 2 SIGNS PER EXPOSED AREA. WHERE UNEVEN PAVEMENT IS ENCOUNTERED, SIGNS SHALL BE PLACED ON EACH SIDE OF THE ROADWAY.

IN THESE SITUATIONS, THE CONTRACTOR SHALL LIMIT HIS OPERATIONS TO ONE WORK ZONE NOT EXCEEDING 2 MILES IN LENGTH UNLESS OTHERWISE NOTED ON THE PLANS OR APPROVED BY THE ENGINEER. ONCE THE CONTRACTOR BEGINS WORK IN A WORK ZONE, A CONTINUOUS OPERATION SHALL BE MAINTAINED UNTIL THE DIFFERENCE IN ELEVATION IS ELIMINATED. SIMULTANEOUS WORK ON SEPARATE ROADWAYS OF DIVIDED HIGHWAYS WILL BE CONSIDERED INDEPENDENTLY IN REGARD TO RESTRICTION OF WORK ZONE ACTIVITY.

3. DIFFERENCES IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS GREATER THAN 6 INCHES BUT NOT EXCEEDING 18 INCHES, THE CONTRACTOR, WITH THE ENGINEER'S APPROVAL, MAY UTILIZE ONE OF THE FOLLOWING:

   a. THE CONTRACTOR SHALL ACCOMPLISH SEPARATION BY DRUMS, BARRICADES OR OTHER APPROVED DEVICES IN ACCORDANCE WITH THE FOLLOWING:

      (1) WHERE POSTED SPEEDS ARE 50 MPH OR GREATER, SPACING OF THE PROTECTIVE DEVICES SHALL NOT EXCEED 100 FEET.

      (2) WHERE POSTED SPEEDS ARE LESS THAN 50 MPH, THE MAXIMUM SPACING OF THE PROTECTIVE DEVICES IN FEET SHALL NOT EXCEED TWICE THE POSTED SPEED IN MILES PER HOUR OR 50 FEET, WHICHEVER SPACING IS GREATER.

   IN ORDER TO USE THIS METHOD, THE CONTRACTOR MUST REDUCE THE DIFFERENCE IN ELEVATION TO 6 INCHES OR LESS BY THE END OF THE WORKDAY THAT THE CONDITION IS CREATED.

   b. THE CONTRACTOR SHALL PROVIDE DRUMS, BARRICADES OR OTHER APPROVED SEPARATION DEVICES AS SPECIFIED IN PARAGRAPH a, AND CONSTRUCT A STONE WEDGE WITH A 4:1 SLOPE, OR FLATTER, TO ELIMINATE

THE VERTICAL OFFSET IF THE LOWER ELEVATION IS AT OR BELOW SUBGRADE AT THE END OF EACH DAY.

c. THE CONTRACTOR SHALL PROVIDE DRUMS, BARRICADES OR OTHER APPROVED SEPARATION DEVICES AS SPECIFIED IN PARAGRAPH a AND IF THE LOWER ELEVATION IS BASE STONE OR ASPHALT PAVEMENT, PLACEMENT OF SUBSEQUENT LAYERS OF PAVEMENT MUST BEGIN THE NEXT WORK DAY AND PROGRESS CONTINUOUSLY UNTIL THE DIFFERENCE IN ELEVATION IS ELIMINATED OR REDUCED TO SIX INCHES OR LESS.

d. THE CONTRACTOR SHALL PROVIDE SEPARATION BY PORTABLE BARRIER RAIL.

FOR PRECEDING CONDITIONS a, b, AND c, THE CONTRACTOR SHALL USE THE SHOULDER DROP-OFF WARNING SIGN WITH PLAQUE (W8-17 AND W8-17P). IT SHALL BE PLACED IN ADVANCE OF AND THROUGHOUT THE EXPOSED AREA. MAXIMUM SPACING BETWEEN THE SIGNS SHALL BE 2,000 FEET WITH A MINIMUM OF 2 SIGNS PER EXPOSED AREA. IN THESE SITUATIONS, THE CONTRACTOR SHALL LIMIT HIS OPERATIONS TO ONE WORK ZONE NOT EXCEEDING 1 MILE IN LENGTH UNLESS OTHERWISE NOTED ON THE PLANS OR APPROVED BY THE ENGINEER. ONCE THE CONTRACTOR BEGINS WORK IN A WORK ZONE, A CONTINUOUS OPERATION SHALL BE MAINTAINED UNTIL THE DIFFERENCE IS ELIMINATED. SIMULTANEOUS WORK ON SEPARATE ROADWAYS OF DIVIDED HIGHWAYS WILL BE CONSIDERED INDEPENDENTLY IN REGARD TO RESTRICTION OF WORK ZONE ACTIVITY.

4. FOR DIFFERENCES IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS GREATER THAN 18 INCHES.

   SEPARATION WILL BE PROVIDED BY USE OF PORTABLE BARRIER RAIL.

   IN THIS SITUATION THE CONTRACTOR SHALL LIMIT HIS OPERATIONS TO ONE WORK ZONE NOT EXCEEDING 1 MILE IN LENGTH UNLESS OTHERWISE NOTED ON THE PLANS OR APPROVED BY THE ENGINEER. ONCE THE CONTRACTOR BEGINS WORK IN A WORK ZONE, A CONTINUOUS OPERATION SHALL BE MAINTAINED UNTIL THE DIFFERENCE IN ELEVATION IS ELIMINATED. SIMULTANEOUS WORK ON SEPARATE ROADWAYS OF DIVIDED HIGHWAYS WILL BE CONSIDERED INDEPENDENTLY IN REGARD TO RESTRICTION OF WORK ZONE ACTIVITY.

B. IF THE DIFFERENCE IN ELEVATION IS WITHIN 30 FEET OF THE NEAREST TRAFFIC LANE BEING USED BY TRAFFIC CAUSED BY GRADING, EXCAVATION FOR UTILITIES, DRAINAGE STRUCTURES, UNDERCUTTING, ETC.:

1. IF THE DIFFERENCE IN ELEVATION IS WITHIN 8 FEET OF THE NEAREST TRAFFIC LANE WITH DIFFERENCE IN ELEVATION GREATER THAN 3/4 INCH AND NOT EXCEEDING 2 INCHES.

   a. WARNING SIGNS (UNEVEN LANES AND/OR SHOULDER DROP-OFF) SHALL BE PLACED IN ADVANCE OF AND THROUGHOUT THE EXPOSED AREA. MAXIMUM SPACING BETWEEN SIGNS SHALL BE 2,000 FEET WITH A MINIMUM OF 2 SIGNS PER EXPOSED AREA. WHERE UNEVEN PAVEMENT IS ENCOUNTERED, SIGNS SHALL BE PLACED ON EACH SIDE OF THE ROADWAY.

2. IF THE DIFFERENCE IN ELEVATION IS WITHIN 8 FEET OF THE NEAREST TRAFFIC LANE WITH DIFFERENCE IN ELEVATION GREATER THAN 2 INCHES AND NOT EXCEEDING 6 INCHES:

   a. SEPARATION SHALL BE ACCOMPLISHED BY DRUMS, BARRICADES OR OTHER APPROVED DEVICES IN ACCORDANCE WITH THE FOLLOWING:

      (1) WHERE POSTED SPEEDS ARE 50 MPH OR GREATER, SPACING OF THE PROTECTIVE DEVICES SHALL NOT EXCEED 100 FEET.

      (2) WHERE POSTED SPEEDS ARE LESS THAN 50 MPH THE MAXIMUM SPACING OF THE PROTECTIVE DEVICES IN FEET SHALL NOT EXCEED TWICE THE POSTED SPEED IN MILES PER HOUR OR 50 FEET, WHICHEVER SPACING IS GREATER.

3. IF THE DIFFERENCE IN ELEVATION IS WITHIN 8 FEET OF THE NEAREST TRAFFIC LANE WITH DIFFERENCE IN ELEVATION GREATER THAN 6 INCHES:

   a. SEPARATION SHALL BE ACCOMPLISHED BY DRUMS, BARRICADES OR OTHER APPROVED DEVICES IN ACCORDANCE WITH THE FOLLOWING:

      (1) WHERE POSTED SPEEDS ARE 50 MPH OR GREATER, SPACING OF THE PROTECTIVE DEVICES SHALL NOT EXCEED 100 FEET.

      (2) WHERE POSTED SPEEDS ARE LESS THAN 50 MPH THE MAXIMUM SPACING OF THE PROTECTIVE DEVICES IN FEET SHALL NOT EXCEED TWICE THE POSTED SPEED IN MILES PER HOUR OR 50 FEET, WHICHEVER SPACING IS GREATER.

   b. ELIMINATE VERTICAL OFFSET BY CONSTRUCTING A STONE WEDGE OR GRADING TO A 4:1 SLOPE, OR FLATTER, OR USE PORTABLE BARRIER RAIL.

   THE CONTRACTOR SHALL SCHEDULE THE WORK SO AS TO MINIMIZE THE TIME TRAFFIC IS EXPOSED TO AN ELEVATION DIFFERENCE. ONCE THE CONTRACTOR BEGINS AN ACTIVITY THAT CREATES AN ELEVATION DIFFERENCE WITHIN 8 FEET OF A TRAFFIC LANE, THE ACTIVITY SHALL BE PURSUED AS A CONTINUOUS OPERATION UNTIL THE ELEVATION DIFFERENCE IS ELIMINATED.

C. IF THE DIFFERENCE IN ELEVATION IS FARTHER THAN 8 FEET FROM THE NEAREST TRAFFIC LANE BUT NOT MORE THAN 30 FEET FROM THE NEAREST TRAFFIC LANE:

SEPARATION SHALL BE ACCOMPLISHED BY DRUMS, BARRICADES OR OTHER APPROVED DEVICES IN ACCORDANCE WITH THE FOLLOWING:

1. WHERE POSTED SPEEDS ARE 50 MPH OR GREATER, SPACING OF THE PROTECTIVE DEVICES SHALL NOT EXCEED 100 FEET.
2. WHERE POSTED SPEEDS ARE LESS THAN 50 MPH, THE MAXIMUM SPACING OF THE PROTECTIVE DEVICES IN FEET SHALL NOT EXCEED TWICE THE POSTED SPEED IN MILES PER HOUR OR 50 FEET, WHICHEVER SPACING IS GREATER.

THE CONTRACTOR SHALL SCHEDULE THE WORK SO AS TO MINIMIZE THE TIME TRAFFIC IS EXPOSED TO AN ELEVATION DIFFERENCE. ONCE THE CONTRACTOR BEGINS AN ACTIVITY THAT CREATES AN ELEVATION DIFFERENCE, THE ACTIVITY SHALL BE PURSUED AS A CONTINUOUS OPERATION UNTIL THE ELEVATION DIFFERENCE IS ELIMINATED.

PDN - CHAPTER 10

INDEX OF STANDARD DRAWINGS

CHAPTER 10 INDEX OF STANDARD DRAWINGS

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INTRODUCTION

ROADWAY DESIGN GUIDELINES AND STANDARD DRAWINGS

Roadway Design Guidelines (RDG) and Standard Drawings have been created to ensure that there is consistency in TDOT projects across the state. The Roadway Design Guidelines and Standard Drawings indicate the current recognized design standards for new construction or reconstruction of existing highways and shall be utilized while giving due regard to topography, natural conditions, availability of road material, and prevailing traffic conditions.

Throughout these guidelines you will see the following terms used. To clarify the meanings intended in this guide, the following definitions apply:

- **Designer** – Preconstruction Roadway Designer, or Consultant Designer
- **Design Manager** – Preconstruction Design Lead, or Consultant Design Manager
- **Project Team** – Preconstruction Team consisting of a Discipline Manager, members of Roadway, Structure, Survey, Environmental, ROW, and Utilities (either TDOT staff or consulting staff), overseen by a Project Manager.
- **Technical Report** – Concept Report developed by the Strategic Transportation Investments Division during Stage 0 of a project.

All forms mentioned throughout this chapter can be found on the Roadway Design -TDOT Documents webpage.

