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English

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SECTION IV – CONSTRUCTION PLANS

CHAPTER 1 - GENERAL PROVISIONS

4-100.00 INTRODUCTION

This chapter addresses construction matters, which do not fit neatly into any of the other chapters.

4-105.00 ROADWAY DESIGN CHECKLIST - CONSTRUCTION PLANS (See 1-105.00)

4-112.00 SIZE OF FULL-SIZE PLAN AND CROSS-SECTION SHEETS (See 2-112.00 and 3-102.00)

4-112.01 SIZE OF FINAL CONSTRUCTION PLANS AND CROSS-SECTION SHEETS (See Section 1-115.10)

4-115.00 IDENTIFICATION OF SUPERVISORS, DESIGNERS, AND CHECKERS ON TITLE SHEET

On the lower left-hand corner of the project title sheet list the name of the TDOT Civil Engineering Manager 1, TDOT Design Manager 1 or TDOT Roadway Specialist Supervisor 2 in charge of the project, the name of the firm designing the project (if being done by a consultant), the name of the designer, the name of the person(s) who checked the plans and the Design Project (P.E.) number. See Figures 4-1a and 4-1b.

TDOT C.E. MANAGER 1 OR
 TDOT TRANSPORTATION MANAGER 1 : _____

DESIGNED BY : (Firm Name) _____

DESIGNER : (Responsible Person) _____ CHECKED BY _____

P.E. NO. (DESIGN) _____

PIN _____

Figure 4-1A
 Title Sheet Identification Format for Consultant Designed Construction

TDOT ROAD SP. SV. 2 : _____
 DESIGNER : _____ CHECKED BY : _____
 P.E. NO. _____ (DESIGN) _____
 PIN _____

Figure 4-1B
 Title Sheet Identification Format for TDOT Designed Construction

4-115.05 SIGNATURES OF THE COMMISSIONER AND THE CHIEF ENGINEER ON TITLE SHEET (See 3-105.05)

4-115.10 ENGINEER’S SEAL, SIGNATURE, AND DATE ON TITLE SHEET

When plans are submitted for Construction, the engineer’s seal, signature, and date shall be placed on the right side of the title sheet inside the sealed by box. The engineer’s seal, signature, and date must also be placed on every subsequent sheet of the Construction Plans (except the cross-sections). Certified digital signatures will be required for all plan submittals.

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 may not allow anyone else to use the certification on his behalf.

Refer to the document Digital Signature Certification Workflow for information in applying a digital signature to a plan set. [Digital Signature Certification Workflow.pdf](#)

4-115.11 FINAL PLANS SUBMITTAL FORMAT

To facilitate the requirements of 4-115.10 all plans will be submitted as pdf portfolios. Each individual sheet in the portfolio shall have one of the following 2 digit prefixes to identify what section of the plans it belongs to for final assembly.

- 01 Roadway
- 02 Structures
- 03 Structures Reference Drawings
- 04 Utilities
- 05 SWPPP
- 06 Natural Stream Design
- 07 Cross-Sections

Refer to the document CADDV8.pdf located on the Standard Design CADD Files and Documents webpage for proper naming convention for MicroStation Sheet files (.sht) from which the corresponding Adobe PDF (.pdf) files are created.

4-115.15 PROJECT LENGTHS

All projects shall show - "Roadway Length, Bridge Length, Box Bridge Length and Project Length" - on the title sheet. If there are no bridges or box bridges, show those lengths as "0.000 miles". 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 will be added below the project length to say "Not included in the project length".

4-115.20 EQUATION BLOCKS ON TITLE SHEET (See 2-115.05)

4-115.25 EXCLUSIONS ON TITLE SHEET (See 2-115.10)

4-115.30 PROJECT DESCRIPTIONS (See 2-115.20)

4-115.35 TRAFFIC DATA BLOCK ON TITLE SHEET

The designer will place the traffic design data block on all construction title sheets, except for those used on 100% State Resurfacing Projects, as per Construction Plans checklist in Section 1-105.00 of the Design Guidelines. For an example of a traffic data block, see Section 2-115.15 of the Design Guidelines.

On 100% State Resurfacing Projects, the designer will be required to show only the current ADT as taken from the report prepared by the Bureau of Planning and Development titled *Traffic Flow Maps - Tennessee Roads and Streets* and the posted speed as submitted by the Regional Construction Office.

4-120.00 HAUL ROADS ON PROJECTS

4-120.01 NEED FOR HAUL ROAD

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. The designer shall communicate with Headquarters Environmental Permits Section staff when a haul road is proposed over any environmental feature as defined in the environmental boundaries document.

4-120.02 HAUL ROAD DESIGN

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" to accommodate two dump trucks passing in opposite directions. 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 bank.

4-120.03 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:

- GEOTEXTLE (TYPE IV)(STABILIZATION)
- ¹BORROW EXCAVATION (GRADED SOLID ROCK)
- ¹MACHINED RIP-RAP (CLASS A-1)
- ¹MACHINED RIP RAP (CLASS B)
- ¹MACHINED RIP RAP (CLASS C)
- ²MINERAL 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:

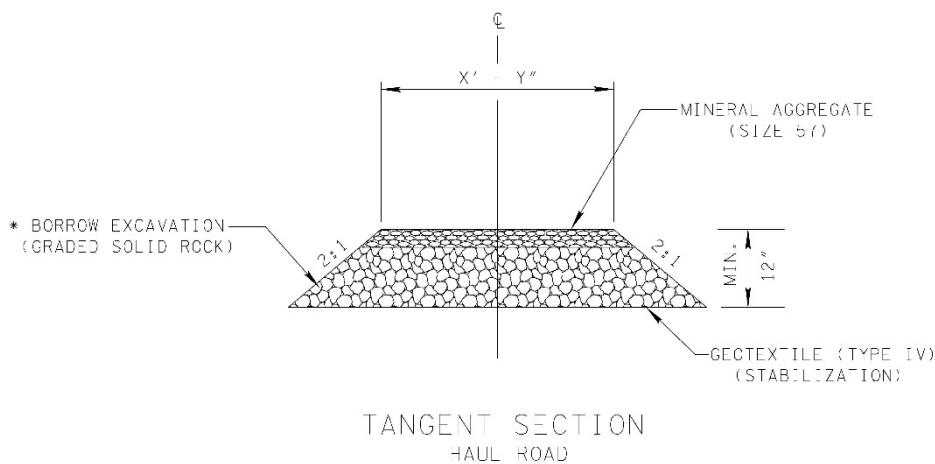
ITEM NO. 203-50 SHALL INCLUDE GEOTEXTILE (TYPE IV), BORROW EXCAVATION (GRADED SOLID ROCK) OR MACHINED RIP-RAP (CLASS A-1, CLASS B, OR CLASS C),

MINERAL AGGREGATE (SIZE 57), AND TEMPORARY DRAINAGE PIPE (IF APPLICABLE). THE MINERAL AGGREGATE INCLUDES AN ADDITIONAL TEN (10) PERCENT FOR MAINTENANCE.

Any items numbers needed for stabilization of the area due from the removal of the haul road shall be paid for separately.

4-120.04 HAUL ROAD TYPICAL SECTION

The following 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 flood plain. The note shall also be shown.



- *NOTE: IF CONSTRUCTION IN AREAS THAT ARE EITHER DRY OR UNSATURATED, HAUL ROAD SHALL BE CONSTRUCTED OF BORROW EXCAVATION (GRADED SOLID ROCK). IF CONSTRUCTED IN WATER OR IN AN AREA WITHIN THE FLOODPLAIN IN THE CASE OF A 5 YEAR STORM EVENT, ONE OF THE FOLLOWING MATERIALS SHALL BE USED IN LIEU OF BORROW EXCAVATION (GRADED SOLID ROCK):
- MACHINED RIP-RAP (CLASS A-1)
 - MACHINED RIP-RAP (CLASS B)
 - MACHINED RIP-RAP (CLASS C)

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 to the designer. The designer shall check with the Headquarters Environmental Permits Section to see if the permit needs to be adjusted due to the typical section revision.

4-125.00 BRIDGE CLEARANCES ON PAVING PROJECTS

The designer shall furnish the Structures Division with a list of all bridges under which the roadway passes. The Structures Division will check the vertical clearance records and furnish the designer with the maximum permissible thickness of overlay under the structure.

4-126.00 RESURFACING PROJECTS WITH BRIDGE REPAIR QUANTITIES

On resurfacing projects that include bridge repairs the designer shall:

- Add the bridge repair quantities received from the Bridge Repair Section to the estimated quantities sheets in a separate quantities box titled "Estimated Bridge Quantities."
- Footnote the Bridge Repair Quantities with the following note and fill in the blank with the appropriate sheet number.
"FOR BRIDGE REPAIR DETAILS SEE SHEET ___"
- Add the bridge repair quantities to the Estimated Quantities Excel file in the Box Bridge Tab.
- 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, all bridge repair sheets and the estimated quantities sheet. The bridge repair type shall be listed as: "BRIDGE"

4-130.00 SALVAGE CREDITS ON FEDERALLY-FUNDED PROJECTS

Salvage credit (credit to Federal funds) is to be considered when there is a need to dispose of expendable and nonexpendable tangible personal property previously acquired with Federal funds. Such property may be unused construction materials, salvaged highway appurtenances or other equipment and/or material for which the useful life extends beyond the construction contract.

Salvage, for credit to Federal funds, need not be a consideration under the following circumstances:

1. The value of the item(s) is less than \$5,000.
2. Salvageable item(s) become the contractor's property by virtue of the contract provisions.(See last paragraphs Subsection 104.10 of the Standard Specifications.)
3. The item(s) will be reused on a future project eligible under Title 23 U.S.C.
4. The cost of salvaging an item(s) would exceed the value of the item(s) salvaged.

If salvage credits are to be applied, the FHWA shall be made aware so that a fair market value may be determined.

If items are to be considered under No. 3 above, maintenance personnel need to be made aware, because certain record keeping will be involved.

4-133.00 CONSTRUCTION PLANS INDEX

The format used in the following construction index is to be adhered to on all construction projects.

The sheet names and sequence of sheets shown in Figure 4-2 are intended to establish a general order for placement of the sheets in the plans. Actual sheet numbers will be determined based on the sheets used on a specific construction project. If certain sheets are not used in the plans, those sheets are to be removed from the Index. However, 2nd sheets should maintain the sheet numbering as shown in Figure 4-2 and any omitted sheets should be listed below the index.

CONSTRUCTION INDEX OF SHEETS

TITLE SHEET 1

ROADWAY INDEX AND STANDARD ROADWAY DRAWINGS 1A

STANDARD ROADWAY DRAWINGS 1A1, 1A2

STANDARD TRAFFIC OPERATIONS & STRUCTURE DRAWINGS 1A3

PROJECT COMMITMENTS 1B

ESTIMATED BRIDGE QUANTITIES AND BRIDGE INDEX 2, 2-1, 2-2

ESTIMATED RETAINING WALL QUANTITIES AND INDEX 2A - 2A1

ESTIMATED ROADWAY QUANTITIES 2B - 2B1

ESTIMATED BOX BRIDGE QUANTITIES 2B2

ESTIMATED UTILITIES QUANTITIES AND SPECIAL NOTES 2B3

ESTIMATED RELOCATION QUANTITIES 2B4

ESTIMATED SIGNAL QUANTITIES AND SPECIAL NOTES 2B5

ESTIMATED LIGHTING QUANTITIES AND SPECIAL NOTES 2B6

TYPICAL SECTIONS AND PAVEMENT SCHEDULE 2C, 2D1, 2C2

GENERAL NOTES 2D, 2D1, 2D2

SPECIAL NOTES 2E, 3E1, 2E2

TABULATED QUANTITIES 2F, 2F1, 2F2

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RIGHT-OF-WAY NOTES, UTILITY NOTES and UTILITY OWNERS 3

RIGHT-OF-WAY ACQUISITION TABLE(S) and PROPERTY MAP(S) 3A - 3B

PRESENT LAYOUT(S) 4 - 10

RIGHT OF WAY DETAILS 4A - 10A

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PROPOSED PROFILE(S) 4C - 10C

RAMP PROFILE(S) 11 - 12

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PRIVATE DRIVE AND FIELD ENTRANCE PROFILE(S) 15 - 18

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ROADWAY CROSS SECTIONS 58- 254

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RETAINING WALL DETAILS R-R5B

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) INDEX S-1

UTILITIES INDEX U1-1

- ① Haul Road profiles follow Side Road profiles in the sheet numbering sequence.
- ② ITS plans differ from signals, signing, and/or lighting.

Figure 4-2
Typical Index of Sheets

4-135.00 GENERAL NOTES ON CONTRACT PLANS (See 6-100.00)

A list of general notes frequently used on project plans is included in Section VI. The designer shall place these notes on the "General Notes" second sheet series of the plans. Good engineering judgment is required in the use of these notes and any other notes in 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 in this document, unless there is an excellent reason for revising the wordage.

4-135.05 SPECIAL NOTES ON CONTRACT PLANS (See 6-200.00)

A list of special notes frequently used on project plans is included in Section VI. Special notes also include notes written specifically for the project or notes that vary in any way from the computerized list of general or special notes listed in Section VI. 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 Section VI.

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 be created.
5. Notes requested by the Environmental Division should be included 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 Special Notes indicating the location of the note.
6. 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

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.