3 Phases of Project Development

1. Preliminary
2. Right-of-Way
3. Construction



4 Stages of Project Delivery Network

1. Context/Scoping
2. Footprint Established
3. Plan-in-Hand
4. PS&E

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SECTION 1 - STANDARD ROADWAY DRAWINGS

10-100.00 STANDARD ROADWAY TITLE SHEET, ABBREVIATIONS, AND LEGENDS

10-100.01 STANDARD ROADWAY DRAWINGS TITLE SHEET

DRAWING	REVISION DATE	DESCRIPTION
RD-TP-1	09-26-16	STANDARD ROADWAY DRAWINGS TITLE SHEET

10-100.02 STANDARD ABBREVIATIONS AND LEGENDS

DRAWING	REVISION DATE	DESCRIPTION
RD-A-1	02-20-20	STANDARD ABBREVIATIONS A THROUGH L
RD-A-2		STANDARD ABBREVIATIONS M THROUGH Z
RD-L-1	02-20-20	STANDARD LEGEND
RD-L-1A		STANDARD LEGEND
RD-L-2	02-20-20	STANDARD LEGEND FOR UTILITY INSTALLATIONS
RD-L-3	03-01-23	STANDARD LEGEND FOR SIGNALIZATION AND LIGHTING
RD-L-4	02-20-20	STANDARD LEGEND FOR SIGNALIZATION AND LIGHTING
RD-L-5	07-30-24	STANDARD LEGEND FOR EROSION PREVENTION AND SEDIMENT CONTROL
RD-L-6	02-20-20	STANDARD LEGEND FOR EROSION PREVENTION AND SEDIMENT CONTROL
RD-L-7	02-20-20	STANDARD LEGEND FOR EROSION PREVENTION AND SEDIMENT CONTROL
RD-L-8	02-20-20	STANDARD LEGEND FOR NATURAL STREAM DESIGN

10-101.00 STANDARD ROADWAY DRAWINGS

10-101.01 RD18 ROUNDABOUT TYPICAL SECTIONS AND DESIGN CRITERIA

DRAWING	REVISION DATE	DESCRIPTION
RD18-RTS-1		DESIGN STANDARDS FOR SINGLE LANE URBAN AND RURAL ROUNDABOUTS
RD18-RTS-2		DESIGN STANDARDS FOR MULTI-LANE URBAN AND RURAL ROUNDABOUTS
RD18-RTS-3		STANDARD CONSTRUCTION DETAILS FOR ROUNDABOUTS
RD18-RSD-1		SIGHT DISTANCE FOR URBAN AND RURAL ROUNDABOUTS

10-101.02 RD11 TYPICAL SECTIONS AND DESIGN CRITERIA

DRAWING	REVISION DATE	DESCRIPTION
RD11-SE-1		TRANSITION AND CROSS SLOPE DETAILS
RD11-SE-2		SUPERELEVATION TRANSITION DETAILS FOR UNDIVIDED ROADWAYS
RD11-SE-2A		SUPERELEVATION TRANSITION SECTIONS FOR UNDIVIDED ROADWAYS
RD11-SE-3		SUPERELEVATION TRANSITION DETAILS FOR DIVIDED ROADWAYS
RD11-SE-3A		SUPERELEVATION TRANSITION SECTIONS FOR DIVIDED ROADWAYS
RD11-TS-1	06-28-19	DESIGN STANDARDS FOR LOW-VOLUME ROADS
RD11-TS-1A	06-28-19	DESIGN STANDARDS FOR LOCAL ROADS AND STREETS
RD11-TS-2		DESIGN STANDARDS FOR COLLECTORS, 2-LANE ROADS AND STREETS
RD11-TS-2A		DESIGN STANDARDS FOR COLLECTOR HIGHWAYS WITH DEPRESSED MEDIAN (4 AND 6 LANE)

RD11-TS-2B		DESIGN STANDARDS FOR COLLECTOR HIGHWAYS WITH FLUSH MEDIAN (4 AND 6 LANE)
RD11-TS-3		DESIGN STANDARD FOR ARTERIAL HIGHWAYS (2-LANE)
RD11-TS-3A	06-28-19	DESIGN STANDARDS FOR ARTERIAL HIGHWAYS WITH DEPRESSED MEDIAN (4 AND 6 LANE)
RD11-TS-3B		DESIGN STANDARDS FOR ARTERIAL HIGHWAYS WITH FLUSH MEDIAN (4 AND 6 LANE)
RD11-TS-3C		DESIGN STANDARDS FOR ARTERIALS WITH INDEPENDENT ROADWAYS (4 AND 6 LANE)
RD11-TS-4		DESIGN STANDARDS FOR ARTERIAL AND FREEWAY RAMPS (1, 2 AND 3 LANE)
RD11-TS-5	06-28-19	DESIGN STANDARDS FOR FREEWAYS WITH DEPRESSED MEDIAN (4 AND 6 LANE)
RD11-TS-5A		DESIGN STANDARDS FOR FREEWAYS WITH INDEPENDENT ROADWAYS (4 AND 6 LANE)
RD11-TS-5B		DESIGN STANDARDS FOR FREEWAYS WITH MEDIAN BARRIER (4 AND 6 LANE)
RD11-TS-5W	06-15-21	TYPICAL DETAILS FOR INSIDE LANE WIDENING OF FREEWAYS
RD11-TS-6		TYPICAL CURB & GUTTER SECTIONS WITH SHOULDERS AND WITH GRASS STRIPS
RD11-TS-6A		TYPICAL CURB & GUTTER SECTIONS WITHOUT SHOULDERS AND WITH GRASS STRIPS
RD11-TS-6B		TYPICAL CURB & GUTTER SECTIONS WITH SHOULDERS AND WITHOUT GRASS STRIPS
RD11-TS-6C		TYPICAL CURB & GUTTER SECTIONS WITHOUT SHOULDERS AND WITHOUT GRASS STRIPS
RD11-TS-7	07-17-20	DESIGN STANDARDS 2-LANE CURB & GUTTER WITH CONTINUOUS 2-WAY LEFT-TURN LANE WITHOUT GRASS STRIPS
RD11-TS-7A	07-17-20	DESIGN STANDARDS 2-LANE CURB & GUTTER WITH CONTINUOUS 2-WAY LEFT-TURN LANE WITH GRASS STRIPS

RD11-TS-7B	07-17-20	DESIGN STANDARDS 2-LANE HIGHWAYS WITH CONTINUOUS 2-WAY LEFT-TURN LANE

10-101.03 RD11 SLOPE DEVELOPMENT AND RUNOFF LENGTHS

DRAWING	REVISION DATE	DESCRIPTION
RD11-LR-1		MINIMUM RUNOFF LENGTHS (L_R) FOR URBAN HIGHWAYS
RD11-LR-2		MINIMUM RUNOFF LENGTHS (L_R) FOR RURAL HIGHWAYS
RD11-S-11		DESIGN AND CONSTRUCTION DETAILS FOR ROADSIDE SLOPE DEVELOPMENT
RD11-S-11A		ROADSIDE DITCH DETAILS FOR DESIGN AND CONSTRUCTION
RD11-S-11B		DESIGN AND CONSTRUCTION DETAILS FOR ROCK CUT SLOPE AND CATCHMENT
RD11-SA-1	01-09-24	SAFETY APPROACH TO UNDERPASSES GRADING DESIGN AND SLOPE PROTECTION

10-101.04 RD11 INTERSECTION SIGHT DISTANCE

DRAWING	REVISION DATE	DESCRIPTION
RD11-SD-1		INTERSECTION SIGHT DISTANCE DESIGN AND GENERAL NOTES
RD11-SD-2		INTERSECTION SIGHT DISTANCE LANDSCAPE AND OBSTRUCTION
RD11-SD-3		INTERSECTION SIGHT DISTANCE 2-LANE ROADWAYS
RD11-SD-4		INTERSECTION SIGHT DISTANCE 4-LANE AND 5-LANE UNDIVIDED ROADWAYS
RD11-SD-5		INTERSECTION SIGHT DISTANCE 4-LANE DIVIDED HIGHWAYS
RD11-SD-6		INTERSECTION SIGHT DISTANCE 6-LANE DIVIDED HIGHWAYS
RD11-SD-7		INTERSECTION SIGHT DISTANCE FOR PASSIVE RAILROAD HIGHWAY GRADE CROSSINGS

10-101.05 UNDERDRAINS

DRAWING	REVISION DATE	DESCRIPTION
RD-UD-3	01-09-24	UNDERDRAIN DETAILS
RD-UD-4	06-28-19	UNDERDRAIN LATERAL DETAILS
RD-UD-6	06-28-19	LATERAL UNDERDRAIN ENDWALL DETAIL FOR 1:1 & 2:1 SLOPES
RD-UD-7	06-28-19	LATERAL UNDERDRAIN ENDWALL DETAIL FOR 3:1 & 4:1 SLOPES
RD-UD-8	06-28-19	LATERAL UNDERDRAIN ENDWALL DETAIL FOR 5:1 SLOPES
RD-UD-9	06-28-19	LATERAL UNDERDRAIN ENDWALL DETAIL FOR 6:1 SLOPES

10-102.00 PIPE CULVERTS AND ENDWALLS

10-102.01 PIPE CULVERTS AND FLUME

DRAWING	REVISION DATE	DESCRIPTION
D-FLU-1	06-28-19	FLUME DETAILS
D-FLU-2		BRIDGE END DRAIN FLUME DETAILS
D-FLU-2A		BRIDGE END DRAIN FLUME DETAILS
D-PB-1	03-01-23	STANDARD DETAILS FOR CONCRETE PIPE INSTALLATION
D-PB-2	03-01-23	STANDARD DETAILS FOR FLEXIBLE PIPE INSTALLATION
D-PB-3	11-30-20	INDUCED TRENCH SOIL EMBANKMENT FOR PIPE CULVERT INSTALLATION
D-PB-4	01-09-24	PIPE COLLAR DETAILS
D-PG-3	06-28-19	FERROUS AND ALUMINUM CORRUGATED METAL PIPE
D-PG-4	06-28-19	FERROUS AND ALUMINUM CORRUGATED METAL PIPE ARCHES

D-PO-1	06-28-19	STANDARD OVAL AND REINFORCED CONCRETE ARCH PIPE CULVERT
D-PS-1	06-28-19	STRUTTING DETAILS FOR CORR. METAL & STRUCTURAL PLATE ROUND PIPE

10-102.02 SAFETY CROSS DRAIN ENDWALLS

DRAWING	REVISION DATE	DESCRIPTION
D-PE-15A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 15” PIPE (FOR 3:1, 4:1 & 6:1 SLOPES)
D-PE-15B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 15” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-18A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 18” PIPE (FOR 3:1, 4:1 & 6:1 SLOPES)
D-PE-18B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 18” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-24A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 24” PIPE (FOR 3:1, 4:1 & 6:1 SLOPES)
D-PE-24B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 24” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-30A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 30” PIPE WITH STEEL PIPE GRATE (FOR 3:1, 4:1 & 6:1 SLOPES)
D-PE-30B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 30” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-36A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 36” PIPE WITH STEEL PIPE GRATE (FOR 3:1, 4:1 & 6:1 SLOPES)
D-PE-36B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 36” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-42A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 42” PIPE WITH STEEL PIPE GRATE (FOR 3:1, 4:1 & 6:1 SLOPES)
D-PE-42B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 42” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-48A	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 48” PIPE WITH STEEL PIPE GRATE (FOR 3:1, 4:1 & 6:1 SLOPES)

D-PE-48B	06-28-19	TYPE “U” CROSS DRAIN ENDWALL FOR 48” PIPE, BILL OF STEEL AND PRECAST NOTES
D-PE-99	03-04-21	TYPE “U” CROSS DRAIN ENDWALL DETAILS, PIPE GRATE & SKEWED CONNECTION

10-102.03 SAFETY SIDE DRAIN ENDWALLS

DRAWING	REVISION DATE	DESCRIPTION
D-SEW-1A	07-07-23	TYPE “SAFETY” SIDE DRAIN ENDWALL WITH STEEL PIPE GRATE, FOR 15” THRU 48” PIPES, 6:1 SLOPE
D-SEW-12D	07-07-23	TYPE “SAFETY” SIDE DRAIN ENDWALL WITH STEEL PIPE GRATE, FOR 18” PIPES, 12:1 SLOPE
SD-MSE-1	06-28-19	SIDE DRAIN MITERED END SECTION

10-102.04 PROTECTED ENDWALLS*

DRAWING	REVISION DATE	DESCRIPTION
D-PE-4	06-28-19	STRAIGHT CONCRETE ENDWALLS (PIPE SIZES 18” TO 30”)
D-PE-5	06-28-19	STRAIGHT CONCRETE ENDWALLS FOR HORIZONTAL OVAL CONCRETE PIPES (ALL SIZES AND SKEWS)
D-PEW-1		PROTECTED ENDWALLS FOR ROUND & OVAL PIPES (PIPE SIZES 18” TO 72”, ALL SKEWS, 2:1 & 3:1 SLOPES)
D-PEW-2		PROTECTED ENDWALLS FOR ROUND PIPES DETAILS & QUANTITIES (PIPE SIZES 18” TO 72”, ALL SKEWS, 2:1 & 3:1 SLOPES)
D-PEW-3		PROTECTED ENDWALLS FOR OVAL PIPES DETAILS & QUANTITIES (EQU. PIPE SIZES 18” TO 72”, ALL SKEWS, 2:1 & 3:1 SLOPES)
D-PEW-4		PROTECTED STRAIGHT ENDWALLS (PIPE SIZES 18” TO 30” & EQU. OVAL PIPES)
D-PEW-5		RIP-RAP END TREATMENT FOR CORRUGATED METAL PIPE, OVAL AND PIPE ARCH CULVERTS WITH BEVELED ENDS (PIPE SIZES 42” & LARGER)

*NOTE: THE PROTECTED ENDWALLS MAY NOT BE USED INSIDE THE CLEAR ZONE UNLESS SHIELDED BY GUARDRAIL OR OTHER SAFETY DEVICE.

10-103.00 CATCH BASINS AND MANHOLES

10-103.01 CATCH BASINS

DRAWING	REVISION DATE	DESCRIPTION
D-CB-DI		ALTERNATE CATCH BASIN DROP INLET DETAILS
D-CB-10LPC	02-20-20	LOW PROFILE LOWERED CURB 32" X 26" RECTANGULAR CONCRETE NO. 10LPC CATCH BASIN
D-CB-10RA	01-28-22	STANDARD PRECAST 48" CIRCULAR NO. 10 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-10S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 10 CATCH BASIN
D-CB-10SB	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 10 CATCH BASIN
D-CB-12LP	02-20-20	LOW PROFILE 32" X 32" SQUARE CONCRETE NO. 12LP CATCH BASIN FOR USE WITH 6” VERTICAL CURB
D-CB-12LPA		ALTERNATE REINFORCEMENT FOR PRECAST CONCRETE 32” X 32” NO. 12LP CATCH BASIN
D-CB-12P	02-20-20	STANDARD PRECAST RECTANGULAR CONCRETE NO.12 CATCH BASIN
D-CB-12RA	01-28-22	STANDARD PRECAST 48" CIRCULAR NO. 12 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-12RB	02-20-20	STANDARD PRECAST 60" AND 72" CIRCULAR NO. 12 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-12RC	02-20-20	STANDARD PRECAST 84" THRU 120" CIRCULAR NO. 12 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-12S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 12 CATCH BASIN
D-CB-12SB	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 12 CATCH BASIN

D-CB-12SC	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 12 CATCH BASIN
D-CB-12SD	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 12 CATCH BASIN
D-CB-12SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 12 CATCH BASIN
D-CB-13P	02-20-20	STANDARD PRECAST RECTANGULAR CONCRETE NO. 13 CATCH BASIN
D-CB-13RA	01-28-22	STANDARD PRECAST 48" CIRCULAR NO. 13 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-13RB	02-20-20	STANDARD PRECAST 60" AND 72" CIRCULAR NO. 13 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-13RC	02-20-20	STANDARD PRECAST 84" THRU 120" CIRCULAR NO. 13 CATCH BASIN FOR USE WITH 6" VERTICAL CURB
D-CB-13S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 13 CATCH BASIN
D-CB-14P	02-20-20	STANDARD PRECAST RECTANGULAR CONCRETE NO. 14 CATCH BASIN
D-CB-14RB	02-20-20	STANDARD PRECAST CIRCULAR NO. 14RB CATCH BASIN
D-CB-14S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 14 CATCH BASIN
D-CB-14SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 14 CATCH BASIN
D-CB-16S	07-17-20	STANDARD RECTANGULAR CONCRETE NO. 16 CATCH BASIN
D-CB-17S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 17 CATCH BASIN
D-CB-25LP	02-20-20	LOW PROFILE 32" X 32" SQUARE CONCRETE NO. 25LP CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25P	02-20-20	STANDARD PRECAST RECTANGULAR CONCRETE NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25RA	01-28-22	STANDARD PRECAST 48" CIRCULAR NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)

D-CB-25RB	02-20-20	STANDARD PRECAST CIRCULAR NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25SB	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25SC	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25SD	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-25SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 25 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-26P	02-20-20	STANDARD PRECAST RECTANGULAR CONCRETE NO. 26 CATCH BASIN
D-CB-26S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 26 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-27S	02-20-20	STANDARD RECTANGULAR CONCRETE NO. 27 CATCH BASIN (FOR USE WITH 6" SLOPING CURB)
D-CB-31R	02-20-20	STANDARD PRECAST CIRCULAR NO. 31 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-31SD	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 31 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-31SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 31 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-32LP	02-20-20	STANDARD 80” X 32” RECTANGULAR CONCRETE NO. 32 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-38RB	03-04-21	STANDARD PRECAST CIRCULAR NO. 38 CATCH BASIN
D-CB-38S	03-04-21	STANDARD 32" X 32" SQUARE CONCRETE NO. 38 CATCH BASIN
D-CB-38SB	03-04-21	STANDARD 4' X 4' SQUARE CONCRETE NO. 38 CATCH BASIN

D-CB-38SC	03-04-21	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 38 CATCH BASIN
D-CB-39RB	03-04-21	STANDARD PRECAST CIRCULAR NO. 39 CATCH BASIN
D-CB-39S	03-04-21	STANDARD 4' X 4' SQUARE CONCRETE NO. 39 CATCH BASIN
D-CB-39SC	03-04-21	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 39 CATCH BASIN
D-CB-39SD	03-04-21	STANDARD 7' X 7' SQUARE CONCRETE NO. 39 CATCH BASIN
D-CB-39SE	03-04-21	STANDARD 9' X 9' SQUARE CONCRETE NO. 39 CATCH BASIN
D-CB-40S	03-04-21	STANDARD 4' X 8' RECTANGULAR CONCRETE NO. 40 CATCH BASIN
D-CB-40SE	03-04-21	STANDARD 9’ X 9’ SQUARE CONCRETE NO. 40 CATCH BASIN
D-CB-41LP	02-20-20	LOW PROFILE 32" X 32" SQUARE CONCRETE NO. 41LP CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-41P	02-20-20	STANDARD 4' X 3' PRECAST RECTANGULAR CONCRETE NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-41RB	02-20-20	STANDARD PRECAST CIRCULAR NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-41S	02-20-20	STANDARD 4' X 3' RECTANGULAR CONCRETE NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-41SB	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-41SC	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-41SD	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)

D-CB-41SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 41 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-42RB	02-20-20	STANDARD PRECAST CIRCULAR NO. 42 CATCH BASIN
D-CB-42S	02-20-20	STANDARD 32" X 32" SQUARE CONCRETE NO. 42 CATCH BASIN
D-CB-42SB	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 42 CATCH BASIN
D-CB-42SC	02-20-20	STANDARD 5'2" X 5'2" SQUARE CONCRETE NO. 42 CATCH BASIN
D-CB-42SD	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 42 CATCH BASIN
D-CB-43R	02-20-20	STANDARD PRECAST CIRCULAR NO. 43R CATCH BASIN
D-CB-43SB	02-20-20	STANDARD 8' X 4' RECTANGULAR CONCRETE NO. 43SB CATCH BASIN
D-CB-43SC	02-20-20	STANDARD 8' X 5' 2" RECTANGULAR CONCRETE NO. 43SC CATCH BASIN
D-CB-44SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 44 CATCH BASIN
D-CB-45S	02-20-20	STANDARD 8' X 4' RECTANGULAR CONCRETE NO. 45 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-46SE	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 46 CATCH BASIN (FOR USE UNDER CONCRETE MEDIAN BARRIER WALL)
D-CB-51SC	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 51 CATCH BASIN (FOR USE IN FRONT OF CONCRETE RETAINING WALL)
D-CB-51SD	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 51 CATCH BASIN (FOR USE IN FRONT OF CONCRETE RETAINING WALL)
D-CB-51SE	02-20-20	STANDARD 9’ X 9’ SQUARE CONCRETE NO. 51 CATCH BASIN

D-CB-52SE	02-20-20	STANDARD 9’ x 9’ SQUARE CONCRETE NO. 52 CATCH BASIN
D-CB-99	02-20-20	MISCELLANEOUS DETAILS FOR RECTANGULAR STRUCTURES
D-CB-99GS		CATCH BASIN DETAILS FOR GRADE SEPARATION WALL
D-CB-99R	01-28-22	MISCELLANEOUS DETAILS FOR ROUND STRUCTURES
D-CB-99RA	10-29-21	BILL OF STEEL FOR ROUND CATCH BASIN LIDS
D-CB-99RB	02-20-20	ROUND JUNCTION BOX SPRING DRAIN BOX
D-CBB-12A	06-28-19	TYPE ‘B’ CAST IRON FRAME, GRATE & VERTICAL INLET DETAILS FOR NOS. 10, 12, 14, 16, & 17 TYPE CATCH BASINS
D-CBB-12B	06-28-19	TYPE ‘B’ CAST IRON FRAME, GRATE & 6" SLOPING INLET DETAILS FOR NOS. 25, 26 & 27 TYPE CATCH BASINS
D-CBB-12D	07-07-23	TYPE “B” CAST IRON FRAME, GRATE & CURB HOOD DETAILS FOR NOS. 10, 12, 14, 16 & 17 TYPE CATCH BASINS
D-CBB-13	06-28-19	TYPE ‘B’ CAST IRON FRAME, GRATE & VERTICAL INLET DETAILS FOR NO. 13 TYPE CATCH BASINS
D-CBB-31	02-20-20	TYPE ‘B’ CAST IRON FRAME, GRATE & INLET DETAILS FOR NOS. 31, 41, 45, 46, & 51 TYPE CATCH BASINS
D-CBB-42	10-29-21	CAST IRON GRATE DETAILS FOR NOS. 42, 43 & 44 TYPE CATCH BASINS
D-RL-1		ROUND LID DETAILS FOR SINGLE CURB AND WALL INLET
D-RL-2		ROUND LID DETAILS FOR DOUBLE CURB AND WALL INLET
D-RL-3		ROUND LID DETAILS FOR SINGLE OPENING AREA DRAIN
D-RL-4		ROUND LID DETAILS FOR DOUBLE OPENING AREA DRAIN
D-RS-1		PRECAST ROUND STRUCTURES (48” THRU 120”)
D-RS-2		PRECAST ROUND STRUCTURES REINFORCEMENT DETAILS
D-RS-3		MISCELLANEOUS DETAILS FOR ROUND STRUCTURES

10-103.02 JUNCTION BOXES

DRAWING	REVISION DATE	DESCRIPTION
D-JBS-1	02-20-20	STANDARD 32" X 32" SQUARE CONCRETE NO. 1 JUNCTION BOX
D-JBS-2	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 2 JUNCTION BOX
D-JBS-3	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 3 JUNCTION BOX
D-JBS-4	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 4 JUNCTION BOX
D-JBS-5	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 5 JUNCTION BOX
D-RJB-1		PRECAST ROUND JUNCTION BOX STRUCTURES (48” THRU 120”)

10-103.03 MANHOLES

DRAWING	REVISION DATE	DESCRIPTION
D-MH-2	02-20-20	STANDARD PRECAST NO. 3 MANHOLE
D-MH-3	02-20-20	TYPICAL DESIGN OF LIDS FOR NO. 3 MANHOLE
D-MH-4	02-20-20	STANDARD NO. 3 MANHOLE CASTINGS AND STEPS
D-MH-5	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 3 MANHOLE
D-MH-6	02-20-20	STANDARD 7' X 7' SQUARE CONCRETE NO. 3 MANHOLE
D-MH-7	02-20-20	STANDARD 9' X 9' SQUARE CONCRETE NO. 3 MANHOLE
D-RMH-1		PRECAST MANHOLE STRUCTURES (48” THRU 120”)

10-103.04 PRECAST RISERS

DRAWING	REVISION DATE	DESCRIPTION
D-RF-1	07-30-24	STANDARD PRECAST RISER

10-103.05 SPRING DRAIN BOXES

DRAWING	REVISION DATE	DESCRIPTION
D-SDS-1	02-20-20	STANDARD 32" X 32" SQUARE CONCRETE NO. 1 SPRING DRAIN BOX
D-SDS-2A	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 2A SPRING DRAIN BOX
D-SDS-2B	02-20-20	STANDARD 4' X 4' SQUARE CONCRETE NO. 2B SPRING DRAIN BOX
D-SDS-3A	02-20-20	STANDARD 5' 2" X 5' 2" SQUARE CONCRETE NO. 3A SPRING DRAIN BOX
D-RSB-1		PRECAST ROUND SPRING DRAIN BOX STRUCTURES (48” THRU 120”)

10-103.06 SLOTTED AND TRENCH DRAINS

DRAWING	REVISION DATE	DESCRIPTION
D-SLD-1	02-20-20	SLOTTED DRAINS
D-SLD-2	02-20-20	SLOTTED DRAINS
D-SLD-3	02-20-20	SLOTTED DRAINS
D-TD-1	07-07-23	TRENCH DRAIN

10-104.00 ROADWAY, PAVEMENT APPURTENANCES, AND FENCES

10-104.01 CONCRETE PAVEMENT

DRAWING	REVISION DATE	DESCRIPTION
RP-CS-1	05-01-20	CONCRETE SHOULDER RUMBLE STRIP DETAIL (FOR 4 LANE DIVIDED HWY)
RP-CS-2	05-01-20	CONCRETE SHOULDER RUMBLE STRIP DETAIL (FOR 6-LANE OR WIDER DIVIDED HIGHWAY)
RP-CS-3		CONCRETE SHOULDER MILLED RUMBLE STRIP DETAILS

RP-J-1	05-01-20	PORTLAND CEMENT CONCRETE PAVEMENT JOINT TYPES AND SPACING
RP-J-3	05-01-20	PORTLAND CEMENT CONCRETE PAVEMENT JOINT TYPES AND SPACING
RP-J-5	05-01-20	TYPICAL ACCELERATION AND DECELERATION LANE JOINT TYPES AND SPACING FOR CONCRETE RAMPS
RP-J-7	05-01-20	CONCRETE RAMP JOINT TYPES AND SPACING
RP-J-9	05-01-20	CONTRACTION AND CONSTRUCTION JOINTS FOR CONCRETE PAVEMENT
RP-J-11	05-01-20	3/4" AND 1 3/4" EXPANSION AND EDGE PAVEMENT JOINTS
RP-J-13	05-01-20	3/4" AND 1 3/4" ELASTOMERIC COMPRESSION JOINT SEALS
RP-J-15	05-01-20	LONGITUDINAL CONTRACTION AND CONSTRUCTION JOINTS
RP-J-17	05-01-20	DOWEL ASSEMBLY DEVICES
RP-J-18	01-28-22	DOWEL ASSEMBLY DEVICES
RP-J-19	05-01-20	DOWEL ASSEMBLY DEVICES
RP-J-23	01-28-22	CONCRETE PAVEMENT REPAIR DETAILS
RP-J-24	05-01-20	CONCRETE PAVEMENT SPALL AND RANDOM CRACK REPAIR DETAILS
RP-J-25	05-01-20	CONCRETE PAVEMENT JOINT REPAIR DETAILS
RP-EPO-1		EMERGENCY PULL OVER AREA

10-104.02 INTERSECTIONS

DRAWING	REVISION DATE	DESCRIPTION
RP-D-15	06-15-21	DETAILS OF STANDARD CONCRETE DRIVEWAYS
RP-D-16	10-29-21	DETAILS OF LOWERED STANDARD CONCRETE DRIVEWAYS
RP-I-5	05-01-20	EXAMPLES OF STREET & ALLEY INTERSECTIONS

RP-DHO-1	07-07-23	MEDIAN OPENINGS ON 4-LANE DIVIDED HIGHWAY
RP-DHO-2	07-30-24	MEDIAN OPENING DETAILS FOR RESTRICTED CROSSING & J-TURN INTERSECTIONS
RP-PMR-1	05-01-20	STANDARD DETAILS FOR PROPOSED PERMANENT MAINTENANCE RAMP