<table border="1"> <tr> <td>TYPE</td> <td>YEAR</td> <td>PROJECT NO.</td> <td>SHEET</td> </tr> <tr> <td>CONST.</td> <td>2017</td> <td>ES22-000111</td> <td>3D</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	TYPE	YEAR	PROJECT NO.	SHEET	CONST.	2017	ES22-000111	3D					<p>SPECIAL NOTES</p> <p>(4) IF THE CONTRACTOR SHALL VERIFY THAT AN ASBESTOS SURVEY HAS BEEN COMPLETED PRIOR TO ANY DEMO, THAT THEY WILL REPORT REHABILITATION ACTIVITIES NOT INCLUDING ASPHALT MILLING OR OVERLAY).</p> <p>(5) ASBESTOS-CONTAINING MATERIALS (ACM) ABATEMENT IS THE REMOVAL OF ASBESTOS FROM A PROJECT. ASBESTOS-CONTAINING MATERIALS SHALL REMAIN CLEAR FOR THE CONSTRUCTION OF THE DEMO, REPAIR, OR REHABILITATION OF BRIDGES. SPECIAL ABATEMENT SHOULD BE ACCOMPLISHED PER SPECIFIC SPECIAL CONTRACT REQUIREMENTS. ASBESTOS-CONTAINING MATERIALS SHALL BE HANDLED AND DISPOSED IN ACCORDANCE WITH THE TDDO-MANDATE (19A) ASBESTOS ABATEMENT. WORK SHALL BE PERFORMED BY AN ACCREDITED FIRM (CONTRACTOR) USING APPROVED AIR-BORNE ASBESTOS AND SUPPLY METHODS TO AVOID THE RELEASE OF ASBESTOS INTO THE AIR.</p> <p>(6) TO THE TDDO, 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.</p> <p>RETAINING WALLS</p> <p>(1) THE (RIGHT-OF-WAY/EASEMENT) BETWEEN STATION TO STATION (MILEAGE) SHALL REMAIN CLEAR FOR THE CONSTRUCTION OF RETAINING WALLS. ANY MATERIALS SHALL BE PLACED THERE WITHOUT APPROVAL FROM STRUCTURES DIVISION.</p> <p>(2) THE OPTIONS FOR RETAINING WALL TYPES SHALL BE LIMITED TO THE APPROVED ALTERNATIVES AS SPECIFIED ON THE RETAINING WALL SHEET(S).</p> <p>(3) VALVE ENGINEERING CHANGE PROPOSALS WILL NOT BE ACCEPTED FOR RETAINING WALLS. (ITEM NUMBERS: 604-07_____)</p> <p>(4) ALL COST OF BUILDING, INSTALLING AND BACKFILLING THE RETAINING WALL SHALL BE INCLUDED IN THE BIDDING PRICE. THE COST OF LIVING SHALL AND ANOMALY SHALL BE INCLUDED IN THE COST OF THE RETAINING WALL. COSTS FOR EXCAVATION OF THE WALL SHALL BE INCLUDED IN THE BIDDING PRICE. THE CONTRACTOR SHALL PROVIDE A WRITTEN WAD. END AREA FOR EXCAVATION FOR THE WALL SHALL BE INCLUDED IN END AREA TOTALS ON CROSS-SECTIONS.</p> <p>PAVEMENT</p> <p>RESURFACING</p> <p>(1) TRAFFIC WILL BE ALLOWED TO TEMPORARILY DRIVE ON THE MILLED SURFACE OF THE ROADWAY UNDER THE FOLLOWING CONDITIONS ONLY:</p> <ul style="list-style-type: none"> a. THE MILLED SURFACE IS FINE TEXTURED. THE FINE TEXTURE SHALL BE OBTAINED BY A MILLING MACHINE UTILIZING A MILLING HEAD WITH MINUTE PACKING 3/8" OR LESS OPERATING AT LESS THAN 80 FEET PER MINUTE. b. THE SURFACE SHALL BE SWEEP AND CLEANED OF ALL LOOSE MATERIALS. c. THE DIFFERENCE IN ELEVATION BETWEEN THE MILLED SURFACE AND THE ADJACENT LANE SHALL NOT EXCEED 1.12 INCHES. d. THE MILLED SURFACE SHALL BE PAVED WITHIN 72 HOURS IF THE CURRENT AOT IS > 70,000 OR WITHIN 96 HOURS IF THE CURRENT AOT IS < 70,000. e. RAIN OR INCLEMENT WEATHER IS NOT EXPECTED OR FORECASTED WITHIN 48 HOURS AFTER MILLING. f. ALL APPLICABLE SIGNING IS INSTALLED IN ACCORDANCE WITH THE TDDO MANDATE (19A) AND ALL APPROVED WARNING SIGN (19A) BE PLACED IN ADVANCE OF ANY MILLED AREAS. g. IF MILLED SURFACE BEGINS TO DETERIORATE. PAVING TO COVER UP DETERIORATING MILLED SURFACES SHOULD OCCUR AS DIRECTED BY THE SUPERVISOR DURING THE NEXT WORKING DAY. REPAIR WORK BUSINESS OCCURS, MILLAGE REPAIRS WILL BE REQUIRED. <p>DEMOLITION</p> <p>DEMOLITION OF BUILDINGS</p> <p>(1) IF THE ASBESTOS SURVEY AND ABATEMENT IS NOT PART OF THE ON THE TDOT HAZARDOUS MATERIALS OFFICE (HMO) SURVEY AND 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 HAZARDOUS MATERIAL OFFICE IN SCHEDULING A SURVEY.</p> <p>(2) ASBESTOS-CONTAINING MATERIALS (ACM) ABATEMENT SHALL BE COMPLETED PRIOR TO ANY DEMOLITION ACTIVITIES FOR BUILDINGS. ALL ASBESTOS-CONTAINING MATERIALS SHALL BE REMOVED AND USED PER USED MATERIALS PROVISIONS AND BE REMOVED IN ACCORDANCE WITH TDDO MANDATE (19A) ASBESTOS ACCREDITATION REQUIREMENTS (19A) 1200-04-1201 MANDATE THAT ACM (CONTRACTOR) USING ACCREDITED ABATEMENT WORKERS AND SUPERVISORS.</p> <p>(3) THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING A NOTICE TO THE TDDO, DIVISION OF AIR POLLUTION CONTROL TEN (10) DAYS IN ADVANCE OF ANY DEMO, REPAIR, OR REHABILITATION OF A STRUCTURAL COMPONENT INVOLVING THE REMOVAL/REPLACEMENT OF A STRUCTURAL COMPONENT.</p> <p>DEMOLITION, REPAIR, OR REHABILITATION OF BRIDGES</p> <p>(4) THE CONTRACTOR SHALL VERIFY THAT AN ASBESTOS SURVEY HAS BEEN COMPLETED PRIOR TO ANY DEMO, THAT THEY WILL REPORT REHABILITATION ACTIVITIES NOT INCLUDING ASPHALT MILLING OR OVERLAY).</p> <p>(5) ASBESTOS-CONTAINING MATERIALS (ACM) ABATEMENT IS THE REMOVAL OF ASBESTOS FROM A PROJECT. ASBESTOS-CONTAINING MATERIALS SHALL REMAIN CLEAR FOR THE CONSTRUCTION OF THE DEMO, REPAIR, OR REHABILITATION OF BRIDGES. SPECIAL ABATEMENT SHOULD BE ACCOMPLISHED PER SPECIFIC SPECIAL CONTRACT REQUIREMENTS. ASBESTOS-CONTAINING MATERIALS SHALL BE HANDLED AND DISPOSED IN ACCORDANCE WITH THE TDDO-MANDATE (19A) ASBESTOS ABATEMENT. WORK SHALL BE PERFORMED BY AN ACCREDITED FIRM (CONTRACTOR) USING APPROVED AIR-BORNE ASBESTOS AND SUPPLY METHODS TO AVOID THE RELEASE OF ASBESTOS INTO THE AIR.</p> <p>(6) TO THE TDDO, 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.</p> <p>GRADING</p> <p>(1) THE GRADING TABULATIONS AND RESULTING EARTHWORK ASSOCIATED WITH THIS PROJECT SHALL BE PREPARED FOR THE SUBMITTAL OF ALL SPECIAL INFORMATION IS PROVIDED FOR REFERENCE INFORMATION AND ESTIMATION GUIDANCE ONLY.</p> <p>(2) BORING DEPTCTIONS SHOWN ON THE FOUNDATION DATA SHEETS, SOIL SHEET S, PLANS, AND CROSS-SECTIONS INDICATE SOIL AND ROCK QUANTITIES SHOWN IN THE GRADING TABULATION OR OTHERWISE IN THE PROJECT OF SIMILAR NATURE, SCOPE AND LOCATION IN PREPARATION OF HIS BID FOR EARTHWORK ITEMS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONDUCT THE EXCAVATION ACTIVITIES IN ACCORDANCE WITH PLANS AND SPECIFICATIONS.</p> <p>(3) EARTHWORK IS PAID FOR UNDER ITEM 203.01. ROAD AND DRAINAGE EXCAVATION (UNCL ASSIGNED). NO ADDITIONAL PAYMENT WILL BE MADE FOR EXCAVATION OF MATERIALS EXCEEDING THE QUANTITIES SHOWN IN THE GRADING TABULATION OR OTHERWISE IN THE PLANS ARE INACCURATE WITH RESPECT TO THE TYPE OF MATERIALS EXCAVATED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION OR AS AMENDED IN SUPPLEMENTAL SPECIFICATIONS.</p> <p>SIGNALIZATION</p> <p>(1) THE DESIGN OF TRAFFIC SIGNAL SUPPORT POLES, MAST ARMS, STANION POLES, ETC. SHALL BE IN CONFORMANCE WITH THE ASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS. TRAFFIC SIGNAL STRUCTURES SHALL BE DESIGNED FOR CANTILEVERED TRAFFIC SIGNAL STRUCTURES SHALL BE DESIGNED FOR FATIGUE CATEGORY 1.</p> <p>(2) THE TRAFFIC SIGNAL SUPPORT POLES SHALL BE DESIGNED IN ACCORDANCE WITH THE ASHTO STANDARD SPECIFICATIONS FOR TRAFFIC SIGNALS (CURRENT EDITION WITH ADDENDUM). WIND LOADS SHALL BE BASED ON A BASIC WIND SPEED OF 90 MPH WITH A 10% EXCEEDANCE. TRAFFIC SIGNAL STRUCTURES SHALL BE DESIGNED FOR FATIGUE CATEGORY 1. FATIGUE LOADS ARE BASED ON THE REQUIREMENTS OF THE ASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL LOADS PER 11.7 OF THE SUBJECT ASHTO DOCUMENT AND THE FOLLOWING LOADS:</p> <ul style="list-style-type: none"> a. GALLONS - NO DESIGN NECESSARY. MERTON DIMENSIONERS 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. <p>(3) THE TRAFFIC SIGNAL SUPPORT POLES SHALL BE POLES WITH CURVED CANTILEVERED ARMS) IN ACCORDANCE WITH METRO PUBLIC WORKS, FOR POLE AND ARM DETAILS. CONTACT MIKE HERTZER AT 615 880-3261.</p> <p>EROSION PREVENTION AND SEDIMENT CONTROL</p> <p>ENVIRONMENTAL</p> <p>(1) STAFF FROM THE BEST ENVIRONMENTAL DIVISION, CONFORMANCE AND FIELD SERVICES OFFICE SHALL BE INVITED TO ALL PRE CONSTRUCTION MEETINGS.</p> <p>ECOLOGY</p> <p>(2) STAFF FROM THE BEST ENVIRONMENTAL DIVISION OR A DESIGNER SHALL ADVISE THE CONTRACTOR DURING THE PRE CONSTRUCTION MEETING WHEN ENVIRONMENTAL DIVISION PERSONNEL OR A DESIGNATED REPRESENTATIVE FROM THE BEST ENVIRONMENTAL DIVISION WHICH COULD AFFECT WATERS OF THE STATE. U.S. OR SPECIFIC STATE AGENCIES.</p> <p>(3) STAFF FROM THE BEST ENVIRONMENTAL DIVISION OR A DESIGNER SHALL ATTEND THE PRE CONSTRUCTION MEETING FOR ALL PROJECTS WHICH HAVE THREATENED OR ENDANGERED SPECIES OR CRITICAL HABITAT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE NECESSARY PERSONNEL AND SUBCONTRACTORS ARE MADE AWARE OF THE NECESSARY PRECAUTIONS THAT MUST BE FOLLOWED.</p> <p>(4) ALL PROJECTS WITH LEGALLY PROTECTED SPECIES OR CRITICAL HABITAT SHALL BE AWARE OF THE NECESSARY PRECAUTIONS THAT MUST BE FOLLOWED. DUST, CEMENT DUST AND ALL OTHER MATERIALS. THESE MATERIALS ARE NOT ALLOWED TO ENTER WATERS OF THE STATE.</p> <p>SCALES BY</p> <p>STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION</p> <p>SPECIAL NOTES</p>
TYPE	YEAR	PROJECT NO.	SHEET										
CONST.	2017	ES22-000111	3D										

Figure 4-3B Example of Special Notes Sheet 4-11

4-136.00 PROJECT COMMITMENTS SHEET IN CONSTRUCTION PLANS

All environmental commitments as well as any other commitments made during the planning and development of the project will be required to be added to the project commitments page found in Project Manager on PPRM. Those commitments will then be required to be included on a separate project commitments sheet in the construction plans.

In order to ensure that all environmental commitments required are included in the construction plans, environmental staff will be required to verify that all project commitments are included in the construction plans as part of the construction re-evaluation.

The project commitments sheet shall be developed using the project commitments sheet excel template developed by the CADD Section. The sheet shall be placed in the plans as sheet 1B or the first 1 sheet in the plans after the Roadway Index and Standard Drawing Index sheet. For projects with no project commitments, the following note shall be placed at the bottom of the Index of Sheets, "No project commitments sheet included in this set of plans."

The following procedures shall be used for identifying project commitments and developing the project commitments sheet.

1. It will be the responsibility of the project manager or the division responsible for the project commitment to place the project commitment into PPRM on the project commitments page found in Project Manager.
2. Design manager and design supervisor will be responsible for checking the project commitments page in PPRM and supplying the commitment information to in-house designers and consultants to develop the project commitments sheet.
3. The project commitments sheet shall be developed at the beginning of construction plans development and updated as needed prior to distributing plans or .PDF plans for permit applications, construction field review, and final construction plans submittal.
4. Each commitment shown on the project commitment sheet shall contain the commitment ID, source division, commitment description, and the station/location.
5. Design managers 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.
6. Project commitments are intended to include commitments made during the development of the environmental document, to mitigate environmental impacts, or 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. In the event that the design manager believes a commitment has been added that is not warranted, the design manager will notify the assistant director in design responsible for the project. The assistant director will follow up with the

appropriate person or persons in the division which added the commitment to determine if the commitment is appropriate.

Figure 4-4 shows an example of the Project Commitments Sheet.

TYPE	YEAR	PROJECT NO.	SHEET NO.

PROJECT COMMITMENTS			
COMMITMENT ID	DESCRIPTION	SOURCE DIVISION	STA. / LOCATION
STR4001	THE CONTRACTOR SHALL NOT DISPOSE OF ANY MATERIAL EITHER ON OR OFF THE PROJECT OR IN ANY ADJACENT AREAS WITHOUT THE APPROVAL OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY WITHOUT APPROVAL BY THE SAME. ALL MATERIAL SHALL BE DEPOSED IN UPLAND (NONWETLAND) AREAS AND ABOVE ORDINARY HIGH WATER ELEVATION.	STRUCTURES	100+00 / LEFT OF C.L. NEAR BRIDGE END

FILE NO.

DESIGN DIVISION

TENNESSEE 0.1.

SCALE: 3/4"

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

**PROJECT
COMMITMENTS**

Figure 4-4
Example of Project Commitments Sheet

4-137.00 ADDITION OF UTILITY SHEETS TO CONSTRUCTION PLANS

The Commissioner is authorized to reimburse utilities for the cost of utility relocation as established by Tennessee Code Annotated, Title 54, Chapter 5, Part 8. As a result of this legislation, utilities will have the option of including their relocations in the Department's plans for certain projects. Construction plans for local controlled projects may include utility relocation plans if requested by the local government.

The Regional Utilities Office will submit a pdf of Utility Sheets, Utility Relocation Plans, and a Utilities Index Sheet directly to the FileNet and notify by email EPlans.Turnins@tn.gov for letting, just as roadway and structure plans are submitted. If utilities are to be included in the construction contract, the Utilities Office will also submit estimated utility quantities to the Design Manager. The roadway designer will be responsible for developing the "Estimated Utility Quantities Sheet" to be included in the roadway plans, using quantities provided by the Design Manager.

In order to establish a uniform procedure for adding utility estimated quantities and sheets to the plans the following guidelines will be used:

1. The Design Manager shall contact the Regional Utilities Office approximately fourteen (14) weeks prior to the letting date to determine if utilities will be included as part of the construction contract. (Responsible Office: Design)
2. The Utilities Office will submit estimated utility quantities (in excel .xls format) with **assigned item numbers, units of measurement, and descriptions** to the Design Manager a minimum of twelve (12) weeks prior to the letting. (Responsible Office: Utilities)
3. Sheet No. 2B3 will be used for the "Estimated Utilities Quantities and Special Notes" sheet. If more than one sheet is needed, additional sheets shall be numbered "2B3A, 2B3B, 2B3C, etc. The following footnote should be added to sheet 2B3: "See Sheet U1-1 for index of utility sheets. Applicable footnotes for Estimated Utilities Quantities will be on the utility tabulation blocks." (Responsible Office: Design)
4. The Utilities Office will be responsible for the Utility Estimate. The Utilities Office will supply the Estimating and Bid Analysis Office with the estimate file and unit prices for all utility items included in the plans. (Responsible Office: Utilities)
5. Sheet No. U1-1, "Utilities Index, Utility Owners, and Utility Sheets" will be shown in the "Roadway Index" after the Cross Sections. If there are no Utility Sheets in the plan set the designer will place the note: "No Utility Sheets" at the bottom of the index. (Responsible Office: Design)
6. All utility sheets (including utility relocation sheets) and utility owners shall be listed on Sheet U1-1, "Utilities Index, Utility Owners, and Utility Sheets." This sheet may include the first utility sheet or it may follow as Sheet U1-2. See Figure 4-5. For format of Utility Owners see Figure 4-6. (Responsible Office: Utilities)
7. All utility sheets (including utility relocation sheets) will use the standard TDOT box in the upper right corner to identify the sheet. See Figure 4-7. (Responsible Office: Utilities)

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8. All sheets shall be placed onto FileNet under the name nnnnnn-nn-Utility.pdf and a notification shall be sent to Eplans.Turnins@tn.gov (Responsible Office: Utilities)
9. An engineer licensed in the State of Tennessee shall seal utility relocation sheets. (Responsible Office: Utilities)
10. Revisions to utility sheets will follow the revision procedure for Letting (See Section 4-140.02) or Construction (See Section 4-150.00).
11. Utility quantities and item numbers will be consistent with the units of measurement used for the roadway plans. (Responsible Office: Utilities)

UTILITIES INDEX (EXAMPLE)

SHEET NAME	SHEET NUMBER
Utilities Index, Utility Owners, and Utility Sheets	U1-1 – U1-xx
Electrical Relocation Sheets	U2-1 – U2-xx
Water Relocation Sheets	U3-1 – U3-xx
Sewer Relocation Sheets	U4-1 – U4-xx
Gas Relocation Sheets	U5-1 – U5-xx
Cable TV Relocation Sheets	U6-1 – U6-xx
TVA Relocation Sheets	U7-1 – U7-xx

Figure 4-5
Typical Utilities Index

UTILITY OWNERS AND CONTACTS

Water:

Metro Water and Sewer
 P.O. Box 123
 Nashville, TN 37243
 Contact: John Smith
 Telephone: 615-555-1212
 Fax: (if available)
 Email: (if available)

Electrical:

Nashville Electric
 1000 Church Street
 Nashville, TN 37216
 Contact: Mike Jones
 Telephone: 615-555-1234
 Fax: (if available)
 Email: (if available)

Sewer:

Metro Water and Sewer
 P.O. Box 123
 Nashville, TN 37243
 Contact: Bill Williams
 Telephone: 615-555-1213
 Fax: (if available)
 Email: (if available)

Figure 4-6
 Typical Format for Utility Owner Information

TYPE	YEAR	PROJECT NO.	SHEET NO.
CONST.	2003	NH-I-40-7(157)359	U1-1

Figure 4-7
 Upper Right Hand Corner Box

1. Use "**CONST.**" for the type project. The designation "ROW" should not be added since utility sheets are not included in the right-of-way plans.
2. Use year project is let for construction.
3. Insert federal construction project number. If not a federal project, use the state construction project number.

4-138.00 ADDITION OF SWPPP SHEETS TO CONSTRUCTION PLANS

For a project with disturbed acreage of 1 acre or greater a SWPPP will be required. The Environmental Division, Natural Resources Office will create the SWPPP sheets.

The Designer will be responsible for adding the SWPPP Sheets Index (S-1) to the index.

The Environmental Division, Natural Resources Office will submit the final SWPPP sheets onto FileNet under the file name: nnnnnn-nn-SWPPP.pdf and a notification shall be sent to Eplans.Turnins@tn.gov.

4-139.00 ADDITION OF NATURAL STREAM DESIGN SHEETS TO CONSTRUCTION PLANS

For a project involving stream relocation the Environmental Division, Natural Resources Office will determine if a Natural Stream Design is required, and will notify the designer in the Permit Assessment.

The roadway designer will not be responsible for developing the Natural Stream Design.

The Designer will be responsible for adding the Estimated Natural Stream Design Quantity Sheet and the Natural Stream Design Plans Index (NS-1) to the index.

- Sheet No. 2C (2C1, 2C2, etc., if needed) will be used for the Natural Stream Design Quantity Sheet.

The designer is not responsible for showing the natural stream design on the proposed sheets, however the designer 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.

The Environmental Division, Natural Resources Office will submit the final Natural Stream Design Plan onto FileNet under the file name: nnnnnn-nn-NSD.pdf and a notification shall be sent to Eplans.Turnins@tn.gov.

4-140.00 SUBMITTAL OF CONSTRUCTION PROJECT PLANS

Final sealed and signed construction plans shall be posted onto FileNet and the Construction Plans Submittal Letter (see Figure 4-8) shall be emailed to Eplans.Turnins@tn.gov, TDOT.EstimatingOffice@tn.gov, and CC the submittal notice to the appropriate Project Development Director. (See Table 3-6 in Section 3 Right-of-Way Plans of the Roadway Design Guidelines for when notification is to be sent to the Environmental Division). For projects involving railroads, also copy the Railroad Coordinator on the submittal notice and note in the email that railroad is involved. For projects with oversight from a project manager, CC the submittal notice to the individual project manager working on the project.

A copy of the Right-of-Way Title Sheet and construction plans submittal letter shall also be attached at the front of the pdf.

The email subject line shall include the Region, County, State Route Number or Route Name, PIN, "Construction Turn-in".

If the project includes grading quantities, a pdf copy of the grading quantity calculation sheets will be emailed to Eplans.Turnins@tn.gov.

4-140.02 LETTING REVISIONS

The determination of a letting revision will be made by the Headquarters Construction Office. An estimate revision may or may not require a Letting Revision. The designer should check with the Printing Services Office to see if the plans have been printed. If the plans have not been printed the revised sheets may be swapped out without formal revision.

The Design Manager responsible for the project will upload the revised plan set to Design FileNet (See Roadway Design Guidelines Chapter 1-105.10 – Letting Revision FileNet Submittal Package) and submit an email notification to the appropriate personnel (See Roadway Design Guidelines Chapter 1-502.01-Internal Distribution Table 1-12). The email will contain the Revision Letter, the Estimate Revision Request (.xltx) form (Figure 4-9) and a pdf of the revised sheets only. In the event that the pdf is larger than the email limit, then the pdf should be broken down into smaller files and additional emails sent. In the body of the email add the following note:

ATTENTION PRINT SHOP: 1 set of 11" x 17" prints of the revised sheets only is requested for the HQ Construction Office. Please contact their office when the prints are ready to be picked up.

Letting Revision Distribution for projects with the following prefixes: **I, IM, ID, NH-1, STP-1, CM-1, MA-1, IXA-1, BR-1 and DPI**; also must send the following:

- FHWA Division, Project Management Engineer W/1 set prints (half size) & 4 copies of the letter

The email subject line shall include the Region, County, State Route Number or Route Name, PIN, "Letting-Revision"

Estimate Revisions

An "Estimate Revision Request" form, shown in Figure 4-9, must be filled out anytime a quantity is changed after the submission of the construction estimate and/or a Letting Revision is issued. 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 state estimate. The completed form shall be attached to the letting revision notification email.



CONSTRUCTION PLANS SUBMITTAL

TO: Plans Assembly, Eplans.Turnins@tn.gov

FROM:

DATE: [Click here to enter a date.](#)

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

The following completed Construction Plan items for the referenced project are being transmitted for the [Click here to enter a date](#) Letting Process.

- Original Construction Drawings (____ Sheets)
- Original Roadway Cross-Sections (____ Sheets)
- Original R.O.W. Title Sheet
- Grading Quantities (*nnnnnn-nn-GradingQuantities.pdf*) (Email Only)
- Resurfacing Plans (____ Sheets)
- Estimate *nnnnnn-nn-ConstructionEstimate.xlsx* (Excel file placed on FileNet and attached in Email distribution)
- Project has railroad involvement

The following items were placed on FileNet [Click here to enter a date.](#)

1. PDF Filename: *nnnnnn-nn-Construction.pdf*
2. ZIP Filename: *nnnnnn-nn-Construction.zip*
3. Estimate: *nnnnnn-nn-ConstructionEstimate.xlsx*

Item 1 shall be a PDF Portfolio including Construction transmittal letter and complete plan set containing each sealed sheet.

Item 2 shall include all MicroStation and GEOPAK files.

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

Email notification including PDF of Construction Transmittal Letter, Grading Quantities, and Estimate

CC: Bid Analysis and Estimating Office: TDOT.EstimatingOffice@tn.gov
 Construction Estimates (HQ): TDOT.Construction.Estimates@tn.gov
 District Operations: [Choose District](#)
 Environmental Coordinator (Regional): [Choose Region](#)

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Environmental Division:	TDOT.Env.AirNoise@tn.gov TDOT.Env.Archaeology@tn.gov TDOT.Env.Ecology@tn.gov TDOT.Env.HazmatOffice@tn.gov TDOT.Env.Historic@tn.gov TDOT.Env.NEPA@tn.gov TDOT.Env.Permits@tn.gov
Geotechnical Engineering Section:	TDOT.Geotech@tn.gov
Operations Director (Regional):	Choose Region
Printing Services Superintendent:	TDOT.PrintShopLettinginfo@tn.gov
Program Development & Scheduling Division:	TDOT.PDSO@tn.gov
Project Development Director (Regional):	Choose Region
Right-of-Way Director (HQ):	TDOT.HQ.ROW@tn.gov
Note in distribution if railroad involved	
Right-of-Way Office (Regional):	Choose Region
Roadway Design Division File Room	TDOT.DesignFileRoom@tn.gov
Strategic Transportation Investment Division	Choose Region
Structures Division:	
If plans include Structures	TDOT.Structures@tn.gov
If plans include Retaining Walls	TDOT.StructuresRW@tn.gov
Traffic Operations Division:	
If plans include ITS Communication	TDOT.ITS@tn.gov
If plans include signals and/or lighting	TDOT.SignalsLighting@tn.gov
Traffic Office (Regional):	Use individual email address
Utility Office (Regional):	Choose Region

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Figure 4-8
Example Construction Plans Submittal Letter

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English

Revised: 08/01/19

ESTIMATE REVISION REQUEST



Project No. 1: _____ PIN: _____ Submitted By: _____
 Project No. 2: _____ County: _____ Revision Date: _____
 Project No. 3: _____ Project Description: _____

CHANGES ITEM NO.				ADDITIONS			DELETIONS ITEM NO.
	QUANTITY PROJECT 1	QUANTITY PROJECT 2	QUANTITY PROJECT 3	ITEM NO.	QUANTITY PROJECT 1	QUANTITY PROJECT 2	

NOTE: ESTIMATE REVISION REQUEST FORM MUST BE SUBMITTED DURING THE LETTING PROCESS WHEN PLANS HAVE BEEN SUBMITTED FOR CONSTRUCTION, AND A CHANGE, ADDITION, OR DELETION OF AN ITEM NUMBER IS NEEDED PRIOR TO THE PROJECT BEING LET. THIS FORM SHALL NOT BE SUBMITTED AFTER PROJECT HAS BEEN LET TO CONTRACT. REFER TO TABLE 1-2, INTERNAL DISTRIBUTION LIST FOR RECIPIENTS EMAIL ADDRESSES.

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Figure 4-9
Estimate Revision Form

4-140.03 ITEM NUMBERS

Item numbers, item descriptions, and units of measurement which are to be used with the January 1, 2015 Standard Specifications for Road and Bridge Construction Book are available at the following website:

<https://www.tdot.tn.gov/APPLICATIONS/RoadwayItems>

The list is updated daily by the Construction Division. A list of the item numbers and descriptions is not printed in the Design Guidelines or Instructional Bulletins.

If a Roadway Design item number is needed, the Design Manager should contact the HQ Roadway Design Division at TDOT.Design@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.

4-140.05 CONSTRUCTION QUANTITIES ESTIMATE DATA FILE

The construction quantities estimate is an Excel file, as shown in Figures 4-10a and 4-10b. Designers shall use a new template for each project. The template shall not be modified.

The templates are available in the self-extracting archive, 2ndSheets.exe at:

<https://www.tn.gov/content/tn/tdot/roadway-design/design-standards/design-cadd-files.html>

Instructions for use of these templates are in **2ndSheetsV8.pdf**, also at the same site.

The Excel estimate templates will accommodate projects with one, two or three State project numbers. For jobs with more than three State project numbers, contact the Estimates and Bid Analysis Office for instructions.

No prices are to be entered in the estimate. Quantities cannot contain commas.

All items shall be listed in numerical order, regardless of the order they are listed in the plans.

SUBTOTAL CODES: (See **2ndSheetsV8.pdf** for detailed instructions)

- a) Roadway items shall be listed on a sheet separate from the Box-Bridge items. The sheet name for Roadway items must start with **Col**.
- b) Box-Bridge items shall be listed on a sheet separate from the Roadway items. The sheet name for Box Bridge items must start with **Box**.
- c) Alternate Roadway items shall be listed after all of the other roadway items. The alternates will be designated in column C as Alternate AA1, Alternate AA2, Alternate AA3, Alternate AB1, Alternate AB2, etc. Alternates AA1 would alternate

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with AA2 and AA3. AB1 would alternate with AB2, etc. Include a blank row between each alternate section.

- d) Non-participating items are listed by column as designated on the **Proj Data** sheet.

4-140.06 SUBMITTAL OF CONSTRUCTION QUANTITIES ESTIMATES

For in-house design projects, the designer should place the completed construction estimate Excel file on FileNet at the time final plans are submitted. The Excel file shall also be emailed to: TDOT.Construction.Estimates@tn.gov, TDOT.EstimatingOffice@tn.gov and CC to TDOT.PDSO@tn.gov. A copy of the email shall be placed in the project folder to document the submittal of the construction estimate.

For consultant design projects, the completed Excel file is to be forwarded with the final construction plans to the Design Manager for submittal. Submittal may be on either CD, DVD, or via email. The manager should place the construction estimate Excel file on FileNet at the time final plans are submitted. The Excel file shall also be emailed to: TDOT.Construction.Estimates@tn.gov, TDOT.EstimatingOffice@tn.gov and CC to TDOT.PDSO@tn.gov. A copy of the email shall be placed in the project folder to document the submittal of the construction estimate.

In the subject line of the email state the following information: "County: PIN."

The following information is also required at the time of Construction plans submittal:

1. If the project includes right-of-way removal items, the unit prices furnished by the Right-of-Way Office will be shown in the unit price column of the submitted estimate. A copy of the letter from the Right-of-Way Office stating the values of the various removal items shall be submitted to the Estimating and Bid Analysis Office. All other unit prices will be set by the Estimating and Bid Analysis Office.
2. If the project includes non-participating items, any information concerning price will be furnished to the Estimating and Bid Analysis Office.

Any and all changes to the items after submittal must be revised in accordance with the Plans and Estimates Revision guidelines. (See Section 4-140.02.)

If further information is required, please contact the Estimating and Bid Analysis Office.

4-140.07 SUBMITTAL OF PRELIMINARY CONSTRUCTION QUANTITIES ESTIMATES (See 3-400.15)

Refer to Section 3-400.15 for procedures to submit preliminary construction quantities estimates.

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	A	B	C	D
1		Project No. 1 Data	Project No. 2 Data	Project No. 3 Data
2	State Project Number	04002-8218-14	04003-3218-94	
3	Federal Project Number	STP/HSIP-30(79)	STP/HSIP-30(79)	
4	Non-Participating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Project Description	From VanBuren County Line To East of Bob Sapp Road	From VanBuren County Line To East of Bob Sapp Road	
7	Letting Date	February 9, 2018		
9	Project Type	Resurfacing	Safety	
10	Units	English 2000	English 2000	
12	County	Bledsoe	Bledsoe	
13	Route	SR-30	SR-30	
14	Road Name			
17	Project Length	5.58 miles	5.58 miles	
18	Beginning Station			
19	Ending Station			
20	Beginning Log Mile	0.00	0.00	
21	Ending Log Mile	5.58	5.58	
22	North Coordinate			
23	East Coordinate			
24	Longitude	-85.253436	-85.253436	
25	Latitude	35.675467	35.675467	
27	Roadway Designer	Diane Evitt		
28	Roadway CE Manager 2	Robert Rodgers		
29	Date Turned In	11-17-17		
31	Bridge Required	No		
32	Bridge Designer			
33	Bridge CE Manager			
35	Estimate Type	Construction		
36	Quantities Calculation Date			
37	Quantities Updated Date			
38				
39				
40	Email this File	TDOT Employees send this file by email to:		
41		Estimates, TDOT.Preliminary or Estimates, TDOT.Construction		
41		ijprelim ijconst		
42		Put the right-of-way or construction number into the subject line on the email.		
42		Project Data / Col #1-Est. Rdwy. Quantities / Col #2-Est. Rdwy. Quantities / Box Bridge Quantities		
42	Ready			

Figure 4-10a
Construction Quantities Estimate Data File Template

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ESTIMATED ROADWAY QUANTITIES					
ITEM NO.	DESCRIPTION	UNIT	ROADWAY QUANTITY 04002-8218-14	SAFETY QUANTITY 04002-3218-94	QUANTITY TOTAL
(1) 303-01	MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON		80	80
403-01.10	HIGH PERFORMANCE FOG SEALS	S.Y.	8593		8593
(1) 705-02.10	GUARDRAIL TRANSITION 27IN TO 31IN	EACH		4	4
705-06.20	TANGENT ENERGY ABSORBING TERM MASH TL-3	EACH		4	4
(1)(2) 706-01	GUARDRAIL REMOVED	L.F.		200	200
(5) 712-01	TRAFFIC CONTROL	LS	1		1
(3) 712-06	SIGNS (CONSTRUCTION)	S.F.	545		545
(8) 716-01.21	Smwp/ble Pvmt Mrks (Bi-Dir)(1 Color)	EACH	370		370
716-02.05	PLASTIC PAVEMENT MARKING (STOP LINE)	L.F.	175		175
716-02.08	PLASTIC PAVEMENT MARKING (8" DOTTED LINE)	L.F.	58		58
(4) 716-03.07	PLASTIC WORD PAVEMENT MARKING (STOP)	EACH	1		1
716-04.04	PLASTIC PAVEMENT MARKING (TRANSVERSE SHOULDER)	L.F.	37		37
(6) 716-05.01	PAINTED PAVEMENT MARKING (4" LINE)	L.M.	2.5		2.5
716-13.02	SPRAY THERMO PVMT MRKNG (60 mil) (6IN LINE)	L.M.	13.6		13.6
717-01	MOBILIZATION	LS	1		1
ALTERNATE AA1					
403-01.01	BITUMINOUS MATERIAL FOR TACK COAT (MICRO-SURFACING)	TON	13		14
(7) 414-03.03	MICRO SURFACING	S.Y.	78468		78468
ALTERNATE AA2					
403-01	BITUMINOUS MATERIAL FOR TACK COAT (TC)	TON	26		27
(7) 411-03.05	ACS MIX(PG64-22) THIN LIFT ASPHALT	S.Y.	78468		78468

Figure 4-10b
Construction Quantities Estimate Data File Template

4-140.09 ESTIMATE CONFIDENTIALITY

The designer 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 designers 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 a Manager in the Roadway Design Division. 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 designers 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 your Manager for proper handling.

4-145.00 FIELD REVIEW PROCEDURES (See 1-120.00, 2-315.00 and 2-315.05)

On interstate resurfacing and controlled access resurfacing projects with interchanges, the designer shall inspect guardrail on all ramps and crossroads, which are State Routes within the access control limit of the interchange, and upgrade guardrail to current standards.

4-150.00 CONSTRUCTION REVISIONS

When a project has been awarded to construction, and a change becomes necessary anywhere on the project, a Construction Plans revision is required. The Design Manager responsible for the project will upload the revised plan set to Design FileNet (See Roadway Design Guidelines Chapter 1-105.11 – Construction Revision FileNet Submittal) and submit an email notification to the appropriate personnel (See Roadway Design Guidelines Chapter 1-502.01- Internal Distribution Table 1-12). The email will contain the revision letter and a pdf of the revised sheets only. In the event that the pdf is larger than the email limit, then the pdf should be broken down into smaller files and additional emails sent. The contract number for the project shall be noted in the revision letter, added to the email subject and included in the appropriate space on FileNet. Note: A ROW Revision may also be required.

Construction Revision Distribution for projects with the following prefixes: **I, IM, ID, NH-1, STP-1, CM-1, MA-1, IXA-1, BR-1 and DPI**; also must send the following:

- FHWA Division, Projects Management Engineer W/1 set prints (half size) & 4 copies of the letter

The email subject line shall include the Region, County, State Route Number or Route Name, PIN, "Construction-Revision"

CHAPTER 2 - EARTHWORK

4-202.00 REMOVAL OF STRUCTURE

When the proposed structure is a girder bridge, the removal items for the existing structure(s) shall be placed on the Estimated Structure Quantities sheet and numbered in sequence beginning with Item No. 202-04.01 and continuing through Item No. 202-04.49, as required.

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. 202-04.99, 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.

4-202.01 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

When Item No. 202-01, Removal of Structures and Obstructions, Lump Sum, or Item No. 202-01.50, Removal of Structures and Obstructions, 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.

4-202.10 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 4-11.

REMOVAL OF BUILDINGS AND OBSTRUCTIONS DESCRIPTION BLOCK		
PAY ITEM	TRACT NO.	DESCRIPTION

NO ADDITIONAL COMPENSATION WILL BE MADE FOR THESE REMOVALS.

Figure 4-11
Removal of Buildings and Obstructions Description Block

4-202.13 ABANDONMENT OF WATER WELLS (See 4-625.00)

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 Tennessee Water Management Division, in accordance with Section 3-130.00 of these guidelines.

4-203.00 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 Construction 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 Construction Field Review by the Roadway Design Division.

4-203.02 DEFINITION OF TERMS USED FOR EARTHWORK GRADING CALCULATIONS

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 to determine appropriate shrink or swell factors. Some geotechnical reports may provide project specific recommendations for shrink and swell factors. It is recommended that the designer contact the Geotechnical Engineering Section (TDOT.Geotech@tn.gov) 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 fairly 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 2-145.10 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 that relatively 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 Section 2-145.10 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 fairly readily 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 in section 4-203.02) 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 pinnaced 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.

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.

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.

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 Geotechnical Section 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 Section 6-200.00 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_."

4-203.05 SHRINKAGE AND SWELL FACTORS (See 2-145.10)

4-203.10 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 Standard Specifications.

4-203.15 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.

4-203.20 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. This item shall be paid for as follows:

Item No. 203-02.01 - Borrow Excavation (Graded Solid Rock) - Ton

Use a factor of 1.7636 tons per cubic yard for estimating quantities.

4-203.25 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, which, 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 construction 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 4-12, 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. For projects with more than one structure, each site shall be estimated, and an item per site used. Use the Roadway Approach Item No. 203-30.01 followed by 203-30.02, etc.

ALL COSTS OF THESE ESTIMATED QUANTITIES TO BE INCLUDED IN PRICE BID FOR ROADWAY APPROACHES ITEM NO. 203-30.01							
Road & Drain Exc. (Uncl.)	Borrow Excavation (Uncl.)	Water	Placing & Spreading Topsoil	Channel Exc.	Seeding w/Mulch	Water Seeding & Sodding M.G.	Sodding (New Sod)
C.Y.	C.Y.	M.G.	C.Y.	C.Y.	Unit	M.G.	S.Y.
1508	169	4	283	440	20	2	38

NO CHANGE IN COMPENSATION WILL BE MADE FOR NORMAL VARIATIONS IN ESTIMATED QUANTITIES.

Figure 4-12
Example of Estimated Quantities for Roadway Approaches Block

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4-203.30 TOPSOIL COMPUTATION (See 3-315.05)

4-203.40 COMPUTATIONS FOR ITEM NO. 203-06 WATER

Water will be measured by the thousand gallon (M.G.).

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 204-10.16):

$$\frac{\text{Width of subgrade (Ft)} \times 0.5 \text{ Ft} \times \text{Length of project (ft)} \times 4 \text{ Gal/C.Y.}}{27 \text{ C.F./C.Y.} \times 1000 \text{ Gal/M.G.}} = \text{M.G.}$$

Subgrade treatment (lime) (Item Nos. 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 Nos. 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):

$$\frac{\text{Volume of base (C.Y.)} \times 30.77 \text{ Gal/C.Y.}}{1000 \text{ Gal/M.G.}} = \text{M.G.}$$

NOTE: For urban-type projects, which require an unusually large amount of water for dust control, use a quantity of water six times the amount calculated.

4-203.45 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.

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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.

**4-203.50 SUBMISSION OF GRADING QUANTITIES SHEETS FOR CONSTRUCTION
(See 2-145.07 and 3-315.20)**

**4-203.55 USE OF ESTIMATED GRADING QUANTITIES BLOCK FOR ROAD AND
DRAINAGE EXCAVATION (UNCLASSIFIED)**

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 use a block as shown in Figure 4-13a. If the designer does not know the composition of the material being excavated, the designer is to use a block as shown in Figure 4-13b.

ESTIMATED GRADING QUANTITIES							
STATION TO STATION	ROAD & DRAINAGE EXC. (UNCL.)		BORROW EXCAVATION		CHANNEL EXC. C.Y.	EXCESS EXC. WASTE C.Y.	EMB. C.Y.
	COMMON - C.Y.	S. ROCK - C.Y.	UNCL. - C.Y.	S. ROCK - C.Y.			

Figure 4-13A
Estimated Grading Quantities Block (Materials Composition Known)

ESTIMATED GRADING QUANTITIES							
STATION TO STATION	ROAD & DRAINAGE EXC. (UNCL.) C.Y.		BORROW EXCAVATION		CHANNEL EXC. C.Y.	EXCESS EXC. WASTE C.Y.	EMB. C.Y.
			UNCL. - C.Y.	S. ROCK - C.Y.			