10-104.03 CURBS

DRAWING	REVISION DATE	DESCRIPTION
RP-SC-1	05-04-22	SLOPING CONCRETE CURB AND CURB AND GUTTER
RP-VC-10	03-04-21	VERTICAL CONCRETE CURBS AND CONCRETE CURBS AND GUTTERS
RP-VC-11	03-04-21	VERTICAL CONCRETE CURBS AND GUTTERS 6” AND 7” DEPTH

10-104.04 WALLS

DRAWING	REVISION DATE	DESCRIPTION
W-CIP-1	05-01-20	ROADWAY FEATURES AT CAST IN PLACE RETAINING WALL
W-MSE-1	05-01-20	ROADWAY FEATURES FOR MSE SEGMENTAL PRECAST FACING RETAINING WALL
W-MSE-2	05-01-20	ROADWAY FEATURES FOR MSE MODULAR BLOCK FACING RETAINING WALL
W-SG-1	07-30-24	STANDARD GRAVITY-TYPE RETAINING WALLS
W-SP-1	05-01-20	ROADWAY FEATURES AT SOLDIER PILE AND SOIL ANCHORED RETAINING WALLS

10-104.05 FENCES AND RIGHT-OF-WAY MARKERS

DRAWING	REVISION DATE	DESCRIPTION
S-F-1	03-01-23	HIGH VISIBILITY FENCE

S-F-10	07-17-20	STANDARD RIGHT-OF-WAY STOCK FENCE
S-F-10A	06-28-19	STANDARD RIGHT-OF-WAY STOCK FENCE WITH TIMBER POSTS
S-F-10B	06-28-19	STANDARD RIGHT-OF-WAY CHAIN LINK FENCE
S-F-10C	06-28-19	RIGHT-OF-WAY FENCE AT BRIDGE AND BOX CULVERTS
S-F-10D	06-28-19	RIGHT-OF-WAY FENCE LOCATIONS AT INTERCHANGES
S-FG-11	07-30-24	STOCK FENCE GATES AND CHAIN LINK FENCE
S-FG-20	06-28-19	EXAMPLES OF WATER GATES AND WATER CROSSINGS
S-RP-2	06-28-19	STANDARD CONCRETE RIGHT-OF-WAY MARKERS

10-105.00 MULTIMODAL

10-105.01 CURB RAMPS

DRAWING	REVISION DATE	DESCRIPTION
MM-CR-1	06-28-19	DETECTABLE WARNING SURFACE PLACEMENT ON CURB RAMPS
MM-CR-2		PERPENDICULAR CURB RAMP
MM-CR-3		PARALLEL CURB RAMP
MM-CR-4		PEDESTRIAN REFUGE
MM-CR-5	06-28-19	SINGLE CROSSING CURB RAMP IN CURVE
MM-CR-6		DUAL CROSSING CURB RAMP PLACED OUTSIDE CURVE
MM-CR-7		CURVE RAMPS IN CURVE BI-DIRECTIONAL DUAL CROSSING
MM-CR-8		MONO-DIRECTIONAL SINGLE CROSSWALK CURB RAMP DETAILS

MM-CR-9		ALTERNATIVE CURB RAMP DETAILS

10-105.02 PAVEMENT MARKINGS

DRAWING	REVISION DATE	DESCRIPTION
MM-PM-1		SIGNING AND PAVEMENT MARKINGS AT INTERSECTION CROSSINGS FOR SHARED-USE PATHS
MM-PM-2	07-30-24	SIGNING AND PAVEMENT MARKINGS FOR BICYCLE LANE OR ROUTES
MM-PM-3	06-15-21	SIGNING AND PAVEMENT MARKINGS FOR BICYCLE LANES ON URBAN ROADWAYS
MM-PM-4		SIGNING AND PAVEMENT MARKINGS FOR BICYCLE LANES
MM-PM-5	05-04-22	SIGNING AND PAVEMENT MARKINGS FOR BICYCLE LANES AT INTERSECTIONS

10-105.03 SAFETY RAIL

DRAWING	REVISION DATE	DESCRIPTION
MM-BPR-1	07-30-24	BIKE AND PEDESTRIAN SAFETY RAIL
MM-BPR-2	10-16-20	BIKE AND PEDESTRIAN MEDIAN BARRIER RAIL
MM-BPR-3		BARRIER SLOPED END TREATMENT
MM-VPR-1		VEHICLE AND PEDESTRIAN SAFETY RAIL

10-105.04 SIDEWALK

DRAWING	REVISION DATE	DESCRIPTION
MM-PS-1		DETAILS FOR PEDESTRIAN STEPS AND HANDRAILS
MM-SW-1	07-07-23	DETAILS FOR CONCRETE SIDEWALK
MM-SW-2		ALTERNATE DETAILS FOR CONCRETE SIDEWALK (REHABILITATION)

10-105.05 TYPICAL SECTION

DRAWING	REVISION DATE	DESCRIPTION
MM-BS-1		TYPICAL BUS STOP LOCATION
MM-TS-1	06-15-21	BIKE ACCOMMODATION DESIGN GUIDANCE
MM-TS-2	06-15-21	LATERAL OFFSETS FOR SIDEWALK AND SHARED USE PATH
MM-TS-3	07-30-24	SEPARATED SHARED USE PATH TYPICAL SECTIONS
MM-PM-3	06-15-21	SIGNING AND PAVEMENT MARKING FOR BIKE LANES ON URBAN ROADWAYS

10-106.00 SAFETY DESIGN AND GUARDRAILS

10-106.01 CLEAR ZONE AND SAFETY PLANS

DRAWING	REVISION DATE	DESCRIPTION
S-CZ-1	06-28-19	CLEAR ZONE CRITERIA
S-PL-1	03-01-23	SAFETY PLAN AT ROADSIDE HAZARDS
S-PL-1A	03-01-23	SAFETY PLAN FOR BARRIER LENGTH OF NEED (FOR RIGID OBJECTS)
S-PL-1B	03-01-23	SAFETY PLAN FOR BARRIER LENGTH OF NEED ON CURVED ROADWAYS
S-PL-3	03-01-23	SAFETY PLAN MINIMUM INSTALLATION AT BRIDGE ENDS
S-PL-4	01-09-24	SAFETY PLAN FOR BRIDGE PIERS IN CLEAR ZONE
S-PL-4A	01-09-24	SAFETY PLAN FOR BRIDGE PIERS IN CLEAR ZONE & OUT
S-PL-5	06-28-19	SAFETY PLAN FOR BRIDGE ENDS IN MEDIANS
S-PL-6	07-30-24	SAFETY PLAN SAFETY HARDWARE PLACEMENT ON OUTSIDE EDGE
S-PL-6A	06-28-19	SAFETY PLAN SAFETY HARDWARE PLACEMENT IN MEDIAN

10-106.02 CABLE BARRIER

DRAWING	REVISION DATE	DESCRIPTION
S-CB-1	01-09-24	CABLE BARRIER PLACEMENT
S-CB-2	07-07-23	HIGH TENSION CABLE BARRIER

10-106.03 CRASH CUSHIONS

DRAWING	REVISION DATE	DESCRIPTION
S-CC-1	01-09-24	CRASH CUSHION
S-CC-2	06-28-19	CRASH CUSHION (GATING) BARREL ARRAY

10-106.04 GUARDRAIL DETAILS

DRAWING	REVISION DATE	DESCRIPTION
S-GR31-1	06-15-21	GUARDRAIL DETAILS
S-GR31-1A	06-28-19	GUARDRAIL AND BLOCK-OUT DETAILS
S-GR31-1B		GUARDRAIL FASTENING HARDWARE
S-GR31-1C	07-07-23	GUARDRAIL GENERAL NOTES AND POST DETAILS
S-GR31-1D	03-01-23	GUARDRAIL POST PLACEMENT IN ROCK

10-106.05 GUARDRAIL CONNECTIONS

DRAWING	REVISION DATE	DESCRIPTION
S-GRC-4	07-07-23	GUARDRAIL CONNECTION TO BRIDGE RAILING CONCRETE PARAPET
S-GRC-5	02-28-20	GUARDRAIL CONNECTION TO BRIDGE ENDS (TRAILING ENDS)
S-GRC-6	07-07-23	GUARDRAIL CONNECTION TO BRIDGE ENDS FOR LOW SPEED ROADWAYS

10-106.06 GUARDRAIL (SPECIAL CASES)

DRAWING	REVISION DATE	DESCRIPTION
S-CPW-1		CURVED PARAPET WALL ≤40 M.P.H.
S-GRS-1	06-15-21	SPECIAL CASE LONG SPAN GUARDRAIL ONE POST OMITTED
S-GRS-2	01-28-22	SPECIAL CASE GUARDRAIL ATTACHMENT TO CONCRETE DECKS
S-GRS-3	06-28-19	SPECIAL CASE GUARDRAIL FOOTING
S-GRS-4	05-04-22	SPECIAL CASE GUARDRAIL HEIGHT TRANSITION DETAIL
S-GRS-5		SPECIAL CASE WEAK-POST GUARDRAIL ATTACHMENT TO CULVERT
S-GRS-5A	06-15-21	WEAK-POST GUARDRAIL ASSEMBLY DETAILS FOR TYPE 1 & 2
S-GRS-5B		WEAK-POST GUARDRAIL ASSEMBLY DETAILS FOR TYPE 3 & 4
S-GRS-6		SPECIAL CASE FLEXIBILITY ON GUARDRAIL POST INSTALLATIONS
S-GRS-7	01-09-24	SHORT – RADIUS - GR SYSTEM (SRGS) CONNECTION TO BRIDGE END
S-GRS-7A	07-30-24	SHORT – RADIUS – GUARDRAIL SYSTEM (SRGS) ANCHOR DETAILS
S-GRS-7B		SHORT RADIUS – GR SYSTEM (SRGS) EYE-BOLT SPACING DETAILS

10-106.07 GUARDRAIL TERMINALS

DRAWING	REVISION DATE	DESCRIPTION
S-GRT-1	10-29-21	TYPE 12 GUARDRAIL TERMINAL BURIED-IN-BACKSLOPE
S-GRT-1A		LAYOUT OF FLARED GUARDRAIL (TL-3)
S-GRT-1B		LAYOUT OF FLARED GUARDRAIL (TL-2)
S-GRT-2	06-28-19	TYPE 38 GUARDRAIL END TERMINAL

S-GRT-2P	10-16-20	EARTH PAD FOR TYPE 38 AND TYPE 21 TERMINAL
S-GRT-2R	06-28-19	EARTH PAD FOR TYPE 38 AND 21 TERMINALS (RETROFIT)
S-GRT-3	06-28-19	TYPE 21 GUARDRAIL END TERMINAL
S-GRT-4		TYPE 21 GATING END TERMINAL
S-GRT-4A		TYPE 21 GATING END TERMINAL ANCHOR DETAILS
S-GRT-4B		GATING TERMINAL POST & RAIL DETAILS

10-106.08 GUARDRAIL ANCHORS

DRAWING	REVISION DATE	DESCRIPTION
S-GRA-1	06-28-19	TYPE 12 GUARDRAIL ANCHOR
S-GRA-1A	06-28-19	GUARDRAIL ANCHOR FOR TYPE 12 TERMINAL (ALTERNATIVE)
S-GRA-3	01-09-24	TYPE 13 GUARDRAIL ANCHOR
S-GRA-4	03-01-23	IN-LINE GUARDRAIL ANCHOR
S-GRA-5	06-28-19	FLARED GUARDRAIL ANCHOR

10-106.09 CONCRETE MEDIAN BARRIERS

DRAWING	REVISION DATE	DESCRIPTION
S-SSMB-1	01-28-22	32” SINGLE SLOPE CONCRETE BARRIER WALL
S-SSMB-1A	10-29-21	36” SINGLE SLOPE CONCRETE BARRIER WALL
S-SSMB-2	10-29-21	51” SINGLE SLOPE CONCRETE BARRIER WALL
S-SSMB-3	10-29-21	51” HALF SIZE SINGLE SLOPE CONCRETE BARRIER WALL
S-SSMB-4	07-17-20	FLARED SINGLE SLOPE CONCRETE MEDIAN BARRIER WALL (VERTICAL BACK)
S-SSMB-5	05-01-20	SINGLE SLOPE MEDIAN BARRIER WALL CATCH BASIN DETAIL

S-SSMB-6	06-28-19	32” CONCRETE SINGLE SLOPE BARRIER WALL WITH SINGLE GUARDRAIL ATTACHMENT
S-SSMB-6A		36” CONCRETE SINGLE SLOPE BARRIER WALL FOR ATTACHING GUARDRAIL
S-SSMB-6B		DUAL GUARDRAIL ATTACHMENT TO SINGLE SLOPE 36” BARRIER WALL
S-SSMB-6C		SINGLE GUARDRAIL ATTACHMENT TO SINGLE SLOPE 36” BARRIER WALL
S-SSMB-6D		51” CONCRETE SINGLE SLOPE BARRIER WALL FOR ATTACHING GUARDRAIL
S-SSMB-6E		DUAL GUARDRAIL ATTACHMENT TO SINGLE SLOPE 51” BARRIER WALL
S-SSMB-6F		SINGLE GUARDRAIL ATTACHMENT TO SINGLE SLOPE 51” BARRIER WALL
S-SSMB-7	05-01-20	FOOTING DETAILS FOR OVERHEAD SIGN STRUCTURE 32” MEDIAN BARRIER WALL
S-SSMB-8	05-01-20	FOOTING DETAILS FOR OVERHEAD SIGN STRUCTURE 51” MEDIAN BARRIER WALL
S-SSMB-9	10-29-21	SINGLE SLOPE BARRIER WALL FOR GRADE SEPARATED MEDIAN
S-SSMB-10	01-09-24	SPECIAL DETAIL FOR CONCRETE MEDIAN BARRIER WALL TRANSITION FROM 32” OR 36” TO 51”