Figure 4-13B
Estimated Grading Quantities Block (Materials Composition Unknown)

4-204.00 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 Roadway Design Division 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.

4-204.05 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. Compute quantities of **culvert excavation** (Figure 4-14) for these structures only if directed to do so. 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.”

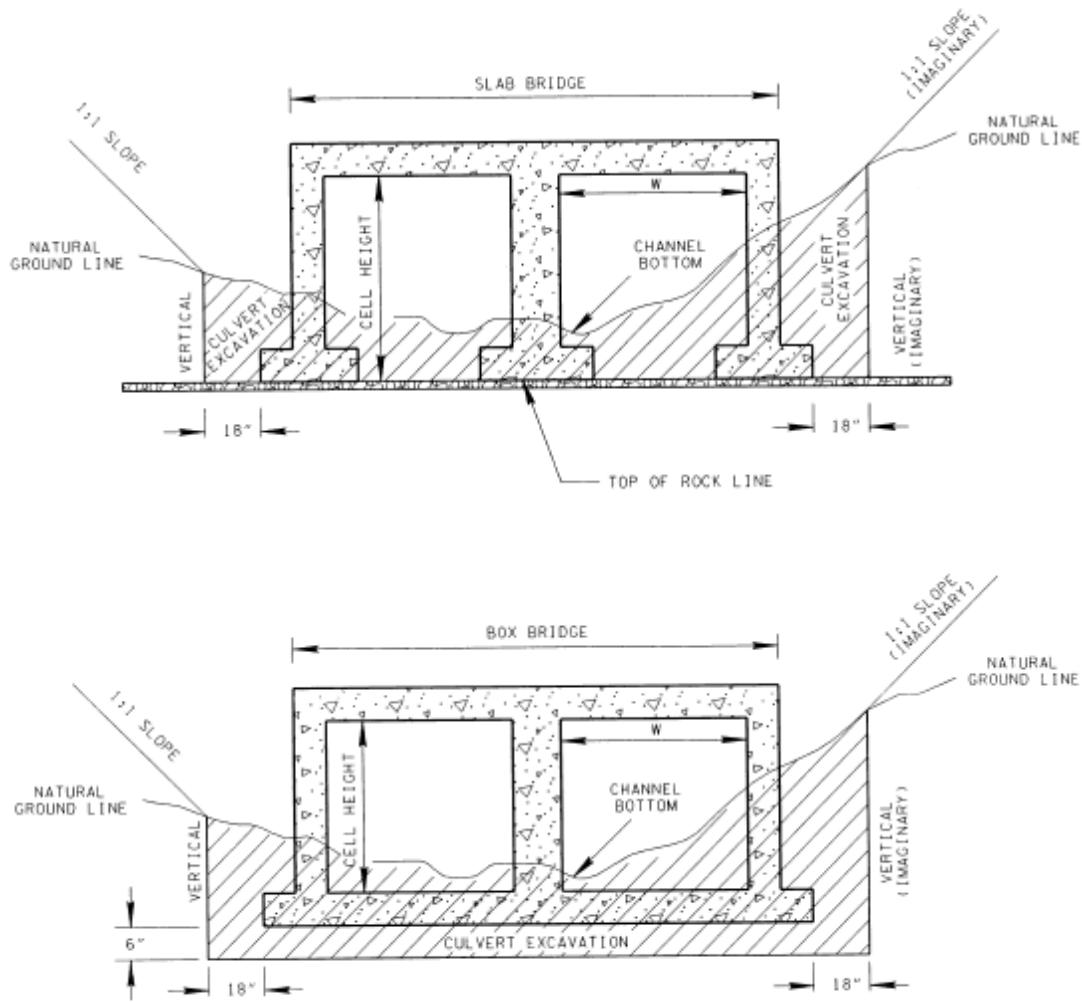


Figure 4-14
Quantities of Culvert Excavation for Slab Type and Box Culverts and Bridges

4-205.00 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)." 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)."

4-209.00 EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) FOOTNOTE

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"

4-209.01 COMPUTATIONS OF EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) QUANTITIES

See Chapter 10 of the Drainage Manual.

4-209.05 EXCAVATION OR PLACEMENT OF RIP-RAP IN THE DRY

See Section 6-400.00 for a "Special Note" which shall be added to all plans with multi-barrel culverts or bridge structures.

CHAPTER 3 - BASES AND SUBGRADE TREATMENT

4-300.00 CRITERIA FOR USE OF PERFORMANCE GRADE ASPHALT ON STATE RESURFACING AND CONSTRUCTION PROJECTS

The type of performance grade asphalt used on all state resurfacing and construction projects shall adhere to the following criteria:

Performance Grade PG64-22 Asphalt is to be used on all state resurfacing projects and construction projects with current ADT less than 10,000.

Performance Grade PG70-22 Asphalt is to be used on all state resurfacing projects and construction projects with current ADT greater than 10,000, and on the NHS system on 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 resurfacing projects and 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 selected urban interstate projects with extremely high volumes. These projects will always be designated by the Pavement Design Section.

On all construction projects where the pavement design has been supplied by the Pavement Design Section, the designer shall check the pavement design to ensure that it concurs with this policy. This will be particularly critical on older projects when the pavement design has been supplied some time ago. If the designer finds a deviation between the pavement design and this policy, they are to contact the Pavement Design Section to clarify the problem and, if necessary, to get the pavement design modified.

4-301.00 COMPUTATION OF SUBGRADE TREATMENT (GRANULAR)

Item No. 301-01 Aggregate for Subgrade Treatment

$$\text{Compacted volume (C.Y.)} \times 2.03 \text{ Tons/C.Y.} = \text{Tons}$$

4-302.00 COMPUTATION OF SUBGRADE TREATMENT (LIME)

Item No. 302-01.01 Hydrated Lime

$$\frac{\text{Subgrade treatment volume (C.Y.)} \times \text{*Weight (Lb./C.Y.)} \times \text{**\%}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

* 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.

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Item No. 302-02 Bituminous Material (S. T. Lime)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

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.

4-303.00 COMPUTATIONS FOR MINERAL AGGREGATE BASE

Item Nos. 303-01, *303-01.08, *303-01.09 and 303-02

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.) \times 2.03 Tons/C.Y. = Tons

* To be used normally when the blending of two or more materials (for example, gravel and chert, etc.) is specified.

Item No. 303-01.01 Granular Backfill (Roadway)

Compacted volume (C.Y.) \times 1.75 Tons/C.Y. = Tons

Item No. 303-01.03 Granular Backfill (Retaining Walls)

Compacted volume (C.Y.) \times 1.75 Tons/C.Y. = Tons

Item No. 502-05 Calcium Chloride Type 1

Total aggregate (Tons) \times 0.06 Bag/ Ton = Bags

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.) \times 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. 303-10.03 through 303-10.06 Mineral Aggregate (Specify Size)

Compacted volume (C.Y.) × 1.75 Tons/C.Y. = Tons

4-303.05 GRANULAR BACKFILL FOR STRUCTURES

Item Nos. 303-01.01, Granular Backfill (Roadway) and 303-01.03, Granular Backfill (Retaining Walls), 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) will be used, and it will be listed on the Estimated Structures Quantity sheet only. It cannot be used in the roadway quantities.

4-304.00 COMPUTATIONS FOR SOIL-CEMENT BASE

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)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./Ton}} = \text{Tons}$$

4-307.00 COMPUTATIONS FOR BITUMINOUS PLANT MIX BASE (HOT MIX)

The computed quantity for asphalt base mixtures is as follows:

$$\frac{\text{Compacted volume (C.Y.)} \times \text{Density (Lb./C.Y.)}}{2,000 \text{ Lb./Ton}} = \text{Tons}$$

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OR

$$\frac{\text{Area (S.Y.)} \times \text{Lb. per S.Y. per inch thickness}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

Values for mixture density, Lb. per S.Y. per inch thickness, and item numbers are provided in Table 4-1 below.

VALUES FOR COMPUTATION OF 307 ASPHALT BASE MIXTURE QUANTITIES			
ITEM NUMBER	DESCRIPTION	DENSITY (LB/CY)	LB per SY per inch thickness
307-01.01	PG 64-22 BASE MIXES (GRADING A)	4140	115
307-01.23	PG 64-22 BASE MIXES (GRADING ACRL)	3240	90
307-01.20	PG 64-22 BASE MIXES (GRADING A-S)	3240	90
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
307-01.15	PG 64-22 BASE MIXES (GRADING CS)	4140	115
307-01.10	PG 64-22 BASE MIXES (GRADING C-W)	3960	110
307-02.01	PG 70-22 BASE MIXES (GRADING A)	4140	115
307-01.24	PG 70-22 BASE MIXES (GRADING ACRL)	3240	90
307-01.21	PG 70-22 BASE MIXES (GRADING A-S)	3240	90
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
307-01.25	PG 76-22 BASE MIXES (GRADING ACRL)	3240	90
307-01.22	PG 76-22 BASE MIXES (GRADING A-S)	3240	90
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
307-04.01	PG 82-22 BASE MIXES (GRADING A)	4140	115
307-04.08	PG 82-22 BASE MIXES (GRADING B-M2)	4068	113

TABLE 4-1 COMPUTATION OF 307 ASPHALT BASE MIXTURE QUANTITIES

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4-309.00 COMPUTATIONS FOR AGGREGATE-CEMENT BASE COURSE - LIMESTONE

Item No. 309-01.01 Mineral Aggregate (A-CBC)

Compacted volume (C.Y.) \times 1.9456 Tons/C.Y.= Tons

Item No. 309-01.02 Portland Cement (A-CBC)

Compacted volume (C.Y.) \times 0.0751 Tons/C.Y.= Tons

Item No. 309-02 Bituminous Material (A-CBC)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

4-309.01 COMPUTATIONS FOR AGGREGATE-CEMENT BASE COURSE - GRAVEL

Item No. 309-01.01 Mineral Aggregate (A-CBC)

Compacted volume (C.Y.) \times 1.8145 Tons/C.Y.= Tons

Item No. 309-01.02 Portland Cement (A-CBC)

Compacted volume (C.Y.) \times 0.0884 Tons/C.Y.= Tons

Item No. 309-02 Bituminous Material (A-CBC)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

4-312.00 COMPUTATIONS FOR AGGREGATE-LIME-FLY ASH STABILIZED BASE COURSE

Item No. 312-01 Mineral Aggregate (ALFSB)

Compacted volume (C.Y.) \times 1.690 Tons/C.Y.= Tons

Item No. 312-02 Lime

Compacted volume (C.Y.) \times 0.0643 Tons/C.Y.= Tons

Item No. 312-03 Fly-Ash

Compacted volume (C.Y.) \times 0.2019 Tons/C.Y.= Tons

Item No. 312-04 Bituminous Material (ALFSB)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.20 \text{ Gal./Sq. Yd.}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

CHAPTER 4 - FLEXIBLE SURFACES

4-400.00 PAVING POLICY - RESURFACING

This policy is for paving on intersections with public roads, private drives, field entrances and business entrances.

1. Public Roads (no curb and gutter)

Public road intersections will be resurfaced a paver width through the intersection as a minimum. Should the pavement of the intersecting road be distressed, the resurfacing width may be increased to the normal right-of-way.

2. Public Roads (curb and gutter section)

On curb and gutter sections, public road intersections will be resurfaced to the end of radius.

3. Private drives, field entrances and business entrances (no curb and gutter)

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 1 foot of width per 1 inch depth of pavement. If the shoulder is narrow enough that the sum of the shoulder and transition is 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 (lane width), the transition shall occur outside of the paver width.

4. Private drives and business entrances (curb and gutter section)

For urban typical sections (curb and gutter), a minimum width of material, not to exceed 1 foot, will be used to feather the pavement edge.

4-400.01 TOTAL LANE MILES PAVED FOR RESURFACING PROJECTS

The title sheet of **all resurfacing projects** shall include the length of the proposed lane miles to be paved. The length will be located under Project length information as “**Total Lane Miles Resurfaced**” and be shown to the nearest tenth of a mile.

The total lane mile length should include all traffic lanes and continuous turning lanes paved. Side roads, paved shoulders, private drives, field entrances, and business entrances, ramps, and turn lanes located at intersections less than 1000 ft. in length do not need to be included in the length.

4-402.00 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)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

* 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.

4-403.00 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 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.

Item No. 403-02 Asphalt Cement for Tack Coat (TC)

$$\frac{\text{Surface area (Sq. Yd.)} \times 0.05 \text{ (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

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.

NOTE: Tack coat shall not be applied on top of either Grading AS or Treated Permeable Base mixtures.

4-403.05 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.

4-404.00 COMPUTATIONS FOR DOUBLE BITUMINOUS SURFACE TREATMENT

Item No. 404-01.01 Bituminous Material for Double Bituminous Surface Treatment (DBST)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

* Rate 0.68 - 0.84 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 proposed pavement schedule in the plans.

Item No. 404-01.02 Mineral Aggregate for Double Bituminous Surface Treatment (DBST)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

* Rate 40 - 58 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 proposed pavement schedule in the plans.

4-405.00 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)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

* 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 4-403.00, 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.

4-405.01 USE OF BITUMINOUS SEAL COAT (CHIP SEAL) ALONG EDGE OF PAVED SHOULDER WHILE MAKING LANE SHIFTS DURING CONSTRUCTION

Application shall begin at point where the stone touches paved shoulder and extend outwardly from the paved shoulder to the point where the stone meets the subgrade. Application rate shall be computed based on 1.5 times the maximum application rate for general use shown in Section 4-405.00. This will allow a quantity large enough for contractor to reapply chip seal as needed during the course of the construction operations.

Chip seal to be paid for under Item Nos. 405-01.01, Bituminous Material for Bituminous Seal Coat (BSC) per Ton, and 405-01.02, Mineral Aggregate for Bituminous Seal Coat (BSC) per Ton. Pay items to be footnoted under the estimated roadway quantities block as follows:

"Includes quantity to be used along edge of paved shoulder while making lane shifts during the course of construction in order to reduce rutting along edge of shoulder."

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4-406.00 COMPUTATIONS FOR BITUMINOUS SEAL COAT (SPLIT APPLICATION)

Item No.406-01.01 Bituminous Material for Bituminous Seal Coat, Split Application (BSC-SA)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Gal./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

* Rate 0.46 - 0.54 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. 406-01.02 Aggregate for Bituminous Seal Coat, Split Application (BSC-SA)

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

* Rate 36 - 44 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.

4-411.00 COMPUTATIONS FOR ASPHALTIC CONCRETE SURFACE (HOT MIX)

The computed quantity for asphalt surface mixtures is as follows:

$$\frac{\text{Compacted volume (C.Y.)} \times \text{Density (Lb./C.Y.)}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

OR

$$\frac{\text{Area (S.Y.)} \times \text{Lb per SY per inch thickness}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

Values for mixture density, Lb. per S.Y. per inch thickness, and item numbers are provided in Table 4-2 below.

VALUES FOR COMPUTATION OF 411 ASPHALT SURFACE MIXTURE QUANTITIES			
ITEM NUMBER	DESCRIPTION	DENSITY (LB/CY)	LB per SY per inch thickness
411-01.10	GRADING D SURFACE (PG 64-22)	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
411-01.07	GRADING E SHOULDER (PG 64-22)	3708	103
411-02.11	GRADING E SURFACE (PG 70-22)	3870	107.5
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
411-03.22	GRADING OGFC SURFACE (PG 70-22)	3168	88
411-03.23	GRADING OGFC SURFACE (PG 76-22)	3168	88*

*For Region 1, McMinn County, Bradley County, Hamilton County, and Marion County, use 94 lbs/sy/in

TABLE 4-2 COMPUTATION OF 411 ASPHALT SURFACE MIXTURE QUANTITIES

4-411.02 RAISED BITUMINOUS RUMBLE STRIPS

Raised bituminous rumble strips are a traffic warning device. 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. At approaches to narrow bridges, where the shoulder width is less than the normal roadway shoulder width, the raised bituminous rumble strip may be used to warn the motoring public of this roadway condition.

4-411.03 RUMBLE STRIPS

Scored rumble strips are a traffic warning device, and when required, shall be constructed in accordance with Standard Drawings RP-CS-1, RP-CS-2, T-M-15, T-M-15A or as shown on the plans. Raised bituminous rumble strips and scored rumble strips are the two types of rumble strips normally used in Tennessee.

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.

Refer to Section 4-716.15 for guidelines for placement of rumble strips on shoulders. Scored shoulders will be constructed on asphalt or concrete shoulders. Asphalt shoulders must have a minimum depth of pavement of one and one-half inches. Scored shoulders should also be omitted adjacent to ramps, acceleration and deceleration lanes including tapers and along the radius of side road approaches, entrances and median crossovers.

Rumble strips shall be specified on all new construction and resurfacing projects on the Interstate System and access controlled state routes. Both the inside and the outside shoulders shall be scored. 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), L.M. For estimating purposes, the item will be measured longitudinally along the edge of each shoulder and will usually be four (4) times the project length less deductions for entrance and exit ramps, public roads, and bridges. When concrete shoulders are present rumble strips are to be constructed in accordance with Standard Drawing RP-CS-1 or RP-CS-2. Rumble strips on concrete shoulders shall be paid for under Item No. 501-03.10, Concrete Shoulder Rumble Strips, L.F., and the item will be measured as the actual length of pavement scored along each shoulder.

Refer to Section 4-716.15 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 only be placed on rural routes with posted speeds of 45 mph or greater. Rumble strips may be used on urban routes where accident history or other factors warrant the placement. When placed on urban routes, designers should give consideration to expected bicycle traffic and noise generated. The 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), L.M. The item will be measured and paid as the actual length of pavement scored along each shoulder.

4-411.04 RUMBLE STRIPES

Rumble stripes are a traffic warning device, and when required, shall be constructed in accordance with Standard Drawing T-M-16. A scored rumble stripe is a scored rumble placed along the outside edge line of the travel lane.

Refer to Section 4-716.15 for guidelines for the placement of rumble stripes. Rumble stripes should normally only be placed on rural routes with posted speeds of 45 mph or greater. The rumble stripe shall consist of a 60 foot scored rumble followed by a 15 gap to allow for bicycles to cross without having to traverse the rumble. Rumble stripes may be used on urban routes where accident history or other factors warrant the placement. When placed on urban routes, designers should give consideration to expected bicycle traffic and noise generated. Rumble stripes may be omitted from locations recommended by the TDOT bicycle coordinator.

Scored rumble stripes are to be paid for under Item No. 411-12.03, Scoring for Rumble Stripe (Non-Continuous) (8 inch Width), L.M. or Item No. 411-12.04, Scoring for Rumble Stripe (Non-Continuous (4 inch Width), L.M. The item will be measured and paid as the actual length of pavement scored along each shoulder.

When rumble stripes are specified, pavement markings shall be Spray Thermoplastic (60 mil). Enhanced Flatline Thermoplastic Markings shall not be used. Striping is to be paid for under the appropriate pavement marking item number.

4-411.05 RIDEABILITY SPECIFICATIONS

For all projects having asphaltic concrete surface greater than 1” thickness, a determination shall be made as to whether or not the rideability specification shall be included in the contract. This determination will be made by the Headquarters Construction Division after the plans have been submitted.

4-414.05 COMPUTATIONS FOR MICRO-SURFACING

Item No. 414-03.01 Emulsified Asphalt for Micro-Surfacing

$$0.12 \times \text{Item No. 414-03.02 aggregate quantity} = \text{Tons}$$

NOTE: Application rate based on 12 percent of the dry weight of the aggregate.

Item No. 414-03.02 Aggregate for Micro-Surfacing

$$\frac{\text{Surface area (Sq. Yd.)} \times \text{XX (Lb./Sq. Yd.)}}{2,000 \text{ Lb./ Ton}} = \text{Tons}$$

NOTE: Application rate of 32 pounds (approximate depth 0.375”) per square yard shall be used if plans require a leveling mixture (14 pounds per square yard) and a surface mixture (18 pounds per square yard) to be placed, or 22 pounds (approximate depth 0.275”) per square yard if only a surface mixture is to be placed, unless otherwise specified.

Item No. 403-01.01 Bituminous Material for Tack Coat (TC) to be used with Micro-Surfacing

$$(0.25) \frac{\text{Surface area (Sq. Yd.)} \times \text{*Rate (Lb./Sq. Yd.)}}{231 \text{ Gal./ Ton}} = \text{Tons}$$

* Rate 0.10 - 0.15 (Gal./Sq. Yd.) of the diluted emulsion

NOTE: The tack coat shall consist of 1 part emulsion and 3 parts water; therefore “0.25” is used as the multiplication factor in the above equation.

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.

4-415.00 COLD PLANING OF BITUMINOUS PAVEMENT

On projects having 2,000 Tons or more of cold planed material, it shall be paid for by the Ton. This shall be calculated using 105 Lb./S.Y/Inch of estimated depth to be cold planed, converted to Tons.

This shall be measured and paid for under Item No. 415-01.01, Cold Planing of Bituminous Pavement per Ton.

On projects where the required depth of cold planing is known and the quantity is less than 2,000 Tons, it may be paid for by the square yard. The Regional Construction Office shall be consulted prior to using this unit of measure. Depth of Cold Planing must be specified on the plans.

This shall be measured and paid for under Item No. 415-01.02 Cold Planing of Bituminous Pavement per Square Yard.

On projects having less than 2,000 Tons of cold planed material, and where no scales are readily available (check with the Regional Construction Office), and the required depth is not known, it shall be paid for by the cubic yard.

This shall be measured and paid for under Item No. 415-01.03, Cold Planing of Bituminous Pavement per Cubic Yard.

4-416.00 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.

On all new construction projects involving asphalt paving without curbs, a safety edge will be applied to the edge of all layers of mix.

For resurfacing projects, a safety edge will be applied only when identified on the Resurfacing Safety Review Checklist completed 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.

Pavement General Note 3 (Section 6-150.00) shall be added to the plans on all projects that specify safety edge.

CHAPTER 5 - RIGID PAVEMENT

4-501.00 PORTLAND CEMENT CONCRETE PAVEMENT (See 4-905.00)

4-502.00 COMPUTATIONS FOR UNDERSEALING CONCRETE PAVEMENT

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 Construction 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.

CHAPTER 6 - STRUCTURES

4-604.00 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.

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 bridges projects, the Standard Drawing Index Sheet shall include the following:

Standard Drawing numbers STD-17-1 through STD-17-7, STD-17-9, STD-17-10, STD-17-15 through STD-17-18, STD-17-23, STD-17-24, and STD-17-29 will be used on all structures.

Standard Drawing STD-17-11 will be used when the structure is on 90 degree skew.

Standard Drawing STD-17-12 will be used when the structure is on 75 degree skew.

Standard Drawing STD-17-13 will be used when the structure is on 60 degree skew.

Standard Drawing STD-17-14 will be used when the structure is on 45 degree skew.

Standard Drawing STD-17-28 will be used for all skews other than 90 degrees.

In addition to these drawings, the designer will use the appropriate STD-17 series of drawings showing the particular structures that apply to the project.

4-604.05 PRECAST, PRESTRESSED BRIDGE DECK PANELS

Precast, pre-stressed bridge deck panels will not be allowed to be used on concrete box or slab type culverts.

4-604.10 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.

The quantities 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.

4-604.20 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 (Figure 4-15), 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 4-16:

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 occurs, the designer will contact the Structures Division (Hydraulics Section) to work out the problem.
3. 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 4-17.
4. Show crown or superelevation when the concrete top slab is to be the riding surface.

- C. On box and slab type culverts and bridges with less than 1 foot of fill (with fill defined as embankment, base and pavement), the designer will be responsible for computing all concrete and reinforcing steel quantities accordingly. The correction factor for the adjustment of reinforcing steel quantities, based on the modifications of vertical height by the designer, is included in Table 4-1 (See associated Figure 4-18). The Structures Division will assist the designer in these calculations, if he or she requires assistance.

- 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.

TDOT - ROADWAY DESIGN GUIDELINES

English

Revised: 08/01/19

“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.*”

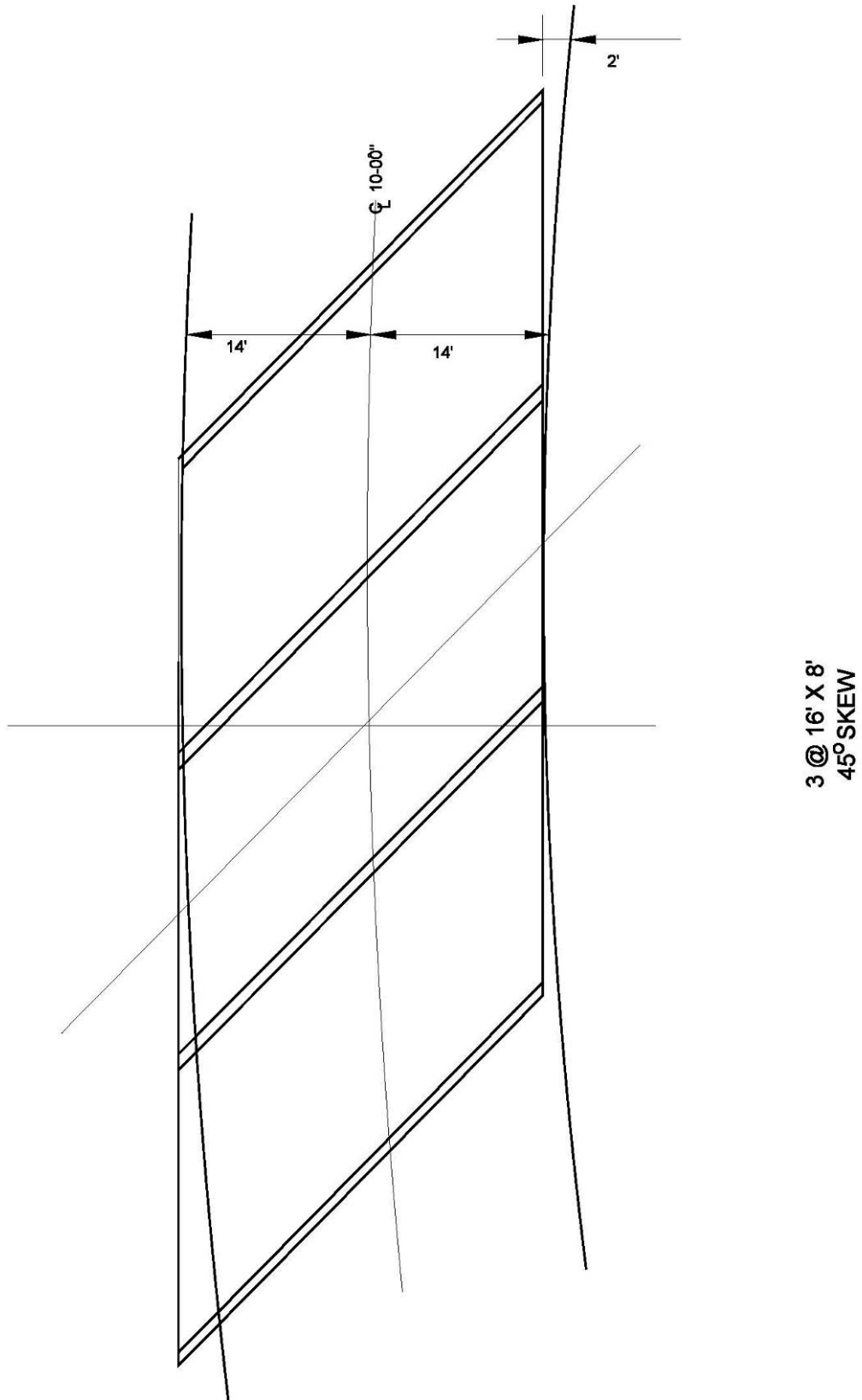


Figure 4-15
Potential Guardrail Encroachment

BOX BRIDGE OR CULVERT ELEVATIONS

STATION	TOP OF CURB ELEV.				TOP OF SLAB ELEV.				FLOW LINE ELEV.				TOP OF WING ELEV.			
	ELEV. A-1	ELEV. A-2	ELEV. A-3	ELEV. A-4	ELEV. B-1	ELEV. B-2	ELEV. B-3	ELEV. B-4	ELEV. C-1	ELEV. C-2	ELEV. C-3	ELEV. C-4	ELEV. D-1	ELEV. D-2	ELEV. D-3	ELEV. D-4

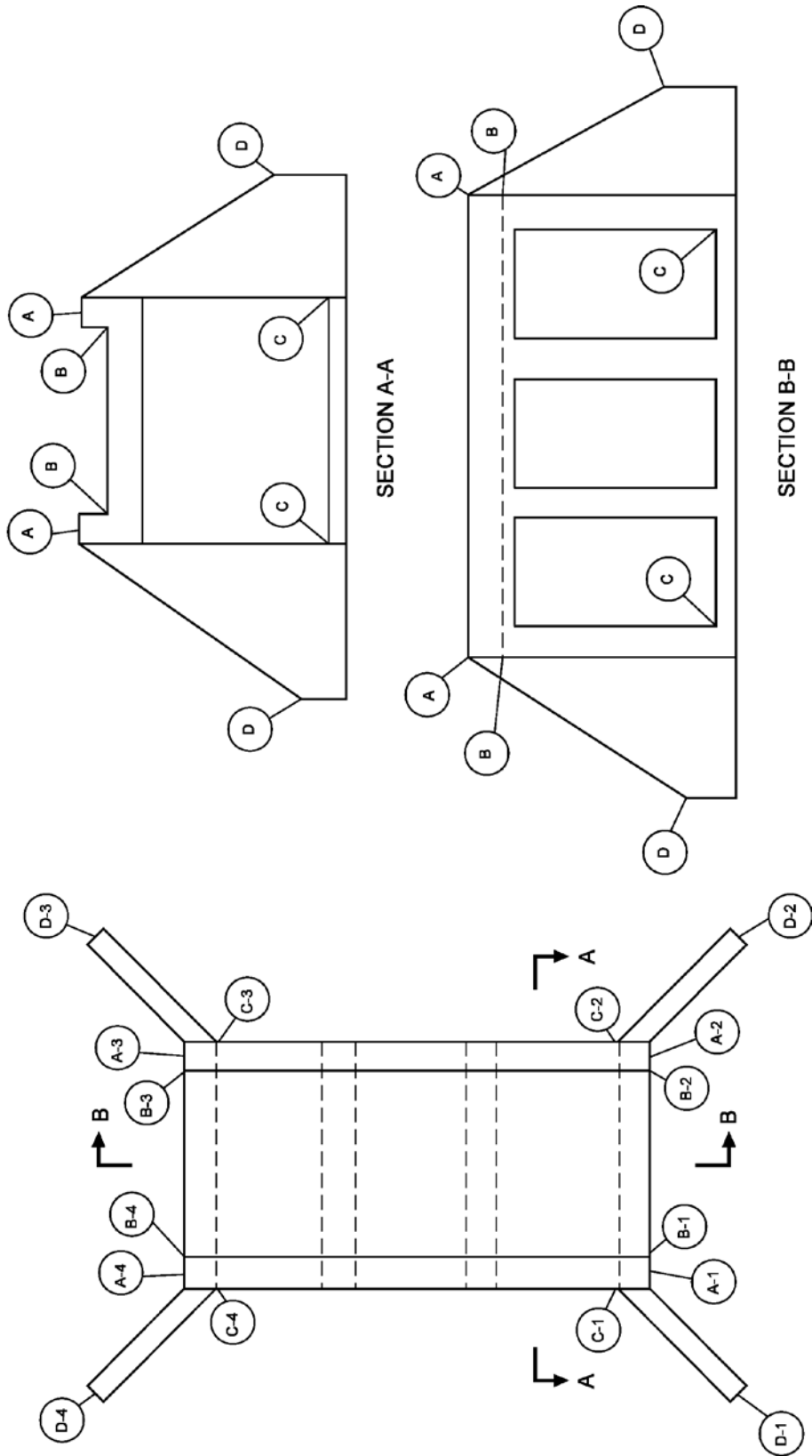


Figure 4-16
Box Bridge or Culvert Elevation Details

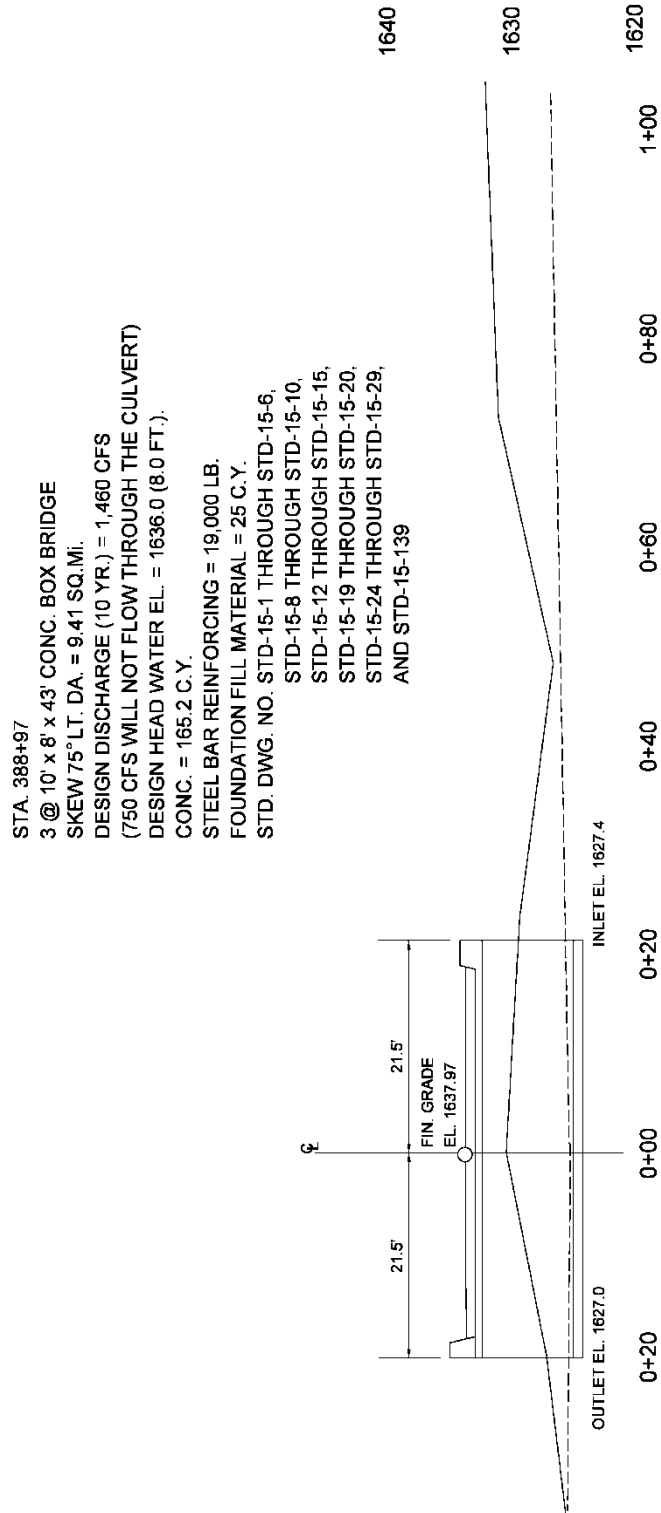


Figure 4-17
 Typical Cross-Section Information for Box and Slab Type Culverts and Bridges

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 4-1
Adjustment Factor for Estimating Additional Reinforcing Steel Quantities in the Vertical Walls of Concrete Box or Slab Type Culverts or Bridges

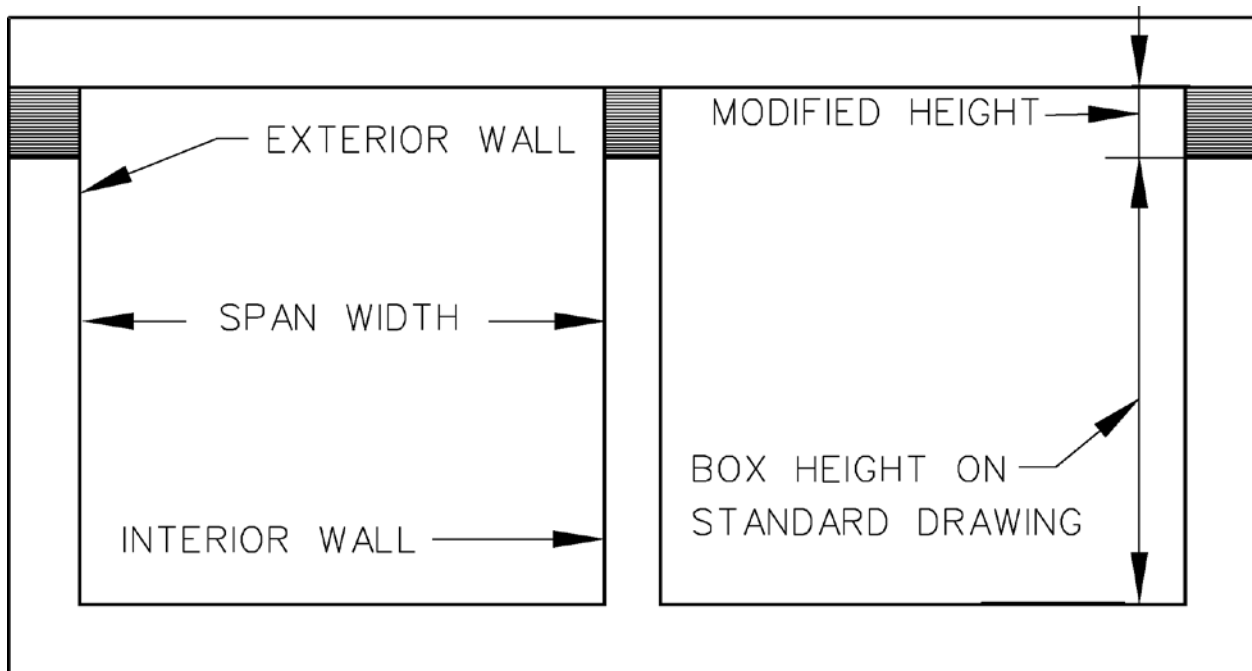


Figure 4-18
Typical Concrete Box or Slab Type Culvert or Bridge Modification

4-604.25 STEEL BAR REINFORCEMENT (ROADWAY)

On all projects which include reinforced concrete box or slab type culverts or bridges, Standard Drawing No. STD-9-1, Standard Reinforcing Bar Support Details for Concrete Slabs, shall be listed on the appropriate culvert sheets and in the 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 No. 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, this drawing will appear in the bridge index and it will not be necessary to list it again in the roadway index.