10-106.10 GUARDRAIL MAINTENANCE

DRAWING	REVISION DATE	DESCRIPTION
S-GR28-1M	06-15-21	W-BEAM & THRIE BEAM BARRIER RAIL AND RUB RAIL DETAILS
S-GR28-2M	06-28-19	GUARDRAIL HARDWARE DETAILS
S-GR28-3M	01-28-22	GUARDRAIL HEIGHT ADJUSTMENT
S-GR28-4M	06-28-19	GUARDRAIL TERMINAL ANCHOR TYPE 13
S-GR28-5M	06-28-19	MEDIAN DIVIDER GUARDRAIL

S-GR28-6M	10-29-21	GUARDRAIL ATTACHMENT TO CONCRETE DECKS
S-GR28-7M	06-28-19	GUARDRAIL ATTACHMENT TO BRIDGE ENDS DETAILS
S-GRC-1M		GUARDRAIL CONNECTION TO BRIDGE ENDS OR BARRIER WALL
S-GRC-2M		GUARDRAIL CONNECTION TO BRIDGE END FOR LOCAL ROADS (ADT<2000)
S-GRC-3M		MEDIAN DIVIDER GUARDRAIL TRANSITION TO CONCRETE MEDIAN BARRIER
S-PL-2M		SAFETY PLAN AT SIDE ROADS OR PRIVATE DRIVES
S-SSMB-6M		GUARDRAIL ATTACHMENT TO EXISTING SINGLE SLOPE CONCRETE BARRIER WALL

10-107.00 DESIGN - TRAFFIC CONTROL

10-107.01 PAVEMENT MARKINGS

DRAWING	REVISION DATE	DESCRIPTION
T-M-1	06-28-19	DETAILS OF PAVEMENT MARKINGS FOR CONVENTIONAL ROADS AND MARKING ABBREVIATIONS
T-M-2	01-09-24	DETAILS OF PAVEMENT MARKINGS FOR CONVENTIONAL ROADS
T-M-3	07-07-23	MARKING STANDARDS FOR TRAFFIC ISLANDS, PAVED SHOULDERS AND MEDIANS ON CONVENTIONAL ROADS
T-M-4	07-17-20	STANDARD INTERSECTION PAVEMENT MARKINGS
T-M-4A	03-01-23	STANDARD UNSIGNALIZED MID-BLOCK CROSSING
T-M-4B	07-30-24	STANDARD SIGNALIZED MID-BLOCK CROSSING
T-M-4C		PEDESTRIAN GATEWAY TREATMENT
T-M-5	03-01-23	MARKING DETAIL FOR EXPRESSWAY AND FREEWAYS
T-M-6	03-01-23	MARKING DETAIL FOR EXPRESSWAY AND FREEWAY INTERCHANGES

T-M-7	06-28-19	GORE MARKING DETAILS FOR EXPRESSWAY & FREEWAY INTERCHANGES
T-M-8	06-28-19	MARKING DETAILS FOR EXPRESSWAYS & FREEWAYS
T-M-9	05-01-23	PAVEMENT MARKING AND SIGNING DETAILS FOR RAMP INTERSECTIONS
T-M-9A		PAVEMENT MARKING AND SIGNING DETAILS FOR RAMP INTERSECTIONS
T-M-9B		PAVEMENT MARKING AND SIGNING DETAILS FOR RAMP INTERSECTIONS
T-M-15	06-28-19	ASPHALT SHOULDER RUMBLE STRIP INSTALLATION DETAILS FOR INTERSTATES AND ACCESS CONTROLLED ROUTES
T-M-15A	06-28-19	ASPHALT SHOULDER RUMBLE STRIP INSTALLATION DETAILS FOR NON-ACCESS CONTROLLED RURAL ROUTES
T-M-16	07-30-24	RUMBLE STRIPE INSTALLATION LAYOUT
T-M-16A	02-03-20	RUMBLE STRIPE DETAILS FOR EDGE OF PAVEMENT AND CENTERLINE
T-M-16B		MUMBLE STRIP/STRIPE DETAILS FOR EDGE OF PAVEMENT
T-M-17	05-04-22	PAVEMENT MARKING DETAILS FOR ROUNDABOUTS
T-M-18	10-29-21	FLEXIBLE DELINEATOR DETAILS
T-M-18A		DELINEATOR MOUNTING DETAILS
T-M-19	07-07-23	PAVEMENT MARKING DETAILS FOR RESTRICTED CROSSING & J-TURN INTERSECTIONS

10-107.02 WORK ZONES

DRAWING	REVISION DATE	DESCRIPTION
T-WZ-10	04-02-12	ADVANCE ROAD WORK SIGNING ON HIGHWAYS AND FREEWAYS
T-WZ-11	03-04-21	ONE LANE CLOSURE DETAIL FOR DIVIDED HIGHWAYS

T-WZ-12	03-04-21	ONE LANE CLOSURE DETAIL FOR BRIDGES ON DIVIDED HIGHWAYS
T-WZ-13	05-01-20	TWO-OUTSIDE LANE CLOSURE FOR EXPRESSWAYS AND FREEWAYS
T-WZ-14	03-04-21	TWO-OUTSIDE LANE CLOSURE FOR INTERSTATES AND EXPRESSWAYS
T-WZ-15	05-01-20	INTERIOR LANE CLOSURE FOR FREEWAYS
T-WZ-16	07-30-24	LANE SHIFT FOR DIVIDED HIGHWAYS AND FREEWAYS
T-WZ-18	07-07-23	SHOULDER CLOSURE DETAIL FOR FREEWAYS AND DIVIDED HIGHWAYS
T-WZ-19	03-04-21	MEDIAN CROSS-OVER DETAIL ON FREEWAYS
T-WZ-20	12-18-99	GEOMETRIC MEDIAN CROSS-OVER DETAIL ON DIVIDED HIGHWAYS
T-WZ-21	05-01-20	LANE CLOSURE WITH LEFT HAND MERGE AND LANE SHIFT
T-WZ-30	09-01-05	TRAFFIC CONTROL 2-LANE, 2-WAY DIVERSION (40 MPH OR LESS)
T-WZ-31	09-01-05	TRAFFIC CONTROL 2-LANE, 2-WAY DIVERSION (GREATER THAN 40 MPH)
T-WZ-32	11-30-20	TRAFFIC CONTROL PLAN SIGNAL LAYOUT FOR TRAFFIC SIGNAL AT TWO LANE BRIDGE RECONSTRUCTION SITE
T-WZ-33	05-27-98	TRAFFIC CONTROL PLAN FOR CLOSE INTERSECTION CONDITIONS USING TRAFFIC SIGNAL AT TWO LANE BRIDGE RECONSTRUCTION SITE
T-WZ-34	09-01-05	TRAFFIC CONTROL PLAN GENERAL NOTES FOR TRAFFIC SIGNAL AT TWO LANE BRIDGE RECONSTRUCTION SITE
T-WZ-35	04-02-12	TRAFFIC CONTROL PLAN PAY ITEM AND SIGN DETAILS FOR TRAFFIC SIGNAL AT TWO LANE BRIDGE RECONSTRUCTION SITE
T-WZ-36	03-05-17	LANE CLOSURE ON LOW-VOLUME 2-LANE HIGHWAY
T-WZ-40	03-05-17	RIGHT LANE CLOSURES AT NEAR SIDE OF INTERSECTIONS

T-WZ-41	03-05-17	LEFT LANE CLOSURES AT NEAR SIDE OF INTERSECTIONS
T-WZ-42	03-05-17	CENTER LANE CLOSURES AT NEAR SIDE OF INTERSECTIONS
T-WZ-50	04-02-12	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 2 OR 3 LANE MAJOR ROUTES
T-WZ-51	04-02-12	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 4 OR 5 LANE MAJOR ROUTES
T-WZ-52	04-02-12	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 4 OR 5 LANE MAJOR AND MINOR ROUTES
T-WZ-53	04-02-12	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 4 OR MORE LANE DIVIDED MAJOR ROUTES
T-WZ-54	04-02-12	TRAFFIC CONTROL FOR SIGNALS ONLY PROJECTS ON 4 OR MORE LANE DIVIDED MAJOR ROUTES AND 4 OR MORE LANE MINOR ROUTES
T-WZ-55	10-29-21	SIDEWALK TRAFFIC CONTROL
T-WZ-56	05-15-22	TRANSVERSE RUMBLE STRIP USE WITHIN WORK ZONES
T-WZ-60		FREEWAY RESURFACING SIGNING LAYOUT
T-WZ-61	05-15-22	ROLLING ROADBLOCK DETAIL FOR DIVIDED HIGHWAYS
T-WZ-62		CONSTRUCTION ACCESS/EMERGENCY PULL-OFF ON FREEWAYS
T-WZ-63	01-09-24	WORK ZONE IN THE VICINITY OF AN ENTRANCE RAMP
T-WZ-64		WORK ZONE IN THE VICINITY OF AN EXIT RAMP
T-WZ-65		LANE CLOSURE WITH LATE MERGE
T-WZ-FAB1		FLASHING YELLOW ARROW BOARD (Replaced T-FAB-1)
T-WZ-PBR1	12-09-22	INTERCONNECTED PORTABLE BARRIER RAIL (Replaced T-PBR-1)
T-WZ-PBR2	02-28-20	DETAILS FOR WORK ZONE CHANNELIZATION DEVICES
T-WZ-PCB1	12-09-22	10 FOOT PORTABLE CONCRETE BARRIER RAIL
T-WZ-PCB2	12-09-22	20 FOOT PORTABLE CONCRETE BARRIER RAIL

T-WZ-PCB2A	12-09-22	20 FOOT PORTABLE CONCRETE BARRIER RAIL STIFFENER TUBE
T-WZ-PCB3	01-28-22	PORTABLE CONCRETE BARRIER RAIL DETAILS
T-WZ-PCB4	12-09-22	PORTABLE CONCRETE BARRIER RAIL ANCHOR PIN DETAILS

10-108.00 EROSION PREVENTION AND SEDIMENT CONTROL

10-108.01 DEWATERING DEVICES

DRAWING	REVISION DATE	DESCRIPTION
EC-STR-1	08-01-12	DEWATERING STRUCTURE
EC-STR-2	08-01-12	SEDIMENT FILTER BAG

10-108.02 SLOPE DEVICES

DRAWING	REVISION DATE	DESCRIPTION
EC-STR-3B	06-15-21	SILT FENCE
EC-STR-3C	03-01-23	SILT FENCE WITH WIRE BACKING
EC-STR-3D	03-01-23	ENHANCED SILT FENCE
EC-STR-3E	04-01-08	SILT FENCE FABRIC JOINING DETAILS
EC-STR-8	06-10-14	FILTER SOCK
EC-STR-27	08-01-12	TEMPORARY SLOPE DRAIN AND BERM
EC-STR-29	08-01-12	PERMANENT SLOPE DRAIN PIPE
EC-STR-34	05-04-22	EROSION CONTROL BLANKET FOR SLOPE INSTALLATION
EC-STR-35	08-01-12	FILTER BERMS
EC-STR-37	06-10-14	SEDIMENT TUBE

10-108.03 DITCH DEVICES

DRAWING	REVISION DATE	DESCRIPTION

EC-STR-4	07-30-24	ENHANCED SILT FENCE CHECK (TRAPEZOIDAL DITCH)
EC-STR-4A	07-30-24	ENHANCED SILT FENCE CHECK (V-DITCH)
EC-STR-4B	08-01-12	ENHANCED SILT FENCE CHECK DETAILS
EC-STR-6	11-30-20	ROCK CHECK DAM
EC-STR-6A	05-06-16	ENHANCED ROCK CHECK DAM
EC-STR-7	05-04-22	SEDIMENT TRAP WITH CHECK DAM
EC-STR-55	08-01-12	GABION CHECK DAM
EC-STR-56	04-01-08	GABION CHECK DAM DESIGN TABLES
EC-STR-57	04-01-08	GABION ASSEMBLY DETAILS
EC-STR-58	04-01-08	GABION ASSEMBLY DETAILS
EC-STR-59	08-01-12	GABION CHECK DAM GENERAL NOTES AND COMPONENT PROPERTIES
EC-STR-61	03-16-17	LEVEL SPREADERS

10-108.04 INLET PROTECTION

DRAWING	REVISION DATE	DESCRIPTION
EC-STR-11	03-16-17	CULVERT PROTECTION TYPE 1
EC-STR-19	04-01-08	CATCH BASIN PROTECTION
EC-STR-39	08-01-12	CURB INLET PROTECTION TYPE 1 & 2
EC-STR-39A	08-01-12	CURB INLET PROTECTION TYPE 3 & 4
EC-STR-40		CATCH BASIN FILTER ASSEMBLY FOR CIRCULAR STRUCTURES
EC-STR-41		CATCH BASIN FILTER ASSEMBLY (TYPE 1)
EC-STR-41A		CATCH BASIN FILTER ASSEMBLY (TYPE 1) SLIPCOVER DETAILS
EC-STR-42		CATCH BASIN FILTER ASSEMBLY (TYPE 2)