4-604.30 CULVERT EXCAVATION FOR BOX OR SLAB TYPE CULVERTS OR BRIDGES (See 4-203.35 and 4-204.05)

4-604.40 STOCK PASSES (See 3-240.00)

4-611.00 CHECKING OF DRAINAGE PLANS PRIOR TO CONSTRUCTION

Before finalizing drainage plans, the designer is to ensure that the drainage portion of their Construction 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 Construction Plans. It is necessary to make this adjustment in order to eliminate costly construction changes to the catch basins, manholes, junction boxes, etc.

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 section 3-200.00.

4-611.05 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.

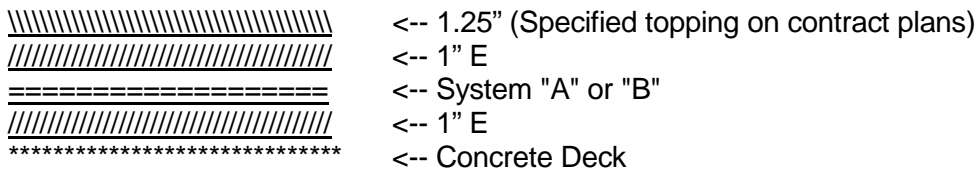
When bridge-end drains are not required, the shoulder shall be paved full width for a distance of 25 feet past the end of the parapet, and rip-rap shall be hand placed around the guardrail for an equal distance.

4-617.00 BRIDGE DECK SEALANT

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.

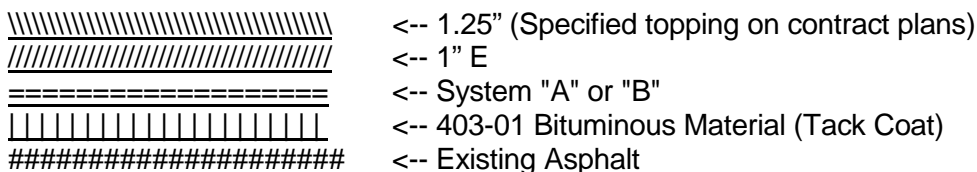
The following is the procedure for using bridge deck sealant:

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:



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 No. 617-01 Bridge Deck Sealant per square yard

4-621.00 TEMPORARY STRUCTURES

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-STA) 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.

4-625.00 ABANDONMENT OF WATER WELLS (See 4-202.13)

Item No. 625-01.01, Well Abandonment per Lump Sum, will no longer be used.

4-650.00 BRIDGE ID NUMBERS

The designer shall add the Bridge ID number for all existing bridges within the project limits (either on the mainline, side street or overpassing the project) to the title sheet and the present layout sheet(s). Bridge ID numbers can be found on the Transportation Investment Report (TIR). Bridge ID numbers can also be queried on state routes, interstates and many major local roads in ETRIMS. For roads where the bridge ID number is not shown on the TIR or in ETRIMS, the designer should request the information from the Regional Survey Section.

CHAPTER 7 - INCIDENTAL CONSTRUCTION

4-705.00 ROADSIDE BARRIERS GENERAL

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. The following sections give guidance on:

- 4-705.10 Warrants: Justify the use of barriers
- 4-705.11 Warrant 1: At Bridges or Box Culverts
- 4-705.12 Warrant 2: Non-Traversable Slopes
- 4-705.13 Warrant 3: Roadside Obstacles
- 4-705.14 Warrant 4: Freeway Median Departures
- 4-705.15 Warrant Exceptions
- 4-705.20 Length of Need: Determine the amount of barrier needed.
- 4-705.30 Barrier Type Selection: Choose the appropriate barrier system.
- 4-705.40 Guardrails
- 4-705.41 Guardrail Special Designs
- 4-705.50 Concrete Median Barriers
- 4-705.60 Cable Barriers

4-705.10 BARRIER WARRANTS

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 the designer to make the determination but the guidelines should not be utilized as a substitute to good engineering judgment.

When barriers are indicated by warrant the designer should consider the following before adding barriers:

- Remove the obstacle (Is the obstacle necessary? If not remove the obstacle)
- Relocate the obstacle (If the obstacle is necessary, can it be moved outside of the clear zone?)
- Redesign the obstacle to be safely traversed (Such as flattening a steep 2:1 slope to flatter than 3:1)
- Make obstacle crashworthy, such as breakaway (Typically applies to signs and some poles)

Only if the case when none of the above four conditions can be utilized should the designer use barriers.

4-705.11 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 guardrail transition section with proper end terminal must be provided at bridge ends.

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

- **S-PL-3** for typical installation at bridge ends
- **S-PL-5** for typical installation at bridge ends in depressed medians

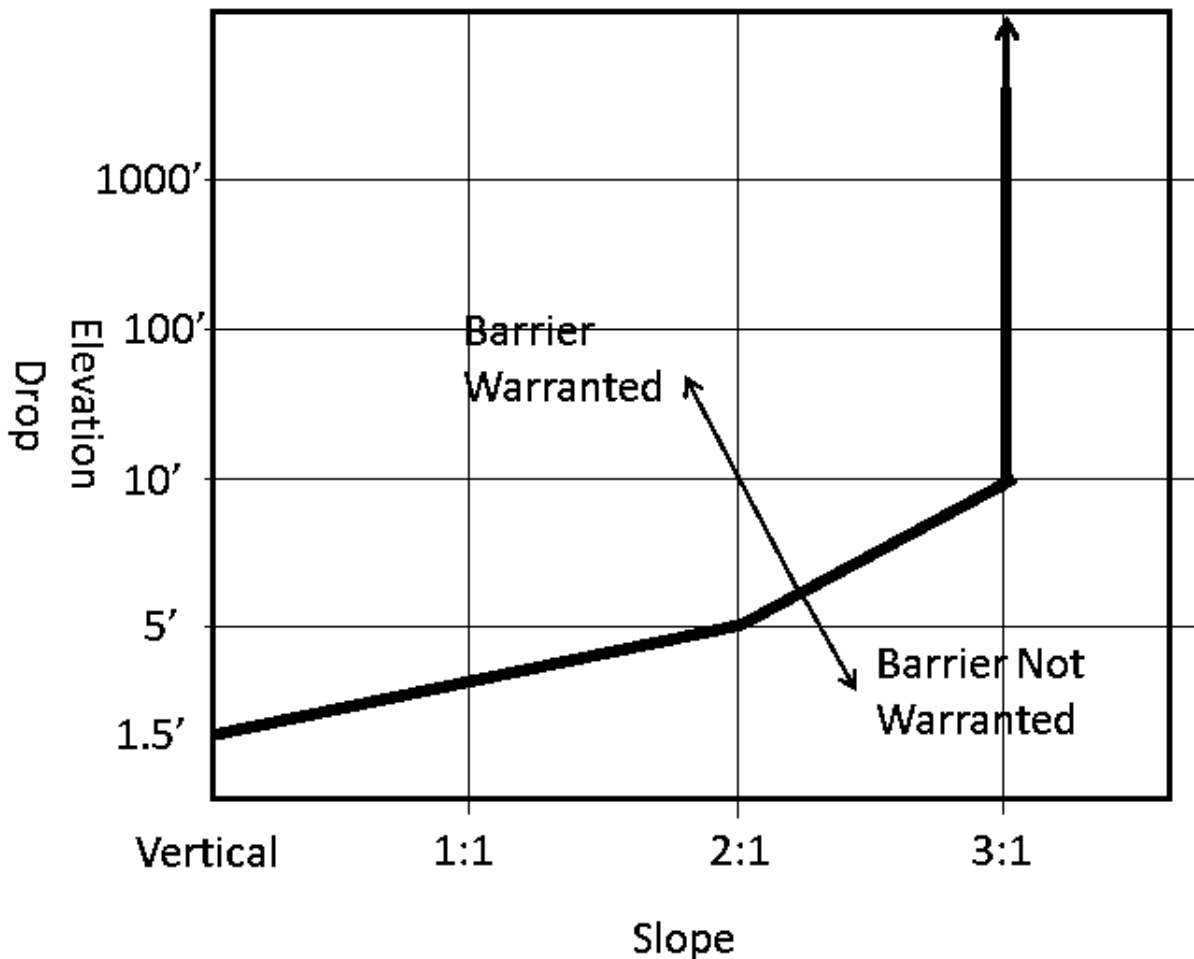
In some cases box culverts or slab bridges may use guardrail instead of concrete bridge rail. The amount of fill over the bridge will determine how the guardrail will be installed. See **Section 4-705.41** and **S-GRS-2** for more information.

4-705.12 WARRANT 2: NON-TRAVERSABLE SLOPES

Barriers are warranted if the combination of nonrecoverable slope (defined by steepness) and the height of the drop off combine to create a hazard of overturning for a vehicle departing the roadway. See the below figure for warrant criteria.

For installation details of barriers when Warrant 2 is met, see Safety Plan Standard Drawings:

- **S-PL-1** for typical installation at hazards
- **S-PL-2** for special installation around driveways or side roads



4-705.13 WARRANT 3: ROADSIDE OBSTACLES

Barriers are warranted anytime an obstacle is found inside the clear zone area (as defined on Standard Drawing **S-CZ-1**) or a hazard is found at the toe of a non-recoverable (3:1 to 4:1) fill slope, even if the clear zone distance is less than the slope length.

For installation details of barriers when Warrant 3 is met, see Safety Plan Standard Drawings:

- **S-PL-1** for typical installation at hazards
- **S-PL-2** for special installation around driveways or side roads

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

- Trees
- Poles
- Bridge Abutments
- Bridge Piers (See Standard Drawing **S-PL-4** for special requirements for bridge piers)
- Streams
- Traffic Signal Supports
- Large Sign Supports

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

Typical Objects Not Warranting Barriers

- Objects utilizing breakaway supports approved by the Department such as signs posts
- 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 standard D-PE endwalls or side 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)

4-705.14 WARRANT 4: FREEWAY MEDIAN DEPARTURES

On full or semi-full access controlled highways (freeways) opposing lanes of traffic are separated by a median or (if no median) a concrete median barrier (in rare cases median divider guardrail may be substituted). In cases when the freeway is separated by a median, the width of the median and average daily traffic volume (ADT) may create a situation when median crossover crashes have a high probability of occurring. 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, see Safety Plan Standard Drawing: **S-PL-6** and **S-PL-6A**

Conditions Warranting Barriers in Median

- Roadways not separated by a median require concrete median barrier (See **RD01-TS-5B**)
- Roadways with medians 30 feet or narrower
- Roadways with medians between 30 and 50 feet with ADT > 20,000 vehicles/day
- Roadways with medians not meeting any above condition but with significant crash history

4-705.15 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 Streets: Barriers are typically not recommended on low speed (30 MPH and less) urban roadways because:

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

Small Sections with Short Drop-offs: Barriers are typically not recommended to protect small 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 share TDOT right-of-way and often times are in the clear zone of rural highways. It is undesirable, impractical and infeasible to install barriers to protect every utility pole. Every effort should be made to coordinate with the utility company to install the poles as far away from the edge of the roadway to mitigate risk. For poles that cannot be moved away from the clear zone the poles should be delineated.

4-705.20 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). The Safety Plan Standard Drawing series drawings show typical installations for various cases.

- S-PL-1: LON along the roadway for objects or hazards (Warrants 2 and 3)
- S-PL-2: Typical installation if a side road/driveway is located within the LON required for another hazard. (Warrants 1-3)
- S-PL-3: Minimum LON to protect bridge ends (Warrant 1)
- S-PL-4: Barrier requirements and LON to shield structures in the clear zone. (Warrant 2)
- S-PL-5: Minimum LON to protect bridge ends in the median (Warrant 1)

4-705.30 BARRIER TYPE SELECTION CRITERIA

Utilize the following guidelines to determine the appropriate system. See appropriate standard drawing for details of each system

A) BARRIER TYPE SELECTION CRITERIA FOR WARRANTS 1 THROUGH 3 (4-705.11 THRU 4-705.13)

(Typical hazards: bridge piers, abutments, retaining walls, sign supports, etc)

- a. If the distance from the edge of shoulder to the object is less than 4 feet: Use concrete median barrier (half wall) or wall specified by Structures Division.
- b. If the distance from the edge of shoulder to the object is greater than 4 feet: Use guardrail

B) BARRIER TYPE SELECTION CRITERIA FOR WARRANT 4 (4-705.14)

(Median crossover crashes)

- a. Medians wider than 32’ use cable barrier.
- b. Medians narrower than 32’ use concrete barrier or median divider guardrail. Concrete median barrier is preferred but for short section median divider guardrail is acceptable.

4-705.40 GUARDRAILS

Guardrails consist of a Steel W-Beam supported by wooden or steel posts. For guardrail sections to be effective an anchor (typically installed in conjunction with an end terminal) must be installed at each end. At impact guardrail deflects up to 4 feet, therefore to provide the system with room to function five feet behind the face of guardrail should be kept clear of obstructions. Ends of guardrails must be terminated with an approved crashworthy end terminal (See Section 4-706.20) and an anchor. See **S-GR31-1** for more details

Double sided guardrail (Median Divider Guardrail) may be used in limited cases in the median in place of concrete barriers, particularly when the required length is relatively short. Median divider guardrails are also used when a 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. See **S-GRC-3** for more details.

4-705.41 GUARDRAIL SPECIAL DESIGNS

Due to site conditions sometimes a guardrail system may not be installed as shown on standard drawing S-GR31-1. However, there are several approved 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:

- **S-GRS-1** if only one post is affected by the obstruction and
- **S-GRS-3** if multiple posts are affected.

Guardrail across Box Culvert or Slab Bridge: In the case when guardrail is run across a box culvert or slab bridge that has fill of less than 3' 4" over the deck the designer shall refer to **S-GRS-2**. In this case the guardrail will be paid for under item 705-01.04. If the fill is greater than 3' 4" guardrail will be installed in the typical method as shown on **S-GR31-1**.

Guardrail at Intersections: When the length of need for guardrail extends beyond the location of an intersection or a drive way, the guardrail shall be curved around the intersection radius and type in-line anchors installed as shown on **S-PL-2**.

Guardrail at Steep Slopes: When a guardrail has to 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 Details A & B on **S-PL-6** and General Note H on **S-GR31-1**.

4-705.50 CONCRETE MEDIAN BARRIERS

Concrete Barrier is a rigid barrier consisting of a 32" or 51" (The additional 19" included on the 51" wall is primarily used as a glare screen to limit headlight glare from opposing lanes in urban areas) tall reinforced concrete wall. 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 severity of impacts with a concrete barrier the system should only be used when the level of protection is required. Therefore they are best suited for:

- To prevent crossover crashes at narrow medians.
- To prevent catastrophic damage to structures near the roadway.
- To protect larger vehicles from falling off of a steep (vertical or nearly so) drop off.

See **S-SSMB-Series** drawings for more details on Concrete Median Barriers.

The ends of concrete median barrier walls are considered a roadside hazard because of their unyielding nature. Because of this, the ends must be protected by means of an approved crash cushion (attenuator) or connected to guardrail system with end terminal. When guardrail is used to protect the end of concrete barrier wall a semi-rigid guardrail transition must be used to prevent the guardrail from deflecting such to create a pocket that would allow a vehicle to impact the end of the wall. See the guardrail connection standard drawings (**S-GRC-series**) for details of the semi-rigid transition guardrail.

4-705.60 CABLE BARRIERS

Cable barrier consists of three or four high tension steel cables supported by steel posts. Cable barriers like guardrails require an anchor to provide the tension for the system to operate. Cable barriers are designed to perform for impacts on either side, thus only one run is necessary to protect a median against crossovers. However, at impact cable barriers deflect up to 9 feet. Because of the large deflection cable barriers are not suited to shield objects close to the roadway or narrow medians. Cable barrier systems are designed to be used on 6:1 or flatter slopes.

Cable barrier systems end with a cable barrier terminal that consists solely of the anchoring system. Cable Barrier Terminals should not be included in the length of need since they do not provide re-directive protection and should be overlapped by another barrier system if the need for protection exists at that location.

4-706.00 END TREATMENTS

To prevent the end of barrier systems from themselves 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:

- 4-706.10 Anchorages
- 4-706.20 Guardrail End Terminals
- 4-705.30-.39 Crash Cushions

4-706.10 ANCHORAGES

For Guardrails to function properly both ends must be anchored to provide the system with tension. Guardrail anchors are shown in the **S-GRA-series** drawings.

In cases where the end treatment is facing oncoming traffic an end terminal is required and the anchor is installed with the terminal. (type 12, type 38 or type 21). Note: the anchor for type 38 is proprietary to each qualified end terminal so no standard drawings are provided for them.

When the end of the guardrail is located outside the clear zone of oncoming traffic a crashworthy end treatment may not be required. In this case the type 13 (inline) anchor is 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 (See **S-PL-2**) to maintain tension. This anchor is to be paid for as an anchor "type in-line."

Cable Barrier systems also require an anchor at each end. Each system has a proprietary anchor so no standard drawing is provided for cable barrier anchorages. See **S-CB-1** for more information.

4-706.20 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 **S-GRT-1**), Item No. 705-04.02. This system is non-gating (that is the entire system is designed to redirect a vehicle). The buried in backslope end terminal requires a backslope of at least 3:1. 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 any numbered highway (interstate, federal, or state) or local roads with design speeds greater than 40 mph, the tangential energy absorbing guardrail end terminal (type 38) (See **S-GRT-2**) shall be used. Payment is to be made under Item No. 705-06.20 Tangent Energy Absorbing Term MASH TL-3. For the system to work as designed the earth pad as shown on **S-GRT-2P** must be installed.

Note: The Type 38 is a gating system (that is part of the system does not redirect a vehicle) and the designer shall verify that the gating section (first 12.5 feet) is outside the length of need.

On roads with posted speeds 45 mph and less, Type 21 (TL-2) terminals may be used instead of a type 38. Payment is to be made under Item No. 705-06.30 GR Terminal (Type 21) MASH TL2. See **S-GRT-3**. For the system to work as designed, the earth pad as shown on **S-GRT-2P** must be installed.

4-706.30 DESIGN AND SELECTION CRITERIA FOR CRASH CUSHIONS

4-706.31 GENERAL DESIGN PRINCIPLES

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. Crash cushions operate on the basis of 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 or 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.

4-706.32 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. Assuming that 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 back-up 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 4-2 summarizes the three types of non-gating/re-directive crash cushion systems considered acceptable for use on TDOT projects. See **Figure 4-19** for selection flowchart.

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

¹ Low history or expectation of impacts occurring over lifetime of crash cushion.

Table 4-2
Non-Gating Re-directive Crash Cushion Classification

4-706.33 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 rather, 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

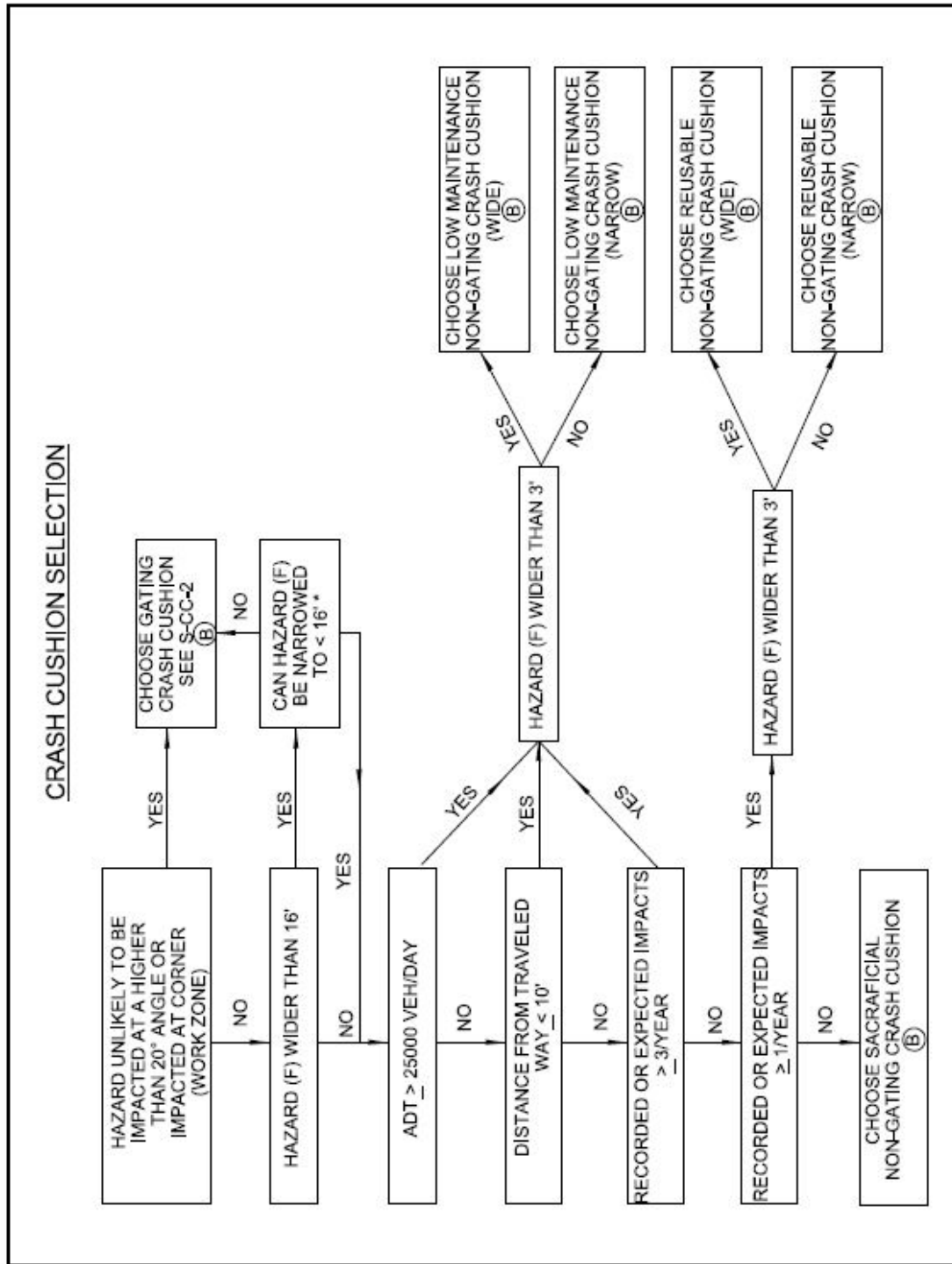
are constrained and the potential for a high angle impact is limited. Every gating system must be specifically designed for the fixed object that it is intended to shield.

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).

4-706.34 CRASH CUSHION SELECTION GUIDELINES

The location of all 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 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 within the final construction plans.

For new construction projects use Figure 4-19 to determine the appropriate type of crash cushion to specify, see Standard Drawing **S-CC-1** for more details. **Maintenance projects** shall follow the maintenance contract.



* REDUCTION TO 16' CAN BE DONE BY MODIFYING BARRIER OR TRANSITION SECTION

Figure 4-19
Crash Cushion Selection Flowchart
(From Standard Drawing S-CC-1)

4-706.35 SITE CHARACTERISTICS

Provisions for providing adequate space (reserve area) for crash cushions to shield fixed objects should be made during the preliminary plan stage for new roadway construction projects and for the rehabilitation or reconstruction of existing roadways. 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 in 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 provided so as 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.

4-706.39 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. All 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. A generic gating crash cushion design is provided on **S-CC-2**.

Both non-gating and gating systems are approved for use in temporary work zones on TDOT projects. Non-gating, redirective systems are available in narrow widths; and thus, have the ability to satisfy attenuation requirements where working conditions are constrained; provided that a paved surface is available for proper anchorage. Where lane widths are constrained, gating systems designed to protect the ends of temporary concrete barriers or other fixed objects are acceptable due to the reduced potential for angled impacts. Additionally, some gating systems do not require a paved surface for short-term temporary installation.

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.

4-707.00 ROW STOCK FENCE

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 ROW Fence for Bridge and Culverts and S-F-10D is approved for use on ROW Fence Locations at Interchanges.

4-709.05 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.)

$$\text{Computed Quantity (C.Y.)} \times 1.75 \text{ Tons/C.Y.} = \text{Total (Tons)}$$

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 rip-rap notes in Section VI, General Notes and Special Notes.

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.

4-710.00 UNDERDRAINS

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.

4-712.00 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. The TMP shall be uploaded to FileNet at the R.O.W. plans submittal, including Significance determination form. TMP shall be signed by supervisor and approved by regional traffic engineer. The naming convention shall be nnnnnn-nn-TMP.pdf where "nnnnnn-nn" shall be the project PIN. The TMP shall be reviewed, revised, and finalized at the Construction Field Review. The Designer shall use the T-WZ series Standard Drawings and the MUTCD to develop the traffic control plans.

All projects, including bridge repair, utility or local program projects, must have a work zone significance evaluation and Transportation Management Plan (TMP) forms complete and uploaded to FileNet. The TMP shall at a 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. If needed, all Operational Strategies agreed to at the Field Review and included on the TMP shall be shown as a special note on the Traffic Control Plan in the project plans. The revised, finalized, and signed TMP shall be uploaded to FileNet at the Construction submittal, replacing the initial TMP. For more detailed information, please see TDOT's [Work Zone Safety and Mobility Manual](#).

CONSTRUCTION SIGNING

The use of advisory speed plates shall be limited to locations where the traffic control design warrants a 10 mile per hour or more reduction in speed, such as an approach into a median crossover on a divided highway. The designer shall make every effort to achieve a traffic control design that would avoid the use of these plates.

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 sign shall be used on road work more than 1 mile in length and 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 sign).

To enhance safety for both the motoring public and construction personnel, the Department has established guidelines and procedures for the reduction of work zone speed limits as warranted by the Guidelines for Establishing Work Zone Speed Limits. The intent is to allow a reduction of the legal speed limit for the shortest period warranted in the area of active

construction work. These procedures include an evaluation of the work zone in question, a review of the guidelines to determine if the reduction in speed is warranted, a written request, and approval by the State Traffic Engineer. Additional detail can be found in the Construction Division Circular Letter 712.04.01.

To comply with the above approved Departmental guidelines and procedures, **regulatory speed limit reduction signs shall not be placed in the Traffic Control Plans.** Any exception shall comply with the Guidelines for Establishing Work Zone Speed Limits, Construction Division Circular Letter 712.04.01, and be approved by both the Roadway Design Division Director and the State Traffic Engineer. Requests for the inclusion of regulatory speed limit signs in the Traffic Control Plans solely based on requests or comments made at field reviews will not be accepted as justification for placement of signs in the plans.

The use of advisory speed plates used in conjunction with construction signs is allowable on Traffic Control Plans provided the advisory speed is appropriate for the roadway geometry.

BARRICADES AND DRUMS

Plastic drums shall be used in lieu of Type II barricades due to better performance in terms of durability and target value.

LIGHTING DEVICES

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, vertical panels 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. High intensity (Type B) lamps, the use of which is optional according to the *MUTCD*, 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. Furthermore, they 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.

MARKINGS

1. 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 marking may remain.
2. Wide-edge line marking is also recommended for use next to portable concrete barrier rail.

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 T-WZ-series Standard Drawings.

Temporary raised pavement markers should also be considered for use through 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 construction field review on projects involving major facilities.

Designers should ensure that the appropriate 716 series of pay items are included in the construction plans for temporary raised pavement markers.

PORTABLE BARRIER RAIL

Taper rates shall be 10:1 or flatter for designs where posted speeds are less than or equal to 40 mph, and 15:1 or flatter for designs where posted speeds are greater than 40 mph. 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 No. 705-20.25, 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.”

BARRIER RAIL DELINEATORS

Barrier rail delineators (item no. 713-02.26 and 713-02.27) shall be used on portable barrier rail in accordance with the T-WZ-Series standard drawings and Section 4-716.11 of these guidelines. 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.

The TDOT approved qualified product list will be used to identify acceptable products.

FREEWAY WORK ZONE CAPACITY

Guidance will be added at a later date regarding freeway work zone capacity.

4-712.01 USE OF UNIFORMED POLICE OFFICERS

The designer shall not include any item for uniformed police officers in the estimated quantities for the project. The use of police officers for traffic control will be determined by the Construction Division at the Construction Field Review.

4-712.05 RECORD-A-COMMENT SIGN

The “**Record-A-Comment**” sign shall be used on all interstate and freeway projects with a current ADT of 30,000 vehicles/day or greater. Signs should be located, in each direction, approximately 1000 feet beyond the “End of Road Work” sign. The signs will be paid for under item 712-06, Signs Construction, S.F.

The “Record-A-Comment” sign should be footnoted in the tabulated block as follows: 96”X48” (Blue Background with White Copy) 0.100” sheet aluminum.

The sign is included in the Tennessee Supplement to the MUTCD as TN-55a.

4-712.10 DIFFERENCES IN ELEVATION BETWEEN ADJACENT ROADWAY ELEMENTS

To minimize the hazard to traffic where differences in elevations between adjacent roadway elements exist, the following procedures shall apply, unless otherwise shown on the Plans or directed by the Engineer. **The designer is advised that the following procedures 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.**

- 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 2 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 planning 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 2 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 two 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 3.5 inches, the Contractor may use warning signs and/or protective devices as applicable and approved by the 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.

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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 6 inches or less.
- d. The Contractor shall provide separation by portable barrier rail.

For proceeding 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 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 the 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:

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.

4-712.15 SPECIAL CONSTRUCTION SIGNS (See 4-712.10)

“WORKERS PRESENT” SIGN

A pay item for the “Workers Present” (TN-44) sign is to be used on all Interstate construction projects in the event that reduced speed limits for the construction zone are approved for use as defined in section 4-712.00. 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 No. 712-06.16, Signs (Construction) (Reduced Speed Warning) per each. This item will be footnoted as follows:

“Item to be used only when the contractor establishes a reduced speed limit 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.”

4-712.25 USE OF LANE CLOSURE WITH LEFT HAND MERGE

Controlled access projects which utilize lane closure details shall be reviewed for the inclusion of Merge Left. Interstate construction or maintenance projects where traffic is reduced to one lane of traffic through the work zone are the primary candidates.

The following criteria will be used for determining Merge Left use:

- Projects on rural interstates should include Merge Left
- Projects on urban interstates 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 Assistant Director, Roadway Design Division, shall be notified in writing for any interstate or controlled access facility with lane closures not utilizing Merge Left prior to finalizing the traffic control. The memorandum shall contain the reasons left merge would be inappropriate.

Standard Drawing T-WZ-21 details Merge Left. The layout and signage may require modification depending on site and field conditions.

4-713.00 FLEXIBLE DELINEATORS

On all interstate and access controlled highways flexible delineators will be installed. 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 standard roadway drawing T-PBR-2 to calculate quantities.

On interstate and access controlled highway resurfacing projects the designer shall replace delineators along the ramps as well as along the main line.

The designer does not need to show the location of the proposed delineators, but must make sure standard roadway drawing T-PBR-2 is included in the contract plans so the proper location can be determined by the engineer and contractor.

On projects with signing and marking plans, the location of the flexible delineators should be shown on the signing and marking plan sheets.

4-713.15 ROADWAY SIGNING SHEETS DEVELOPMENT GUIDELINES

The development of signing plans and sign schedule sheets is the responsibility of the Roadway 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. In addition, the Signing Designer will provide signing, item numbers, quantities, signing details, standard drawings, and signing notes to roadway designers.

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.

Regional Roadway Design Managers and Assigned Signing Designers

Region 1	Christie Brown Andrew Padgett	Design Manager – (865) 594-0742, Christie.Brown@tn.gov Signing Designer – (865) 594-0742, Andrew.Padgett@tn.gov
Region 2	Robert Rodgers Kevin Crisp	Design Manager – (423) 510-1138, Robert.Rodgers@tn.gov Signing Designer – (423) 634-7522, Kevin.Crisp@tn.gov
Region 3	Sharon Schutz	Design Manager – (615) 350-4208, Sharon.Schutz@tn.gov

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	Scott Johnson	Signing Designer – (615) 350-4263, Scott.Johnson@tn.gov
Region 4	Gary Scruggs	Design Manager – (731) 935-0149, Gary.Scruggs@tn.gov
	Larry Brasher	Signing Designer – (731) 935-0144, Larry.Brasher@tn.gov

The Design Manager will be responsible for determining if Signing and/or Pavement Marking sheets are needed on projects other than interstate 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.

Below is the work flow for preparation of roadway signing plan sheets:

At the start of construction plans preparation, the roadway 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.

- After developing signing and sign schedule sheets, the Signing Designer submits a PDF file to Regional Traffic Engineering Office for review.
- The Regional Traffic Engineering Office reviews the proposed signing and provides the Signing Designer with any comments.
- 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 for review. (TDOT.TrafficOps.Sign-Reviews@tn.gov)
- The Signing Designer submits the signed and stamped proposed signing and sign schedule sheets to the Roadway designer no later than 4 weeks prior to construction plans turn-in.

Interstate and full access control projects

For interstate 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 Manager 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 different types 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 Nos. 713-16.20 through 713-16.29. Appropriate Foot Notes, General Notes, and Standard Drawings will also need to be included.

If any particular 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.

See Traffic Operations Division, Traffic Design Manual, Chapter 14, Signing and Pavement Marking for more guidance.

4-713.20 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 base 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 does 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 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 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 show 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” sheet of aluminum 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. New signs shall be paid for under item number 712-06.10, New Signs (Construction), per S.F. Design Managers should contact the construction office to have item numbers assigned when the traffic control plan involves relocating existing signs.

Traffic control plans shall be emailed to the Traffic Operations Division, Traffic Engineering Office a minimum of twelve weeks prior to the construction field review for review when advance guide signs or exit directional signs are included in the traffic control plan. For resurfacing projects, plans should be sent as soon as possible. **No other traffic control plans shall be sent for review.**

See Section 6-160.00 for notes to be placed in the general notes on all access controlled and interstate projects and on access controlled and interstate 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.

For all traffic control plan reviews, an email should be sent to the Traffic Operations Division, Traffic Engineering Office. The proposed traffic control plan shall be attached to the email as a single pdf file that contains only the traffic control sheets. A copy of the email shall be placed in the project folder to document the submittal of traffic control plans for review.

The naming convention for the traffic control plan pdf will include the PIN and the Region #, XXXXXX-XX-TrafficControlReview-RegX.pdf. If there are modifications, including submitting additional information, then the naming convention will be XXXXXX-XX-TrafficControlReview-

RegX-Rev-00-00-00.pdf. Revised traffic control plan review request will contain all traffic control sheets.

Example: 123456-00-TrafficControlReview-Reg1.pdf

When assembling the pdf file, select small file size of default file size in Adobe Acrobat Standard in order to keep the proposed traffic control plans under the email limit. If the file exceeds the email limit, the designer should split the packet into multiple emails and add Part 1, Part 2, etc. to the naming convention.

Example: 123456-00-TrafficControlReview-Reg1-Part1.pdf

For the Roadway Plans prepared by consultants, the proposed traffic control plans should be prepared as described above and emailed to the Roadway Design Manager for review. Upon acceptance, the design manager will forward the plans to the Traffic Operations Division, Traffic Engineering Office.

The proposed traffic control plans should be resubmitted whenever major design revisions are made that could affect the traffic control plan as determined by the Design Manager.

4-713.25 NOTE ALLOWING TRAFFIC TO TEMPORARILY DRIVE ON MILLED SURFACE TO BE PLACED IN INTERSTATE RESURFACING PLANS

See Section 6-215.01 for a note to be added to interstate resurfacing plans for all projects which include cold planing items. The note should be added as a Special Note.

Designers should also include the motorcycle warning sign (TN-64) on interstate resurfacing projects. Two (2) signs should be placed on the interstate in advance of the cold planed section. A motorcycle warning sign should also be placed on entrance ramps located within the limits of a cold planed section.

4-713.30 HISTORICAL MARKERS

On projects impacting a Tennessee Historical Marker sign, the designer shall add item number 713-16.5X "Remove and Replace Sign (description)" per each to the quantities. The designer shall also add special note from section 6-220.00.

4-714.00 ROADWAY LIGHTING (See 2-315.05)

See Traffic Design Manual, Chapter 15, Roadway and Intersection Lighting.

4-716.00 CHANNELIZATION STRIPING

For all channelization markings detailed on Standard Drawing T-M-7, the following pay items and methods of measurement shall be used:

- A. 716-02.04, Plastic Pavement Marking (Channelization Striping) - Sq. Yd.

716-05.04, Painted 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.

B. 716-04.04, Plastic Pavement Marking (Transverse Shoulder) - Linear Feet

The unit of payment is per linear foot of diagonal marking. The 4 inch edge line is paid for under a "Pavement Marking (Line)" item.

C. 716-02.07, Plastic Pavement Marking (24" Barrier Line) - Linear Feet
716-05.07, Painted Pavement Marking (24" Barrier Line) - Linear Feet

The unit of payment is per linear foot of boundary line (with no diagonal marking used).

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.

4-716.05 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 good pavement marking plan for a project. Special problem areas may require special treatment, which shall be determined on the Construction Field Review.