EC-STR-42A	CATCH BASIN FILTER ASSEMBLY (TYPE 2) SLIPCOVER DETAILS
EC-STR-43	CATCH BASIN FILTER ASSEMBLY (TYPE 3)
EC-STR-43A	CATCH BASIN FILTER ASSEMBLY (TYPE 3) SLIPCOVER DETAILS
EC-STR-44	CATCH BASIN FILTER ASSEMBLY (TYPE 4)
EC-STR-44A	CATCH BASIN FILTER ASSEMBLY (TYPE 4) SLIPCOVER DETAILS
EC-STR-45	CATCH BASIN FILTER ASSEMBLY (TYPE 5)
EC-STR-45A	CATCH BASIN FILTER ASSEMBLY (TYPE 5) SLIPCOVER DETAILS
EC-STR-46	CATCH BASIN FILTER ASSEMBLY (TYPE 6)
EC-STR-46A	CATCH BASIN FILTER ASSEMBLY (TYPE 6) SLIPCOVER DETAILS
EC-STR-47	CATCH BASIN FILTER ASSEMBLY (TYPE 7)
EC-STR-47A	CATCH BASIN FILTER ASSEMBLY (TYPE 7) SLIPCOVER DETAILS
EC-STR-48	CATCH BASIN FILTER ASSEMBLY (TYPE 8)
EC-STR-48A	CATCH BASIN FILTER ASSEMBLY (TYPE 8) SLIPCOVER DETAILS
EC-STR-49	CATCH BASIN FILTER ASSEMBLY (TYPE 9)
EC-STR-49A	CATCH BASIN FILTER ASSEMBLY (TYPE 9) SLIPCOVER DETAILS
EC-STR-50	CATCH BASIN FILTER ASSEMBLY (TYPE 10)
EC-STR-50A	CATCH BASIN FILTER ASSEMBLY (TYPE 10) SLIPCOVER DETAILS
EC-STR-51	CATCH BASIN FILTER ASSEMBLY (TYPE 11)
EC-STR-51A	CATCH BASIN FILTER ASSEMBLY (TYPE 11) SLIPCOVER DETAILS

10-108.05 DETAINING DEVICES

DRAWING	REVISION DATE	DESCRIPTION
EC-STR-12	08-01-12	ROCK SEDIMENT DAM
EC-STR-13	08-01-12	ROCK AND EARTH SEDIMENT EMBANKMENT
EC-STR-15	08-01-12	SEDIMENT BASIN
EC-STR-16	08-01-12	SEDIMENT BASIN RISER AND COLLAR APPURTENANCES
EC-STR-17	08-01-12	SEDIMENT BASIN EMBANKMENT DETAILS
EC-STR-18		SEDIMENT BASIN FLOATING OUTLET STRUCTURE
EC-STR-21	05-04-22	PERMANENT RIPRAP BASIN ENERGY DISSIPATORS

10-108.06 IN-STREAM DEVICES

DRAWING	REVISION DATE	DESCRIPTION
EC-STR-11A	08-01-12	CULVERT PROTECTION TYPE 2
EC-STR-25	08-01-12	TEMPORARY CULVERT CROSSING, CONSTRUCTION EXIT, CONSTRUCTION FORD
EC-STR-30		INSTREAM DIVERSION (WITHOUT TRAFFIC)
EC-STR-30A		INSTREAM DIVERSION (WITH TRAFFIC)
EC-STR-31	05-04-22	TEMPORARY DIVERSION CHANNEL
EC-STR-31A	04-01-08	TEMPORARY DIVERSION CHANNEL DESIGN
EC-STR-32	08-01-12	TEMPORARY DIVERSION CULVERTS
EC-STR-33	08-01-12	SUSPENDED PIPE DIVERSION (DOWNSTREAM)
EC-STR-33A	08-01-12	SUSPENDED PIPE DIVERSION (UPSTREAM)
EC-STR-36	05-04-22	TURF REINFORCEMENT MAT FOR CHANNEL INSTALLATION
EC-STR-38	08-01-12	FLOATING TURBIDITY CURTAIN

10-109.00 NATURAL STREAM DESIGN

10-109.01 DEFLECTORS, VANES, AND ENERGY DISSIPATORS

DRAWING	REVISION DATE	DESCRIPTION
D-NSD-13	05-01-20	LONGITUDINAL STONE TOE
D-NSD-21	05-01-20	BOULDER CLUSTERS
D-NSD-22	05-01-20	BOULDER CROSS VANE
D-NSD-23	05-01-20	BOULDER CROSS VANE WITH STEP
D-NSD-24	05-01-20	BOULDER W-WEIR
D-NSD-25	05-01-20	BOULDER VANES AND J-HOOK
D-NSD-26	11-30-20	LOG VANES, ROOT WADS, AND BOULDER J-HOOK
D-NSD-27	11-30-20	LOG AND BOULDER STEP POOLS
D-NSD-28	05-01-20	BOULDER RIFFLES
D-NSD-28A	11-30-20	LOG RIFFLES
D-NSD-29	05-01-20	CONSTRUCTED ALLUVIAL RIFFLE
D-NSD-30	05-01-20	SUBSTRATE RESTORATION
D-NSD-31	05-01-20	CLAY CHANNEL PLUG
D-NSD-32	05-01-20	WOOD TOE WITH GEO-LIFTS
D-NSD-32A	05-01-20	BOULDER TOE WITH GEO-LIFTS
D-NSD-33	05-01-20	COIR FIBER EROSION CONTROL BLANKET AND COIR FIBER ROLLS
D-NSD-34	05-01-20	LIVE STAKES AND LIVE SILTATION
D-NSD-35	05-01-20	LIVE FASCINES
D-NSD-36	05-01-20	BRUSH MATTRESS
D-NSD-37	05-01-20	SPECIAL NOTES FOR NATURAL STREAM DESIGN

SECTION 2 – STANDARD TRAFFIC OPERATIONS DRAWINGS

10-200.00 SIGNS

DRAWING	REVISION DATE	DESCRIPTION
T-S-6	02-12-91	STANDARD MOUNTING DETAILS - BOLTED EXTRUDED PANELS
T-S-7	02-12-91	HIGHWAY SHIELDS USED ON INTERSTATE AND U.S. NUMBERED ROUTES
T-S-8	07-15-91	HIGHWAY SHIELDS USED ON STATE NUMBERED ROUTES AND ARROWS
T-S-9	06-10-14	STANDARD LAYOUT - GROUND MOUNTED SIGNS
T-S-10	04-04-12	STANDARD MOUNTING DETAILS FLAT SHEET SIGNS, ALUMINUM-STEEL DESIGN
T-S-11	06-06-11	DELINEATOR AND MILEPOST DETAILS
T-S-12	07-10-17	STANDARD STEEL GROUND MOUNTED SIGNS, BREAK-AWAY TYPE POST FOOTING DETAILS, SQUARE TUBES
T-S-13	10-21-19	I-BEAM BREAK-AWAY LARGE SIGN SUPPORT DETAILS
T-S-14	10-21-19	WF-BEAM BREAK-AWAY LARGE SIGN SUPPORT DETAILS
T-S-15	12-07-90	STANDARD CONDUIT & GROUND DETAILS FOR OVERHEAD & CANTILEVER SIGN STRUCTURES
T-S-16	07-02-15	GROUND MOUNTED ROADSIDE SIGN PLACEMENT DETAILS
T-S-16A	07-02-15	GROUND MOUNTED ROADSIDE SIGN PLACEMENT DETAILS
T-S-17	07-11-17	STANDARD GROUND MOUNTED SIGN USING PERFORATED/KNOCKOUT SQUARE TUBE
T-S-18	02-14-14	END OF ROADWAY, DEAD END SIGNS, AND METAL BARRICADES (TYPE III)
T-S-19	06-12-20	STANDARD STEEL SIGN SUPPORTS
T-S-20	07-11-17	SIGN DETAILS
T-S-21	04-10-19	DETAILS FOR SIGNS MOUNTS ON CONCRETE MEDIAN BARRIERS

T-S-22	04-10-19	SIGN LAYOUT FOR HOV LANES
T-S-23A	07-11-17	MULTI-DIRECTIONAL SLIP BASE BREAKAWAY P-POST SIGN SUPPORT
T-S-23B	07-19-13	MULTI-DIRECTIONAL SLIP BASE BREAKAWAY STRUCTURAL PIPE SIGN SUPPORT
T-S-23C	07-02-15	BREAKWAY POST SIGN SUPPORTS
T-S-24	08-02-13	DETAILS OF SIGN WITH SOLAR FLASHING ASSEMBLY
T-S-25		SIGNING PLAN DETAILS FOR ROUNDABOUTS
T-S-26	07-07-23	SIGNING PLAN FOR RESTRICTED CROSSING & J-TURN INTERSECTIONS

10-201.00 SIGNALS

DRAWING	REVISION DATE	DESCRIPTION
T-SG-1	06-27-16	WOOD POLE DETAILS FOR SPAN MOUNTED SIGNALS
T-SG-2	06-27-16	LOOP LEAD-INS, CONDUIT AND PULL BOXES
T-SG-3	07-11-17	STANDARD NOTES AND DETAILS OF INDUCTIVE LOOPS
T-SG-3A	06-27-16	ALTERNATE DETECTION DETAILS
T-SG-4	06-27-16	SPAN WIRE AND MESSENGER CABLE DETAILS
T-SG-5	06-27-16	CONTROLLER CABINET DETAILS
T-SG-6	10-21-19	PEDESTRIAN SIGNAL DETAILS
T-SG-7	10-21-19	SIGNAL HEAD ASSEMBLIES
T-SG-7A		TYPICAL SIGNAL HEAD PLACEMENT APPROACHES WITH NO THROUGH MOVEMENTS
T-SG-7B	10-21-19	TYPICAL SIGNAL HEAD PLACEMENT APPROACHES WITH NO THROUGH MOVEMENTS
T-SG-7C		TYPICAL SIGNAL HEAD PLACEMENT ONE-LANE AND TWO-LANE APPROACHES
T-SG-7D	10-21-19	TYPICAL SIGNAL HEAD PLACEMENT TWO-LANE APPROACHES

T-SG-7E		TYPICAL SIGNAL HEAD PLACEMENT THREE-LANE APPROACHES
T-SG-7F	07-13-17	TYPICAL SIGNAL HEAD PLACEMENT THREE-LANE APPROACHES
T-SG-7G		TYPICAL SIGNAL HEAD PLACEMENT THREE-LANE APPROACHES
T-SG-7H	10-21-19	TYPICAL SIGNAL HEAD PLACEMENT THREE-LANE AND FOUR-LANE APPROACHES
T-SG-7HH	07-13-17	TYPICAL SIGNAL HEAD PLACEMENT FOUR-LANE APROACHES
T-SG-7J		TYPICAL SIGNAL HEAD PLACEMENT FOUR-LANE APPROACHES
T-SG-7K	11-17-20	TYPICAL SIGNAL HEAD PLACEMENT FOUR-LANE APPROACHES
T-SG-7L	10-21-19	TYPICAL SIGNAL HEAD PLACEMENT FOUR-LANE APPROACHES
T-SG-7M		TYPICAL SIGNAL HEAD PLACEMENT FIVE-LANE APPROACHES
T-SG-7N		TYPICAL SIGNAL HEAD PLACEMENT FIVE-LANE APPROACHES
T-SG-7NN	07-13-17	TYPICAL SIGNAL HEAD PLACEMENT FIVE-LANE APPROACHES
T-SG-7P		TYPICAL SIGNAL HEAD PLACEMENT FIVE-LANE APPROACHES
T-SG-7PP	07-13-17	TYPICAL SIGNAL HEAD PLACEMENT FIVE-LANE APPROACHES
T-SG-7R		TYPICAL SIGNAL HEAD PLACEMENT SIX-LANE APPROACHES
T-SG-7S	10-21-19	TYPICAL SIGNAL HEAD PLACEMENT SIX-LANE AND SEVEN-LANE APPROACHES
T-SG-8	06-27-16	STRAIN POLE DETAILS FOR SPAN MOUNTED SIGNALS
T-SG-9	10-21-19	DETAILS OF CANTILEVER SIGNAL SUPPORT

T-SG-9A	07-12-17	MISCELLANEOUS SIGNAL DETAILS
T-SG-10	07-11-17	MAST ARM POLE AND STRAIN POLES FOUNDATION DETAILS
T-SG-11	07-12-17	MAINTENANCE OF EXISTING SIGNALS DURING HIGHWAY CONSTRUCTION
T-SG-12	12-20-19	TYPICAL WIRING FOR SIGNAL HEADS AND DETECTION LOOPS
T-SG-13	06-27-16	FLASHING BEACON DETAIL

10-202.00 LIGHTING AND UTILITY POLES

DRAWING	REVISION DATE	DESCRIPTION
T-FO-1		FIBER OPTIC AERIAL ENTRANCE DETAILS
T-FO-2		FIBER OPTIC UNDERGROUND ENTRANCE DETAILS
T-FO-3		FIBER OPTIC AERIAL CONNECTION DETAILS
T-FO-4		FIBER OPTIC PULL BOX, CABINET & POLE DETAILS
T-L-1	09-12-23	STANDARD LIGHTING FOUNDATION DETAILS
T-L-1SA	09-11-13	STANDARD LIGHTING DETAILS FOR SINGLE ARM SUPPORTS
T-L-1TM		STANDARD LIGHTING DETAILS TENON MOUNTED OFFSET LIGHTING SUPPORTS
T-L-2	12-04-13	FOUNDATION DETAIL FOR LUMINAIRE MOUNTED ON CONCRETE MEDIAN BARRIER
T-L-3	04-15-96	STANDARD LIGHTING DETAILS PULL BOXES
T-L-4	05-25-11	STANDARD LIGHTING DETAILS CONDUIT, CABLE INSTALLATION

10-203.00 RAILROAD CROSSING

DRAWING	REVISION DATE	DESCRIPTION

T-RR-1	11-01-11	TYPICAL PAVEMENT MARKING AT RAILROAD ACTIVE HIGHWAY GRADE CROSSINGS AND RAILROAD ADVANCE WARNING SIGN
T-RR-2	11-01-11	STANDARD DRAWING FOR RAILROAD AND HIGHWAY CROSSING SIGNAL WITH GATE
T-RR-3	11-01-11	STANDARD DRAWING FOR RAILROAD-HIGHWAY CROSSING SIGNAL
T-RR-4	11-01-11	STANDARD DRAWING FOR TYPICAL CURB & GUTTER PLAN FOR RAILROAD-HIGHWAY CROSSING WITH OR WITHOUT GATES
T-RR-5	11-01-11	RAILROAD-HIGHWAY CROSSING SIGNAL WITH CANTILEVER SPAN
T-RR-6	10-25-13	TYPICAL SIGNING AND MARKING AT PASSIVE RAILROAD HIGHWAY GRADE CROSSINGS