Traffic volumes may be found in the Strategic Transportation Investments Division latest Traffic Flow Maps book. The information is available at:

<https://www.tn.gov/tdot/driver-how-do-i/look-at-or-order-state-maps/maps/traffic-maps.html>

Generally, centerlines and edge lines shall be placed on all pavements with a minimum total width of 16 feet.

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. A centerline on the final surface may be required depending on the surface materials.

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 the sections 4-716.10 through 4-716.36 for guidance for temporary and permanent pavement marking and section 6-135.00 for pavement marking general notes.

See Traffic Design Manual, Chapter 14, Signing and Pavement Marking.

4-716.10 TEMPORARY PAVEMENT MARKINGS

Temporary pavement markings on the intermediate layers of pavement open to traffic will be installed to permanent standards daily with reflective tape or reflectorized paint.

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

4-716.11 TEMPORARY PAVEMENT MARKING FOR USE ON PAVEMENT SURFACE OTHER THAN FINAL

1. ON ALL INTERSTATES AND EXPRESSWAYS (Duration of Marking>1 month)

A. On Non-Transition Sections:

- a. **Lane lines** – use 8" painted white skip lines and white raised pavement markers on 40' spacing.
- b. **Left edge lines** (yellow) – Use 8" painted solid yellow lines and yellow raised pavement markers on 20' spacing.
- c. **Right edge lines** (white) – **Allow as equals:**
 - (1) Use 8" solid white wet-reflective temporary tape (according to manufacturer's specifications).
 - (2) Use 8" painted solid white lines with an approved white barrier rail delineator on top of barrier rail on 20' spacing,

OR

 - Use 8" painted solid white lines only or with white flexible delineators 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 and white raised pavement markers on 20' spacing.
- b. **Left edge lines** (yellow) – Use 8" painted solid yellow lines and yellow raised pavement markers on 20' spacing.

- c. **Right edge lines** (white) – Allow as equals:
- (1) Use 8” solid white wet-reflective temporary tape (according to manufacturer’s specifications)
 - (2) Use 8” painted solid white lines with an approved white barrier rail delineator on top of barrier rail on 20’ spacing.
- OR**
- Use 8” painted solid white lines only or with white flexible delineators 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 Construction 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, 716-01.06, and/or 716-01.07.

2. STATE ROUTES WITH 4 OR MORE LANES (Unlit During Construction)

- A. **Lane Lines** – Use white painted skip lines, 2” wider than prescribed permanent lines, and raised pavement markers on 80’ spacing.
- B. **Edge and center lines** – Use solid lines (yellow or white, as appropriate) 2” wider than prescribed permanent lines. Raised pavement markers (yellow or white, as appropriate) may be specified for use on a case-by-case basis, as determined at the Construction 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 Construction 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, 716-01.06, and/or 716-01.07.

3. ALL OTHER STATE ROUTES

All Lines – Use regular 4” marking lines. Centerline yellow raised pavement markers may be considered on a case-by-case basis. Discuss need at Construction 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 Construction 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, 716-01.06, and/or 716-01.07.

4-716.12 LOCAL ROUTE PAVEMENT MARKINGS (EXCLUDING STATE ROUTE)

On local roads where roadway departures are not a significant concern and the ADT < 2000, no permanent striping is required on the final surface if Item Number 716-05.01 Painted Pavement Marking (15 mil 4IN) is used as the temporary striping for the final layer.

On Local Roads with the ADT ≥ 2000, permanent pavement markings shall be Item Number 716-13.02 Spray Thermo Pavement Marking (60 mil 6IN).

4-716.13 PAVEMENT MARKING PLANS ON INTERSTATE AND FULL-ACCESS CONTROL ROADWAYS (See 3-330.00)

4-716.15 PERMANENT PAVEMENT MARKINGS (See 4-411.03 and 4-411.04)

Designers should refer to Tables 4-3A and 4-3B for pavement marking guidelines for all interstate and state routes. In addition to pavement marking guidelines, Tables 4-3A and 4-3B 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 on the Construction Field Review and approved by the Director of the Roadway Design Division.

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Items numbers for pavement markings are available on the TDOT web site at:

<https://www.tdot.tn.gov/APPLICATIONS/RoadwayItems>

Type	Thickness (mils)	Bead Package	Pavement Type				Comments
			Asphalt			Concrete	
			Conventional	OGFC	HFS		
Thermoplastic Spray	60	Type I	X		X	X Note 2	Spray Thermoplastic, Multipolymer
Thermoplastic Extruded	100	Type I & IV	X		X	X Note 2	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 Note 2	Audible feedback, Wet visibility Per SP 716IPA
Polyurea	20	Type I	X	X	X		Moisture resistance
Tape	85	NA	X			X Note 2	
Specialty Pavement Markings							
Extruded	100	Type I & IV	X Note 3		X Note 3	X Note 3	Enhanced Flatline Thermoplastic,
Pre-formed	90 - 125	N/A	X Note 3		X Note 3	X Note 3	
Temporary Traffic Control							
Paint	15	N/A	X	X	X	X	See section 4-716.10
<p>Notes:</p> <ol style="list-style-type: none"> For projects using an Open-Graded Friction Course (OGFC) for the surface layer, only Enhanced Flat Line 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 4-3B. The designer shall footnote the Enhanced Flat Line Thermoplastic Quantity with the following note: <i>“Contractor shall use the extruded or ribbon method for application.”</i> Use Hi-Contrast pavement marking which is recessed for lane lines, edge lines, dotted lines, skip lines, and HOV lines on concrete surfaces. 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 4-3A
Permanent pavement Markings Selection Guide Based on Pavement Type**

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Revised: 08/01/19

Roadway Functional Classification		Permanent Pavement Markings Snowplowable Raised Pavement Markers Rumble Strip and Rumble Stripe												
		Edge Lines	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	716-01.21 SRPM (Bi-Dir) (1-Color)	716-01.22 SRPM (Mono-Dir) (1-color)	716-01.23 SRPM (Bi-Dir) (2-color)	411-12-01 16" Rumble Strip	411-12.03 8" Rumble Stripe	411-12.04 4" Rumble Stripe	411-12.05 CL Rumble Stripe		
Roadway Functional Classification	Freeways or Divided State Route	Edge Lines	X Note 3						X Note 2					
		Lane Lines	X Note 3					X Note 1						
		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	Note 1							
		Edge Lines	X Note 3			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	X Note 1							X Note 2
		Edge Lines Shoulder ≥ 8'	X Note 3						X Note 2					
		Edge Lines Shoulder > 2' and < 8'	X Note 3							X Note 2				
		Edge Lines Shoulder < 2'	X Note 3							X Note 2		X Note 2		
		Lane Lines	X Note 3									X Note 2		
Local Roads and streets ADT ≥ 2000	All Lines Note 6				X									

Table 4-3B, Continued
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:
 - a. 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.
 - b. 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.
 - c. 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).
 - d. 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.
 - e. 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.
 - f. 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
 - a. All resurfacing projects shall follow the guidance in Table 4-3B for pavement marking and rumble installations. See 4-411.03 and 4-411.04 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.
 - b. Rumble strips are not required on ramps.
 - c. 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.
 - d. 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
 - e. 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 Strips, L.F. The length of scoring shall be measured as the actual length of pavement scored.
 - f. Freeways and divided highways, See STD DWG T-M-15
 Undivided state routes, See STD DWG T-M-15A
 Undivided state routes, See STD DWG T-M-16 and 16A

Table 4-3B, Continued
Permanent Pavement Markings, Raised Pavement Markers,
Rumble Strip and Rumble Stripe Guidelines Notes

- g. The Designer or the Field Engineer may choose to alternate rumble with profile thermoplastic pavement marking (per SP716IPA) 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. Designer may choose to use one of the specialty pavement marking material as needed.

- 4. Use applicable standard drawings:
 - a. Freeways, See STD DWG T-M-5, T-M-6, T-M-7 and T-M-8
 - b. State Route, See STD DWG T-M-1, T-M-2, T-M-3
 - c. HOV Lanes, See STD DWG T-M-5
 - d. Gore Areas, See T-M-6, SRPM along edge line only.

- 5. The 2'-4' dotted line extensions shall be used along freeway exit and entrance ramps and for double left turn lanes through intersections. The 3' – 9' dotted lines shall be used along freeway exit ramps. See Standard Drawings T-M-4, 5, 6 and 8.

- 6. See 4-716.12 for additional information.

**Table 4-3B, Continued
Permanent Pavement Markings, Raised Pavement Markers,
Rumble Strip and Rumble Stripe Guidelines Notes**

4-716.16 STRIPING RAMPS ON RESURFACING PLANS

In the process of preparing plans for construction or resurfacing projects involving roadways that abut connecting ramps, consideration shall be given to striping these ramps. When work is not being done on the entire ramp, this ramp would not normally be re-striped beyond where the work is being done. The roadway designer shall contact the Regional Traffic Engineer to determine the need to re-stripe these ramps in their entirety. Stop bars, turn lane arrows and other pavement instructive markings may be included at the discretion of the Regional Traffic Engineer applying the appropriate standard drawings that shall be included in the plans. The decision to re-stripe shall be made based on the condition of the pavement markings and consideration may be given to compliance with the standards. If this striping is done, the ramps shall be marked using current standards for pavement markings as shown on Standard Drawings T-M-6 and T-M-9 and other appropriate standard drawings and marked up to the connecting roadway. Add the following to the plans:

“Ramps shall be marked up to where they connect to the intersecting roadway.”

4-716.17 STRIPING ON MICRO SURFACE PAVEMENTS

Pavement markings on micro surface pavements should follow guidance provided in Table 4-3 for lane lines and edge lines.

4-716.20 PAVEMENT MARKING GENERAL NOTES FOR ROADWAY PLANS

See section 6-135.00 for General Pavement Marking Notes.

4-716.25 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 linear foot.

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 linear foot.

4-716.30 USE OF REMOVABLE PAVEMENT MARKING LINE

Item No. 712-09.01, Removable Pavement Marking Line per linear foot, 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. 716-05.01, Painted Pavement Marking (4" Line) per linear mile, 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 be paved, cold planed or otherwise removed.

4-716.35 SNOWPLOWABLE RAISED PAVEMENT MARKERS

Snowplowable raised pavement markers shall be included on all Interstate and full-access controlled roadways. See Table 4-3 for guidance.

On interstate and full-access control resurfacing projects, the designer 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.

On projects which the Traffic Operations Division will be developing the marking and signing plans, the snowplowable raised pavement markers will also be included in these plans.

4-716.36 SNOWPLOWABLE RAISED PAVEMENT MARKERS ON STATE ROUTES

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 T-M- series standard drawings and the current edition of the MUTCD.

On resurfacing projects, the designer 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.

Spacing of 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 construction 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 4-3B for guidance regarding type of markers to be used.

4-730.08 REPLACEMENT OF TRAFFIC SIGNAL DETECTION LOOPS

When there are existing traffic signals on a cold planing 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 planing 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.

See Section 6-165.00 for notes which shall be added to all plans with the replacement of traffic signal detection loops.

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.

4-730.10 TRAFFIC SIGNALS (See 2-315.00)

See Traffic Design Manual, Chapters 4 through 12 for Traffic Signal Design.

4-730.12 MAST ARM POLES

All drilled shaft foundations used for traffic signal poles with a mast arm greater than or equal to 65 feet in length must be 4'-0" in diameter.

4-730.13 INTERSECTION POLE DESIGNER SOFTWARE

TDOT's Intersection Pole Designer Software should be run using the table values below instead of the program default values:

Mast Arm Length (feet)	Mast Arm Diameter (inch)	Mast Arm Weight (lbs./ft.)
30 or less	8.25	17.90
31 thru 35	8.50	20.25
36 thru 40	9.00	21.80
41 thru 45	9.50	23.00
46 thru 50	10.00	27.50
51 thru 55	10.50	31.50
56 thru 60	11.00	38.10
61 thru 65	11.30	41.00
66 thru 70	11.60	43.95
71 thru 75	12.70	50.85
76 thru 80	13.80	57.75
81 thru 85	14.90	64.65
86 thru 90	16.00	71.55

Mast arms shall be limited to 90 feet in length.

4-730.15 STRUCTURAL SUPPORTS FOR TRAFFIC SIGNALS

See Section 6-225.00 for a "Special Note" which shall be added to all plans with proposed signal poles, mast arms, strain poles, etc.

The Traffic Operations Division will forward all signal designs to the Structures Division for pole design. Design Managers should contact the Traffic Operations Division on projects the design consultant is performing signal design to coordinate this requirement.

4-730.20 TEMPORARY TRAFFIC SIGNAL SYSTEMS USED AT TWO-LANE BRIDGE RECONSTRUCTION SITES

TDOT - ROADWAY DESIGN GUIDELINES

English

Revised: 08/01/19

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 details and general notes.

CHAPTER 8 - ROADSIDE DEVELOPMENT

4-801.00 SEEDING (WITH MULCH) (See 4-801.05)

Method for computation of seeding on right-of-way.

$$\frac{\text{Area to be seeded (Sq. ft.)}}{1,000 \text{ Sq. ft./ unit}} \times 1.25 = \text{_____ units}$$

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.

$$\frac{\text{Excess material to be wasted (C.Y.)}}{500 \text{ C.Y./ unit}} = \text{_____ units}$$

Item No. 801-01
and/or
Item No. 801-01.02

$$\frac{\text{Borrow material (C.Y.)}}{500 \text{ C.Y./ unit}} = \text{_____ units}$$

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.

4-801.05 CROWN VETCH MIXTURE (WITH MULCH)

See Section 4-801.00 for computations.

Item 801-01.02, Crown Vetch Mixture (with Mulch), 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 Construction 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), and description 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.

4-801.07 TEMPORARY SEEDING (WITH MULCH)

The use of Temporary Seeding (with Mulch) is strongly recommended on projects.

Item No. 801-01.07 Temporary Seeding (With Mulch)

Item No. 801-02 Seeding (Without Mulch)

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.

$$\frac{\text{Total area of seeding (Sq. ft.)} \times \text{number of effective phases of the sequence of construction}}{1,000 \text{ (Sq. ft.)/unit}} = \text{Total seeding (UNITS)}$$

Exceptional locations where the slopes are flatter than 3H:1V, but where crown vetch is requested on the Construction Field Review, shall be outlined on the proposed layout sheet in a manner similar to Figure 4-20.

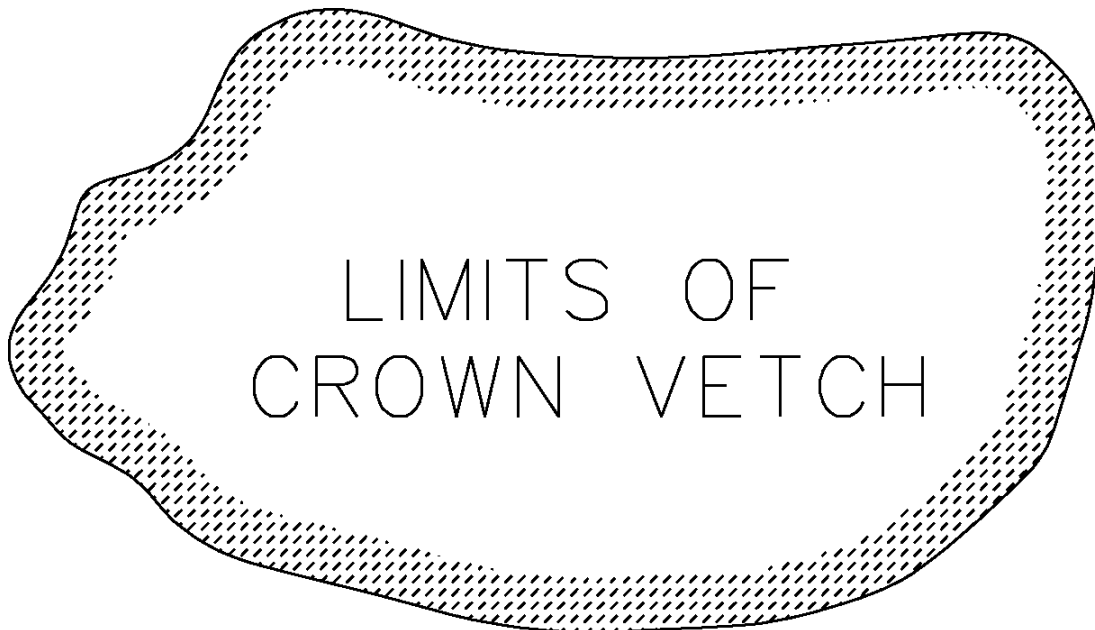


Figure 4-20
Typical Limits of Crown Vetch

4-801.10 WATER (SEEDING AND SODDING)

Item No. 801-03 Water (Seeding and Sodding)

Water for seeding, sodding, crown vetch mixture or sprigging (crown vetch):

Water will be measured by the thousand gallon (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)

$$\frac{\text{Surface area (Sq.ft.)} \times 0.1 \text{ M.G./unit}}{1,000 \text{ Sq.ft./unit}} = \text{_____ M.G.} \quad \text{Item 801-03}$$

$$\text{Total seeding (units)} \times 0.1 \text{ M.G./unit} = \text{Total Water (M.G.)}$$

The designer shall **footnote** pay item as follows:

"Includes _____ thousand gallons for erosion prevention and sediment control."

Sodding:

$$\frac{\text{Surface area (Sq.Yd.)} \times 10 \text{ Gal./Sq.Yd.}}{1,000 \text{ Gal./M.G.}} = \text{_____ M. Gal.} \quad \text{Item 801-03}$$

4-801.15 SEEDING (SUPPLEMENTAL APPLICATION)

10 pound Minimum Quantity

$$\text{Units of 801-01 (Seeding (with Mulch))} \times 1.5 \text{ Lb/Unit} \times 1.15 = \text{_____ Lbs.} \quad \text{Item 801-07}$$

$$\text{Units of 801-01.02 (Crown Vetch Mixture (with Mulch))} \times 1.5 \text{ Lb/Unit} \times 1.15 = \text{_____ Lbs.} \quad \text{Item 801-07.01}$$

Note: For larger projects with significant amount of disturbed area, include item number 801-07 and/or item number 801-07.07 when using item number 801-01 and/or 801-01.02.

4-801.20 FERTILIZER (SUPPLEMENTAL APPLICATION)

1 Ton Minimum Quantity

$$\text{Units of 801-01 and/or 801-01.02} \times \frac{23 \text{ Lbs./Unit}}{2,000 \text{ Lb./Ton}} \times 1.15 = \text{_____ Ton} \quad \text{Item 801-08}$$

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.

4-805.00 EROSION CONTROL BLANKET

See Chapter 10 of the Drainage Manual.

4-806.00 PROJECT MOWING CYCLE

Projects on State Routes with high traffic volumes and high visibility shall include Item No. 806-02.03, Project Mowing, 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 a 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 construction 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 Cycl., 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 Cycl."

CHAPTER 9 - MATERIALS

4-905.00 SILICONE SEALANT

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*.