SECTION 3 – STANDARD STRUCTURE DRAWINGS

10-300.00 NEW STRUCTURES

DRAWING	REVISION DATE	DESCRIPTION
STD-1-1	05-10-21	BRIDGE RAILING CONCRETE PARAPET
STD-1-1SS	05-10-21	BRIDGE RAILING SINGLE SLOPE CONCRETE PARAPET
STD-1-2	05-10-21	STEEL SLIDER PLATE ASSEMBLIES FOR CONCRETE PARAPET AND BRIDGE DECK DRAIN DETAILS
STD-1-2SS	05-10-21	STEEL SLIDER PLATE ASSEMBLIES FOR SINGLE SLOPE CONCRETE PARAPET AND BRIDGE DECK DRAIN DETAILS
STD-1- 3	05-10-21	STANDARD CONCRETE MEDIAN BARRIER
STD-1-3SS	05-10-21	STANDARD SINGLE SLOPE CONCRETE MEDIAN BARRIER
STD-1-4	05-10-21	STEEL SLIDER PLATE ASSEMBLIES FOR CONCRETE MEDIAN BARRIER

STD-1-4SS	05-10-21	STEEL SLIDER PLATE ASSEMBLIES FOR SINGLE SLOPE CONCRETE MEDIAN BARRIER
STD-1-5	05-10-21	REINFORCED CONCRETE PAVEMENT AT BRIDGE ENDS
STD-1-6	05-10-21	BRIDGE END DRAIN DETAILS 2’ X 8’-7” & 4’ X 8’-7” WITH PAVEMENT AT BRIDGE ENDS
STD-1-7	05-10-21	BRIDGE END DRAIN DETAILS 2’ X 8’-7” & 4’ X 8’-7” WITH PAVEMENT AT BRIDGE ENDS
STD-1-8	05-10-21	BRIDGE END DRAIN DETAILS 2’ X 8’-7” WITH PAVEMENT AT BRIDGE ENDS
STD-1-9	05-10-21	BRIDGE END DRAIN DETAILS 4’ X 8’-7” WITH PAVEMENT AT BRIDGE ENDS
STD-1-10	05-10-21	BRIDGE END DRAIN DETAILS 2’ X 8’-7” & 4’ X 8’-7” WITHOUT PAVEMENT AT BRIDGE ENDS
STD-1-11	05-10-21	BRIDGE END DRAIN DETAILS 2’ X 8’-7” & 4’ X 8’-7” WITHOUT PAVEMENT AT BRIDGE ENDS
STD-1-12	05-10-21	BRIDGE END DRAIN DETAILS 2’ X 8’-7” WITHOUT PAVEMENT AT BRIDGE ENDS
STD-1-13	05-10-21	BRIDGE END DRAIN DETAILS 4’ X 8’-7” WITHOUT PAVEMENT AT BRIDGE ENDS
STD-2-1	11-01-10	BRIDGE MOUNTED INTERCONNECTED PORTABLE BARRIER RAIL
STD-2-2		VERTICAL PANEL DETAILS
STD-2-3		BRIDGE MOUNTED INTERCONNECTED PORTABLE BARIER RAIL ALTERNATE CONNECTION DETAIL
STD-3-1	11-01-10	STRIPSEAL EXPANSION JOINT NEW CONSTRUCTION
STD-3-2	11-01-10	STRIPSEAL EXPANSION JOINT NEW CONSTRUCTION
STD-4-1	04-08-05	STANDARD PRECAST PRESTRESSED BRIDGE DECK PANELS GENERAL DETAILS
STD-4-2	04-08-05	STANDARD PRECAST PRESTRESSED BRIDGE DECK PANELS DESIGN CRITERIA
STD-4-3	03-02-02	STANDARD PRECAST PRESTRESSED BRIDGE DECK PANELS GENERAL DETAILS

STD-4-4	06-10-96	STANDARD PRECAST PRESTRESSED BRIDGE DECK PANELS CONSTRUCTION DETAILS
STD-5-1	10-25-93	STANDARD PILE DETAILS
STD-5-2	05-01-14	STANDARD PILE DETAILS
STD-6-1	12-08-23	STANDARD SEISMIC DETAILS
STD-6-2	11-07-94	STANDARD SEISMIC DETAILS
STD-7-1	04-15-20	STANDARD CONCRETE RAIL
STD-8-2	11-01-10	LIGHT STANDARD SUPPORT DETAILS
STD-8-2SS		SINGLE SLOPE PARAPET STANDARD LIGHT SUPPORT DETAILS
STD-8-3	09-01-91	MEDIAN BARRIER LIGHT STANDARD SUPPORT DETAILS
STD-8-3SS	06-15-20	SINGLE SLOPE MEDIAN BARRIER STANDARD LIGHT SUPPORT DETAILS
STD-8-4		SIGN, LUMINAIRE, AND TRAFFIC SIGNAL SUPPORTS
STD-8-5	5-10-21	STANDARD PROTECTIVE FENCE DETAILS
STD-8-6	10-03-18	TRI-STAR STATE EMBLEM FINISH DETAILS
STD-9-1	10-07-08	STANDARD REINFORCING BAR SUPPORT DETAILS FOR CONCRETE SLABS
STD-10-1	06-05-23	MISCELLANEOUS ABUTMENT AND DRAINAGE DETAILS
STD-10-2	06-05-23	MISC. ABUTMENT & PAVEMENT AT BRIDGE ENDS BACKFILL DETAILS
STD-10-3	01-10-24	MISC. ABUTMENT & PAVEMENT AT BRIDGE ENDS DITCH DETAILS
STD-11-1	04-15-20	BRIDGE RAILING CONCRETE PARAPET WITH STRUCTURAL TUBING
STD-11-2	04-15-20	STANDARD CONCRETE CLASSIC RAIL
STD-11-3	04-15-20	STANDARD CONCRETE PEDESTRIAN CLASSIC RAIL
STD-11-4		CONCRETE CLASSIC RAIL (42” TALL)

STD-11-4A		CONCRETE CLASSIC RAIL (42” TALL)
STD-14-1	06-05-23	STANDARD DETAILS AND INTERMEDIATE DIAPHRAGM DETAILS FOR BULB-TEE BEAMS
STD-14-1A		STANDARD DETAILS AND INTERMEDIATE DIAPHRAGM DETAILS FOR BULB-TEE BEAMS (8" WEBS)
STD-14-2		STANDARD DETAILS AND INTERMEDIATE DIAPHRAGM DETAILS FOR I-BEAMS
STD-14-3		STANDARD DETAILS FOR PRESTRESSED BOX BEAMS

10-301.00 LRFD BOX CULVERTS

(See Section 2-600.01)

DRAWING	REVISION DATE	DESCRIPTION
STD-17-1		INDEX OF DRAWINGS
STD-17-2		TERMINOLOGY OF DRAWINGS
STD-17-3		GENERAL NOTES
STD-17-4		DESIGN SECTION LIMITS
STD-17-5		TYPICAL SECTIONS AND DETAILS
STD-17-6		TYPICAL ELEVATION
STD-17-7		CURB, RAIL & EDGE BEAM DETAILS - SKEW NOT LESS THAN 45 DEG.
STD-17-8		EDGE BEAM DETAILS FOR FILLS GREATER THAN 3’ - 6”
STD-17-9		INTERIOR WALL END TREATMENTS
STD-17-10		TYPICAL WINGWALL DETAILS AND NOTES
STD-17-11		WINGWALL DIMENSIONS AND QUANTITIES
STD-17-12		WINGWALL DIMENSIONS AND QUANTITIES
STD-17-13		WINGWALL DIMENSIONS AND QUANTITIES
STD-17-14		WINGWALL DIMENSIONS AND QUANTITIES

STD-17-15		WINGWALL AND SPECIAL RETAINING WALL DESIGN SECTIONS
STD-17-16		WINGWALL DESIGN SECTIONS
STD-17-17	06-01-11	BACKFILL AND DRAINAGE DETAILS
STD-17-18		BACKFILL DETAILS
STD-17-19	06-20-18	PAVED OUTLET DETAIL
STD-17-20		LOW FLOW CHANNEL CONSTRUCTION DETAILS FOR CULVERT INLET AND OUTLET
STD-17-21		DEBRIS DEFLECTION WALL FOR BOX BRIDGE
STD-17-22		DEBRIS DEFLECTION WALL FOR SLAB BRIDGE
STD-17-23		SIDEWALK AND MISCELLANEOUS DETAILS
STD-17-24		WARPED SLOPE DETAIL
STD-17-25		STAGE CONSTRUCTION JOINT DETAIL (FILL ABOVE TOP OF SLAB NOT GREATER THAN 3’-6”)
STD-17-26		EXTENSION DETAILS
STD-17-27		EXTENSION DETAILS FOR SCOURED OUTLET
STD-17-28		END SECTION DETAILS
STD-17-29		PRECAST BOX CULVERT DETAILS
STD-17-34		STANDARD INTERNAL ENERGY DISSIPATOR FOR BOX AND PIPE CULVERTS
STD-17-51	05-01-14	BOX BRIDGE, 1 BARREL AT 6’, CLEAR HTS. 3’ - 6’, 0 - 60’ FILL
STD-17-52		BOX BRIDGE, 1 BARREL AT 8’, CLEAR HTS. 3’ - 5’, 0 - 60’ FILL
STD-17-53		BOX BRIDGE, 1 BARREL AT 8’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-54		BOX BRIDGE, 1 BARREL AT 10’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-55		BOX BRIDGE, 1 BARREL AT 10’, CLEAR HTS. 7’ - 10’, 0 - 60’ FILL

STD-17-56		BOX BRIDGE, 1 BARREL AT 12', CLEAR HTS. 4' - 6', 0 - 60' FILL
STD-17-57		BOX BRIDGE, 1 BARREL AT 12', CLEAR HTS. 7' - 9', 0 - 60' FILL
STD-17-58		BOX BRIDGE, 1 BARREL AT 12', CLEAR HTS. 10' - 12', 0 - 60' FILL
STD-17-59		BOX BRIDGE, 1 BARREL AT 14', CLEAR HTS. 5' - 7', 0 - 60' FILL
STD-17-60		BOX BRIDGE, 1 BARREL AT 14', CLEAR HTS. 8' - 11', 0 - 60' FILL
STD-17-61		BOX BRIDGE, 1 BARREL AT 14', CLEAR HTS. 12' - 14', 0 - 60' FILL
STD-17-62		BOX BRIDGE, 1 BARREL AT 16', CLEAR HTS. 6' - 8', 0 - 60' FILL
STD-17-63		BOX BRIDGE, 1 BARREL AT 16', CLEAR HTS. 9' - 12', 0 - 60' FILL
STD-17-64		BOX BRIDGE, 1 BARREL AT 16', CLEAR HTS. 13' - 16', 0 - 60' FILL
STD-17-65		BOX BRIDGE, 1 BARREL AT 18', CLEAR HTS. 6' - 8', 0 - 60' FILL
STD-17-66		BOX BRIDGE, 1 BARREL AT 18', CLEAR HTS. 9' - 11', 0 - 60' FILL
STD-17-67		BOX BRIDGE, 1 BARREL AT 18', CLEAR HTS. 12' - 14', 0 - 60' FILL
STD-17-68		BOX BRIDGE, 1 BARREL AT 18', CLEAR HTS. 15' - 18', 0 - 60' FILL
STD-17-71	05-01-14	BOX BRIDGE, 2 BARRELS AT 6', CLEAR HTS. 3' - 6', 0 - 60' FILL
STD-17-72		BOX BRIDGE, 2 BARRELS AT 8', CLEAR HTS. 3' - 5', 0 - 60' FILL
STD-17-73		BOX BRIDGE, 2 BARRELS AT 8', CLEAR HTS. 6' - 8', 0 - 60' FILL

STD-17-74	BOX BRIDGE, 2 BARRELS AT 10’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-75	BOX BRIDGE, 2 BARRELS AT 10’, CLEAR HTS. 7’ - 10’, 0 - 60’ FILL
STD-17-76	BOX BRIDGE, 2 BARRELS AT 12’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-77	BOX BRIDGE, 2 BARRELS AT 12’, CLEAR HTS. 7’ - 9’, 0 - 60’ FILL
STD-17-78	BOX BRIDGE, 2 BARRELS AT 12’, CLEAR HTS. 10’ - 12’, 0 - 60’ FILL
STD-17-79	BOX BRIDGE, 2 BARRELS AT 14’, CLEAR HTS. 5’ - 7’, 0 - 60’ FILL
STD-17-80	BOX BRIDGE, 2 BARRELS AT 14’, CLEAR HTS. 8’ - 11’, 0 - 60’ FILL
STD-17-81	BOX BRIDGE, 2 BARRELS AT 14’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-82	BOX BRIDGE, 2 BARRELS AT 16’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-83	BOX BRIDGE, 2 BARRELS AT 16’, CLEAR HTS. 9’ - 12’, 0 - 60’ FILL
STD-17-84	BOX BRIDGE, 2 BARRELS AT 16’, CLEAR HTS. 13’ - 16’, 0 - 60’ FILL
STD-17-85	BOX BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-86	BOX BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 9’ - 11’, 0 - 60’ FILL
STD-17-87	BOX BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-88	BOX BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 15’ - 18’, 0 - 60’ FILL
STD-17-91	BOX BRIDGE, 3 BARRELS AT 6’, CLEAR HTS. 3’ - 6’, 0 - 60’ FILL
STD-17-92	BOX BRIDGE, 3 BARRELS AT 8’, CLEAR HTS. 3’ - 5’, 0 - 60’ FILL

STD-17-93	BOX BRIDGE, 3 BARRELS AT 8’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-94	BOX BRIDGE, 3 BARRELS AT 10’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-95	BOX BRIDGE, 3 BARRELS AT 10’, CLEAR HTS. 7’ - 10’, 0 - 60’ FILL
STD-17-96	BOX BRIDGE, 3 BARRELS AT 12’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-97	BOX BRIDGE, 3 BARRELS AT 12’, CLEAR HTS. 7’ - 9’, 0 - 60’ FILL
STD-17-98	BOX BRIDGE, 3 BARRELS AT 12’, CLEAR HTS. 10’ - 12’, 0 - 60’ FILL
STD-17-99	BOX BRIDGE, 3 BARRELS AT 14’, CLEAR HTS. 5’ - 7’, 0 - 60’ FILL
STD-17-100	BOX BRIDGE, 3 BARRELS AT 14’, CLEAR HTS. 8’ - 11’, 0 - 60’ FILL
STD-17-101	BOX BRIDGE, 3 BARRELS AT 14’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-102	BOX BRIDGE, 3 BARRELS AT 16’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-103	BOX BRIDGE, 3 BARRELS AT 16’, CLEAR HTS. 9’ - 12’, 0 - 60’ FILL
STD-17-104	BOX BRIDGE, 3 BARRELS AT 16’, CLEAR HTS. 13’ - 16’, 0 - 60’ FILL
STD-17-105	BOX BRIDGE, 3 BARRELS AT 18’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-106	BOX BRIDGE, 3 BARRELS AT 18’, CLEAR HTS. 9’ - 11’, 0 - 60’ FILL
STD-17-107	BOX BRIDGE, 3 BARRELS AT 18’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-108	BOX BRIDGE, 3 BARRELS AT 18’, CLEAR HTS. 15’ - 18’, 0 - 60’ FILL

STD-17-111	SLAB BRIDGE, 1 BARREL AT 6’, CLEAR HTS. 3’ - 6’, 0 - 60’ FILL
STD-17-112	SLAB BRIDGE, 1 BARREL AT 8’, CLEAR HTS. 3’ - 5’, 0 - 60’ FILL
STD-17-113	SLAB BRIDGE, 1 BARREL AT 8’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-114	SLAB BRIDGE, 1 BARREL AT 10’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-115	SLAB BRIDGE, 1 BARREL AT 10’, CLEAR HTS. 7’ - 10’, 0 - 60’ FILL
STD-17-116	SLAB BRIDGE, 1 BARREL AT 12’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-117	SLAB BRIDGE, 1 BARREL AT 12’, CLEAR HTS. 7’ - 9’, 0 - 60’ FILL
STD-17-118	SLAB BRIDGE, 1 BARREL AT 12’, CLEAR HTS. 10’ - 12’, 0 - 60’ FILL
STD-17-119	SLAB BRIDGE, 1 BARREL AT 14’, CLEAR HTS. 5’ - 7’, 0 - 60’ FILL
STD-17-120	SLAB BRIDGE, 1 BARREL AT 14’, CLEAR HTS. 8’ - 11’, 0 - 60’ FILL
STD-17-121	SLAB BRIDGE, 1 BARREL AT 14’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-122	SLAB BRIDGE, 1 BARREL AT 16’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-123	SLAB BRIDGE, 1 BARREL AT 16’, CLEAR HTS. 9’ - 12’, 0 - 60’ FILL
STD-17-124	SLAB BRIDGE, 1 BARREL AT 16’, CLEAR HTS. 13’ - 16’, 0 - 60’ FILL
STD-17-125	SLAB BRIDGE, 1 BARREL AT 18’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-126	SLAB BRIDGE, 1 BARREL AT 18’, CLEAR HTS. 9’ - 11’, 0 - 60’ FILL
STD-17-127	SLAB BRIDGE, 1 BARREL AT 18’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL

STD-17-128	SLAB BRIDGE, 1 BARREL AT 18’, CLEAR HTS. 15’ - 18’, 0 - 60’ FILL
STD-17-131	SLAB BRIDGE, 2 BARRELS AT 6’, CLEAR HTS. 3’ - 6’, 0 - 60’ FILL
STD-17-132	SLAB BRIDGE, 2 BARRELS AT 8’, CLEAR HTS. 3’ - 5’, 0 - 60’ FILL
STD-17-133	SLAB BRIDGE, 2 BARRELS AT 8’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-134	SLAB BRIDGE, 2 BARRELS AT 10’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-135	SLAB BRIDGE, 2 BARRELS AT 10’, CLEAR HTS. 7’ - 10’, 0 - 60’ FILL
STD-17-136	SLAB BRIDGE, 2 BARRELS AT 12’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-137	SLAB BRIDGE, 2 BARRELS AT 12’, CLEAR HTS. 7’ - 9’, 0 - 60’ FILL
STD-17-138	SLAB BRIDGE, 2 BARRELS AT 12’, CLEAR HTS. 10’ - 12’, 0 - 60’ FILL
STD-17-139	SLAB BRIDGE, 2 BARRELS AT 14’, CLEAR HTS. 5’ - 7’, 0 - 60’ FILL
STD-17-140	SLAB BRIDGE, 2 BARRELS AT 14’, CLEAR HTS. 8’ - 11’, 0 - 60’ FILL
STD-17-141	SLAB BRIDGE, 2 BARRELS AT 14’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-142	SLAB BRIDGE, 2 BARRELS AT 16’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-143	SLAB BRIDGE, 2 BARRELS AT 16’, CLEAR HTS. 9’ - 12’, 0 - 60’ FILL
STD-17-144	SLAB BRIDGE, 2 BARRELS AT 16’, CLEAR HTS. 13’ - 16’, 0 - 60’ FILL
STD-17-145	SLAB BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL

STD-17-146	SLAB BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 9’ - 11’, 0 - 60’ FILL
STD-17-147	SLAB BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-148	SLAB BRIDGE, 2 BARRELS AT 18’, CLEAR HTS. 15’ - 18’, 0 - 60’ FILL
STD-17-151	SLAB BRIDGE, 3 BARRELS AT 6’, CLEAR HTS. 3’ - 6’, 0 - 60’ FILL
STD-17-152	SLAB BRIDGE, 3 BARRELS AT 8’, CLEAR HTS. 3’ - 5’, 0 - 60’ FILL
STD-17-153	SLAB BRIDGE, 3 BARRELS AT 8’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-154	SLAB BRIDGE, 3 BARRELS AT 10’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-155	SLAB BRIDGE, 3 BARRELS AT 10’, CLEAR HTS. 7’ - 10’, 0 - 60’ FILL
STD-17-156	SLAB BRIDGE, 3 BARRELS AT 12’, CLEAR HTS. 4’ - 6’, 0 - 60’ FILL
STD-17-157	SLAB BRIDGE, 3 BARRELS AT 12’, CLEAR HTS. 7’ - 9’, 0 - 60’ FILL
STD-17-158	SLAB BRIDGE, 3 BARRELS AT 12’, CLEAR HTS. 10’ - 12’, 0 - 60’ FILL
STD-17-159	SLAB BRIDGE, 3 BARRELS AT 14’, CLEAR HTS. 5’ - 7’, 0 - 60’ FILL
STD-17-160	SLAB BRIDGE, 3 BARRELS AT 14’, CLEAR HTS. 8’ - 11’, 0 - 60’ FILL
STD-17-161	SLAB BRIDGE, 3 BARRELS AT 14’, CLEAR HTS. 12’ - 14’, 0 - 60’ FILL
STD-17-162	SLAB BRIDGE, 3 BARRELS AT 16’, CLEAR HTS. 6’ - 8’, 0 - 60’ FILL
STD-17-163	SLAB BRIDGE, 3 BARRELS AT 16’, CLEAR HTS. 9’ - 12’, 0 - 60’ FILL
STD-17-164	SLAB BRIDGE, 3 BARRELS AT 16’, CLEAR HTS. 13’ - 16’, 0 - 60’ FILL

STD-17-165	SLAB BRIDGE, 3 BARRELS AT 18', CLEAR HTS. 6' - 8', 0 - 60' FILL
STD-17-166	SLAB BRIDGE, 3 BARRELS AT 18', CLEAR HTS. 9' - 11', 0 - 60' FILL
STD-17-167	SLAB BRIDGE, 3 BARRELS AT 18', CLEAR HTS. 12' - 14', 0 - 60' FILL
STD-17-168	SLAB BRIDGE, 3 BARRELS AT 18', CLEAR HTS. 15' - 18', 0 - 60' FILL

10-302.00 BRIDGE REPAIRS

DRAWING	REVISION DATE	DESCRIPTION
SBR-2-115	06-15-16	GENERAL NOTES AND DETAILS FOR EXPANSION JOINT REPLACEMENT CONSTRUCTION TYPES "A" THRU "J" – 1991
SBR-2-116	01-04-96	GENERAL DETAILS FOR STRIPSEAL EXPANSION JOINT REPLACEMENT CONSTRUCTION DETAILS TYPES "A" THRU "J" – 1991
SBR-2-117	05-30-96	STRIPSEAL EXPANSION JOINTS - REPLACEMENT CONSTRUCTION DETAILS TYPE "A" AND TYPE "B" – 1991
SBR-2-118	05-30-96	STRIPSEAL EXPANSION JOINT REPLACEMENT CONSTRUCTION DETAILS TYPE "C" AND TYPE "D" – 1991
SBR-2-119	05-30-96	STRIPSEAL EXPANSION JOINT REPLACEMENT CONSTRUCTION DETAILS TYPE "E" AND TYPE "F" – 1991
SBR-2-120	05-30-96	STRIPSEAL EXPANSION JOINT REPLACEMENT CONSTRUCTION DETAILS TYPE "G" AND "H" – 1991
SBR-2-121	01-04-96	STRIPSEAL EXPANSION JOINT REPLACEMENT CONSTRUCTION DETAILS TYPE "J" – 1991
SBR-2-122	01-04-96	DETAILS FOR PRECAST SLAB BRIDGE CHANNELS, SPANS 16' - 0" THRU 34' - 0", DEGREE OF SKEW 90 - 75 - 60 - 45 – 1992
SBR-2-123	01-04-96	DETAILS FOR PRECAST SLAB BRIDGE CHANNELS, SPANS 16' - 0" THRU 34' - 0", DEGREE OF SKEW 90 - 75 - 60 - 45 – 1992

SBR-2-124	01-04-96	DETAILS SHOWING REPLACEMENT OF EXISTING BRIDGERAIL SYSTEM WITH NEW JERSEY SHAPE CONCRETE PARAPET AND NEW 10’ -2” ENDPOST – 1988
SBR-2-125	11-05-01	DETAILS SHOWING REPLACEMENT OF EXISTING BRIDGERAIL SYSTEM WITH NEW JERSEY SHAPE CONCRETE PARAPET AND NEW 10’ -2” ENDPOST – 1988
SBR-2-126	01-04-96	DETAILS SHOWING REPLACEMENT OF EXISTING BRIDGERAIL SYSTEM WITH NEW JERSEY SHAPE CONCRETE PARAPET AND NEW 10’ -2” ENDPOST – 1988
SBR-2-127	11-05-01	DETAILS SHOWING PIER PROTECTION WITH NEW CONCRETE BARRIER WALL – 1988
SBR-2-128	01-04-96	DETAILS SHOWING PIER PROTECTION WITH NEW CONCRETE BARRIER WALL – 1988
SBR-2-129	11-05-01	DETAILS SHOWING PIER PROTECTION WITH NEW VERTICAL CONCRETE BARRIER – 1988
SBR-2-130	01-04-96	DETAILS SHOWING PIER PROTECTION WITH NEW VERTICAL CONCRETE BARRIER – 1988
SBR-2-131	01-22-02	DETAILS SHOWING GUARDRAIL ATTACHMENT AT BRIDGE ENDS TO EXISTING CONCRETE SLOPE FACE ENDPOST – 1989
SBR-2-132	01-04-96	DETAILS SHOWING GUARDRAIL ATTACHMENT AT BRIDGE ENDS TO EXISTING CONCRETE SLOPE FACE ENDPOST – 1989
SBR-2-133	01-22-02	DETAILS SHOWING GUARDRAIL ATTACHMENT AT BRIDGE ENDS TO EXISTING CONCRETE VERTICAL FACE ENDPOST – 1989
SBR-2-134	01-04-96	DETAILS SHOWING GUARDRAIL ATTACHMENT AT BRIDGE ENDS TO EXISTING CONCRETE VERTICAL FACE ENDPOST – 1989
SBR-2-135	01-22-02	GUARDRAIL ATACHMENT TO EXISTING PIER PROTECTION – 1991
SBR-2-136	11-05-01	STANDARD DRAWING FOR REPLACING EXISTING CONCRETE ENDPOST AND GUARDRAIL AT EXISTING BRIDGE ENDS – 1992
SBR-2-137	11-05-01	STANDARD SHOWING DETAILS FOR ATTACHING NEW GUARDRAIL TO EXISTING END OF BRIDGE – 1992

SBR-2-138	11-05-01	STANDARD SHOWING DETAILS FOR ATTACHING NEW GUARDRAIL AT EXISTING BRIDGE END AND ALONG EXISTING BRIDGE RAIL – 1992
SBR-2-140	11-05-01	STANDARD SHOWING DETAILS FOR ATTACHING NEW GUARDRAIL ALONG EXISTING BRIDGE RAILS – 1992
SBR-2-144	01-22-02	STANDARD SHOWING DETAILS OF ATTACHING GUARDRAIL BRIDGERAIL TO TOP OF EXISTING CURBS – 1992